INVESTIGATION ON THE ROOT CAUSES OF HIGH LOADING AT THE ANCHOR POINT OF HIGH PRESSURE STEAM PIPING ON PIPERACK

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A project report submitted in partial fulfilment of the requirements for the award of Master of Engineering (Mechanical)

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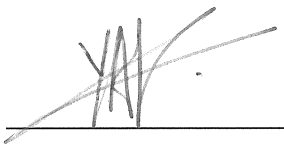
April 2015

DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

Signature : 

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APPROVAL FOR SUBMISSION

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Specially dedicated to

my beloved wife, parents, and parents-in-law

ACKNOWLEDGEMENTS

I would like to thank everyone who had contributed to the successful completion of this project. I would like to express my gratitude to my research supervisor, Dr. WANG Chan Chin for his invaluable advice, guidance and his enormous patience throughout the development of the research.

In addition, I would also like to express my gratitude to my loving wife, parent, friends, colleagues and superiors who had helped and given me encouragement...

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ABSTRACT

The root causes of high loading at the anchor point of high pressure steam piping was studied. Subsequently, this research investigated possible approaches to reduce the loading at anchor point. Several factors like pipe materials, pipe supports, and the piperack structure were studied to investigate the root cause. Possible method to reduce the anchor load by considering the factors of thermal expansion for different pipe materials, friction at the contact surface between pipe support and piperack, locations of pipe support and anchor points, and different types of expansion loop were studied. Investigation results showed that the loading on anchor points was reduced significantly (by 20% ~ 30%) when the values of friction coefficient at the contact surface between pipe support and piperack become smaller (from 0.3 become 0.15 ~ 0.05) and adjustments on the particular dimension of expansion loop. Reduction in the anchor load on piperack had also reduced the cost of the piperack structure due to reduction in its beam size.

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LIST OF SYMBOLS / ABBREVIATIONS

°C	Celsius, temperature
BarG	bar gauge, pressure
m	meter
mm	millimetre
mm^2	millimetre square, area
N	Newton, Load
N.m.	moment
DX	direction in X axis, mm
DY	direction in Y axis, mm
DZ	direction in Z axis, mm
P1	pressure, KPa
T1	temperature, °C
∅	rebar diameter, mm
NPS	nominal pipe size, inches
OD	outer diameter, mm
PTFE	Polytetrafluoroethylene

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CHAPTER 1

INTRODUCTION

1.1 Background

Cost and schedule of an EPC (Engineering, Procurement, and Construction) are always the major concerns in designing onshore petrochemical plant. The main reason is because of demand and supply of the petrochemical product fluctuates according to price of crude oil. Most of the EPC Project have to set the achievable milestones until project completion, where it is to avoid cost escalation or over budget, as well as meeting the sales and production target of a petrochemical plant.

Typically civil structure contributes around 30~40% of total construction cost. This take into account that the total construction cost is only portion of total project cost. Bausbacher and Hunt (1993, p.261) stated that “A pipe rack is the main artery of a process unit. It connects all equipment with lines that cannot run through adjacent areas”.

If the cost of piperack design can be decreased by reducing the anchor load of steam piping, it will become a value added in engineering design for EPC project in petrochemical industry.

1.2 Objectives

The main objective of this research is to investigate the root cause of high thermal loading at the anchor point of high pressure steam piping on piperack and subsequently find out some approach to reduce the loading.

For the scope of work, this research will utilize stress analysis software to conduct simulation for investigation and also approach to reduce loading at anchor point. The factors include pipe material, support lubrication, and the piperack structure. The study will be focused on influences of thermal expansion for different pipe materials, friction condition, locations of pipe support and anchor points, and different types of expansion loop. The simulation method will be carried out to find out the parameters that influence the anchor load.

Superheated high pressure steam piping is commonly used in petrochemical industry like Ethylene Plant and Ammonia Plant. However, thermal expansion of the pipe is relatively large due to its extremely high operating temperature, ~500°C. Expansion loop and anchor pipe supports on piperack are to consider high thermal loading from steam piping.

In general, not all piperack structure is designed to withstand axial load that is more than one tonne in axial direction of pipe. But, the loading produced by thermal expansion of steam piping that acts on anchor support during operation is normally more than one ton and, sometimes it is between two to four tonnes depends on the route of steam piping.

The thermal loading that generates by steam piping is constant throughout the entire operation period until next shut down of the plant. Such kind of condition may potentially lead to creep failure on pipe material and the structure that attached with it, for example is the pipe body, pipe shoe, and piperack that welded together at designated anchor point.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Finite element analysis is one of the popular tools that has been used in analysis for pressure vessels and piping. Among the research works that have done (Mackerle 2002, Mackerle 2005), it is shown that STR (linear and nonlinear, dynamic and static, stress and deflection analyses) and FRA (fracture mechanics problems) contributes the highest number of research journal/article from year 1976 until 2004. This research works is referring to various general and specialized journals, conference proceedings materials as well as theses and dissertations (Mackerle 2005). From here, the trend of research can be observed by its priority. Figure 2.1 below provides better visualization on the research works.

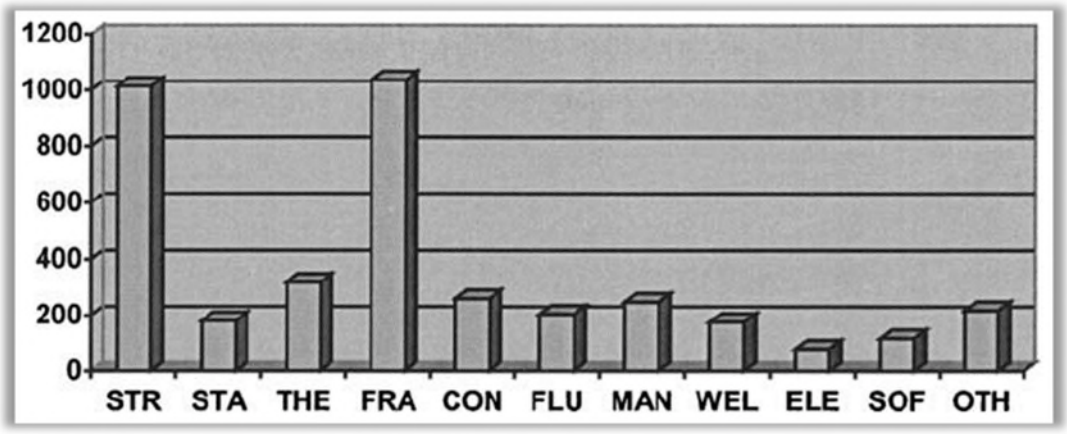

Figure 2.1: Finite elements and various topics in piping and pressure vessels from 1976 to 2004 (Mackerle 2005)

Piping analysis with emphasis on computer graphics has been long developed especially during 1980's (Revesz 1985). Nowadays, software with graphical input to model piping systems becomes a common tools in petrochemical or oil & gas industry. CAESAR II (Intergraph® CAESAR II® 2014) is one of the popular software that equipped with such features and currently being use for static and dynamic analysis in both onshore and offshore sector. Seismic analysis is normally not considered for onshore piping in Malaysia, however other parameter like wind load is consider as an occasional case as part of the static analysis.

CAESER II has an user interface that is user friendly with graphical input to model piping systems in computer. This software is not using FEM (Finite Element Method) in its stress analysis, but indeed using the theory of beam element in its stress analysis.

Existing work shown that the dynamic behaviour of the piping/flange configuration can be accurately represented by using a simplified beam model with a center mass that equal to the mass of the flange (Semkea et al., 2006). Hence this is one of the supporting documents to use CAESAR II in piping stress analysis, which is using beam element model instead of finite element model. Another journal (Mathan and Siva Prasad 2012) explained that type of gasket (metal or spiral wound) will affect the natural frequency of piping systems with flange joint. Flange joint with metal and spiral wound gasket shown a variation of 12.3 percent in natural frequency of the piping system when subjected to bending test. Also, it concludes that the flange joint with simply supported ends are basically more prone to leakage than the joints with clamped ends when under harmonic excitations. In most cases, flange joint will be part of the piping systems on piperack. However, high pressure steam piping that is using flange rating of 1500 and larger will normally uses ring type joint gasket instead of sheet or spiral wound gasket.

2.2 High Pressure Steam Piping on Piperack

Civil structure like main piperack that found in most of the petrochemical or oil & gas plant is used to support the pipe load in either operating or shutdown condition. Sometime the piperack even designed to withstand hydrostatic load during construction period. Most of the pipe load are contributed by the pipe weight, insulation, fluid medium, and its horizontal axial load due to thermal expansion during operating conditions.

Large bore piping (NPS14”~16”) with high pressure steam service at high operating temperature will produce high horizontal axial loading at the designated anchor point on the piperack. Typical operating condition of high pressure steam is normally 100 BarG at 500°C. Although several expansion loops was considered in the piping routing design, sometime the horizontal axial piping load acting at the anchor point maybe still more than 2 tonne or higher. Now, the main concern here is to look for a methodology to investigate the root causes of high loading at anchor point and possible approach to reduce the load. This approach will lead to lower structure cost of the piperack and shorter construction period.

2.3 Relevant Literatures

Other than the type of fluid medium, conventional insulation materials like rock wool that applies on steam piping to prevent heat loss is another crucial factor that contributes to vertical load and frictional force that act on piperack structure either during operating or shut down conditions. According to a journal, optimum economic thickness of the thermal insulations can be estimated quickly as a function of diameter for steel pipe and equipment and the thermal conductivity of insulation by proposing some simple correlation (Bahadori and Vuthaluru 2010a). Average absolute deviation percent of the proposed correlation in comparison with the typical data is 2.12% which demonstrating the excellent performance of the proposed correlation (Bahadori and Vuthaluru 2010a). The proposed correlation covers for pipeline diameter and temperature up to and include 0.5 m and 700°C respectively (Bahadori and Vuthaluru

2010a). Optimum and economical thickness can provide a balance between heat loss and insulation thickness that lead to cost saving.

In a recent study, Bahadori and Vuthaluru (2010b) proposed a simple correlation that formulated for estimation of heat flow through the insulation, thermal insulation thickness and thermal resistance for flat surfaces, ducts and pipes. It indicates that data calculated from propose correlation when compared with the reported data, shown that average absolute deviation is around 3.25%. If optimisation can be done on the steam piping system to reduce the loading that act on civil structure, especially on the anchor point (fixed support), the cost and weight of the civil structure will be reduced. Such cost saving will also lead to shorter design period that require by civil engineer due to less complexity.

Based on the study by Bakre, Jangid, and Reddy (2007), it shown that piping system is sensitive to the friction between pipe support and its contacted medium that use during seismic analysis. In piping static stress analysis, friction at the contact surface between pipe support and its contacted medium that used is part of the parameters that contributes to the loading on pipe support include anchor point. Different types of contact between pipe shoe and piperack can be metal-metal, metal-PTFE, PTFE-PTFE, and etc. Friction will be increased if the contact surface is coarse, and will be reduced if the contact surface is smooth. Hence, such parameter shall be part of the study to reduce the loading at anchor point.

According to research by Mackerle (2004) regarding to finite element method that applied to creep and creep fracture/damage for engineering materials and structures, piping materials is one of the subject that being study for its creep behaviour. Creep can occur due to long-term exposure to high level of stresses that even though is still below the yield strength limit of the material (Creep (deformation) 2014). The concern here is that, high pressure steam piping materials that operates at high temperature and pressure can be potentially being exposed to risk of creep phenomenon. Loading due to thermal expansion that imposed on anchor point can intensify the potential of creep phenomenon on either attached pipe shoe/support or the piperack structure. If creep behaviour happens and lead to the damage occurs on either pipe body or piperack, the consequences can be catastrophic to either human or

asset of the petrochemical plant. As per journal published by Boyle (2013), “elastic follow-up” is one of the creep behaviours that happens in high temperature piping. Expansion loop is one of the common examples by “elastic follow-up”. McEvily (2013, p.233) stated that “When the pipe is subjected to thermal expansion, a straight pipe that has a higher stiffness can cause higher accumulation of creep strain in an elbow that has a lower stiffness”. Hence, high loading due to thermal expansion can lead to such phenomenon of “elastic follow-up” in the piping systems.

Jeong and Young (2012) reported that, thermal fatigue and corrosion is part of the many root causes that lead to piping failure in nuclear power plant. Such failure mode can be potentially a risk to high pressure steam piping that has high thermal loading acting on anchor points. Expansion loop that commonly used for high pressure steam piping is as per Figure-2.2 below.

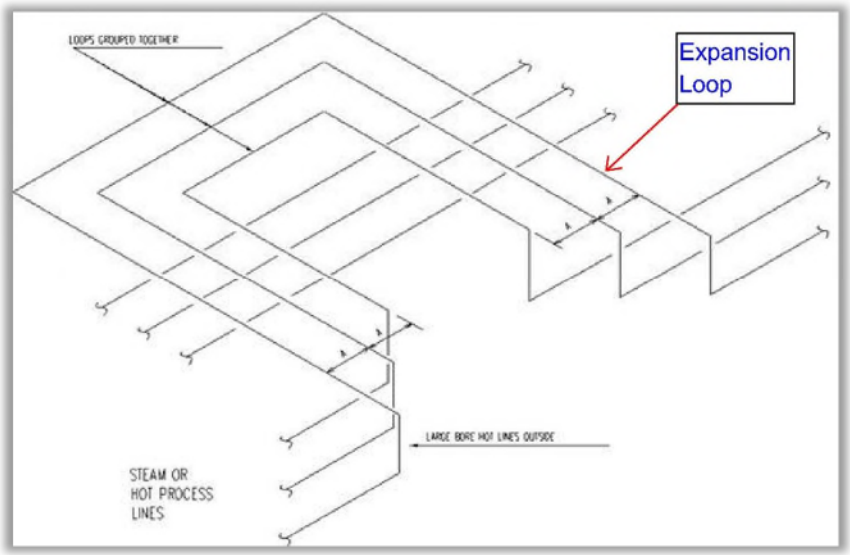

Figure 2.2: Expansion Loop (Plant Layout – Pipeway Design 2014)

During operating condition, high pressure steam is flowing at its designated speed to meet the consumption of its end user like heat exchanger. Such flow rate can induce erosion on the internal wall of pipe body and subsequently thinning the wall thickness. Based on the proposed approach to conduct piping stress analysis on non-uniform wall thickness by Ming and Aggarwal (2011), they emphasized a method that

is cost and time effective. It had shown that the issues on uneven wall thickness due to fabrication and erosion are major concerns in the current industry.

According to the method proposed by Fonseca, de Melo and Oliveira (2005), time saving can be achieved when low number of finite pipe elements and nodes is used, without compromising on the accuracy of output data generated from the analysis of thermo-mechanical behaviour of a piping system. The piping systems is based a simple expansion loop as illustrated in Figure-2.2.

In order to develop a systematic approach for reducing the thermal load that acts on anchor points, it is necessary to describe a detail procedure with proper documentation once the necessary steps was being conducted throughout the research. A good example can be found in the article that published by Sukaih (2002). One of the ideas in reducing the force that acts on piperack is to find a method to distribute the thermal load evenly between expansion loop and anchor point.

When the steam piping is routed from piperack to pressure vessel like heat exchanger, the last anchor point will be located on the piprack. The locations of anchor point can have moderate impact to the nozzle of heat exchanger due to forces and moment that produce by thermal expansion. Schwarz (2004) summarised the results of various FEM analyses in order to establish stiffness coefficients for the nozzles in spherical and cylindrical pressure vessels. Schwarz (2004, p.189) have stated that "Although a large piece of the parameter space is covered, there are still a lot of vessel–nozzle configurations not covered by this work".

Finally, prevention of over stresses on piping system that lead to fracture failure is part of the consideration during piping design. The consequences that caused by such failures can be catastrophic to the plant, mankind, and environment.

CHAPTER 3

METHODOLOGY

3.1 Research Method

In this chapter, methodology will be divided into two parts. Firstly, to conduct investigations to identify the factors of high loading at the anchor points of steam piping systems. Secondly, to propose methods that can reduce the loading at anchor points.

During investigations period, parameters below will be studied;

- Pipe materials
- Friction coefficient (Coulomb Friction) - Pipe Support Design
- Piperack with different Span

In the second step, factors below will be study further with wider extent for possible approach to reduce the loading;

- Behaviour of thermal expansion for different pipe material
- Friction coefficient (Coulomb Friction)
- Location of pipe support and anchor point
- Different size and type of design for expansion loop

3.2 Sensitivity Analysis On Design Parameters

At the beginning of investigation, a base case model used as reference for benchmarking purpose with design parameters as below;

Piping Code: ASME B31.3 – 2010, March 31, 2011
Base Material: A335 P22
Nominal Pipe Size (NPS): 14” (OD=355.6mm)
Schedule / Wall Thickness: 41.55mm
Insulation Material: ASTM C533 Calcium Silicate, 200mm thickness
Insulation Density: 184.2 kg/m^3
Friction Coefficient: 0.3 (Carbon Steel to Carbon Steel)
Gap of Guide Support: 3.0mm
Steam Design Temperature, P1: 525°C
Steam Design Pressure, T1: 120 BarG
Ambient Temperature: 28°C
Piperack Span: 7.5 meter
Overall Length between Node 10 and Node 230: 90 meter

Default units in CAESAR II were based on English units instead of SI units. Since most of the units that used in this project were different from the default units in CAESAR II, hence customised units that used in this project for CAESAR II piping stress analysis were shown as per table below;

Table 3.1: Units in CAESAR II Piping Stress Analysis

ITEM	Internal Units		Constant		User Units
Length	inches	*	25.400000	=	mm.
Force	pounds	*	4.448222	=	N.
Mass-dynamics	pounds	*	0.453592	=	Kg.
Moment-input	in.-lb.	*	0.112985	=	N.m.
Moment-output	in.-lb.	*	0.112985	=	N.m.
Stress	lbs./sq.in.	*	6.894757	=	KPa
Temperature Scale	degrees F	*	0.555556	=	C
Pressure	psig	*	6.894757	=	KPa
Elastic Modulus	lbs./sq.in.	*	6.894757	=	KPa
Pipe Density	lbs./sq.in.	*	0.027680	=	kg./cu.cm.
Insulation Density	lbs./cu.in.	*	0.027680	=	kg./cu.cm.
Fluid Density	lbs./cu.in.	*	0.027680	=	kg./cu.cm.
Translational Stiffness	lbs./in.	*	1.751269	=	N./cm.
Rotational Stiffness	in-lb/deg	*	0.112985	=	N.m./deg
Uniform Load	lb./in.	*	1.751269	=	N.cm.
G Load	g’s	*	1.000000	=	g’s
Wind Load	lbs./sq.in.	*	6.894757	=	KPa
Elevation	inches	*	0.025400	=	m.
Compound Length	inches	*	25.400000	=	mm.
Diameter	inches	*	25.400000	=	mm.
Thickness	inches	*	25.400000	=	mm.
Nominals				=	ON

3.2.1 Current Design as Base Case Model

Below is the 3D model which was used as the base case for piping stress analysis. The model is in symmetry shape and the piping system from node 10 to node 100 is exactly typical to piping system from node 100 and node 230. Generally, the loading caused by thermal expansion at node 100 in Z-direction that generated during operating condition will cancel out each other, which is at the centre of base case model.

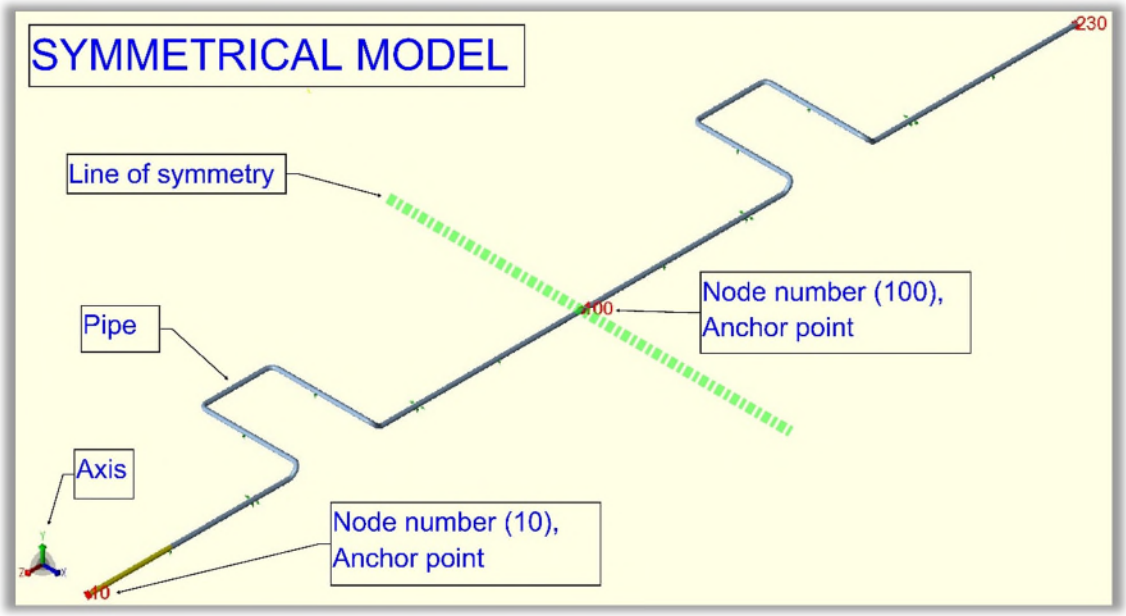

Figure 3.1: Base Case Model Piping System

Base case model is using the same parameter as describe in section 3.2 for piping stress analysis. Based on the simulated results, the force components that act on anchor points of both end (node 10 and node 230) due to thermal expansion during operating condition are shown in Table 3.2. Directions of X, Y, and Z in Table 3.2 for each axis were shown in Figure 3.1. The force components are divided according to the axis as shown in Figure 3.1.

Table 3.2: Base Case – Forces on Anchor Point at Both End

Node No.	Force Components (Newton)		
	X	Y	Z
10	15991	-12660	85353
230	15991	-12660	-85353

As shown in Table 3.2, the force in Z-direction that act on anchor point are highest and is more than five times of the forces in X and Y-direction.

3.2.2 Influence of Pipe Materials

To investigate the root cause, a different pipe material was selected for piping stress analysis using the same model as described in section 3.2. All parameters remained the same, except that the pipe material and wall thickness was changed to A335 P11 and 48.35mm respectively. Based on the simulated results, the force components that act on anchor points of both end (node 10 and node 230) due to thermal expansion during operating condition are shown in Table 3.3.

Table 3.3: Different Pipe Material - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)		
	X	Y	Z
10	15128	-12724	82438
230	15128	-12724	-82438

Compared to the loading data of base model in Table 3.2, it shows the decrease of forces in X and Z-direction. The force in Y-directions shows minor increase. The loading in Z-direction that act on anchor point remained as highest and was more than five times of the loading in X and Y-direction.

3.2.3 Influence of Pipe Supports– Friction Coefficient

To investigate the root cause, a different pipe support with lower friction was selected for piping stress analysis using the same model as described in section 3.2. All parameters remained the same, except that the friction coefficient on all support points was changed to 0.2. Lower friction coefficient can achieve by using material like stainless steel half round bar, graphite or Teflon on support point. Based on the simulated results, the force components that act on anchor points of both end (node 10 and node 230) due to thermal expansion during operating condition are shown in Table 3.4.

Table 3.4: Different Pipe Support (Friction Coefficient) - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)		
	X	Y	Z
10	17213	-12611	77863
230	17213	-12611	-77863

Compared to the loading data of base model in Table 3.2, it shows the increase of force in X-direction. Whereby, the force in Y and Z-direction shows decrease. The loading in Z-direction that act on anchor point remained as highest and was more than four times of the loading in X and Y-direction.

3.2.4 Influence of Piperack Support Span

To investigate the root cause, a different piperack design with longer span was selected for piping stress analysis using the same model as described in section 3.2. All parameters remain the same, except that the piperack support span was changed to 8.0 meters and the overall length between node 10 and 230 become 96 meters. Maximum

pipe support span on the piperack is normally determined by the minimum pipe size on the piperack. Based on the simulated results, the force components that act on anchor points of both ends (node 10 and node 230) due to thermal expansion during operating condition are shown in Table 3.5.

Table 3.5: Different Piperack Support Span - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)		
	X	Y	Z
10	14628	-13876	89176
230	14628	-13876	-89176

Compared to the loading data of base model in Table 3.2, it shows the increase of forces in Y and Z-direction. The force in X-direction shows minor decrease. Changes of forces at all directions were not obvious. The loading in Z-direction that act on anchor point remained as highest and was more than six times of the loading in X and Y-direction.

3.3 Possible Approaches to Reduce the Loading

Based on the analysis results that produced in section 3.2, it has shown that various factors such as pipe materials, friction at the contact surface between pipe support and piperack, and pipe support span show impact to the value of loading that acts on the anchor point. In view of these, detailed studies will be conducted in this project to identify the possible approach in reducing the loading on anchor point.

3.3.1 Thermal Expansion for Different Pipe Materials

According to common practice in petrochemical industry of Malaysia, pipe materials as shown in Table 3.6 have been used for ultra-high pressure steam service with design pressure and temperature of 120 BarG and 525 °C respectively.

Table 3.6: Thermal Expansion for Different Pipe Materials

Base Pipe Materials	Mean Coefficient of Linear Thermal Expansion Between 21.1°C and 525°C, μm/m-°C (The American Society of Mechanical Engineers, 2011 p232)
A335 P11	14.3
A335 P22	14.3

Due to the limited choices of pipe materials that can be used at 525°C, hence the data in section 3.2.2 are used for the investigation.

3.3.2 Friction Coefficient

As mentioned in section 3.1 and results collected in section 3.2.3, friction coefficient is one of design factors to reduce the loading on anchor point. In this study, friction coefficients in the range of 0.05 ~ 0.50 was input to the base case model in piping stress analysis. The analysis results are shows in Table 3.7. Friction coefficients from 0.35 to 0.50 are imaginary and only used as comparison purpose in this project, because the surface conditions in these range is very rough. Physical conditions for friction coefficient from 0.05 to 0.30 will be discuss in section 5.2 of chapter 5. Smaller friction coefficient means that the surface is smoother.

Table 3.7: Influence of Friction Coefficient - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)			Resultant Force (Newton)	Friction Coefficient
	X	Y	Z		
10	19216	-12532	64719	68665	0.05
230	19216	-12532	-64719	68665	
10	18524	-12559	69450	72967	0.10
230	18524	-12559	-69450	72967	
10	17857	-12585	73754	76921	0.15
230	17857	-12585	-73754	76921	
10	17213	-12611	77863	80734	0.20
230	17213	-12611	-77863	80734	
10	16591	-12636	81728	84347	0.25
230	16591	-12636	-81728	84347	
10	15991	-12660	85353	87756	0.30
230	15991	-12660	-85353	87756	
10	15412	-12683	88689	90907	0.35
230	15412	-12683	-88689	90907	
10	15455	-12681	92851	94979	0.40
230	15455	-12681	-92851	94979	
10	15395	-12679	97399	99420	0.45
230	15395	-12679	-97399	99420	
10	14864	-12698	102690	104534	0.50
230	14864	-12698	-102690	104534	

From the table above, it shows the decrease of force in Z-direction when friction coefficient decreased. The force in X-direction shows increases when friction coefficient reduced. Force in Y-direction shown not much difference.

3.3.3 Locations of Pipe Support and Anchor Point

As mentioned in section 3.1 and results collected in section 3.2.4, piperack span is one of design factors to reduce the loading on anchor point. In this study, piperack span in the range of 6.0 ~ 9.5 meters was input to the base case modal in piping stress analysis. The analysis results are shown in Table 3.8.

Table 3.8: Location of Pipe Support and Anchor Point - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)			Resultant Force (Newton)	Support Span (Meter)
	X	Y	Z		
10	21114	-8988	76028	79416	6.0
230	21114	-8988	-76028	79416	
10	19306	-10210	78097	81093	6.5
230	19306	-10210	-78097	81093	
10	17396	-11434	83233	85797	7.0
230	17396	-11434	-83233	85797	
10	15991	-12660	85353	87756	7.5
230	15991	-12660	-85353	87756	
10	14628	-13876	89176	91427	8.0
230	14628	-13876	-89176	91427	
10	13402	-15085	92984	95148	8.5
230	13402	-15085	-92984	95148	
10	12417	-16280	97055	99191	9.0
230	12417	-16280	-97055	99191	
10	11633	-17460	101339	103488	9.5
230	11633	-17460	-101339	103488	

From the table above, it shows the decrease of forces in Z and Y-direction when piperack span decreased. The force in X-direction shows 24% increase when piperack span decreased from 7.5 meters to 6.0 meters.

3.3.4 Structural Design of Expansion Loop

This section studied about the structural design of expansion loop that may contribute to the change of forces that act on the anchor points. “A”, “B” and “C” were examined as shown in Figure 3.2 below.

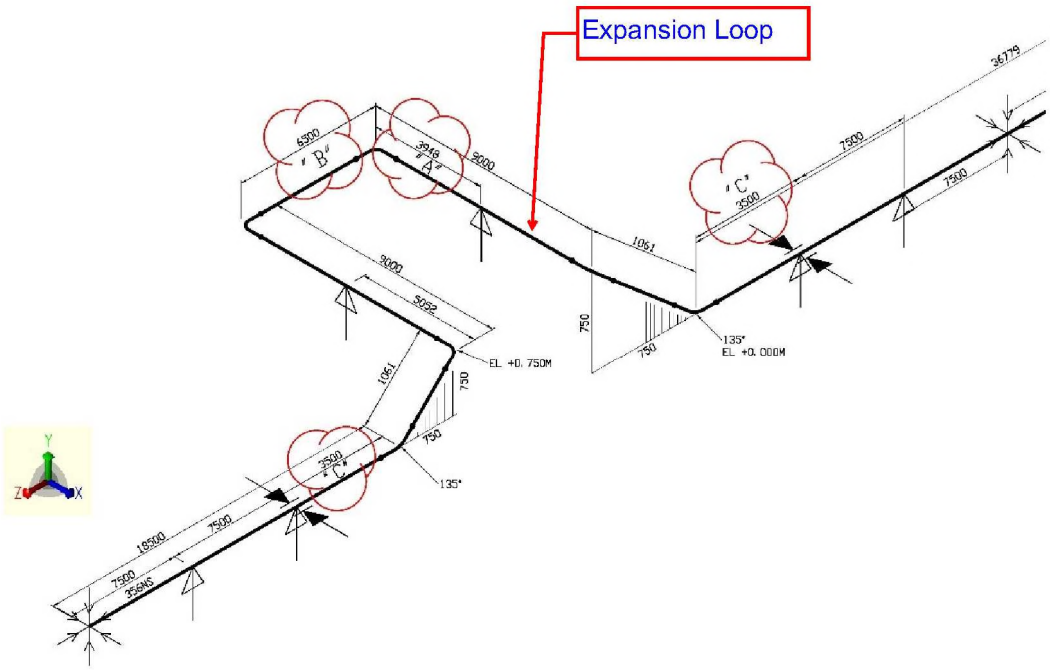

Figure 3.2: Dimensions of “A”, “B” and “C” in Expansion Loop

Adjustment of length size will be carried out separately into two steps as below;

- Adjustment for dimension “A”
- Adjustment for both dimension “B” and “C”

All other parameters remained the same as base case.

Table 3.9: Dimension of "A", Adjustment of Size for Expansion Loop – Forces on Anchor Point at Both End

Node No.	Force Components (Newton)			Resultant Force (Newton)	Dimension (mm) "A"
	X	Y	Z		
10	17776	-12964	96393	98872	3348
230	17776	-12964	-96393	98872	
10	17130	-12877	92276	94732	3548
230	17130	-12877	-92276	94732	
10	16548	-12775	88687	91118	3748
230	16548	-12775	-88687	91118	
10	15991	-12660	85353	87756	3948
230	15991	-12660	-85353	87756	
10	15457	-12533	82253	84626	4148
230	15457	-12533	-82253	84626	
10	14945	-12395	79367	81707	4348
230	14945	-12395	-79367	81707	
10	14454	-12246	76635	78942	4548
230	14454	-12246	-76635	78942	

From the table above, it shows the decrease of force in Z-direction when dimension "A" increased. The force in X-direction shows increase when dimension "A" reduced. Force in Y-direction shows not much difference.

Table 3.10: Dimension of "B" and "C", Adjustment of Size for Expansion Loop - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)			Resultant Force (Newton)	Dimension (mm)	
	X	Y	Z		"B"	"C"
10	15764	-12877	86572	88933	6100	3700
230	15764	-12877	-86572	88933		
10	15875	-12767	85952	88333	6300	3600
230	15875	-12767	-85952	88333		
10	15991	-12660	85353	87756	6500	3500
230	15991	-12660	-85353	87756		
10	16113	-12556	84774	87200	6700	3400
230	16113	-12556	-84774	87200		
10	16241	-12456	84213	86665	6900	3300
230	16241	-12456	-84213	86665		
10	16374	-12360	83671	86149	7100	3100
230	16374	-12360	-83671	86149		

From the table above, it shows minor decrease of force in Z-direction when dimension "B" increased and "C" decreased. Whereby, the force in X-direction shows minor increase. Force in Y-direction shown not much difference.

Subsequently, minor modification with 90-degree elbows added into the base case model to replace the 45-degree elbows are shown in Figure 3.3. 90-degree elbows had added into area indicated with red cloud. The height (Dimension "D") in the range of 1066 ~ 1466 millimetres was used to the base case in piping stress analysis. All other parameters remain the same as base case. Stress analysis results by varying Dimension "D" are shown in Table 3.11.

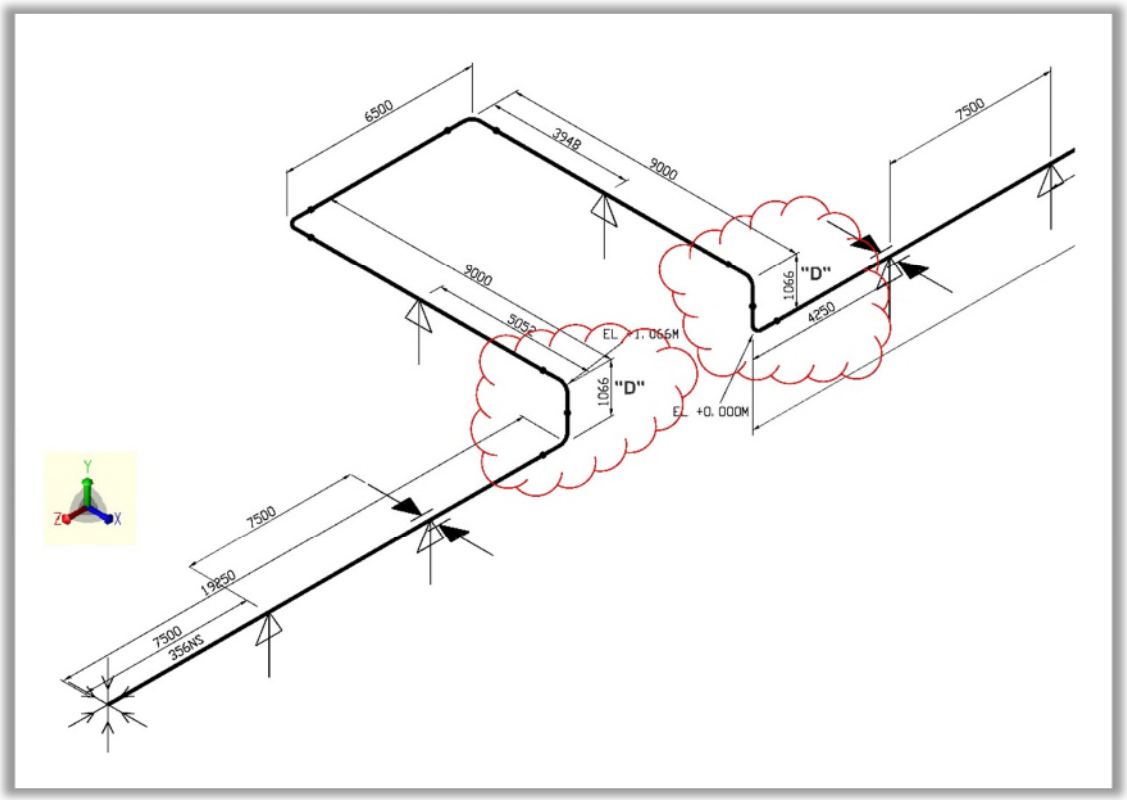

Figure 3.3: Minor Modification on Expansion Loop with Additional 90 Degree Elbow and Dimensions of "D" in Expansion Loop

Table 3.11: Dimension of "D", Adjustment of Height for Modified Expansion Loop with 90 Degree Elbow - Forces on Anchor Point at Both End

Node No.	Force Components (Newton)			Resultant Force (Newton)	Dimension (mm) "D"
	X	Y	Z		
10	14926	-12646	83917	86167	1066
230	14926	-12646	-83917	86167	
10	14708	-12569	83556	85767	1166
230	14708	-12569	-83556	85767	
10	14490	-12494	83185	85357	1266
230	14490	-12494	-83185	85357	
10	14274	-12423	82808	84943	1366
230	14274	-12423	-82808	84943	
10	14060	-12355	82425	84523	1466
230	14060	-12355	-82425	84523	

From Table 3.11, it shows the changes of dimension “D” did not contribute significantly to the force components on anchor points in all direction. However, the forces in X, Y, and Z-direction shows decrease when dimension “D” reduced.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results and Observations

Generally, the results and data that generated by using the methods as described in Chapter 3 are favourable to reduce of force components that acts on anchor point. This chapter discusses and analyse further based on the data that collected in Chapter 3.

To provide better understanding and visualization of the piping stress analysis results that obtained in Chapter 3, this chapter includes several important discussions as below;

- Graphs that plotted based on the data in Chapter 3
- Optimisation on the base case model to reduce the force components on anchor points
- Preliminary discussion on the cost reduction of support beam in piperack.

4.2 Analytical Results

From Chapter 3, all piping models that used for stress analysis are modified from base case model that is in symmetrical shape. In addition, all the analysis results in Chapter 3 shows that the force components at both ends (node 10 and 230) are

shown as identical except that the force in Z-direction at both nodes 10 and 230 which are opposite to each other. For example, Table 3.7 shows that when the friction coefficient is 0.05 the forces at both ends (node 10 and 230) in X and Y-direction shows the same value of 19216 and -12532, whereby the force at both end (node 10 and 230) in Z-direction is 64719 and -64719 respectively.

To simplify the graphs, the force components at node 10 that collected in section 3.3 of chapter 3 will be used as base data to produce the graphs that demonstrate various design parameters that influenced the force components on anchor points.

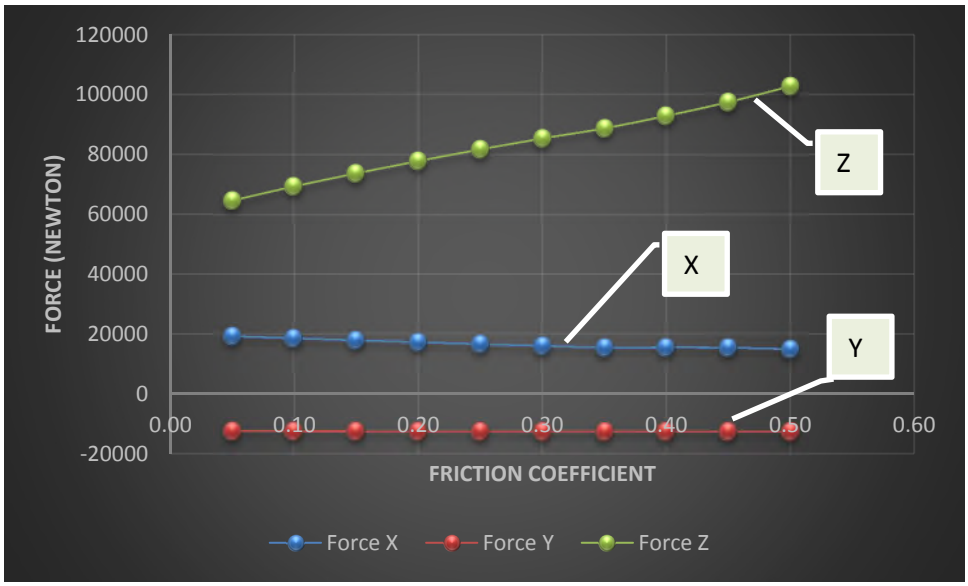

Figure 4.1: Friction Coefficient VS Force Components

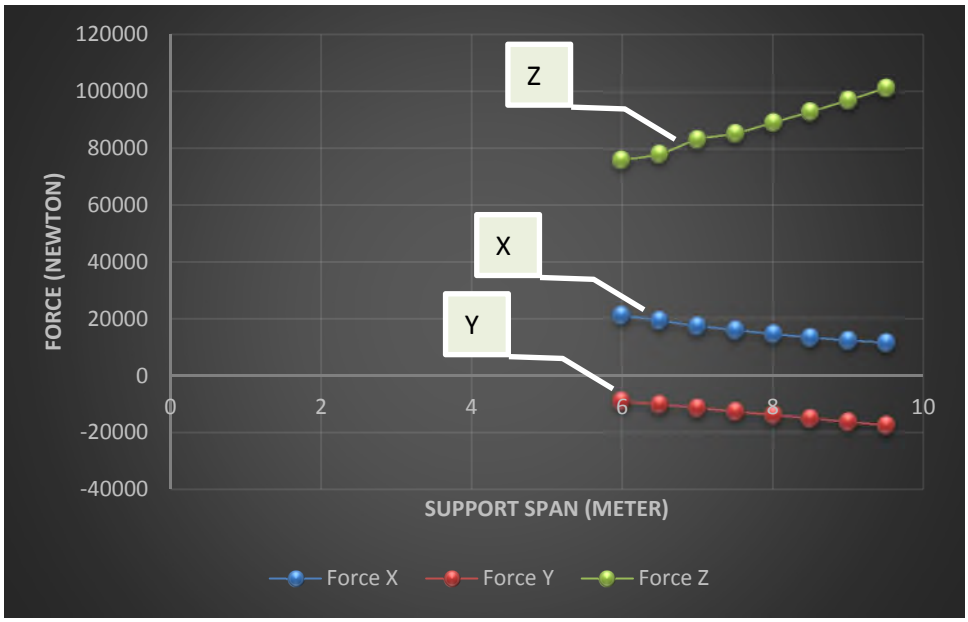

Figure 4.2: Piperack Span VS Force Components

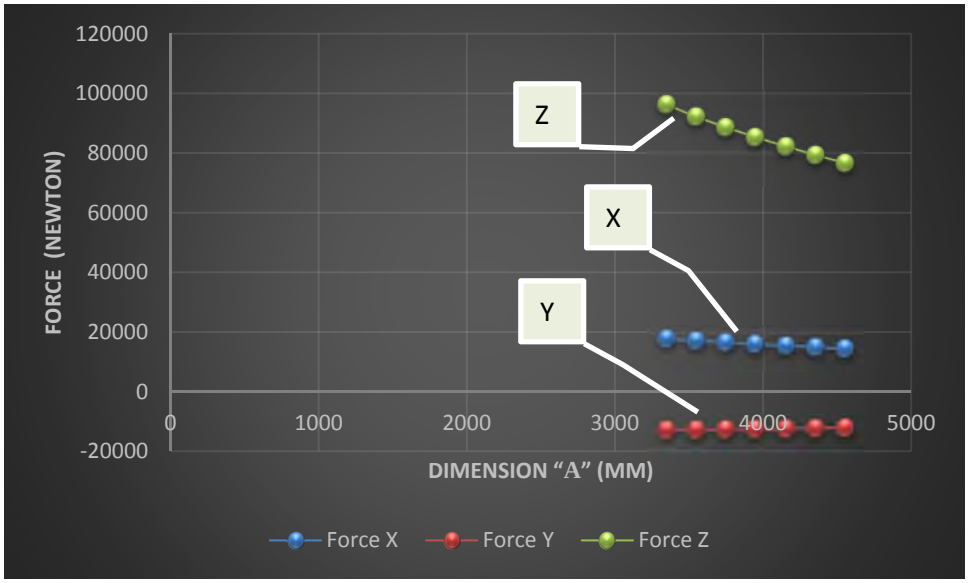

Figure 4.3: Expansion Loop- Dimension "A" VS Force Components

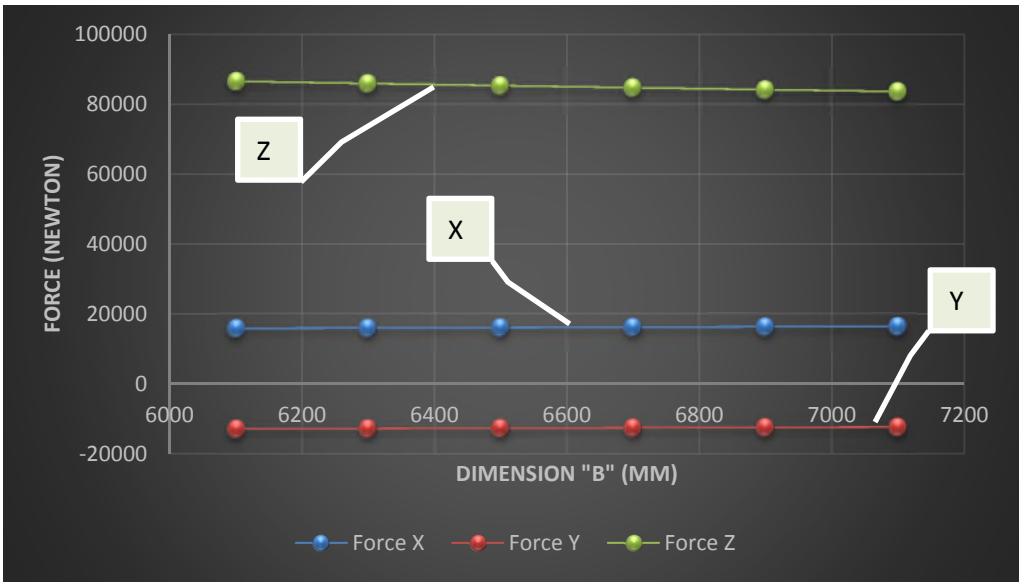

Figure 4.4: Expansion Loop- Dimension "B" VS Force Components

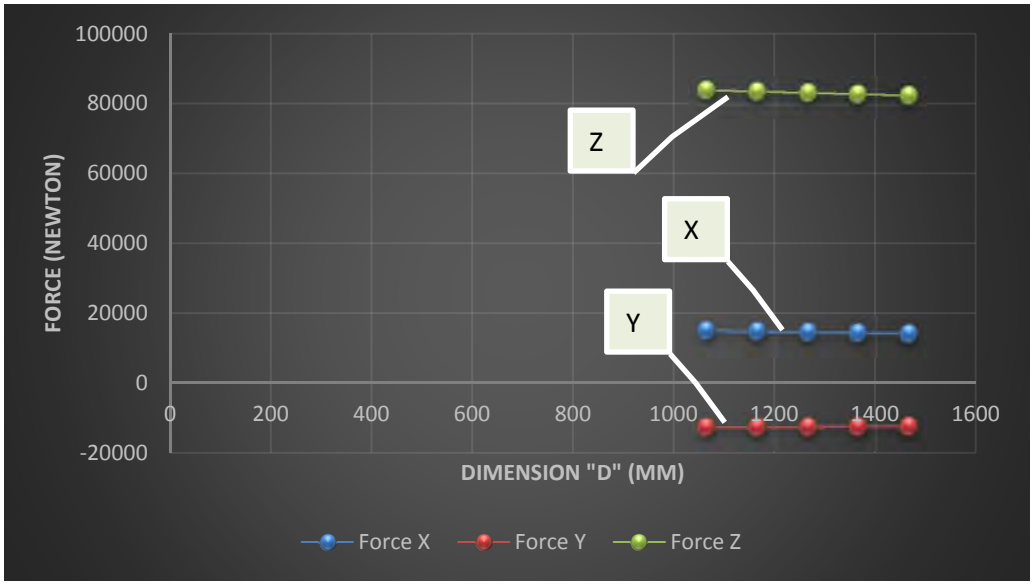

Figure 4.5: Modified Expansion Loop- Dimension "D" VS Force Components

Based on the trend that shown on the graph from Figure 4.1 to Figure 4.5, it shows that friction coefficients act as the most essential elements in the reduction of force in Z-direction. Smaller values of friction coefficient lead to lower force acting at the Z-direction. This is because lower friction coefficient in the support points allowed the pipe to displace easily which will lead to lower force acting on anchor points in the

pipe axial direction. Whereby, force in the X-direction shows minor increase due to larger piping displacements in transverse direction.

Besides that, shorter piperack span and larger dimension “A” in expansion loop also lead to lower force in Z-direction. Other than that, adjustments on dimension “B” and “D” in the expansion loop shows no significant reduction of force in Z-direction. Table 4.1 below shows the changes of loading magnitude against the base case model due to various factors as described in Chapter 3.

Table 4.1: Changes on Magnitude of Forces due to Different Factors

Factors	Changes in Force Components (Newton)			Essentiality
	ΔX	ΔY	ΔZ	
Material change to A335 P11	-863	+64	-2915	Moderate
Friction coefficient down to 0.05	+3225	-128	-20634	High
Piperack Span down to 6.0m	+5123	-3672	-9325	High
Dimension "A" up to 4548mm	-1537	-414	-8718	High
Dimension "B" up to 7100 & "C" down to 3100mm	+383	-300	-1682	Low
Dimension "D" up to 1466mm	-866	-291	-1492	Low

Remarks: (-) = Decrease, (+) = Increase

Table above shows that piping material A335 P11 generates lower force in the Z-direction when compared to A335 P22. On the other hand, force in Y-direction shows that it is less sensitive to most of the factors, except for the piperack span when it reduced from 7.5 meters to 6.0 meters, the force in Y-direction decreased by 3672 newton, which is favourable. Generally, shorter piperack span lead to smaller force in Z-direction because shorter pipe length leads to smaller thermal expansions and displacements.

Among the factors listed in Table 4.1, shorter piperack span and lower friction coefficient shows larger increase of the force in X-direction. Whereby, other factors do not shows as essential elements that lead to major changes of the force in X-direction. Generally, factors that lead to changes on force components that are less than 1000 newton are consider as less essential.

In the next section, several optimisations will be incorporate into base case model based on the essential factors that contributed to lower forces on anchor point.

4.3 Optimal Design

In order to proceed for optimisations in the base case, factors below which shows to be essential in contributing to lower forces on anchor point will be incorporate into the base case.

- Lower friction coefficient (0.05~0.15)
- Dimension "A" Up to 4548mm

Factors below that shows contribution to lower forces are not consider in the optimisation.

- Pipe material changed to A335 P11
- Piperack Span Down to 6.0 meters

The reason of not using A335 P11 as one of the optimisation method is because at temperature above 300°C, the allowable stress (The American Society of Mechanical Engineers, 2011 p161) of this material decreased much faster than A335 P22 materials (The American Society of Mechanical Engineers, 2011 p163). Whereby in terms of cost ratio between P11 and P22, generally it is 0.85:1.0 which means that P11 is cheaper than P22 by 15% if according to recent international steel market. The cost ratio that mentioned above is generally for reference purpose and maybe varies among different pipe manufacturers.

Regarding to the piperack span down to 6 meters, it will lead to higher civil structure cost because shorter piperack span means that more foundations/footings and column is required. Higher structure cost is not favourable because objective of this project is to reduce the forces on anchor point and subsequently reduce the complexity and cost of the piperack. However, in the real world, shorter piperack span may be consider when the civil structure cost is less significant than the piping cost.

In this section, optimisations were conducted by incorporate the adjustment on dimension "A" (4548mm) in expansion loop and various friction coefficients (0.05~0.15) into the base case model for stress analysis. Optimisation results are shown in the Table 4.2.

Table 4.2: Stress Analysis Results of Optimised Model

Node No.	Force Components (Newton)			Friction Coefficient
	X	Y	Z	
10	17750	-12122	56512	0.05
230	17750	-12122	-56512	
10	17038	-12148	61208	0.10
230	17038	-12148	-61208	
10	16354	-12174	65401	0.15
230	16354	-12174	-65401	

Based on the table above, it shows the drastic decrease of the force in the Z-direction when friction coefficient decreased. Whereby, the force in X-direction shows insignificant increase when friction coefficient decreased. Force in Y-direction shows not much difference in the optimised model.

Table below shows the changes in force components between optimised model and base case model. As explained earlier, only changes of force components on node 10 will be calculate since the model that use in this project is in symmetrical shape.

Table 4.3: Changes on Magnitude of Forces - Optimised Model VS Base Case Model

Node No.	Changes in Force Components (Newton)			Friction Coefficient
	ΔX	ΔY	ΔZ	
10	1759	538	-28841	0.05
10	1047	512	-24145	0.10
10	363	486	-19952	0.15

Remarks: (-) = Decrease, (+) = Increase

Next, code compliance (% of code stress against allowable stress) between optimised model and base case model are summarized as per table below.

Table 4.4: Code Compliance - Optimized Model VS Base Case Model

Model	Load Case	Code Stress (KPa)	Allowable Stress (KPa)	Code compliance (% of code stress against allowable stress)	Node	Friction coefficient
Base case Model	Sustained	43885.0	63326.2	69.3	45	0.30
Optimized Model-1	Sustained	49712.7	63326.2	78.5	45	0.15
Optimized Model-2	Sustained	49712.7	63326.2	78.5	45	0.10
Optimized Model-3	Sustained	49704.0	63326.2	78.5	45	0.05

Based on Table 4.4 above, both base case model and optimised model shows that highest code stress (%) occurred on the same node and both are during sustained condition. The highest code stress of optimised model is 78.5%, and it is higher than

the code stress in base case model, which is 69.3%. Location of node 45 that indicated in Figure 4.6 is for both base case model and optimised model. Subsequently, the stress distribution (%) during sustained condition for base case model and optimised model are shows in Figure 4.7 until 4.10 respectively.

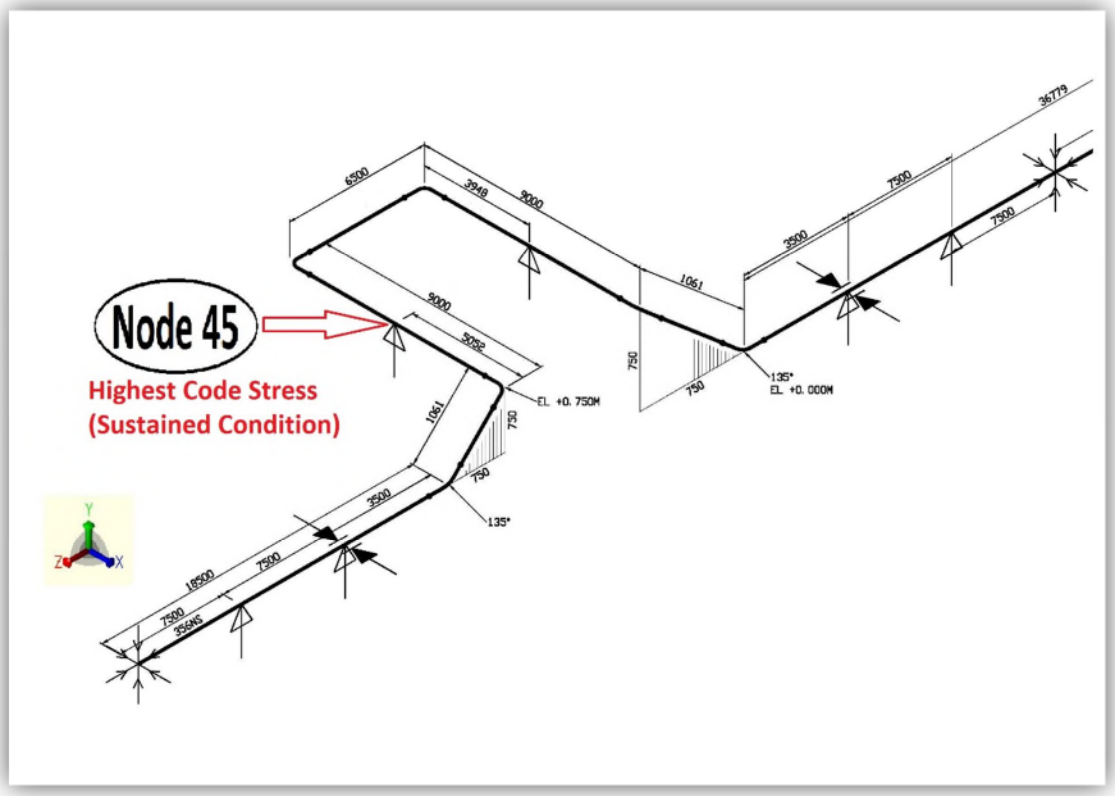

Figure 4.6: Location of Node for Highest Code Stress (%) in Both Base Case and Optimised Case

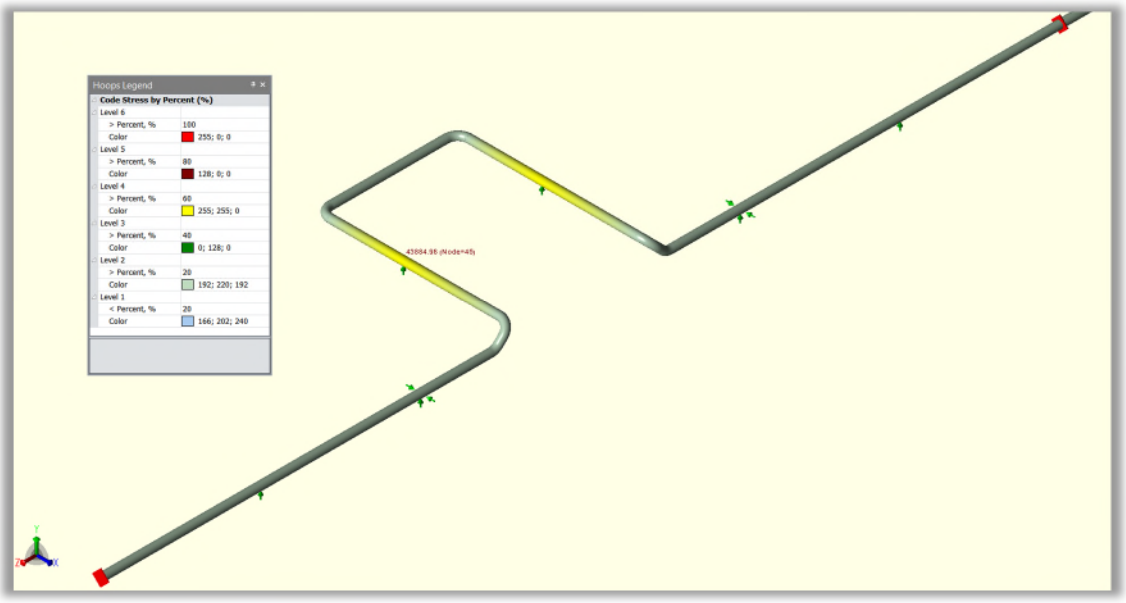

Figure 4.7: Sustained Condition- Distribution of Code Stress (%) for Base Case Model

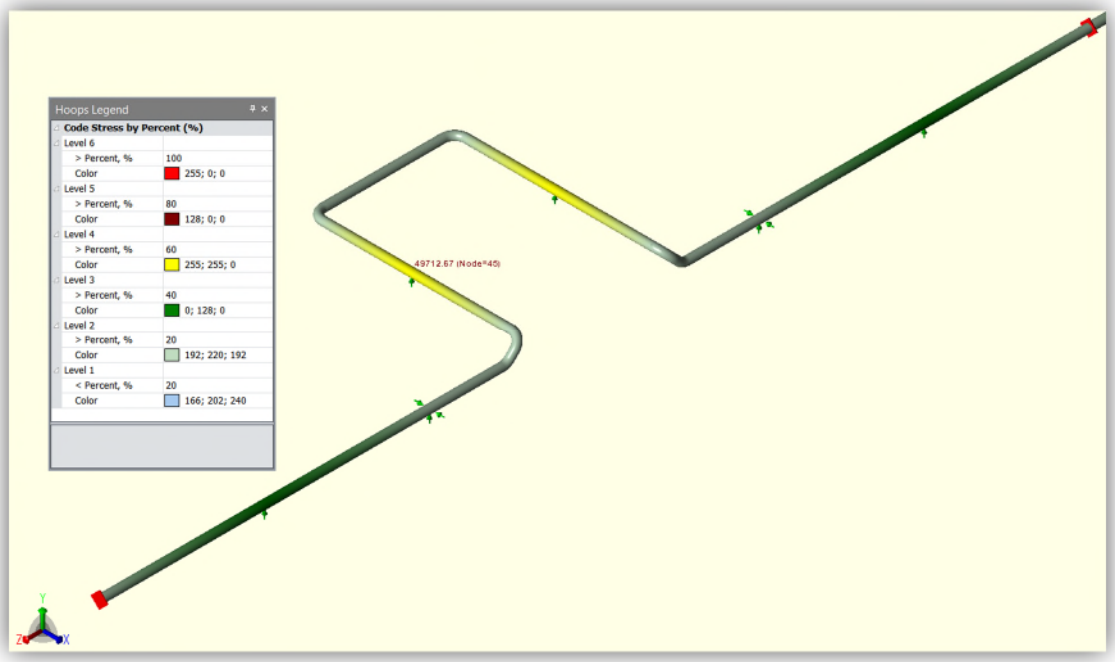

Figure 4.8: Sustained Condition- Distribution of Code Stress (%) for Optimised Model-1

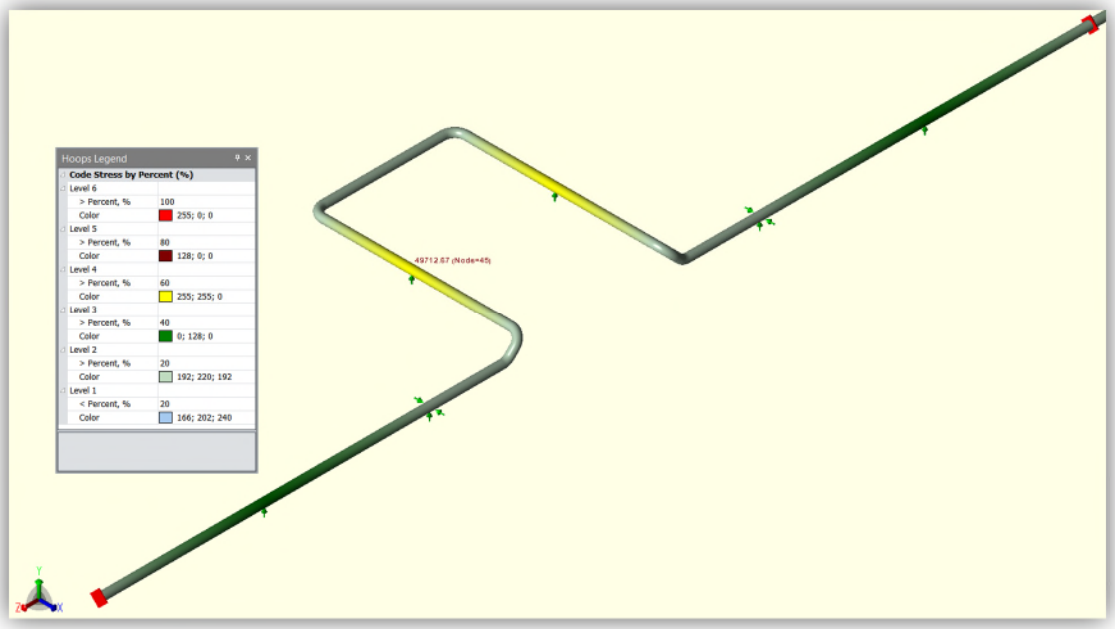

Figure 4.9: Sustained Condition- Distribution of Code Stress (%) for Optimised Model-2

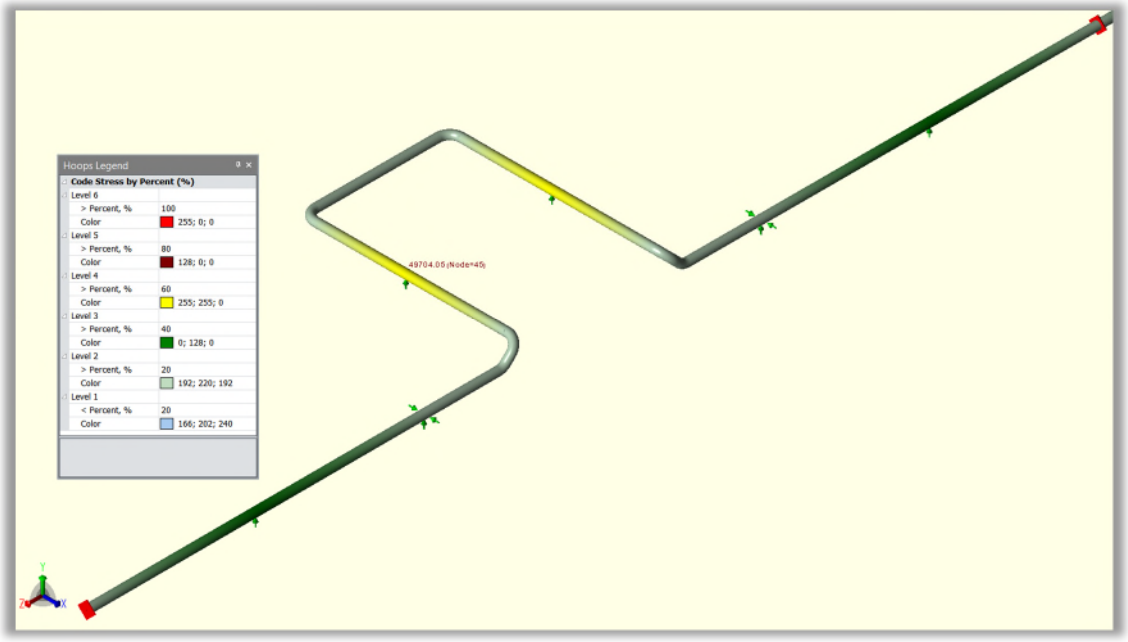

Figure 4.10: Sustained Condition- Distribution of Code Stress (%) for Optimised Model-3

Subsequently, based on the distribution of code stress (%) that shows between base case model and optimised model, an increase of code stress (%) was observed at the location near to anchor point which shows as dark green on all the optimised model. As shown in the legend of each figures (4.7~4.10), dark green means that the code stress is between 40%~60% of the allowable stress.

Beside the code stress, resultant force (operating condition) on node 10 for both base case and optimised case are shown in Table 4.5 and a graph (Figure 4.11) was plotted to provide better visualization.

Table 4.5: Resultant Force - Base Case Model VS Optimised Model

Model	Node	Case	Force Components (Newton)			Resultant Force (Newton)	Friction coefficient
			X	Y	Z		
Base case Model	10	0	15991	-12660	85353	87756	0.30
Optimised Model-1	10	1	16354	-12174	65401	68505	0.15
Optimised Model-2	10	2	17038	-12148	61208	64686	0.10
Optimised Model-3	10	3	17750	-12122	56512	60462	0.05

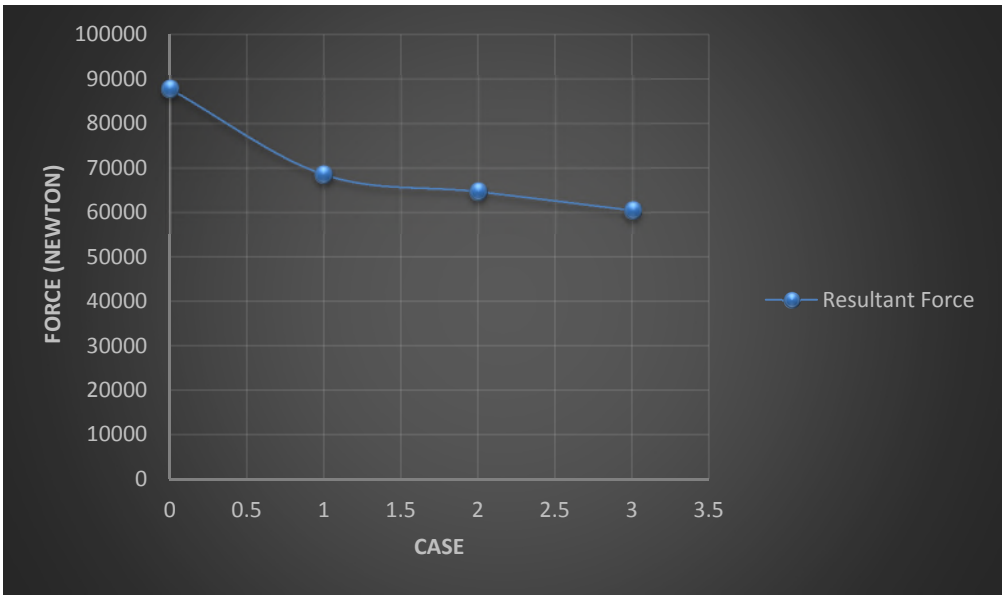

Figure 4.11: Resultant Force- Base Case Model VS Optimised Model

Based on the Figure above, resultant force of the optimised model (case 1, 2 and 3) shows significant decrease when compared against the base case model (case 0).

Table 4.6 shows the maximum displacements (operating condition) of each direction (X, Y, and Z) between base case model and optimised model during operating conditions.

Table 4.6: Thermal Displacements (Operating Condition) - Base Case Model VS Optimised Model

Model	Node	Maximum Displacement (mm)		
		X	Y	Z
Base case Model	50	-118.231	-15.171	19.607
	50	-118.231	-15.171	19.607
	38	-41.432	6.37	-135.604
Optimised Model-1	50	-121.04	-20.837	19.61
	50	-121.04	-20.837	19.61
	38	-40.63	7.274	-135.566
Optimised Model-2	50	-121.93	-20.807	19.61
	50	-121.93	-20.807	19.61
	38	-41.458	7.309	-135.572
Optimised Model-3	50	-122.843	-20.777	19.61
	50	-122.843	-20.777	19.61
	38	-42.307	7.347	-135.579

Remarks: xxxxx is the maximum value at each axis.

Based on the thermal displacements during operating conditions as shown in Table 4.6, it shows that the largest displacement of each axis remained on the same node for both base case model and optimised model. Besides that, there are no significant changes on the magnitude of thermal displacement between base case model and optimised model. For better visualization, Figure 4.12 shows the deflection shape of Optimised Model-3.

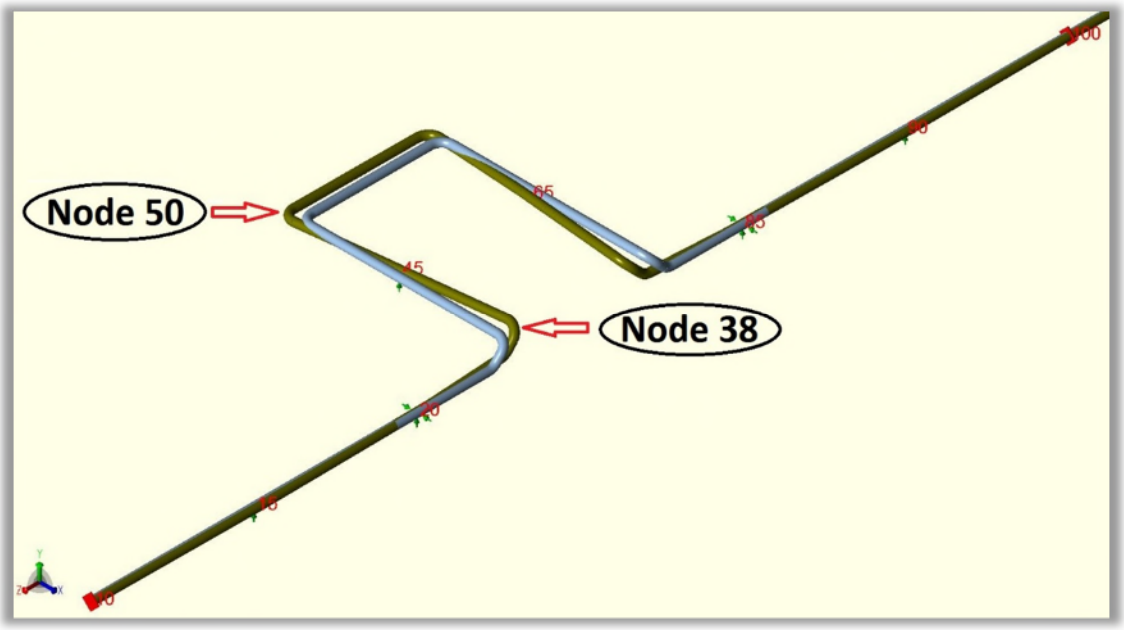

Figure 4.12: Thermal Displacement (Operating Condition) - Optimize Model-3

Based on thermal displacement as shown in the figure above, it shows symmetrical deflections (brown colour) between node 10 and 100. Since the piping model in this project is in symmetrical shape, hence the thermal displacements that occurred between node 100 and 230 must be equally same as the figure above.

4.4 Piperack Beam Design for Cost Reduction

As discussed in chapter 1, the purpose of this project is to find the possible approaches to reduce the forces on anchor point and subsequently reduce the beam size of the supporting structure. Due to costing point of view, steel beam is less economical than concrete beam with rebar reinforcement. The reason is that the size of the concrete beam and the quantity/size of rebar can be adjusted according to the civil design calculation. Whereby, steel beam does not have such flexibility and limited by the size range available in the market, which means that for loading that is slightly above the boundary limit of a particular steel beam it will require another steel size that may be much larger.

This section discussed about the differences on the size and quantity of the rebar in concrete beam between base case and optimised model with preliminary comparison on its tentative cost between these two models.

For easy understanding, Optimised Model-2 is selected to compare against base case model. In this comparison, supporting beam is assumed as concrete with rebar reinforcement. Based on the preliminary calculations, the size of the beam is 600mm X 230mm for both cases and the beam facing to be contact with piping is 230mm. As common practice, the piperack will carry other pipes and assumed as three numbers of 8” pipe with gas/air and two numbers of 8” pipe with water.

Figure 4.13 shows the tentative section view of the supporting beam and its piping. The vertical loading of each pipe are shown in Figure 4.13, except the loading of 14” steam piping which will be based on its resultant force. In this preliminary comparison, the beam size is designed to withstand the indicated loading from all directions or axis. Length of concrete beam is 4 meters and height of the piperack is 6 meters.

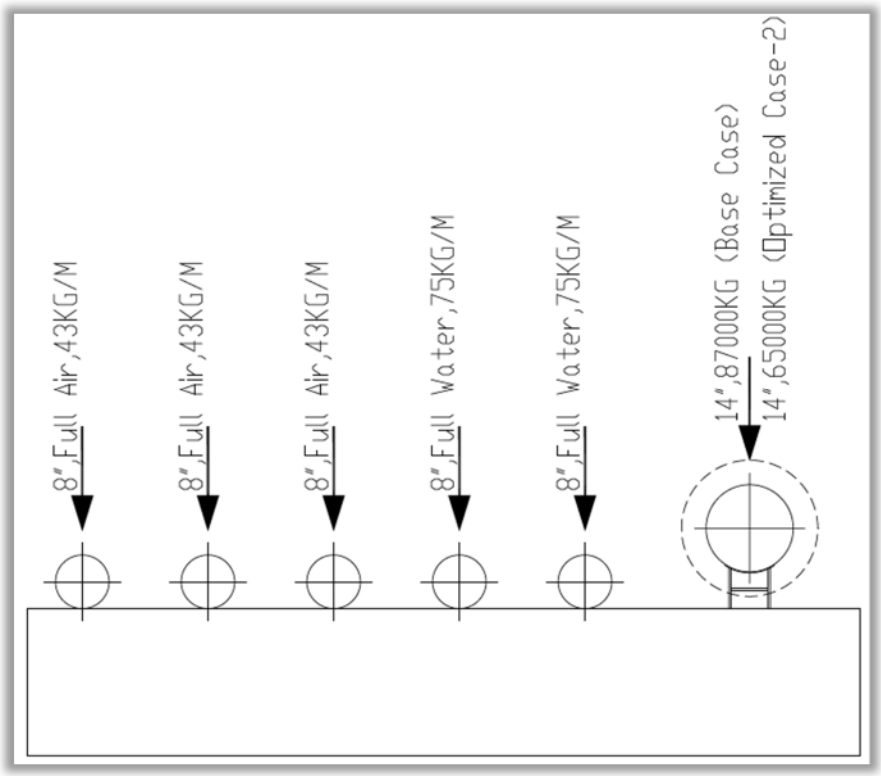

Figure 4.13: Loading on Piperack for Preliminary Comparison on Civil Beam Size

Table 4.7 shows the tentative size of rebar for base case model and optimised model. Required sectional area of rebar is calculated based on the load that shown in Figure 4.13. The length of rebar depends on the length of beam, which is around 4 meters in this project. Since the sizes of rebar that available in the market are quite varied, hence only three sizes are shown in the Table 4.7.

Table 4.7: Size of Rebar and Quantity- Base Case Model VS Optimised Model-2

Model	Required Area of Rebars at Bottom of Beam (mm^2)	Quantity of Rebar (pieces)		
		Ø25mm	Ø20mm	Ø16mm
Base case Model	1290	2.63	4.11	6.42
Optimised Model-2	1213	2.47	3.86	6.03

Table 4.7 shows that base case required more numbers of rebar than the optimised model. The unit rate of rebar is determined by price/weight and is currently assumed as RM5.50/kg. It is important to shows the price of rebar between base case and optimised model as per table below.

Table 4.8: Price of Rebar - Base Case Model VS Optimized Model-2

Model	Required Area of Rebars at Bottom of Beam (mm^2)	Cost of Rebars (RM/m) (Note 1)		
		Ø25mm (3.83kg/m)	Ø20mm (2.45kg/m)	Ø16mm (1.57kg/m)
Base case Model	1290	55.41	55.41	55.40
Optimised Model-2	1213	52.04	52.04	52.03

Remark: Rebar density=7800kg/m^3

Notes:

1. Cost of Rebar calculated as below;

   Weight/Length = π x (Rebar Diameter/2)^2 x Rebar Density

   = (22/7) x (0.025/2)^2 x 7800

   = 3.83kg/m

   Cost of Rebar = (Weight/Length) x Rebar Quantity x (Price/Weight)

   = 3.83 x 2.63 x 5.50

   = RM55.41

According to the table above, it shows that the cost of rebar for optimized model is around 6% lowered than the base case model. This 6% of cost saving is only calculated for one concrete beam and the total number of concrete beams will be subject to the scale of each project. Total cost saving may also involve reduction of piperack footing size due to lower resultant force, however detail studies was not cover in this project.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

This chapter concludes all the results and findings that obtained in chapter 3 and 4. Based on the research outcome of this project, it shows that the methods mentioned in research proposal are not all effective in reducing the forces on anchor points.

However, some factors, such as friction coefficient and adjustment of Dimension ”A” on expansion loop shows as important factor in reduction of forces at anchor points. Based on the model that optimised using these two factors, it shows significant reduction to the forces that act on anchor points. From Table 4.5, it shows that all three optimised models produced lower resultant force as compared to the base case model.

With not much difference on the thermal displacements between optimised model and base case model, this is favourable because large thermal displacements will lead to interference to nearby piping on piperack and relevant structure like piperack column. In this project, thermal displacements in horizontal (X & Z) directions are higher than vertical (Y) direction.

The research outcome of this project shows that a large reduction in the force at axial direction (Z-axis) could practically be achieved. However, there are several precautions need to be taken care, especially after the optimisation. Further

information on the precautions and recommendations will be discussed in the subsequent section in this chapter.

5.2 Recommendations

This section discusses about the recommendation to achieve the optimisation as discovered in chapter 3 and 4.

Interfacing material with lower friction coefficient at the support points are shown in Table 5.0 below.

Table 5.0: Interfacing Material with Lower Friction Coefficient

Interfacing Material	Friction Coefficient
Graphite - Graphite	0.15
Stainless Steel-PTFE	0.10
PTFE-PTFE	0.08
Rolling support*	0.05

Remarks: *ONLY apply if necessary

Based on the research outcome of this project, interfacing material with lower friction coefficient shall only applied on resting support and guide support. Because anchor points normally welded or bolted on piperack as fix point and no interfacing material can be inserted. This kind of pipe supports with special interfacing material can be procured from available vendor in the market. Although this type of supports are not commonly used, but sometimes necessary for some specific piping system like high pressure steam where high loading are likely to incur at the anchor points.

As for the adjustment of dimension “A” in expansion loop, it involved no special material to be used but indeed only a simple dimension adjustment.

5.3 Precautions

This section discuss about the precautions to be considered when optimisation of the piping systems is necessary.

Firstly, optimisation shall only be applied when there are unacceptable high loadings at the anchor points. Because pipe support design with lower friction coefficient does not fall under common categories, but need to be procured from available pipe support vendor. Sometimes, longer lead time may be incurred but subject to market and vendor availability, of course not to forget about the project schedule to meet the completion date.

Since the adjustment of dimension “A” may lead to larger deflections of the expansion loop during sustained or operating conditions. Hence, it is important to check the allowable deflections of each project to avoid conflict with project specifications. Not to forget that adjustment on dimension “A” will lead to longer shape of expansion loops, thus it is important to ensure its possible interference with nearby piping, equipment or civil structure.

Besides that, it is important to make sure that the anchor points in symmetrical piping systems produced forces that can be withstand by the piperack. In addition, it is necessary to ensure the support design of pipe shoe is able to withstand the restraint load as shows in the stress analysis report produce by CAESER II.

Based on the stress analysis report that produce by CAESER II regarding to the thermal displacements that occur during operation conditions, it must be use to ensure that either horizontal or vertical movement did not clash or interfere with any nearby piping, equipment or civil structure and must keep a minimum space between them. Minimum space to be keep is normally between 50mm or 100 mm and subject to requirements in project specification.

Although preliminary comparison shown that there is cost reduction for rebar in concrete beam, however the detail calculations on the civil structure was not covered

in this project and further assessment is necessary especially during detail design of piperack structure.

Finally, all data that simulated and collected during the research period of this project are used to analyse which factors are act as crucial elements that contribute to the loading on anchor point. Beside the results and findings that discussed in this project, there may be still some other methods or elements not covered in this project.

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APPENDICES

APPENDIX A: Analysis/Calculation Report

A.1 CAESAR II Analysis Report

- 1-1 Root Cause Investigation [80 pages]
- 1-2 Possible Approach [600 pages]
- 1-3 Optimised Model [60 pages]

A.2 Wall Thickness Calculation [2 pages]

A.3 Preliminary Civil Beam Size and Rebar Calculation [8 pages]

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .30

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .30

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .30
Node 85 +Y Mu = .30

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .30

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Root Cause:
Base Case

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Root Cause:
Base Case

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Root Cause:
Base Case

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117364.4 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27191.6 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138651.9 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42454.8	0	0	15	31956.2	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27181.6	227785.8	11.9		14953.3	227204.6	6.6	B31.3
1(OPE)	15	32204.4	0	0	20	76132.4	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		14953.3	227203.4	6.6		60613.6	228909.4	26.5	B31.3
1(OPE)	20	76329.4	0	0	28	93582.3	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		60613.6	228906.8	26.5		78470.5	233366.2	33.6	B31.3
1(OPE)	28	93582.3	0	0	29	94586	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		78470.5	233366.2	33.6		79450.4	233174.8	34.1	B31.3
1(OPE)	29	94586	0	0	30	95489.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		79450.4	233174.8	34.1		80076.4	233001	34.4	B31.3
1(OPE)	30	95489.3	0	0	38	96243.7	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		80076.4	233001	34.4		80904.9	232825.1	34.7	B31.3
1(OPE)	38	96243.7	0	0	39	94109.1	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		80904.9	232825.1	34.7		78691.7	232744.5	33.8	B31.3

Root Cause:
Base Case

1(OPE)	39	94109.1	0	0	40	86853.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		78691.7	232744.5	33.8		70619.5	233040.4	30.3	B31.3
1(OPE)	40	86853.2	0	0	45	60647.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		70619.5	233040.4	30.3		35593.4	207641.7	17.1	B31.3
1(OPE)	45	61000.6	0	0	48	123433.3	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35593.4	207665.7	17.1		106298.1	231505.7	45.9	B31.3
1(OPE)	48	123433.3	0	0	49	130178.8	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106298.1	231505.7	45.9		114123	233171.3	48.9	B31.3
1(OPE)	49	130178.8	0	0	50	132943.4	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114123	233171.3	48.9		117364.4	232689.6	50.4	B31.3
1(OPE)	50	132943.4	0	0	59	130178.8	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117364.4	232689.6	50.4		114123	233171.3	48.9	B31.3
1(OPE)	59	130178.8	0	0	60	123433.3	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114123	233171.3	48.9		106298.1	231505.7	45.9	B31.3
1(OPE)	60	123433.3	0	0	65	61000.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106298.1	231505.7	45.9		35593.3	207665.7	17.1	B31.3
1(OPE)	65	60647.7	0	0	68	86853.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35593.3	207641.7	17.1		70619.5	233040.4	30.3	B31.3
1(OPE)	68	86853.2	0	0	69	94109.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		70619.5	233040.4	30.3		78691.7	232744.5	33.8	B31.3
1(OPE)	69	94109.2	0	0	70	96243.7	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		78691.7	232744.5	33.8		80904.9	232825.1	34.7	B31.3
1(OPE)	70	96243.7	0	0	78	95489.3	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		80904.9	232825.1	34.7		80076.4	233001	34.4	B31.3
1(OPE)	78	95489.3	0	0	79	94586.1	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		80076.4	233001	34.4		79450.4	233174.8	34.1	B31.3
1(OPE)	79	94586.1	0	0	80	93582.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		79450.4	233174.8	34.1		78470.5	233366.2	33.6	B31.3

Root Cause:
Base Case
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1(OPE)	80	93582.3	0	0	85	76329.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		78470.5	233366.2	33.6		60613.7	228906.8	26.5	B31.3
1(OPE)	85	76132.5	0	0	90	32204.4	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		60613.7	228909.4	26.5		14953.3	227203.5	6.6	B31.3
1(OPE)	90	31956.2	0	0	100	42454.9	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		14953.3	227204.6	6.6		27181.7	227785.7	11.9	B31.3
1(OPE)	100	42454.9	0	0	110	31956.2	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27181.7	227785.7	11.9		14953.3	227204.6	6.6	B31.3
1(OPE)	110	32204.4	0	0	120	76132.5	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		14953.3	227203.5	6.6		60613.7	228909.4	26.5	B31.3
1(OPE)	120	76329.5	0	0	128	93582.4	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		60613.7	228906.8	26.5		78470.5	233366.2	33.6	B31.3
1(OPE)	128	93582.4	0	0	129	94586.1	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		78470.5	233366.2	33.6		79450.4	233174.8	34.1	B31.3
1(OPE)	129	94586.1	0	0	130	95489.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		79450.4	233174.8	34.1		80076.5	233001	34.4	B31.3
1(OPE)	130	95489.3	0	0	139	94109.2	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		80076.5	233001	34.4		78691.7	232744.5	33.8	B31.3
1(OPE)	139	94109.2	0	0	140	86853.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		78691.7	232744.5	33.8		70619.5	233040.4	30.3	B31.3
1(OPE)	140	86853.2	0	0	150	60647.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		70619.5	233040.4	30.3		35593.3	207641.7	17.1	B31.3
1(OPE)	150	61000.6	0	0	158	123433.3	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35593.3	207665.7	17.1		106298.1	231505.7	45.9	B31.3
1(OPE)	158	123433.3	0	0	159	130178.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106298.1	231505.7	45.9		114123	233171.2	48.9	B31.3
1(OPE)	159	130178.7	0	0	160	132943.4	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114123	233171.2	48.9		117364.4	232689.6	50.4	B31.3

Root Cause:
Base Case
Page 11 of 20

1(OPE)	160	132943.4	0	0	168	132943.4	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117364.4	232689.6	50.4		117364.4	232689.6	50.4	B31.3
1(OPE)	168	132943.4	0	0	169	130178.8	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117364.4	232689.6	50.4		114123	233171.2	48.9	B31.3
1(OPE)	169	130178.8	0	0	170	123433.3	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114123	233171.2	48.9		106298.1	231505.7	45.9	B31.3
1(OPE)	170	123433.3	0	0	180	61000.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106298.1	231505.7	45.9		35593.3	207665.7	17.1	B31.3
1(OPE)	180	60647.7	0	0	188	86853.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35593.3	207641.7	17.1		70619.5	233040.4	30.3	B31.3
1(OPE)	188	86853.2	0	0	189	94109.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		70619.5	233040.4	30.3		78691.7	232744.5	33.8	B31.3
1(OPE)	189	94109.2	0	0	190	96243.7	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		78691.7	232744.5	33.8		80904.9	232825.1	34.7	B31.3
1(OPE)	190	96243.7	0	0	199	94586	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		80904.9	232825.1	34.7		79450.3	233174.8	34.1	B31.3
1(OPE)	199	94586	0	0	200	93582.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		79450.3	233174.8	34.1		78470.4	233366.2	33.6	B31.3
1(OPE)	200	93582.3	0	0	210	76329.4	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		78470.4	233366.2	33.6		60613.7	228906.8	26.5	B31.3
1(OPE)	210	76132.4	0	0	220	32204.4	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		60613.7	228909.4	26.5		14953.3	227203.4	6.6	B31.3
1(OPE)	220	31956.2	0	0	230	42454.8	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		14953.3	227204.6	6.6		27181.6	227785.8	11.9	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15991	-12660	85353	-13958	-78094	4030	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	16100	1295	85671	3214	-78353	5556	0	0	0
	MAX	16100/L3	-13954/L	85671/L	-17172/L	-78353/L	5556/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1873	-34468	-10169	0	0	0	9.965	0	-54.11
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1406	-5232	-10121	0	0	0	9.962	0	-54.11
	MAX	1873/L1	-34468/L	-10169/L1				9.965/L1	-0.000/L1	-54.110/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3397	-23594	-8036	0	0	0	-3	0	-108.229
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-2076	546	-7932	0	0	0	-2.992	0	-108.228
	MAX	-3397/L1	-24140/L	-8036/L1				-3.000/L1	-0.000/L2	-108.229/L1
45		Rigid +Y								
	1(OPE)	-12904	-47698	-6185	0	0	0	-84.252	0	-40.381
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-13868	3391	-6768	0	0	0	-84.258	0	-40.384
	MAX	-13868/L	-51089/L	-6768/L3				-84.258/L	-0.000/L2	-40.384/L3
65		Rigid +Y								
	1(OPE)	-12904	-47698	6185	0	0	0	-84.252	0	40.381
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-13868	3391	6768	0	0	0	-84.258	0	40.384
	MAX	-13868/L	-51089/L	6768/L3				-84.258/L	-0.000/L2	40.384/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3398	-23594	8036	0	0	0	-3	0	108.229
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-2076	546	7932	0	0	0	-2.992	0	108.228
	MAX	-3398/L1	-24140/L	8036/L1				-3.000/L1	-0.000/L2	108.229/L1
90		Rigid +Y								
	1(OPE)	1873	-34468	10169	0	0	0	9.965	0	54.11
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1406	-5232	10121	0	0	0	9.962	0	54.11
	MAX	1873/L1	-34468/L	10169/L1				9.965/L1	-0.000/L1	54.110/L1
100		Rigid ANC								
	1(OPE)	31983	-25320	0	0	0	8060	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	32200	2589	0	0	0	11111	0	0	0
	MAX	32200/L3	-27909/L	-0/L1	0/L2	-0/L1	11111/L3	0.000/L3	-0.000/L2	-0.000/L1

Root Cause:
Base Case

110		Rigid +Y								
	1(OPE)	1873	-34468	-10169	0	0	0	9.965	0	-54.11
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1406	-5232	-10121	0	0	0	9.962	0	-54.11
	MAX	1873/L1	-34468/L	-10169/L1				9.965/L1	-0.000/L1	-54.110/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3398	-23594	-8036	0	0	0	-3	0	-108.229
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-2076	546	-7932	0	0	0	-2.992	0	-108.228
	MAX	-3398/L1	-24140/L	-8036/L1				-3.000/L1	-0.000/L2	-108.229/L1
150		Rigid +Y								
	1(OPE)	-12904	-47698	-6185	0	0	0	-84.252	0	-40.381
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-13868	3391	-6768	0	0	0	-84.258	0	-40.384
	MAX	-13868/L	-51089/L	-6768/L3				-84.258/L	-0.000/L2	-40.384/L3
180		Rigid +Y								
	1(OPE)	-12904	-47698	6185	0	0	0	-84.252	0	40.381
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-13868	3391	6768	0	0	0	-84.258	0	40.384
	MAX	-13868/L	-51089/L	6768/L3				-84.258/L	-0.000/L2	40.384/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3397	-23594	8036	0	0	0	-3	0	108.229
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-2076	546	7932	0	0	0	-2.992	0	108.228
	MAX	-3397/L1	-24140/L	8036/L1				-3.000/L1	-0.000/L2	108.229/L1
220		Rigid +Y								
	1(OPE)	1873	-34468	10169	0	0	0	9.965	0	54.11
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1406	-5232	10121	0	0	0	9.962	0	54.11
	MAX	1873/L1	-34468/L	10169/L1				9.965/L1	-0.000/L1	54.110/L1
230		Rigid ANC								
	1(OPE)	15991	-12660	-85353	13958	78094	4030	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	16100	1295	-85671	-3214	78353	5556	0	0	0
	MAX	16100/L3	-13954/L	-85671/L	17172/L3	78353/L3	5556/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.962	0	-54.11	-0.0065	-0.0713	0.0285
20	-2.992	0	-108.228	0.0263	0.3572	0.0569
28	-32.862	2.825	-131.892	0.0759	0.7023	0.0694
29	-35.492	3.401	-133.308	0.0826	0.7471	0.0727
30	-37.962	4.498	-134.381	0.0884	0.7891	0.0798
38	-41.318	6.408	-135.598	0.0913	0.8319	0.0761
39	-46.891	8.541	-134.66	0.0978	0.9148	0.0918
40	-51.621	8.894	-128.934	0.0999	0.9993	0.1005
45	-84.258	0	-40.384	0.059	1.1202	0.1188
48	-108.927	-7.078	17.323	0.0281	0.7507	0.1188
49	-113.474	-7.791	20.754	0.0241	0.6224	0.1193
50	-118.236	-7.976	19.607	0.019	0.4873	0.1197
59	-113.474	-7.791	-20.755	-0.0241	-0.6224	0.1193
60	-108.927	-7.078	-17.323	-0.0281	-0.7507	0.1188
65	-84.258	0	40.384	-0.059	-1.1202	0.1188
68	-51.621	8.894	128.934	-0.0999	-0.9993	0.1005
69	-46.891	8.541	134.66	-0.0978	-0.9148	0.0918
70	-41.318	6.408	135.598	-0.0913	-0.8319	0.0761
78	-37.962	4.498	134.381	-0.0884	-0.7891	0.0798
79	-35.492	3.401	133.308	-0.0826	-0.7471	0.0727
80	-32.862	2.825	131.892	-0.0759	-0.7023	0.0694
85	-2.992	0	108.228	-0.0263	-0.3572	0.0569
90	9.962	0	54.11	0.0065	0.0713	0.0285
100	0	0	0	0	0	0
110	9.962	0	-54.11	-0.0065	-0.0713	0.0285
120	-2.992	0	-108.228	0.0263	0.3572	0.0569
128	-32.862	2.825	-131.892	0.0759	0.7023	0.0694
129	-35.492	3.401	-133.308	0.0826	0.7471	0.0727
130	-37.962	4.498	-134.381	0.0884	0.7891	0.0798
139	-46.891	8.541	-134.66	0.0978	0.9148	0.0918
140	-51.621	8.894	-128.934	0.0999	0.9993	0.1005
150	-84.258	0	-40.384	0.059	1.1202	0.1188
158	-108.927	-7.078	17.323	0.0281	0.7507	0.1188
159	-113.473	-7.791	20.755	0.0241	0.6224	0.1193
160	-118.236	-7.976	19.607	0.019	0.4873	0.1197
168	-118.236	-7.976	-19.607	-0.019	-0.4873	0.1197
169	-113.474	-7.791	-20.754	-0.0241	-0.6224	0.1193
170	-108.927	-7.078	-17.323	-0.0281	-0.7507	0.1188
180	-84.258	0	40.384	-0.059	-1.1202	0.1188

Root Cause:
Base Case

188	-51.621	8.894	128.934	-0.0999	-0.9993	0.1005
189	-46.891	8.541	134.66	-0.0978	-0.9148	0.0918
190	-41.318	6.408	135.598	-0.0913	-0.8319	0.0761
199	-35.492	3.401	133.308	-0.0826	-0.7471	0.0727
200	-32.862	2.825	131.892	-0.0759	-0.7023	0.0694
210	-2.992	0	108.228	-0.0263	-0.3572	0.0569
220	9.962	0	54.11	0.0065	0.0713	0.0285
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:41
Job Name: A335 P22_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.965	0	-54.11	-0.0076	-0.0719	0.0207
20	-3	0	-108.229	0.0308	0.3598	0.0413
28	-33.071	2.795	-131.893	0.0749	0.7058	0.0503
29	-35.699	3.369	-133.309	0.0817	0.7504	0.0534
30	-38.14	4.463	-134.384	0.0876	0.7921	0.0602
38	-41.432	6.37	-135.604	0.0904	0.8347	0.0562
39	-46.921	8.554	-134.665	0.0963	0.9168	0.0713
40	-51.615	9.041	-128.932	0.0975	1.0005	0.0799
45	-84.252	0	-40.381	0.0479	1.1198	0.1733
48	-108.921	-12.959	17.322	0.0104	0.7507	0.2398
49	-113.468	-14.528	20.754	0.0056	0.6224	0.2419
50	-118.231	-15.171	19.607	0.001	0.4873	0.2426
59	-113.468	-14.528	-20.754	-0.0056	-0.6224	0.2419
60	-108.921	-12.959	-17.322	-0.0104	-0.7507	0.2398
65	-84.252	0	40.381	-0.0479	-1.1198	0.1733
68	-51.615	9.041	128.932	-0.0975	-1.0005	0.0799
69	-46.921	8.554	134.665	-0.0963	-0.9168	0.0713
70	-41.432	6.37	135.604	-0.0904	-0.8347	0.0562
78	-38.14	4.463	134.384	-0.0876	-0.7921	0.0602
79	-35.699	3.369	133.309	-0.0817	-0.7504	0.0534
80	-33.071	2.795	131.893	-0.0749	-0.7058	0.0503
85	-3	0	108.229	-0.0308	-0.3598	0.0413
90	9.965	0	54.11	0.0076	0.0719	0.0207
100	0	0	0	0	0	0
110	9.965	0	-54.11	-0.0076	-0.0719	0.0207
120	-3	0	-108.229	0.0308	0.3598	0.0413
128	-33.071	2.795	-131.893	0.0749	0.7058	0.0503
129	-35.699	3.369	-133.309	0.0817	0.7504	0.0534
130	-38.14	4.463	-134.384	0.0876	0.7921	0.0602
139	-46.921	8.554	-134.665	0.0963	0.9168	0.0713
140	-51.615	9.041	-128.932	0.0975	1.0005	0.0799
150	-84.252	0	-40.381	0.0479	1.1198	0.1733
158	-108.921	-12.959	17.322	0.0104	0.7507	0.2398
159	-113.468	-14.528	20.754	0.0056	0.6224	0.2419
160	-118.231	-15.171	19.607	0.001	0.4873	0.2426
168	-118.231	-15.171	-19.607	-0.001	-0.4873	0.2426
169	-113.468	-14.528	-20.754	-0.0056	-0.6224	0.2419
170	-108.921	-12.959	-17.322	-0.0104	-0.7507	0.2398
180	-84.252	0	40.381	-0.0479	-1.1198	0.1733

Root Cause:
Base Case

188	-51.615	9.041	128.932	-0.0975	-1.0005	0.0799
189	-46.921	8.554	134.665	-0.0963	-0.9168	0.0713
190	-41.432	6.37	135.604	-0.0904	-0.8347	0.0562
199	-35.699	3.369	133.309	-0.0817	-0.7504	0.0534
200	-33.071	2.795	131.893	-0.0749	-0.7058	0.0503
210	-3	0	108.229	-0.0308	-0.3598	0.0413
220	9.965	0	54.11	0.0076	0.0719	0.0207
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 52,984 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (181)A335 P11 E= 204,204,624 KPa
EH1= 166,057,632 KPa EH2= 204,204,624 KPa EH3= 204,204,624 KPa
EH4= 204,204,624 KPa EH5= 204,204,624 KPa EH6= 204,204,624 KPa
EH7= 204,204,624 KPa EH8= 204,204,624 KPa EH9= 204,204,624 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

Root Cause:
Different Pipe Material

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .30

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .30

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .30
Node 85 +Y Mu = .30

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .30

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

Root Cause:
Different Pipe Material

Node 110 +Y Mu = .30

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 129
Angle/Node @2= .00 128

From 130 To 140 DY= 750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 199

From 200 To 210 DZ= -3,500.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS

Root Cause:
Different Pipe Material

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (181)A335 P11 E= 204,204,624 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 52,984 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Root Cause:
Different Pipe Material

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide			3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide			3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide			3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide			3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

```
INPUT UNITS USED...

UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =  mm.
     FORCE           pounds      x     4.448  =  N.
     MASS(dynamics)  pounds      x     0.454  =  Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =  N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =  N.m.
     STRESS          lbs./sq.in. x     6.895  =  KPa
     TEMP. SCALE     degrees F.  x     0.556  =  C
     PRESSURE        psig        x     6.895  =  KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =  KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =  kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =  kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =  kg./cu.cm.
```

Root Cause:
Different Pipe Material
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TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Root Cause:
Different Pipe Material

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Root Cause:
Different Pipe Material

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 82.8 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 52984.1
Axial Stress: 17793.5 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 112260.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 26146.8 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 133402.1 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	41090.6	0	0	15	31305.8	0	0	B31.3
2(SUS)		23740.8	52984.1	44.8		24322	52984.1	45.9	B31.3
3(EXP)		25711.1	214858.1	12		14167.2	214277	6.6	B31.3
1(OPE)	15	31552.2	0	0	20	73084.6	0	0	B31.3
2(SUS)		24323.2	52984.1	45.9		22617.4	52984.1	42.7	B31.3
3(EXP)		14167.2	214275.8	6.6		57485.6	215981.5	26.6	B31.3
1(OPE)	20	73275.8	0	0	28	90547.6	0	0	B31.3
2(SUS)		22620.1	52984.1	42.7		18161.1	52984.1	34.3	B31.3
3(EXP)		57485.6	215978.9	26.6		75372.8	220437.9	34.2	B31.3
1(OPE)	28	90547.6	0	0	29	91553.8	0	0	B31.3
2(SUS)		18161.1	52984.1	34.3		18352.8	52984.1	34.6	B31.3
3(EXP)		75372.8	220437.9	34.2		76359.7	220246.2	34.7	B31.3
1(OPE)	29	91553.8	0	0	30	92457.6	0	0	B31.3
2(SUS)		18352.8	52984.1	34.6		18526.6	52984.1	35	B31.3
3(EXP)		76359.7	220246.2	34.7		77000	220072.4	35	B31.3
1(OPE)	30	92457.6	0	0	38	93228.8	0	0	B31.3
2(SUS)		18526.6	52984.1	35		18702.7	52984.1	35.3	B31.3
3(EXP)		77000	220072.4	35		77845.8	219896.3	35.4	B31.3
1(OPE)	38	93228.8	0	0	39	91226.3	0	0	B31.3
2(SUS)		18702.7	52984.1	35.3		18783.6	52984.1	35.5	B31.3
3(EXP)		77845.8	219896.3	35.4		75779	219815.4	34.5	B31.3

Root Cause:
Different Pipe Material

1(OPE)	39	91226.3	0	0	40	84274.7	0	0	B31.3
2(SUS)		18783.6	52984.1	35.5		18487.2	52984.1	34.9	B31.3
3(EXP)		75779	219815.4	34.5		68042.5	220111.8	30.9	B31.3
1(OPE)	40	84274.7	0	0	45	59433	0	0	B31.3
2(SUS)		18487.2	52984.1	34.9		43885	52984.1	82.8	B31.3
3(EXP)		68042.5	220111.8	30.9		34084.4	194714	17.5	B31.3
1(OPE)	45	59786.7	0	0	48	118817.6	0	0	B31.3
2(SUS)		43861	52984.1	82.8		20021	52984.1	37.8	B31.3
3(EXP)		34084.4	194738	17.5		101680.9	218578	46.5	B31.3
1(OPE)	48	118817.6	0	0	49	125263.5	0	0	B31.3
2(SUS)		20021	52984.1	37.8		18355.4	52984.1	34.6	B31.3
3(EXP)		101680.9	218578	46.5		109161.8	220243.6	49.6	B31.3
1(OPE)	49	125263.5	0	0	50	127904.7	0	0	B31.3
2(SUS)		18355.4	52984.1	34.6		18837.1	52984.1	35.6	B31.3
3(EXP)		109161.8	220243.6	49.6		112260.8	219761.9	51.1	B31.3
1(OPE)	50	127904.7	0	0	59	125263.5	0	0	B31.3
2(SUS)		18837.1	52984.1	35.6		18355.4	52984.1	34.6	B31.3
3(EXP)		112260.8	219761.9	51.1		109161.8	220243.6	49.6	B31.3
1(OPE)	59	125263.5	0	0	60	118817.5	0	0	B31.3
2(SUS)		18355.4	52984.1	34.6		20021	52984.1	37.8	B31.3
3(EXP)		109161.8	220243.6	49.6		101680.9	218578	46.5	B31.3
1(OPE)	60	118817.5	0	0	65	59786.7	0	0	B31.3
2(SUS)		20021	52984.1	37.8		43861	52984.1	82.8	B31.3
3(EXP)		101680.9	218578	46.5		34084.3	194738	17.5	B31.3
1(OPE)	65	59433	0	0	68	84274.7	0	0	B31.3
2(SUS)		43885	52984.1	82.8		18487.2	52984.1	34.9	B31.3
3(EXP)		34084.3	194714	17.5		68042.5	220111.8	30.9	B31.3
1(OPE)	68	84274.7	0	0	69	91226.3	0	0	B31.3
2(SUS)		18487.2	52984.1	34.9		18783.6	52984.1	35.5	B31.3
3(EXP)		68042.5	220111.8	30.9		75779	219815.4	34.5	B31.3
1(OPE)	69	91226.3	0	0	70	93228.8	0	0	B31.3
2(SUS)		18783.6	52984.1	35.5		18702.7	52984.1	35.3	B31.3
3(EXP)		75779	219815.4	34.5		77845.8	219896.3	35.4	B31.3
1(OPE)	70	93228.8	0	0	78	92457.7	0	0	B31.3
2(SUS)		18702.7	52984.1	35.3		18526.6	52984.1	35	B31.3
3(EXP)		77845.8	219896.3	35.4		77000.1	220072.4	35	B31.3
1(OPE)	78	92457.7	0	0	79	91553.8	0	0	B31.3
2(SUS)		18526.6	52984.1	35		18352.8	52984.1	34.6	B31.3
3(EXP)		77000.1	220072.4	35		76359.7	220246.2	34.7	B31.3
1(OPE)	79	91553.8	0	0	80	90547.6	0	0	B31.3
2(SUS)		18352.8	52984.1	34.6		18161.1	52984.1	34.3	B31.3
3(EXP)		76359.7	220246.2	34.7		75372.8	220437.9	34.2	B31.3

Root Cause:
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1(OPE)	80	90547.6	0	0	85	73275.9	0	0	B31.3
2(SUS)		18161.1	52984.1	34.3		22620.1	52984.1	42.7	B31.3
3(EXP)		75372.8	220437.9	34.2		57485.6	215978.9	26.6	B31.3
1(OPE)	85	73084.7	0	0	90	31552.2	0	0	B31.3
2(SUS)		22617.4	52984.1	42.7		24323.2	52984.1	45.9	B31.3
3(EXP)		57485.6	215981.5	26.6		14167.1	214275.8	6.6	B31.3
1(OPE)	90	31305.8	0	0	100	41090.7	0	0	B31.3
2(SUS)		24322	52984.1	45.9		23740.9	52984.1	44.8	B31.3
3(EXP)		14167.1	214277	6.6		25711.2	214858.1	12	B31.3
1(OPE)	100	41090.8	0	0	110	31305.8	0	0	B31.3
2(SUS)		23740.9	52984.1	44.8		24322	52984.1	45.9	B31.3
3(EXP)		25711.2	214858.1	12		14167.2	214277	6.6	B31.3
1(OPE)	110	31552.2	0	0	120	73084.7	0	0	B31.3
2(SUS)		24323.2	52984.1	45.9		22617.4	52984.1	42.7	B31.3
3(EXP)		14167.2	214275.8	6.6		57485.6	215981.6	26.6	B31.3
1(OPE)	120	73275.9	0	0	128	90547.7	0	0	B31.3
2(SUS)		22620.1	52984.1	42.7		18161	52984.1	34.3	B31.3
3(EXP)		57485.6	215978.9	26.6		75372.9	220437.9	34.2	B31.3
1(OPE)	128	90547.7	0	0	129	91553.8	0	0	B31.3
2(SUS)		18161	52984.1	34.3		18352.8	52984.1	34.6	B31.3
3(EXP)		75372.9	220437.9	34.2		76359.8	220246.2	34.7	B31.3
1(OPE)	129	91553.8	0	0	130	92457.7	0	0	B31.3
2(SUS)		18352.8	52984.1	34.6		18526.6	52984.1	35	B31.3
3(EXP)		76359.8	220246.2	34.7		77000.1	220072.4	35	B31.3
1(OPE)	130	92457.7	0	0	139	91226.3	0	0	B31.3
2(SUS)		18526.6	52984.1	35		18783.6	52984.1	35.5	B31.3
3(EXP)		77000.1	220072.4	35		75779	219815.4	34.5	B31.3
1(OPE)	139	91226.3	0	0	140	84274.7	0	0	B31.3
2(SUS)		18783.6	52984.1	35.5		18487.2	52984.1	34.9	B31.3
3(EXP)		75779	219815.4	34.5		68042.5	220111.8	30.9	B31.3
1(OPE)	140	84274.7	0	0	150	59433	0	0	B31.3
2(SUS)		18487.2	52984.1	34.9		43885	52984.1	82.8	B31.3
3(EXP)		68042.5	220111.8	30.9		34084.3	194714	17.5	B31.3
1(OPE)	150	59786.7	0	0	158	118817.5	0	0	B31.3
2(SUS)		43861	52984.1	82.8		20021	52984.1	37.8	B31.3
3(EXP)		34084.3	194738	17.5		101680.9	218578	46.5	B31.3
1(OPE)	158	118817.5	0	0	159	125263.4	0	0	B31.3
2(SUS)		20021	52984.1	37.8		18355.4	52984.1	34.6	B31.3
3(EXP)		101680.9	218578	46.5		109161.8	220243.6	49.6	B31.3
1(OPE)	159	125263.4	0	0	160	127904.7	0	0	B31.3
2(SUS)		18355.4	52984.1	34.6		18837.1	52984.1	35.6	B31.3
3(EXP)		109161.8	220243.6	49.6		112260.7	219761.9	51.1	B31.3

Root Cause:
Different Pipe Material

1(OPE)	160	127904.7	0	0	168	127904.7	0	0	B31.3
2(SUS)		18837.1	52984.1	35.6		18837.1	52984.1	35.6	B31.3
3(EXP)		112260.7	219761.9	51.1		112260.8	219761.9	51.1	B31.3
1(OPE)	168	127904.7	0	0	169	125263.5	0	0	B31.3
2(SUS)		18837.1	52984.1	35.6		18355.4	52984.1	34.6	B31.3
3(EXP)		112260.8	219761.9	51.1		109161.8	220243.6	49.6	B31.3
1(OPE)	169	125263.5	0	0	170	118817.5	0	0	B31.3
2(SUS)		18355.4	52984.1	34.6		20021	52984.1	37.8	B31.3
3(EXP)		109161.8	220243.6	49.6		101680.9	218578	46.5	B31.3
1(OPE)	170	118817.5	0	0	180	59786.7	0	0	B31.3
2(SUS)		20021	52984.1	37.8		43861	52984.1	82.8	B31.3
3(EXP)		101680.9	218578	46.5		34084.4	194738	17.5	B31.3
1(OPE)	180	59433	0	0	188	84274.7	0	0	B31.3
2(SUS)		43885	52984.1	82.8		18487.2	52984.1	34.9	B31.3
3(EXP)		34084.4	194714	17.5		68042.5	220111.8	30.9	B31.3
1(OPE)	188	84274.7	0	0	189	91226.3	0	0	B31.3
2(SUS)		18487.2	52984.1	34.9		18783.6	52984.1	35.5	B31.3
3(EXP)		68042.5	220111.8	30.9		75779	219815.4	34.5	B31.3
1(OPE)	189	91226.3	0	0	190	93228.8	0	0	B31.3
2(SUS)		18783.6	52984.1	35.5		18702.7	52984.1	35.3	B31.3
3(EXP)		75779	219815.4	34.5		77845.8	219896.3	35.4	B31.3
1(OPE)	190	93228.8	0	0	199	91553.8	0	0	B31.3
2(SUS)		18702.7	52984.1	35.3		18352.8	52984.1	34.6	B31.3
3(EXP)		77845.8	219896.3	35.4		76359.7	220246.2	34.7	B31.3
1(OPE)	199	91553.8	0	0	200	90547.6	0	0	B31.3
2(SUS)		18352.8	52984.1	34.6		18161	52984.1	34.3	B31.3
3(EXP)		76359.7	220246.2	34.7		75372.8	220437.9	34.2	B31.3
1(OPE)	200	90547.6	0	0	210	73275.9	0	0	B31.3
2(SUS)		18161	52984.1	34.3		22620.1	52984.1	42.7	B31.3
3(EXP)		75372.8	220437.9	34.2		57485.6	215978.9	26.6	B31.3
1(OPE)	210	73084.7	0	0	220	31552.2	0	0	B31.3
2(SUS)		22617.4	52984.1	42.7		24323.2	52984.1	45.9	B31.3
3(EXP)		57485.6	215981.6	26.6		14167.2	214275.8	6.6	B31.3
1(OPE)	220	31305.8	0	0	230	41090.6	0	0	B31.3
2(SUS)		24322	52984.1	45.9		23740.8	52984.1	44.8	B31.3
3(EXP)		14167.2	214277	6.6		25711.1	214858.1	12	B31.3

Root Cause:
Different Pipe Material
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15128	-12724	82438	-14117	-73853	3726	0	0	0
	2(SUS)	-109	-13954	-315	-17172	261	-1525	0	0	0
	3(EXP)	15237	1230	82754	3055	-74114	5251	0	0	0
	MAX	15237/L3	-13954/L	82754/L	-17172/L	-74114/L	5251/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1838	-34209	-10097	0	0	0	9.72	0	-53.383
	2(SUS)	468	-29237	-49	0	0	0	0.003	0	0
	3(EXP)	1370	-4972	-10047	0	0	0	9.717	0	-53.382
	MAX	1838/L1	-34209/L	-10097/L1				9.720/L1	-0.000/L1	-53.383/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2468	-23733	-7797	0	0	0	-3	0	-106.774
	2(SUS)	-1325	-24140	-107	0	0	0	-0.008	0	-0.001
	3(EXP)	-1142	406	-7691	0	0	0	-2.992	0	-106.773
	MAX	-2468/L1	-24140/L	-7797/L1				-3.000/L1	-0.000/L2	-106.774/L1
45		Rigid +Y								
	1(OPE)	-12912	-47753	-6206	0	0	0	-82.927	0	-39.857
	2(SUS)	966	-51089	586	0	0	0	0.006	0	0.003
	3(EXP)	-13878	3335	-6791	0	0	0	-82.932	0	-39.86
	MAX	-13878/L	-51089/L	-6791/L3				-82.932/L	-0.000/L2	-39.860/L3
65		Rigid +Y								
	1(OPE)	-12912	-47753	6206	0	0	0	-82.927	0	39.857
	2(SUS)	966	-51089	-586	0	0	0	0.006	0	-0.003
	3(EXP)	-13878	3335	6791	0	0	0	-82.932	0	39.86
	MAX	-13878/L	-51089/L	6791/L3				-82.932/L	-0.000/L2	39.860/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2468	-23733	7798	0	0	0	-3	0	106.774
	2(SUS)	-1325	-24140	107	0	0	0	-0.008	0	0.001
	3(EXP)	-1142	406	7691	0	0	0	-2.992	0	106.773
	MAX	-2468/L1	-24140/L	7798/L1				-3.000/L1	-0.000/L2	106.774/L1
90		Rigid +Y								
	1(OPE)	1838	-34209	10097	0	0	0	9.72	0	53.383
	2(SUS)	468	-29237	49	0	0	0	0.003	0	0
	3(EXP)	1370	-4972	10047	0	0	0	9.717	0	53.382
	MAX	1838/L1	-34209/L	10097/L1				9.720/L1	-0.000/L1	53.383/L1
100		Rigid ANC								
	1(OPE)	30256	-25448	0	0	0	7451	0	0	0
	2(SUS)	-218	-27909	0	0	0	-3051	0	0	0
	3(EXP)	30474	2461	0	0	0	10502	0	0	0
	MAX	30474/L3	-27909/L	-0/L1	0/L2	-0/L1	10502/L3	0.000/L3	-0.000/L2	-0.000/L1

Root Cause:
Different Pipe Material

110		Rigid +Y								
	1(OPE)	1838	-34209	-10097	0	0	0	9.72	0	-53.383
	2(SUS)	468	-29237	-49	0	0	0	0.003	0	0
	3(EXP)	1370	-4972	-10047	0	0	0	9.717	0	-53.382
	MAX	1838/L1	-34209/L	-10097/L1				9.720/L1	-0.000/L1	-53.383/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2468	-23733	-7797	0	0	0	-3	0	-106.774
	2(SUS)	-1325	-24140	-107	0	0	0	-0.008	0	-0.001
	3(EXP)	-1142	406	-7691	0	0	0	-2.992	0	-106.773
	MAX	-2468/L1	-24140/L	-7797/L1				-3.000/L1	-0.000/L2	-106.774/L1
150		Rigid +Y								
	1(OPE)	-12912	-47753	-6206	0	0	0	-82.927	0	-39.857
	2(SUS)	966	-51089	586	0	0	0	0.006	0	0.003
	3(EXP)	-13878	3335	-6791	0	0	0	-82.932	0	-39.86
	MAX	-13878/L	-51089/L	-6791/L3				-82.932/L	-0.000/L2	-39.860/L3
180		Rigid +Y								
	1(OPE)	-12912	-47753	6206	0	0	0	-82.927	0	39.857
	2(SUS)	966	-51089	-586	0	0	0	0.006	0	-0.003
	3(EXP)	-13878	3335	6791	0	0	0	-82.932	0	39.86
	MAX	-13878/L	-51089/L	6791/L3				-82.932/L	-0.000/L2	39.860/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2468	-23733	7797	0	0	0	-3	0	106.774
	2(SUS)	-1325	-24140	107	0	0	0	-0.008	0	0.001
	3(EXP)	-1142	406	7691	0	0	0	-2.992	0	106.773
	MAX	-2468/L1	-24140/L	7797/L1				-3.000/L1	-0.000/L2	106.774/L1
220		Rigid +Y								
	1(OPE)	1838	-34209	10097	0	0	0	9.72	0	53.383
	2(SUS)	468	-29237	49	0	0	0	0.003	0	0
	3(EXP)	1370	-4972	10047	0	0	0	9.717	0	53.382
	MAX	1838/L1	-34209/L	10097/L1				9.720/L1	-0.000/L1	53.383/L1
230		Rigid ANC								
	1(OPE)	15128	-12724	-82438	14117	73853	3726	0	0	0
	2(SUS)	-109	-13954	315	17172	-261	-1525	0	0	0
	3(EXP)	15237	1230	-82754	-3055	74114	5251	0	0	0
	MAX	15237/L3	-13954/L	-82754/L	17172/L3	74114/L3	5251/L3	0.000/L3	-0.000/L2	-0.000/L3

Root Cause:
Different Pipe Material
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.717	0	-53.382	-0.0064	-0.0695	0.0278
20	-2.992	0	-106.773	0.0258	0.3498	0.0555
28	-32.278	2.776	-130.12	0.0747	0.6899	0.0677
29	-34.861	3.345	-131.516	0.0814	0.7343	0.0709
30	-37.289	4.426	-132.575	0.0872	0.776	0.0779
38	-40.587	6.31	-133.776	0.0901	0.8184	0.0743
39	-46.072	8.417	-132.856	0.0965	0.9007	0.09
40	-50.734	8.769	-127.217	0.0986	0.9847	0.0987
45	-82.932	0	-39.86	0.0582	1.1055	0.1173
48	-107.27	-6.988	17.089	0.0278	0.7408	0.1173
49	-111.756	-7.693	20.475	0.0237	0.6142	0.1177
50	-116.456	-7.875	19.344	0.0188	0.4809	0.1182
59	-111.756	-7.693	-20.475	-0.0237	-0.6142	0.1177
60	-107.27	-6.988	-17.089	-0.0278	-0.7408	0.1173
65	-82.932	0	39.86	-0.0582	-1.1055	0.1173
68	-50.734	8.769	127.217	-0.0986	-0.9847	0.0987
69	-46.072	8.417	132.856	-0.0965	-0.9007	0.09
70	-40.587	6.31	133.776	-0.0901	-0.8184	0.0743
78	-37.289	4.426	132.575	-0.0872	-0.776	0.0779
79	-34.861	3.345	131.516	-0.0814	-0.7343	0.0709
80	-32.278	2.776	130.12	-0.0747	-0.6899	0.0677
85	-2.992	0	106.773	-0.0258	-0.3498	0.0555
90	9.717	0	53.382	0.0064	0.0695	0.0278
100	0	0	0	0	0	0
110	9.717	0	-53.382	-0.0064	-0.0695	0.0278
120	-2.992	0	-106.773	0.0258	0.3498	0.0555
128	-32.278	2.776	-130.12	0.0747	0.6899	0.0677
129	-34.861	3.345	-131.516	0.0814	0.7343	0.0709
130	-37.289	4.426	-132.575	0.0872	0.776	0.0779
139	-46.072	8.417	-132.856	0.0965	0.9007	0.09
140	-50.734	8.769	-127.217	0.0986	0.9847	0.0987
150	-82.932	0	-39.86	0.0582	1.1055	0.1173
158	-107.27	-6.988	17.089	0.0278	0.7408	0.1173
159	-111.756	-7.693	20.475	0.0237	0.6142	0.1177
160	-116.456	-7.875	19.344	0.0188	0.4809	0.1182
168	-116.456	-7.875	-19.344	-0.0188	-0.4809	0.1182
169	-111.756	-7.693	-20.475	-0.0237	-0.6142	0.1177
170	-107.27	-6.988	-17.089	-0.0278	-0.7408	0.1173
180	-82.932	0	39.86	-0.0582	-1.1055	0.1173

Root Cause:
Different Pipe Material

188	-50.734	8.769	127.217	-0.0986	-0.9847	0.0987
189	-46.072	8.417	132.856	-0.0965	-0.9007	0.09
190	-40.587	6.31	133.776	-0.0901	-0.8184	0.0743
199	-34.861	3.345	131.516	-0.0814	-0.7343	0.0709
200	-32.278	2.776	130.12	-0.0747	-0.6899	0.0677
210	-2.992	0	106.773	-0.0258	-0.3498	0.0555
220	9.717	0	53.382	0.0064	0.0695	0.0278
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0081
20	-0.008	0	-0.001	0.0046	0.0026	-0.0161
28	-0.215	-0.03	-0.001	-0.001	0.0036	-0.0197
29	-0.214	-0.034	-0.001	-0.0009	0.0034	-0.0199
30	-0.183	-0.036	-0.003	-0.0009	0.0031	-0.0202
38	-0.117	-0.039	-0.006	-0.001	0.0028	-0.0205
39	-0.032	0.013	-0.005	-0.0016	0.0021	-0.0212
40	0.006	0.151	0.002	-0.0024	0.0013	-0.0212
45	0.006	0	0.003	-0.0114	-0.0003	0.0563
48	0.006	-6.067	-0.001	-0.0182	0.0001	0.1249
49	0.005	-6.95	0	-0.019	0.0001	0.1265
50	0.005	-7.423	0	-0.0186	0.0001	0.1267
59	0.005	-6.95	0	0.019	-0.0001	0.1265
60	0.006	-6.067	0.001	0.0182	-0.0001	0.1249
65	0.006	0	-0.003	0.0114	0.0003	0.0563
68	0.006	0.151	-0.002	0.0024	-0.0013	-0.0212
69	-0.032	0.013	0.005	0.0016	-0.0021	-0.0212
70	-0.117	-0.039	0.006	0.001	-0.0028	-0.0205
78	-0.183	-0.036	0.003	0.0009	-0.0031	-0.0202
79	-0.214	-0.034	0.001	0.0009	-0.0034	-0.0199
80	-0.215	-0.03	0.001	0.001	-0.0036	-0.0197
85	-0.008	0	0.001	-0.0046	-0.0026	-0.0161
90	0.003	0	0	0.0011	0.0006	-0.0081
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0081
120	-0.008	0	-0.001	0.0046	0.0026	-0.0161
128	-0.215	-0.03	-0.001	-0.001	0.0036	-0.0197
129	-0.214	-0.034	-0.001	-0.0009	0.0034	-0.0199
130	-0.183	-0.036	-0.003	-0.0009	0.0031	-0.0202
139	-0.032	0.013	-0.005	-0.0016	0.0021	-0.0212
140	0.006	0.151	0.002	-0.0024	0.0013	-0.0212
150	0.006	0	0.003	-0.0114	-0.0003	0.0563
158	0.006	-6.067	-0.001	-0.0182	0.0001	0.1249
159	0.005	-6.95	0	-0.019	0.0001	0.1265
160	0.005	-7.423	0	-0.0186	0.0001	0.1267
168	0.005	-7.423	0	0.0186	-0.0001	0.1267
169	0.005	-6.95	0	0.019	-0.0001	0.1265
170	0.006	-6.067	0.001	0.0182	-0.0001	0.1249
180	0.006	0	-0.003	0.0114	0.0003	0.0563

Root Cause:
Different Pipe Material

188	0.006	0.151	-0.002	0.0024	-0.0013	-0.0212
189	-0.032	0.013	0.005	0.0016	-0.0021	-0.0212
190	-0.117	-0.039	0.006	0.001	-0.0028	-0.0205
199	-0.214	-0.034	0.001	0.0009	-0.0034	-0.0199
200	-0.215	-0.03	0.001	0.001	-0.0036	-0.0197
210	-0.008	0	0.001	-0.0046	-0.0026	-0.0161
220	0.003	0	0	0.0011	0.0006	-0.0081
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:46
Job Name: A335 P11_2 EXPANSION LOOP
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.72	0	-53.383	-0.0075	-0.0701	0.0197
20	-3	0	-106.774	0.0304	0.3524	0.0394
28	-32.493	2.746	-130.12	0.0737	0.6935	0.048
29	-35.075	3.311	-131.518	0.0805	0.7376	0.051
30	-37.472	4.39	-132.578	0.0863	0.779	0.0577
38	-40.704	6.271	-133.783	0.0891	0.8213	0.0538
39	-46.104	8.43	-132.861	0.095	0.9028	0.0688
40	-50.728	8.92	-127.215	0.0961	0.9859	0.0775
45	-82.927	0	-39.857	0.0468	1.1052	0.1735
48	-107.265	-13.056	17.088	0.0095	0.7408	0.2421
49	-111.751	-14.643	20.475	0.0047	0.6142	0.2443
50	-116.451	-15.298	19.344	0.0002	0.4809	0.2449
59	-111.751	-14.643	-20.475	-0.0047	-0.6142	0.2443
60	-107.265	-13.056	-17.088	-0.0095	-0.7408	0.2421
65	-82.927	0	39.857	-0.0468	-1.1052	0.1735
68	-50.728	8.92	127.215	-0.0961	-0.9859	0.0775
69	-46.104	8.43	132.861	-0.095	-0.9028	0.0688
70	-40.704	6.271	133.783	-0.0891	-0.8213	0.0538
78	-37.472	4.39	132.578	-0.0863	-0.779	0.0577
79	-35.075	3.311	131.518	-0.0805	-0.7376	0.051
80	-32.493	2.746	130.12	-0.0737	-0.6935	0.048
85	-3	0	106.774	-0.0304	-0.3524	0.0394
90	9.72	0	53.383	0.0075	0.0701	0.0197
100	0	0	0	0	0	0
110	9.72	0	-53.383	-0.0075	-0.0701	0.0197
120	-3	0	-106.774	0.0304	0.3524	0.0394
128	-32.493	2.746	-130.12	0.0737	0.6935	0.048
129	-35.075	3.311	-131.518	0.0805	0.7376	0.051
130	-37.472	4.39	-132.578	0.0863	0.779	0.0577
139	-46.104	8.43	-132.861	0.095	0.9028	0.0688
140	-50.728	8.92	-127.215	0.0961	0.9859	0.0775
150	-82.927	0	-39.857	0.0468	1.1052	0.1735
158	-107.264	-13.056	17.088	0.0095	0.7408	0.2421
159	-111.751	-14.643	20.475	0.0047	0.6142	0.2443
160	-116.451	-15.298	19.344	0.0002	0.4809	0.2449
168	-116.451	-15.298	-19.344	-0.0002	-0.4809	0.2449
169	-111.751	-14.643	-20.475	-0.0047	-0.6142	0.2443
170	-107.265	-13.056	-17.088	-0.0095	-0.7408	0.2421
180	-82.927	0	39.857	-0.0468	-1.1052	0.1735

Root Cause:
Different Pipe Material

188	-50.728	8.92	127.215	-0.0961	-0.9859	0.0775
189	-46.104	8.43	132.861	-0.095	-0.9028	0.0688
190	-40.704	6.271	133.783	-0.0891	-0.8213	0.0538
199	-35.075	3.311	131.518	-0.0805	-0.7376	0.051
200	-32.493	2.746	130.12	-0.0737	-0.6935	0.048
210	-3	0	106.774	-0.0304	-0.3524	0.0394
220	9.72	0	53.383	0.0075	0.0701	0.0197
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .20
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .20
Node 20 +Y Mu = .20

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .20

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .20

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .20
Node 85 +Y Mu = .20

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .20

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

Root Cause:
Different Support Design-Friction Factor

```
  Node  110  +Y   Mu = .20
 ------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .20
   Node  120  Guide   Gap= 3.000 mm.   Mu = .20
 ------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .20
 ------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .20
 ------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .20
   Node  210  Guide   Gap= 3.000 mm.   Mu = .20
 ------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Root Cause:

Different Support Design-Friction Factor

```
  Node  220  +Y   Mu = .20
-------------------------------------------------------------------------------
From  220  To  230 DZ= -7,500.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                        v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                         App.P Sy/St Switch = ON   Sc= 137,895 KPa
                        Sh1= 63,326 KPa   Sh2= 137,895 KPa
                        Sh3= 137,895 KPa   Sh4= 137,895 KPa
                        Sh5= 137,895 KPa   Sh6= 137,895 KPa
                        Sh7= 137,895 KPa   Sh8= 137,895 KPa
                        Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 29
                        Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 39
                        Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 49
                        Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 69
                        Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 79
                        Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50
                       129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
```

Root Cause:

Different Support Design-Friction Factor

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	Len / GAP	MU / YIELD	Dir / FORCE	Vectors
10	ANC			.20	.000	.000 .000
15	+Y			.20	.000	1.000 .000
20	Guide		3.00	.20	.000	.000 .000
20	+Y			.20	.000	1.000 .000
45	+Y			.20	.000	1.000 .000
65	+Y			.20	.000	1.000 .000
85	Guide		3.00	.20	.000	.000 .000
85	+Y			.20	.000	1.000 .000
90	+Y			.20	.000	1.000 .000
100	ANC			.20	.000	.000 .000
110	+Y			.20	.000	1.000 .000
120	+Y			.20	.000	1.000 .000
120	Guide		3.00	.20	.000	.000 .000
150	+Y			.20	.000	1.000 .000
180	+Y			.20	.000	1.000 .000
210	+Y			.20	.000	1.000 .000
210	Guide		3.00	.20	.000	.000 .000
220	+Y			.20	.000	1.000 .000
230	ANC			.20	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Root Cause:

Different Support Design-Friction Factor

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Root Cause:
Different Support Design-Friction Factor
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B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Root Cause:
Different Support Design-Friction Factor
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Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117121.4 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 26194.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138404.8 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	44600.2	0	0	15	33203.2	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		29180.6	227785.8	12.8		16135.2	227204.6	7.1	B31.3
1(OPE)	15	33369.2	0	0	20	79209.3	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		16135.2	227203.4	7.1		63592.7	228909.4	27.8	B31.3
1(OPE)	20	79363.2	0	0	28	91289.8	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		63592.7	228906.8	27.8		76122	233366.2	32.6	B31.3
1(OPE)	28	91289.8	0	0	29	91967.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		76122	233366.2	32.6		76774.1	233174.8	32.9	B31.3
1(OPE)	29	91967.5	0	0	30	92590.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		76774.1	233174.8	32.9		77126.2	233001	33.1	B31.3
1(OPE)	30	92590.3	0	0	38	92996.1	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		77126.2	233001	33.1		77603.5	232825.1	33.3	B31.3
1(OPE)	38	92996.1	0	0	39	90607.8	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		77603.5	232825.1	33.3		75068.8	232744.5	32.3	B31.3

Root Cause:
Different Support Design-Friction Factor

1(OPE)	39	90607.8	0	0	40	83462.8	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		75068.8	232744.5	32.3		67116.6	233040.4	28.8	B31.3
1(OPE)	40	83462.8	0	0	45	60580.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		67116.6	233040.4	28.8		35369.8	207641.7	17	B31.3
1(OPE)	45	60820	0	0	48	123192.8	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35369.8	207665.7	17		106057.6	231505.7	45.8	B31.3
1(OPE)	48	123192.8	0	0	49	129936.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106057.6	231505.7	45.8		113880.7	233171.3	48.8	B31.3
1(OPE)	49	129936.7	0	0	50	132700.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113880.7	233171.3	48.8		117121.4	232689.6	50.3	B31.3
1(OPE)	50	132700.8	0	0	59	129936.7	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117121.4	232689.6	50.3		113880.7	233171.3	48.8	B31.3
1(OPE)	59	129936.7	0	0	60	123192.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113880.7	233171.3	48.8		106057.6	231505.7	45.8	B31.3
1(OPE)	60	123192.8	0	0	65	60820	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106057.6	231505.7	45.8		35369.7	207665.7	17	B31.3
1(OPE)	65	60580.7	0	0	68	83462.8	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35369.7	207641.7	17		67116.6	233040.4	28.8	B31.3
1(OPE)	68	83462.8	0	0	69	90607.8	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		67116.6	233040.4	28.8		75068.8	232744.5	32.3	B31.3
1(OPE)	69	90607.8	0	0	70	92996.1	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		75068.8	232744.5	32.3		77603.5	232825.1	33.3	B31.3
1(OPE)	70	92996.1	0	0	78	92590.3	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		77603.5	232825.1	33.3		77126.3	233001	33.1	B31.3
1(OPE)	78	92590.3	0	0	79	91967.5	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		77126.3	233001	33.1		76774.1	233174.8	32.9	B31.3
1(OPE)	79	91967.5	0	0	80	91289.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		76774.1	233174.8	32.9		76122	233366.2	32.6	B31.3

Root Cause:
Different Support Design-Friction Factor
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1(OPE)	80	91289.8	0	0	85	79363.3	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		76122	233366.2	32.6		63592.8	228906.8	27.8	B31.3
1(OPE)	85	79209.4	0	0	90	33369.2	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		63592.8	228909.4	27.8		16135.2	227203.5	7.1	B31.3
1(OPE)	90	33203.2	0	0	100	44600.3	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		16135.2	227204.6	7.1		29180.7	227785.7	12.8	B31.3
1(OPE)	100	44600.3	0	0	110	33203.2	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		29180.7	227785.7	12.8		16135.2	227204.6	7.1	B31.3
1(OPE)	110	33369.2	0	0	120	79209.4	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		16135.2	227203.5	7.1		63592.8	228909.4	27.8	B31.3
1(OPE)	120	79363.3	0	0	128	91289.8	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		63592.8	228906.8	27.8		76122	233366.2	32.6	B31.3
1(OPE)	128	91289.8	0	0	129	91967.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		76122	233366.2	32.6		76774.2	233174.8	32.9	B31.3
1(OPE)	129	91967.5	0	0	130	92590.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		76774.2	233174.8	32.9		77126.3	233001	33.1	B31.3
1(OPE)	130	92590.3	0	0	139	90607.8	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		77126.3	233001	33.1		75068.8	232744.5	32.3	B31.3
1(OPE)	139	90607.8	0	0	140	83462.8	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		75068.8	232744.5	32.3		67116.6	233040.4	28.8	B31.3
1(OPE)	140	83462.8	0	0	150	60580.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		67116.6	233040.4	28.8		35369.7	207641.7	17	B31.3
1(OPE)	150	60820	0	0	158	123192.8	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35369.7	207665.7	17		106057.6	231505.7	45.8	B31.3
1(OPE)	158	123192.8	0	0	159	129936.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106057.6	231505.7	45.8		113880.7	233171.2	48.8	B31.3
1(OPE)	159	129936.7	0	0	160	132700.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113880.7	233171.2	48.8		117121.4	232689.6	50.3	B31.3

Root Cause:
Different Support Design-Friction Factor
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1(OPE)	160	132700.8	0	0	168	132700.8	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117121.4	232689.6	50.3		117121.4	232689.6	50.3	B31.3
1(OPE)	168	132700.8	0	0	169	129936.7	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117121.4	232689.6	50.3		113880.7	233171.2	48.8	B31.3
1(OPE)	169	129936.7	0	0	170	123192.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113880.7	233171.2	48.8		106057.6	231505.7	45.8	B31.3
1(OPE)	170	123192.8	0	0	180	60820	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106057.6	231505.7	45.8		35369.7	207665.7	17	B31.3
1(OPE)	180	60580.7	0	0	188	83462.8	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35369.7	207641.7	17		67116.6	233040.4	28.8	B31.3
1(OPE)	188	83462.8	0	0	189	90607.8	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		67116.6	233040.4	28.8		75068.8	232744.5	32.3	B31.3
1(OPE)	189	90607.8	0	0	190	92996.1	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		75068.8	232744.5	32.3		77603.5	232825.1	33.3	B31.3
1(OPE)	190	92996.1	0	0	199	91967.5	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		77603.5	232825.1	33.3		76774.1	233174.8	32.9	B31.3
1(OPE)	199	91967.5	0	0	200	91289.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		76774.1	233174.8	32.9		76122	233366.2	32.6	B31.3
1(OPE)	200	91289.8	0	0	210	79363.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		76122	233366.2	32.6		63592.7	228906.8	27.8	B31.3
1(OPE)	210	79209.4	0	0	220	33369.2	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		63592.7	228909.4	27.8		16135.2	227203.4	7.1	B31.3
1(OPE)	220	33203.2	0	0	230	44600.2	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		16135.2	227204.6	7.1		29180.6	227785.8	12.8	B31.3

Root Cause:
Different Support Design-Friction Factor
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	17213	-12611	77863	-13836	-83860	4448	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	17321	1344	78181	3336	-84119	5973	0	0	0
	MAX	17321/L3	-13954/L	78181/L	-17172/L	-84119/L	5973/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1342	-34666	-6802	0	0	0	10.675	0	-54.116
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	875	-5430	-6754	0	0	0	10.672	0	-54.116
	MAX	1342/L1	-34666/L	-6802/L1				10.675/L	-0.000/L1	-54.116/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-8747	-22835	-6289	0	0	0	-3	0	-108.239
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-7425	1305	-6185	0	0	0	-2.992	0	-108.238
	MAX	-8747/L1	-24140/L	-6289/L1				-3.000/L1	-0.000/L2	-108.239/L1
45		Rigid +Y								
	1(OPE)	-8748	-48307	-4100	0	0	0	-85.867	0	-40.238
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-9712	2781	-4683	0	0	0	-85.873	0	-40.241
	MAX	-9712/L3	-51089/L	-4683/L3				-85.873/L	-0.000/L2	-40.241/L3
65		Rigid +Y								
	1(OPE)	-8748	-48307	4100	0	0	0	-85.867	0	40.238
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-9712	2781	4683	0	0	0	-85.873	0	40.241
	MAX	-9712/L3	-51089/L	4683/L3				-85.873/L	-0.000/L2	40.241/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-8747	-22835	6289	0	0	0	-3	0	108.239
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-7425	1305	6185	0	0	0	-2.992	0	108.238
	MAX	-8747/L1	-24140/L	6289/L1				-3.000/L1	-0.000/L2	108.239/L1
90		Rigid +Y								
	1(OPE)	1342	-34666	6802	0	0	0	10.675	0	54.116
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	875	-5430	6754	0	0	0	10.672	0	54.116
	MAX	1342/L1	-34666/L	6802/L1				10.675/L	-0.000/L1	54.116/L1
100		Rigid ANC								
	1(OPE)	34425	-25222	0	0	0	8895	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	34642	2687	0	0	0	11946	0	0	0
	MAX	34642/L3	-27909/L	-0/L1	0/L2	-0/L1	11946/L3	0.000/L3	-0.000/L2	-0.000/L1

Root Cause:
Different Support Design-Friction Factor

110		Rigid +Y								
	1(OPE)	1342	-34666	-6802	0	0	0	10.675	0	-54.116
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	875	-5430	-6754	0	0	0	10.672	0	-54.116
	MAX	1342/L1	-34666/L	-6802/L1				10.675/L	-0.000/L1	-54.116/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-8747	-22835	-6289	0	0	0	-3	0	-108.239
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-7425	1305	-6185	0	0	0	-2.992	0	-108.238
	MAX	-8747/L1	-24140/L	-6289/L1				-3.000/L1	-0.000/L2	-108.239/L1
150		Rigid +Y								
	1(OPE)	-8748	-48307	-4100	0	0	0	-85.867	0	-40.238
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-9712	2781	-4683	0	0	0	-85.873	0	-40.241
	MAX	-9712/L3	-51089/L	-4683/L3				-85.873/L	-0.000/L2	-40.241/L3
180		Rigid +Y								
	1(OPE)	-8748	-48307	4100	0	0	0	-85.867	0	40.238
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-9712	2781	4683	0	0	0	-85.873	0	40.241
	MAX	-9712/L3	-51089/L	4683/L3				-85.873/L	-0.000/L2	40.241/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-8747	-22835	6289	0	0	0	-3	0	108.239
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-7425	1305	6185	0	0	0	-2.992	0	108.238
	MAX	-8747/L1	-24140/L	6289/L1				-3.000/L1	-0.000/L2	108.239/L1
220		Rigid +Y								
	1(OPE)	1342	-34666	6802	0	0	0	10.675	0	54.116
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	875	-5430	6754	0	0	0	10.672	0	54.116
	MAX	1342/L1	-34666/L	6802/L1				10.675/L	-0.000/L1	54.116/L1
230		Rigid ANC								
	1(OPE)	17213	-12611	-77863	13836	83860	4448	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	17321	1344	-78181	-3336	84119	5973	0	0	0
	MAX	17321/L1	-13954/L	-78181/L	17172/L1	84119/L1	5973/L3	0.000/L3	-0.000/L2	-0.000/L3

Root Cause:
Different Support Design-Friction Factor
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.672	0	-54.116	-0.0068	-0.076	0.0306
20	-2.992	0	-108.238	0.0273	0.3762	0.0612
28	-34.132	2.893	-131.903	0.0766	0.7229	0.0746
29	-36.837	3.472	-133.318	0.0832	0.7663	0.0779
30	-39.374	4.57	-134.391	0.0888	0.8069	0.0847
38	-42.813	6.481	-135.607	0.0915	0.848	0.0811
39	-48.475	8.603	-134.631	0.0977	0.9273	0.0957
40	-53.233	8.933	-128.839	0.0995	1.0077	0.1032
45	-85.873	0	-40.241	0.0588	1.1174	0.1182
48	-110.541	-7.043	17.336	0.028	0.7491	0.1182
49	-115.085	-7.753	20.758	0.024	0.6211	0.1187
50	-119.84	-7.937	19.607	0.0189	0.4863	0.1192
59	-115.085	-7.753	-20.758	-0.024	-0.6211	0.1187
60	-110.541	-7.043	-17.336	-0.028	-0.7491	0.1182
65	-85.873	0	40.241	-0.0588	-1.1174	0.1182
68	-53.233	8.933	128.839	-0.0995	-1.0077	0.1032
69	-48.475	8.603	134.631	-0.0977	-0.9273	0.0957
70	-42.813	6.481	135.607	-0.0915	-0.848	0.0811
78	-39.374	4.57	134.391	-0.0888	-0.8069	0.0847
79	-36.837	3.472	133.318	-0.0832	-0.7663	0.0779
80	-34.132	2.893	131.903	-0.0766	-0.7229	0.0746
85	-2.992	0	108.238	-0.0273	-0.3762	0.0612
90	10.672	0	54.116	0.0068	0.076	0.0306
100	0	0	0	0	0	0
110	10.672	0	-54.116	-0.0068	-0.076	0.0306
120	-2.992	0	-108.238	0.0273	0.3762	0.0612
128	-34.132	2.893	-131.903	0.0766	0.7229	0.0746
129	-36.837	3.472	-133.318	0.0832	0.7663	0.0779
130	-39.374	4.57	-134.391	0.0888	0.8069	0.0847
139	-48.475	8.603	-134.631	0.0977	0.9273	0.0957
140	-53.233	8.933	-128.839	0.0995	1.0077	0.1032
150	-85.873	0	-40.241	0.0588	1.1174	0.1182
158	-110.541	-7.043	17.336	0.028	0.7491	0.1182
159	-115.084	-7.753	20.758	0.024	0.6211	0.1187
160	-119.84	-7.937	19.607	0.0189	0.4863	0.1192
168	-119.84	-7.937	-19.607	-0.0189	-0.4863	0.1192
169	-115.085	-7.753	-20.758	-0.024	-0.6211	0.1187
170	-110.541	-7.043	-17.336	-0.028	-0.7491	0.1182
180	-85.873	0	40.241	-0.0588	-1.1174	0.1182

Root Cause:
Different Support Design-Friction Factor

188	-53.233	8.933	128.839	-0.0995	-1.0077	0.1032
189	-48.475	8.603	134.631	-0.0977	-0.9273	0.0957
190	-42.813	6.481	135.607	-0.0915	-0.848	0.0811
199	-36.837	3.472	133.318	-0.0832	-0.7663	0.0779
200	-34.132	2.893	131.903	-0.0766	-0.7229	0.0746
210	-2.992	0	108.238	-0.0273	-0.3762	0.0612
220	10.672	0	54.116	0.0068	0.076	0.0306
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

Root Cause:
Different Support Design-Friction Factor

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 15:54
Job Name: A335 P22_2 EXPANSION LOOP_MU0.2
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.675	0	-54.116	-0.0079	-0.0766	0.0228
20	-3	0	-108.239	0.0318	0.3788	0.0456
28	-34.34	2.864	-131.904	0.0757	0.7264	0.0555
29	-37.044	3.44	-133.32	0.0823	0.7696	0.0586
30	-39.551	4.535	-134.394	0.0879	0.8098	0.0652
38	-42.927	6.443	-135.613	0.0906	0.8508	0.0612
39	-48.506	8.615	-134.636	0.0962	0.9293	0.0752
40	-53.227	9.08	-128.837	0.0972	1.0089	0.0826
45	-85.867	0	-40.238	0.0477	1.117	0.1727
48	-110.536	-12.924	17.335	0.0103	0.7492	0.2392
49	-115.079	-14.49	20.758	0.0055	0.6211	0.2413
50	-119.835	-15.131	19.607	0.0009	0.4863	0.242
59	-115.079	-14.49	-20.758	-0.0055	-0.6211	0.2413
60	-110.536	-12.924	-17.335	-0.0103	-0.7492	0.2392
65	-85.867	0	40.238	-0.0477	-1.117	0.1727
68	-53.227	9.08	128.837	-0.0972	-1.0089	0.0826
69	-48.506	8.615	134.636	-0.0962	-0.9293	0.0752
70	-42.927	6.443	135.613	-0.0906	-0.8508	0.0612
78	-39.551	4.535	134.394	-0.0879	-0.8098	0.0652
79	-37.044	3.44	133.32	-0.0823	-0.7696	0.0586
80	-34.34	2.864	131.904	-0.0757	-0.7264	0.0555
85	-3	0	108.239	-0.0318	-0.3788	0.0456
90	10.675	0	54.116	0.0079	0.0766	0.0228
100	0	0	0	0	0	0
110	10.675	0	-54.116	-0.0079	-0.0766	0.0228
120	-3	0	-108.239	0.0318	0.3788	0.0456
128	-34.34	2.864	-131.904	0.0757	0.7264	0.0555
129	-37.044	3.44	-133.32	0.0823	0.7696	0.0586
130	-39.551	4.535	-134.394	0.0879	0.8098	0.0652
139	-48.505	8.615	-134.636	0.0962	0.9293	0.0752
140	-53.227	9.08	-128.837	0.0972	1.0089	0.0826
150	-85.867	0	-40.238	0.0477	1.117	0.1727
158	-110.536	-12.924	17.335	0.0103	0.7492	0.2392
159	-115.079	-14.49	20.758	0.0055	0.6211	0.2413
160	-119.835	-15.131	19.607	0.0009	0.4863	0.242
168	-119.835	-15.131	-19.607	-0.0009	-0.4863	0.242
169	-115.079	-14.49	-20.758	-0.0055	-0.6211	0.2413
170	-110.536	-12.924	-17.335	-0.0103	-0.7492	0.2392
180	-85.867	0	40.238	-0.0477	-1.117	0.1727

Root Cause:
Different Support Design-Friction Factor

188	-53.227	9.08	128.837	-0.0972	-1.0089	0.0826
189	-48.505	8.615	134.636	-0.0962	-0.9293	0.0752
190	-42.927	6.443	135.613	-0.0906	-0.8508	0.0612
199	-37.044	3.44	133.32	-0.0823	-0.7696	0.0586
200	-34.34	2.864	131.904	-0.0757	-0.7264	0.0555
210	-3	0	108.239	-0.0318	-0.3788	0.0456
220	10.675	0	54.116	0.0079	0.0766	0.0228
230	0	0	0	0	0	0

Root Cause:
Different Support Design-Friction Factor

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -8,000.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -8,000.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,000.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

Root Cause:
Different Piperack Support Span

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
------------------------------------------------------------------------------
From  80  To  85 DZ= -4,000.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
------------------------------------------------------------------------------
From  85  To  90 DZ= -8,000.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
------------------------------------------------------------------------------
From  90  To  100 DZ= -8,000.000 mm.
RESTRAINTS
  Node  100  ANC
------------------------------------------------------------------------------
From  100  To  110 DZ= -8,000.000 mm.
RESTRAINTS
```

Root Cause:

Different Piperack Support Span

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -8,000.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -4,000.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -4,000.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -8,000.000 mm.
 RESTRAINTS
```

Root Cause:

Different Piperack Support Span

Node 220 +Y Mu = .30

From 220 To 230 DZ= -8,000.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Root Cause:

Different Piperack Support Span

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Root Cause:

Different Piperack Support Span

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Root Cause:
Different Piperack Support Span

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Root Cause:
Different Piperack Support Span

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-8000.000
20	.000	.000	-16000.000
30	.000	.000	-20000.000
40	.000	750.000	-20750.000
45	-5052.000	750.000	-20750.000
50	-9000.000	750.000	-20750.000
60	-9000.000	750.000	-27250.000
65	-5052.000	750.000	-27250.000
70	.000	750.000	-27250.000
80	.000	.000	-28000.000
85	.000	.000	-32000.000
90	.000	.000	-40000.000
100	.000	.000	-48000.000
110	.000	.000	-56000.000
120	.000	.000	-64000.000
130	.000	.000	-68000.000
140	.000	750.000	-68750.000
150	-5052.000	750.000	-68750.000
160	-9000.000	750.000	-68750.000
170	-9000.000	750.000	-75250.000
180	-5052.000	750.000	-75250.000
190	.000	750.000	-75250.000
200	.000	.000	-76000.000
210	.000	.000	-80000.000
220	.000	.000	-88000.000
230	.000	.000	-96000.000

Root Cause:
Different Piperack Support Span

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43876.4 Allowable Stress: 63326.2
Axial Stress: 17789.1 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 124526.2 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27843.3 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 145969.3 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42083.1	0	0	15	31697.2	0	0	B31.3
2(SUS)		24719.3	63326.2	39		24931.5	63326.2	39.4	B31.3
3(EXP)		26707.3	226807.4	11.8		14444.7	226595.2	6.4	B31.3
1(OPE)	15	31950.6	0	0	20	75159.2	0	0	B31.3
2(SUS)		24932.3	63326.2	39.4		24335.8	63326.2	38.4	B31.3
3(EXP)		14444.7	226594.3	6.4		59757.5	227190.9	26.3	B31.3
1(OPE)	20	75373.5	0	0	28	95407.5	0	0	B31.3
2(SUS)		24337.6	63326.2	38.4		18328.4	63326.2	28.9	B31.3
3(EXP)		59757.5	227189.1	26.3		80282.5	233198.2	34.4	B31.3
1(OPE)	28	95407.5	0	0	29	96414.3	0	0	B31.3
2(SUS)		18328.4	63326.2	28.9		18429.4	63326.2	29.1	B31.3
3(EXP)		80282.5	233198.2	34.4		81253.6	233097.3	34.9	B31.3
1(OPE)	29	96414.3	0	0	30	97315.7	0	0	B31.3
2(SUS)		18429.4	63326.2	29.1		18557.6	63326.2	29.3	B31.3
3(EXP)		81253.6	233097.3	34.9		81863.5	232969.1	35.1	B31.3
1(OPE)	30	97315.7	0	0	38	98049.6	0	0	B31.3
2(SUS)		18557.6	63326.2	29.3		18639.8	63326.2	29.4	B31.3
3(EXP)		81863.5	232969.1	35.1		82676.7	232886.8	35.5	B31.3
1(OPE)	38	98049.6	0	0	39	95773.7	0	0	B31.3
2(SUS)		18639.8	63326.2	29.4		18629.9	63326.2	29.4	B31.3
3(EXP)		82676.7	232886.8	35.5		80321	232896.8	34.5	B31.3

Root Cause:
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1(OPE)	39	95773.7	0	0	40	88185.6	0	0	B31.3
2(SUS)		18629.9	63326.2	29.4		18394.3	63326.2	29	B31.3
3(EXP)		80321	232896.8	34.5		71905	233132.3	30.8	B31.3
1(OPE)	40	88185.6	0	0	45	63269.7	0	0	B31.3
2(SUS)		18394.3	63326.2	29		43876.4	63326.2	69.3	B31.3
3(EXP)		71905	233132.3	30.8		38637.9	207650.2	18.6	B31.3
1(OPE)	45	63625.2	0	0	48	130032	0	0	B31.3
2(SUS)		43856.2	63326.2	69.3		20011.4	63326.2	31.6	B31.3
3(EXP)		38637.9	207670.4	18.6		112902.5	231515.2	48.8	B31.3
1(OPE)	48	130032	0	0	49	137105.2	0	0	B31.3
2(SUS)		20011.4	63326.2	31.6		18207.6	63326.2	28.8	B31.3
3(EXP)		112902.5	231515.2	48.8		121121.5	233319.1	51.9	B31.3
1(OPE)	49	137105.2	0	0	50	140005.8	0	0	B31.3
2(SUS)		18207.6	63326.2	28.8		19057.1	63326.2	30.1	B31.3
3(EXP)		121121.5	233319.1	51.9		124526.2	232469.5	53.6	B31.3
1(OPE)	50	140005.8	0	0	59	137105.2	0	0	B31.3
2(SUS)		19057.1	63326.2	30.1		18207.6	63326.2	28.8	B31.3
3(EXP)		124526.2	232469.5	53.6		121121.5	233319.1	51.9	B31.3
1(OPE)	59	137105.2	0	0	60	130032	0	0	B31.3
2(SUS)		18207.6	63326.2	28.8		20011.4	63326.2	31.6	B31.3
3(EXP)		121121.5	233319.1	51.9		112902.5	231515.2	48.8	B31.3
1(OPE)	60	130032	0	0	65	63625.2	0	0	B31.3
2(SUS)		20011.4	63326.2	31.6		43856.2	63326.2	69.3	B31.3
3(EXP)		112902.5	231515.2	48.8		38637.9	207670.4	18.6	B31.3
1(OPE)	65	63269.7	0	0	68	88185.6	0	0	B31.3
2(SUS)		43876.4	63326.2	69.3		18394.3	63326.2	29	B31.3
3(EXP)		38637.9	207650.2	18.6		71905	233132.3	30.8	B31.3
1(OPE)	68	88185.6	0	0	69	95773.7	0	0	B31.3
2(SUS)		18394.3	63326.2	29		18629.9	63326.2	29.4	B31.3
3(EXP)		71905	233132.3	30.8		80321	232896.8	34.5	B31.3
1(OPE)	69	95773.7	0	0	70	98049.6	0	0	B31.3
2(SUS)		18629.9	63326.2	29.4		18639.8	63326.2	29.4	B31.3
3(EXP)		80321	232896.8	34.5		82676.7	232886.8	35.5	B31.3
1(OPE)	70	98049.6	0	0	78	97315.7	0	0	B31.3
2(SUS)		18639.8	63326.2	29.4		18557.6	63326.2	29.3	B31.3
3(EXP)		82676.7	232886.8	35.5		81863.5	232969.1	35.1	B31.3
1(OPE)	78	97315.7	0	0	79	96414.4	0	0	B31.3
2(SUS)		18557.6	63326.2	29.3		18429.4	63326.2	29.1	B31.3
3(EXP)		81863.5	232969.1	35.1		81253.6	233097.3	34.9	B31.3
1(OPE)	79	96414.4	0	0	80	95407.5	0	0	B31.3
2(SUS)		18429.4	63326.2	29.1		18328.4	63326.2	28.9	B31.3
3(EXP)		81253.6	233097.3	34.9		80282.5	233198.2	34.4	B31.3

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1(OPE)	80	95407.5	0	0	85	75373.5	0	0	B31.3
2(SUS)		18328.4	63326.2	28.9		24337.6	63326.2	38.4	B31.3
3(EXP)		80282.5	233198.2	34.4		59757.5	227189.1	26.3	B31.3
1(OPE)	85	75159.3	0	0	90	31950.6	0	0	B31.3
2(SUS)		24335.8	63326.2	38.4		24932.3	63326.2	39.4	B31.3
3(EXP)		59757.5	227190.9	26.3		14444.7	226594.3	6.4	B31.3
1(OPE)	90	31697.2	0	0	100	42083.2	0	0	B31.3
2(SUS)		24931.5	63326.2	39.4		24719.3	63326.2	39	B31.3
3(EXP)		14444.7	226595.2	6.4		26707.4	226807.3	11.8	B31.3
1(OPE)	100	42083.2	0	0	110	31697.2	0	0	B31.3
2(SUS)		24719.3	63326.2	39		24931.5	63326.2	39.4	B31.3
3(EXP)		26707.4	226807.3	11.8		14444.7	226595.2	6.4	B31.3
1(OPE)	110	31950.6	0	0	120	75159.3	0	0	B31.3
2(SUS)		24932.3	63326.2	39.4		24335.8	63326.2	38.4	B31.3
3(EXP)		14444.7	226594.3	6.4		59757.5	227190.9	26.3	B31.3
1(OPE)	120	75373.5	0	0	128	95407.6	0	0	B31.3
2(SUS)		24337.6	63326.2	38.4		18328.4	63326.2	28.9	B31.3
3(EXP)		59757.5	227189.1	26.3		80282.5	233198.2	34.4	B31.3
1(OPE)	128	95407.6	0	0	129	96414.4	0	0	B31.3
2(SUS)		18328.4	63326.2	28.9		18429.4	63326.2	29.1	B31.3
3(EXP)		80282.5	233198.2	34.4		81253.6	233097.3	34.9	B31.3
1(OPE)	129	96414.4	0	0	130	97315.8	0	0	B31.3
2(SUS)		18429.4	63326.2	29.1		18557.6	63326.2	29.3	B31.3
3(EXP)		81253.6	233097.3	34.9		81863.6	232969.1	35.1	B31.3
1(OPE)	130	97315.8	0	0	139	95773.7	0	0	B31.3
2(SUS)		18557.6	63326.2	29.3		18629.9	63326.2	29.4	B31.3
3(EXP)		81863.6	232969.1	35.1		80321	232896.8	34.5	B31.3
1(OPE)	139	95773.7	0	0	140	88185.6	0	0	B31.3
2(SUS)		18629.9	63326.2	29.4		18394.3	63326.2	29	B31.3
3(EXP)		80321	232896.8	34.5		71905	233132.3	30.8	B31.3
1(OPE)	140	88185.6	0	0	150	63269.7	0	0	B31.3
2(SUS)		18394.3	63326.2	29		43876.4	63326.2	69.3	B31.3
3(EXP)		71905	233132.3	30.8		38637.8	207650.2	18.6	B31.3
1(OPE)	150	63625.2	0	0	158	130031.9	0	0	B31.3
2(SUS)		43856.2	63326.2	69.3		20011.4	63326.2	31.6	B31.3
3(EXP)		38637.8	207670.4	18.6		112902.5	231515.2	48.8	B31.3
1(OPE)	158	130031.9	0	0	159	137105.2	0	0	B31.3
2(SUS)		20011.4	63326.2	31.6		18207.6	63326.2	28.8	B31.3
3(EXP)		112902.5	231515.2	48.8		121121.4	233319.1	51.9	B31.3
1(OPE)	159	137105.2	0	0	160	140005.8	0	0	B31.3
2(SUS)		18207.6	63326.2	28.8		19057.1	63326.2	30.1	B31.3
3(EXP)		121121.4	233319.1	51.9		124526.1	232469.5	53.6	B31.3

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1(OPE)	160	140005.8	0	0	168	140005.8	0	0	B31.3
2(SUS)		19057.1	63326.2	30.1		19057.1	63326.2	30.1	B31.3
3(EXP)		124526.1	232469.5	53.6		124526.1	232469.5	53.6	B31.3
1(OPE)	168	140005.8	0	0	169	137105.2	0	0	B31.3
2(SUS)		19057.1	63326.2	30.1		18207.6	63326.2	28.8	B31.3
3(EXP)		124526.1	232469.5	53.6		121121.5	233319.1	51.9	B31.3
1(OPE)	169	137105.2	0	0	170	130032	0	0	B31.3
2(SUS)		18207.6	63326.2	28.8		20011.4	63326.2	31.6	B31.3
3(EXP)		121121.5	233319.1	51.9		112902.5	231515.2	48.8	B31.3
1(OPE)	170	130032	0	0	180	63625.2	0	0	B31.3
2(SUS)		20011.4	63326.2	31.6		43856.2	63326.2	69.3	B31.3
3(EXP)		112902.5	231515.2	48.8		38637.9	207670.4	18.6	B31.3
1(OPE)	180	63269.7	0	0	188	88185.6	0	0	B31.3
2(SUS)		43876.4	63326.2	69.3		18394.3	63326.2	29	B31.3
3(EXP)		38637.9	207650.2	18.6		71905	233132.3	30.8	B31.3
1(OPE)	188	88185.6	0	0	189	95773.7	0	0	B31.3
2(SUS)		18394.3	63326.2	29		18629.9	63326.2	29.4	B31.3
3(EXP)		71905	233132.3	30.8		80321	232896.8	34.5	B31.3
1(OPE)	189	95773.7	0	0	190	98049.6	0	0	B31.3
2(SUS)		18629.9	63326.2	29.4		18639.8	63326.2	29.4	B31.3
3(EXP)		80321	232896.8	34.5		82676.7	232886.8	35.5	B31.3
1(OPE)	190	98049.6	0	0	199	96414.3	0	0	B31.3
2(SUS)		18639.8	63326.2	29.4		18429.4	63326.2	29.1	B31.3
3(EXP)		82676.7	232886.8	35.5		81253.6	233097.3	34.9	B31.3
1(OPE)	199	96414.3	0	0	200	95407.5	0	0	B31.3
2(SUS)		18429.4	63326.2	29.1		18328.4	63326.2	28.9	B31.3
3(EXP)		81253.6	233097.3	34.9		80282.4	233198.2	34.4	B31.3
1(OPE)	200	95407.5	0	0	210	75373.5	0	0	B31.3
2(SUS)		18328.4	63326.2	28.9		24337.6	63326.2	38.4	B31.3
3(EXP)		80282.4	233198.2	34.4		59757.5	227189.1	26.3	B31.3
1(OPE)	210	75159.3	0	0	220	31950.6	0	0	B31.3
2(SUS)		24335.8	63326.2	38.4		24932.3	63326.2	39.4	B31.3
3(EXP)		59757.5	227190.9	26.3		14444.7	226594.3	6.4	B31.3
1(OPE)	220	31697.2	0	0	230	42083.1	0	0	B31.3
2(SUS)		24931.5	63326.2	39.4		24719.3	63326.2	39	B31.3
3(EXP)		14444.7	226595.2	6.4		26707.3	226807.4	11.8	B31.3

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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14628	-13876	89176	-16865	-76693	4010	0	0	0
	2(SUS)	-106	-15044	-205	-19960	272	-1765	0	0	0
	3(EXP)	14733	1168	89381	3096	-76965	5775	0	0	0
	MAX	14733/L3	-15044/L	89381/L	-19960/L	-76965/L	5775/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	2015	-35254	-10382	0	0	0	11.2	0	-57.714
	2(SUS)	448	-30540	-33	0	0	0	0.003	0	0
	3(EXP)	1566	-4714	-10349	0	0	0	11.197	0	-57.713
	MAX	2015/L1	-35254/L	-10382/L1				11.200/L	-0.000/L1	-57.714/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2069	-27273	-8736	0	0	0	-3	0	-115.437
	2(SUS)	-1154	-27392	-72	0	0	0	-0.007	0	0
	3(EXP)	-915	119	-8664	0	0	0	-2.993	0	-115.437
	MAX	-2069/L1	-27392/L	-8736/L1				-3.000/L1	-0.000/L2	-115.437/L1
45		Rigid +Y								
	1(OPE)	-12909	-47686	-6164	0	0	0	-92.854	0	-44.339
	2(SUS)	811	-51113	272	0	0	0	0.005	0	0.002
	3(EXP)	-13721	3427	-6437	0	0	0	-92.858	0	-44.341
	MAX	-13721/L	-51113/L	-6437/L3				-92.858/L	-0.000/L2	-44.341/L3
65		Rigid +Y								
	1(OPE)	-12909	-47686	6164	0	0	0	-92.854	0	44.339
	2(SUS)	811	-51113	-272	0	0	0	0.005	0	-0.002
	3(EXP)	-13721	3427	6437	0	0	0	-92.858	0	44.341
	MAX	-13721/L	-51113/L	6437/L3				-92.858/L	-0.000/L2	44.341/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2069	-27273	8736	0	0	0	-3	0	115.437
	2(SUS)	-1154	-27392	72	0	0	0	-0.007	0	0
	3(EXP)	-915	119	8664	0	0	0	-2.993	0	115.437
	MAX	-2069/L1	-27392/L	8736/L1				-3.000/L1	-0.000/L2	115.437/L1
90		Rigid +Y								
	1(OPE)	2015	-35254	10382	0	0	0	11.2	0	57.714
	2(SUS)	448	-30540	33	0	0	0	0.003	0	0
	3(EXP)	1566	-4714	10349	0	0	0	11.197	0	57.713
	MAX	2015/L1	-35254/L	10382/L1				11.200/L	-0.000/L1	57.714/L1
100		Rigid ANC								
	1(OPE)	29255	-27753	0	0	0	8020	0	0	0
	2(SUS)	-212	-30089	0	0	0	-3530	0	0	0
	3(EXP)	29467	2336	0	0	0	11550	0	0	0
	MAX	29467/L3	-30089/L	-0/L1	0/L1	-0/L1	11550/L3	0.000/L3	-0.000/L2	-0.000/L1

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110		Rigid +Y								
	1(OPE)	2015	-35254	-10382	0	0	0	11.2	0	-57.714
	2(SUS)	448	-30540	-33	0	0	0	0.003	0	0
	3(EXP)	1566	-4714	-10349	0	0	0	11.197	0	-57.713
	MAX	2015/L1	-35254/L	-10382/L1				11.200/L	-0.000/L1	-57.714/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2069	-27273	-8736	0	0	0	-3	0	-115.437
	2(SUS)	-1154	-27392	-72	0	0	0	-0.007	0	0
	3(EXP)	-915	119	-8664	0	0	0	-2.993	0	-115.437
	MAX	-2069/L1	-27392/L	-8736/L1				-3.000/L1	-0.000/L2	-115.437/L1
150		Rigid +Y								
	1(OPE)	-12909	-47686	-6164	0	0	0	-92.853	0	-44.339
	2(SUS)	811	-51113	272	0	0	0	0.005	0	0.002
	3(EXP)	-13721	3427	-6437	0	0	0	-92.858	0	-44.341
	MAX	-13721/L	-51113/L	-6437/L3				-92.858/L	-0.000/L2	-44.341/L3
180		Rigid +Y								
	1(OPE)	-12909	-47686	6164	0	0	0	-92.853	0	44.339
	2(SUS)	811	-51113	-272	0	0	0	0.005	0	-0.002
	3(EXP)	-13721	3427	6437	0	0	0	-92.858	0	44.341
	MAX	-13721/L	-51113/L	6437/L3				-92.858/L	-0.000/L2	44.341/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2069	-27273	8736	0	0	0	-3	0	115.437
	2(SUS)	-1154	-27392	72	0	0	0	-0.007	0	0
	3(EXP)	-915	119	8664	0	0	0	-2.993	0	115.437
	MAX	-2069/L1	-27392/L	8736/L1				-3.000/L1	-0.000/L2	115.437/L1
220		Rigid +Y								
	1(OPE)	2015	-35254	10382	0	0	0	11.2	0	57.714
	2(SUS)	448	-30540	33	0	0	0	0.003	0	0
	3(EXP)	1566	-4714	10349	0	0	0	11.197	0	57.713
	MAX	2015/L1	-35254/L	10382/L1				11.200/L	-0.000/L1	57.714/L1
230		Rigid ANC								
	1(OPE)	14628	-13876	-89176	16865	76693	4010	0	0	0
	2(SUS)	-106	-15044	205	19960	-272	-1765	0	0	0
	3(EXP)	14733	1168	-89381	-3096	76965	5775	0	0	0
	MAX	14733/L3	-15044/L	-89381/L	19960/L3	76965/L3	5775/L3	0.000/L3	-0.000/L2	-0.000/L3

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Different Piperack Support Span
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.197	0	-57.713	-0.0067	-0.0763	0.0316
20	-2.993	0	-115.437	0.0269	0.3726	0.0631
28	-40.103	3.51	-142.708	0.0841	0.7731	0.078
29	-42.993	4.116	-144.118	0.091	0.8189	0.0814
30	-45.699	5.238	-145.173	0.0969	0.8619	0.0887
38	-49.365	7.18	-146.358	0.0999	0.9056	0.0849
39	-55.327	9.329	-145.175	0.1063	0.9903	0.101
40	-60.221	9.637	-138.931	0.1082	1.0764	0.1097
45	-92.858	0	-44.341	0.0639	1.1911	0.1283
48	-117.527	-7.643	16.948	0.0305	0.7965	0.1283
49	-122.185	-8.413	20.657	0.0261	0.6603	0.1288
50	-127.169	-8.612	19.606	0.0206	0.517	0.1293
59	-122.185	-8.413	-20.657	-0.0261	-0.6603	0.1288
60	-117.527	-7.643	-16.948	-0.0305	-0.7965	0.1283
65	-92.858	0	44.341	-0.0639	-1.1911	0.1283
68	-60.221	9.637	138.931	-0.1082	-1.0764	0.1098
69	-55.327	9.329	145.175	-0.1063	-0.9903	0.101
70	-49.365	7.18	146.358	-0.0999	-0.9056	0.0849
78	-45.699	5.238	145.174	-0.0969	-0.8619	0.0887
79	-42.993	4.116	144.118	-0.091	-0.8189	0.0814
80	-40.103	3.51	142.708	-0.0841	-0.7731	0.078
85	-2.993	0	115.437	-0.0269	-0.3726	0.0631
90	11.197	0	57.713	0.0067	0.0763	0.0316
100	0	0	0	0	0	0
110	11.197	0	-57.713	-0.0067	-0.0763	0.0316
120	-2.993	0	-115.437	0.0269	0.3726	0.0631
128	-40.103	3.51	-142.708	0.0841	0.7731	0.078
129	-42.993	4.116	-144.118	0.091	0.8189	0.0814
130	-45.699	5.238	-145.173	0.0969	0.8619	0.0887
139	-55.327	9.329	-145.175	0.1063	0.9903	0.101
140	-60.221	9.637	-138.931	0.1082	1.0764	0.1097
150	-92.858	0	-44.341	0.0639	1.1911	0.1283
158	-117.527	-7.643	16.948	0.0305	0.7965	0.1283
159	-122.185	-8.413	20.657	0.0261	0.6603	0.1288
160	-127.169	-8.612	19.606	0.0206	0.517	0.1293
168	-127.169	-8.612	-19.606	-0.0206	-0.517	0.1293
169	-122.185	-8.413	-20.657	-0.0261	-0.6603	0.1288
170	-117.527	-7.643	-16.948	-0.0305	-0.7965	0.1283
180	-92.858	0	44.341	-0.0639	-1.1911	0.1283

Root Cause:
Different Piperack Support Span

188	-60.221	9.637	138.931	-0.1082	-1.0764	0.1097
189	-55.327	9.329	145.175	-0.1063	-0.9903	0.101
190	-49.365	7.18	146.358	-0.0999	-0.9056	0.0849
199	-42.993	4.116	144.117	-0.091	-0.8189	0.0814
200	-40.103	3.51	142.708	-0.0841	-0.7731	0.078
210	-2.993	0	115.437	-0.0269	-0.3726	0.0631
220	11.197	0	57.713	0.0067	0.0763	0.0316
230	0	0	0	0	0	0

Root Cause:
Different Piperack Support Span

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0004	-0.0006	-0.0096
20	-0.007	0	0	0.0017	0.0027	-0.0193
28	-0.264	-0.392	-0.001	-0.0065	0.004	-0.0238
29	-0.261	-0.415	-0.005	-0.0063	0.0038	-0.0241
30	-0.223	-0.433	-0.017	-0.0061	0.0035	-0.0244
38	-0.143	-0.456	-0.04	-0.006	0.0033	-0.0248
39	-0.04	-0.415	-0.06	-0.0064	0.0027	-0.0255
40	0.005	-0.257	-0.057	-0.007	0.002	-0.0256
45	0.005	0	0.002	-0.0138	0.0001	0.0494
48	0.005	-5.573	0	-0.019	-0.0001	0.1159
49	0.005	-6.398	0	-0.0196	0	0.1175
50	0.005	-6.849	0	-0.0189	0	0.1176
59	0.005	-6.398	0	0.0196	0	0.1175
60	0.005	-5.573	0	0.019	0.0001	0.1159
65	0.005	0	-0.002	0.0138	-0.0001	0.0494
68	0.005	-0.257	0.057	0.007	-0.002	-0.0256
69	-0.04	-0.415	0.06	0.0064	-0.0027	-0.0255
70	-0.143	-0.456	0.04	0.006	-0.0033	-0.0248
78	-0.223	-0.433	0.017	0.0061	-0.0035	-0.0244
79	-0.261	-0.415	0.005	0.0063	-0.0038	-0.0241
80	-0.264	-0.392	0.001	0.0065	-0.004	-0.0238
85	-0.007	0	0	-0.0017	-0.0027	-0.0193
90	0.003	0	0	0.0004	0.0006	-0.0096
100	0	0	0	0	0	0
110	0.003	0	0	-0.0004	-0.0006	-0.0096
120	-0.007	0	0	0.0017	0.0027	-0.0193
128	-0.264	-0.392	-0.001	-0.0065	0.004	-0.0238
129	-0.261	-0.415	-0.005	-0.0063	0.0038	-0.0241
130	-0.223	-0.433	-0.017	-0.0061	0.0035	-0.0244
139	-0.04	-0.415	-0.06	-0.0064	0.0027	-0.0255
140	0.005	-0.257	-0.057	-0.007	0.002	-0.0256
150	0.005	0	0.002	-0.0138	0.0001	0.0494
158	0.005	-5.573	0	-0.019	-0.0001	0.1159
159	0.005	-6.398	0	-0.0196	0	0.1175
160	0.005	-6.849	0	-0.0189	0	0.1176
168	0.005	-6.849	0	0.0189	0	0.1176
169	0.005	-6.398	0	0.0196	0	0.1175
170	0.005	-5.573	0	0.019	0.0001	0.1159
180	0.005	0	-0.002	0.0138	-0.0001	0.0494

Root Cause:
Different Piperack Support Span

188	0.005	-0.257	0.057	0.007	-0.002	-0.0256
189	-0.04	-0.415	0.06	0.0064	-0.0027	-0.0255
190	-0.143	-0.456	0.04	0.006	-0.0033	-0.0248
199	-0.261	-0.415	0.005	0.0063	-0.0038	-0.0241
200	-0.264	-0.392	0.001	0.0065	-0.004	-0.0238
210	-0.007	0	0	-0.0017	-0.0027	-0.0193
220	0.003	0	0	0.0004	0.0006	-0.0096
230	0	0	0	0	0	0

Root Cause:
Different Piperack Support Span

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: DEC 6, 2014 Time: 15:49
Job Name: A335 P22_2 EXPANSION LOOP_8M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.2	0	-57.714	-0.0071	-0.0769	0.0219
20	-3	0	-115.437	0.0286	0.3753	0.0438
28	-40.367	3.117	-142.708	0.0775	0.7771	0.0542
29	-43.253	3.701	-144.123	0.0847	0.8227	0.0573
30	-45.922	4.804	-145.191	0.0908	0.8654	0.0642
38	-49.508	6.724	-146.398	0.0938	0.909	0.0601
39	-55.367	8.914	-145.236	0.1	0.993	0.0755
40	-60.216	9.38	-138.988	0.1012	1.0784	0.0842
45	-92.854	0	-44.339	0.0501	1.1912	0.1776
48	-117.522	-13.216	16.948	0.0115	0.7965	0.2441
49	-122.18	-14.811	20.658	0.0065	0.6603	0.2462
50	-127.164	-15.461	19.606	0.0017	0.517	0.2469
59	-122.18	-14.811	-20.657	-0.0065	-0.6603	0.2462
60	-117.522	-13.216	-16.948	-0.0115	-0.7965	0.2441
65	-92.854	0	44.339	-0.0501	-1.1912	0.1776
68	-60.216	9.38	138.988	-0.1012	-1.0784	0.0842
69	-55.367	8.914	145.236	-0.1	-0.993	0.0755
70	-49.508	6.724	146.398	-0.0938	-0.909	0.0601
78	-45.922	4.804	145.191	-0.0908	-0.8654	0.0642
79	-43.253	3.701	144.123	-0.0847	-0.8227	0.0573
80	-40.367	3.117	142.708	-0.0775	-0.7771	0.0542
85	-3	0	115.437	-0.0286	-0.3753	0.0438
90	11.2	0	57.714	0.0071	0.0769	0.0219
100	0	0	0	0	0	0
110	11.2	0	-57.714	-0.0071	-0.0769	0.0219
120	-3	0	-115.437	0.0286	0.3753	0.0438
128	-40.367	3.117	-142.708	0.0775	0.7771	0.0542
129	-43.253	3.701	-144.123	0.0847	0.8227	0.0573
130	-45.922	4.804	-145.191	0.0908	0.8654	0.0642
139	-55.366	8.914	-145.236	0.1	0.993	0.0755
140	-60.216	9.38	-138.988	0.1012	1.0784	0.0842
150	-92.853	0	-44.339	0.0501	1.1912	0.1776
158	-117.522	-13.216	16.948	0.0115	0.7965	0.2441
159	-122.18	-14.811	20.658	0.0065	0.6603	0.2462
160	-127.164	-15.461	19.606	0.0017	0.517	0.2469
168	-127.164	-15.461	-19.606	-0.0017	-0.5169	0.2469
169	-122.18	-14.811	-20.657	-0.0065	-0.6603	0.2462
170	-117.522	-13.216	-16.948	-0.0115	-0.7965	0.2441
180	-92.853	0	44.339	-0.0501	-1.1912	0.1776

Root Cause:
Different Piperack Support Span

188	-60.216	9.38	138.988	-0.1012	-1.0784	0.0842
189	-55.366	8.914	145.236	-0.1	-0.993	0.0755
190	-49.508	6.724	146.398	-0.0938	-0.909	0.0601
199	-43.253	3.701	144.122	-0.0847	-0.8227	0.0573
200	-40.367	3.117	142.708	-0.0775	-0.7771	0.0542
210	-3	0	115.437	-0.0286	-0.3753	0.0438
220	11.2	0	57.714	0.0071	0.0769	0.0219
230	0	0	0	0	0	0

Root Cause:
Different Piperack Support Span

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .05
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .05
Node 20 +Y Mu = .05

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .05

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .05

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .05
Node 85 +Y Mu = .05

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .05

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .05
   Node  120  Guide   Gap= 3.000 mm.   Mu = .05
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .05
   Node  210  Guide   Gap= 3.000 mm.   Mu = .05
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .05

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Len MU Dir Vectors
10	ANC			.05	.000	.000 .000
15	+Y			.05	.000	1.000 .000
20	Guide		3.00	.05	.000	.000 .000
20	+Y			.05	.000	1.000 .000
45	+Y			.05	.000	1.000 .000
65	+Y			.05	.000	1.000 .000
85	Guide		3.00	.05	.000	.000 .000
85	+Y			.05	.000	1.000 .000
90	+Y			.05	.000	1.000 .000
100	ANC			.05	.000	.000 .000
110	+Y			.05	.000	1.000 .000
120	+Y			.05	.000	1.000 .000
120	Guide		3.00	.05	.000	.000 .000
150	+Y			.05	.000	1.000 .000
180	+Y			.05	.000	1.000 .000
210	+Y			.05	.000	1.000 .000
210	Guide		3.00	.05	.000	.000 .000
220	+Y			.05	.000	1.000 .000
230	ANC			.05	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.05

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.05

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.05

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43882.9 Allowable Stress: 63326.2
Axial Stress: 17791.5 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 116687.0 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 24630.4 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 137958.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	48129.4	0	0	15	35315.8	0	0	B31.3
2(SUS)		23741.1	63326.2	37.5		24318.8	63326.2	38.4	B31.3
3(EXP)		32422	227785.6	14.2		18059.6	227207.8	7.9	B31.3
1(OPE)	15	35357.5	0	0	20	84058.4	0	0	B31.3
2(SUS)		24320	63326.2	38.4		22612.7	63326.2	35.7	B31.3
3(EXP)		18059.6	227206.7	7.9		68318.9	228914	29.8	B31.3
1(OPE)	20	84104.1	0	0	28	87697.1	0	0	B31.3
2(SUS)		22615	63326.2	35.7		18146.6	63326.2	28.7	B31.3
3(EXP)		68318.9	228911.6	29.8		72422.7	233380.1	31	B31.3
1(OPE)	28	87697.1	0	0	29	87863.9	0	0	B31.3
2(SUS)		18146.6	63326.2	28.7		18329	63326.2	28.9	B31.3
3(EXP)		72422.7	233380.1	31		72555.6	233197.6	31.1	B31.3
1(OPE)	29	87863.9	0	0	30	88047	0	0	B31.3
2(SUS)		18329	63326.2	28.9		18501.5	63326.2	29.2	B31.3
3(EXP)		72555.6	233197.6	31.1		72473.1	233025.1	31.1	B31.3
1(OPE)	30	88047	0	0	38	87909.7	0	0	B31.3
2(SUS)		18501.5	63326.2	29.2		18669.9	63326.2	29.5	B31.3
3(EXP)		72473.1	233025.1	31.1		72396.8	232856.7	31.1	B31.3
1(OPE)	38	87909.7	0	0	39	85131.1	0	0	B31.3
2(SUS)		18669.9	63326.2	29.5		18740	63326.2	29.6	B31.3
3(EXP)		72396.8	232856.7	31.1		69359.1	232786.7	29.8	B31.3

Possible Approach:
Friction Factor 0.05

1(OPE)	39	85131.1	0	0	40	78156.5	0	0	B31.3
2(SUS)		18740	63326.2	29.6		18461.4	63326.2	29.2	B31.3
3(EXP)		69359.1	232786.7	29.8		61593.1	233065.3	26.4	B31.3
1(OPE)	40	78156.5	0	0	45	60577.2	0	0	B31.3
2(SUS)		18461.4	63326.2	29.2		43882.9	63326.2	69.3	B31.3
3(EXP)		61593.1	233065.3	26.4		35132.7	207643.7	16.9	B31.3
1(OPE)	45	60638.6	0	0	48	122785.8	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35132.7	207665.8	16.9		105649.9	231505.7	45.6	B31.3
1(OPE)	48	122785.8	0	0	49	129512.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105649.9	231505.7	45.6		113454.1	233171.3	48.7	B31.3
1(OPE)	49	129512.1	0	0	50	132269	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.5	63326.2	29.7	B31.3
3(EXP)		113454.1	233171.3	48.7		116687	232689.1	50.1	B31.3
1(OPE)	50	132269	0	0	59	129512.1	0	0	B31.3
2(SUS)		18837.5	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116687	232689.1	50.1		113454.1	233171.3	48.7	B31.3
1(OPE)	59	129512.1	0	0	60	122785.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113454.1	233171.3	48.7		105649.8	231505.7	45.6	B31.3
1(OPE)	60	122785.8	0	0	65	60638.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105649.8	231505.7	45.6		35132.7	207665.8	16.9	B31.3
1(OPE)	65	60577.2	0	0	68	78156.5	0	0	B31.3
2(SUS)		43882.9	63326.2	69.3		18461.4	63326.2	29.2	B31.3
3(EXP)		35132.7	207643.7	16.9		61593.1	233065.3	26.4	B31.3
1(OPE)	68	78156.5	0	0	69	85131.1	0	0	B31.3
2(SUS)		18461.4	63326.2	29.2		18740	63326.2	29.6	B31.3
3(EXP)		61593.1	233065.3	26.4		69359.1	232786.7	29.8	B31.3
1(OPE)	69	85131.1	0	0	70	87909.7	0	0	B31.3
2(SUS)		18740	63326.2	29.6		18669.9	63326.2	29.5	B31.3
3(EXP)		69359.1	232786.7	29.8		72396.8	232856.7	31.1	B31.3
1(OPE)	70	87909.7	0	0	78	88047.1	0	0	B31.3
2(SUS)		18669.9	63326.2	29.5		18501.5	63326.2	29.2	B31.3
3(EXP)		72396.8	232856.7	31.1		72473.1	233025.1	31.1	B31.3
1(OPE)	78	88047	0	0	79	87863.9	0	0	B31.3
2(SUS)		18501.5	63326.2	29.2		18329	63326.2	28.9	B31.3
3(EXP)		72473.1	233025.1	31.1		72555.6	233197.6	31.1	B31.3
1(OPE)	79	87863.9	0	0	80	87697.1	0	0	B31.3
2(SUS)		18329	63326.2	28.9		18146.6	63326.2	28.7	B31.3
3(EXP)		72555.6	233197.6	31.1		72422.8	233380.1	31	B31.3

Possible Approach:
Friction Factor 0.05

1(OPE)	80	87697.1	0	0	85	84104.1	0	0	B31.3
2(SUS)		18146.6	63326.2	28.7		22615	63326.2	35.7	B31.3
3(EXP)		72422.8	233380.1	31		68318.9	228911.6	29.8	B31.3
1(OPE)	85	84058.5	0	0	90	35357.5	0	0	B31.3
2(SUS)		22612.7	63326.2	35.7		24320	63326.2	38.4	B31.3
3(EXP)		68318.9	228914	29.8		18059.6	227206.7	7.9	B31.3
1(OPE)	90	35315.8	0	0	100	48129.5	0	0	B31.3
2(SUS)		24318.8	63326.2	38.4		23741.1	63326.2	37.5	B31.3
3(EXP)		18059.6	227207.8	7.9		32422.1	227785.5	14.2	B31.3
1(OPE)	100	48129.5	0	0	110	35315.8	0	0	B31.3
2(SUS)		23741.1	63326.2	37.5		24318.8	63326.2	38.4	B31.3
3(EXP)		32422.2	227785.5	14.2		18059.6	227207.8	7.9	B31.3
1(OPE)	110	35357.5	0	0	120	84058.5	0	0	B31.3
2(SUS)		24320	63326.2	38.4		22612.6	63326.2	35.7	B31.3
3(EXP)		18059.6	227206.7	7.9		68319	228914	29.8	B31.3
1(OPE)	120	84104.2	0	0	128	87697.1	0	0	B31.3
2(SUS)		22615	63326.2	35.7		18146.6	63326.2	28.7	B31.3
3(EXP)		68319	228911.7	29.8		72422.8	233380.1	31	B31.3
1(OPE)	128	87697.1	0	0	129	87863.9	0	0	B31.3
2(SUS)		18146.6	63326.2	28.7		18329	63326.2	28.9	B31.3
3(EXP)		72422.8	233380.1	31		72555.7	233197.6	31.1	B31.3
1(OPE)	129	87863.9	0	0	130	88047.1	0	0	B31.3
2(SUS)		18329	63326.2	28.9		18501.5	63326.2	29.2	B31.3
3(EXP)		72555.7	233197.6	31.1		72473.1	233025.1	31.1	B31.3
1(OPE)	130	88047.1	0	0	139	85131.1	0	0	B31.3
2(SUS)		18501.5	63326.2	29.2		18740	63326.2	29.6	B31.3
3(EXP)		72473.1	233025.1	31.1		69359.1	232786.7	29.8	B31.3
1(OPE)	139	85131.1	0	0	140	78156.5	0	0	B31.3
2(SUS)		18740	63326.2	29.6		18461.4	63326.2	29.2	B31.3
3(EXP)		69359.1	232786.7	29.8		61593.1	233065.3	26.4	B31.3
1(OPE)	140	78156.5	0	0	150	60577.2	0	0	B31.3
2(SUS)		18461.4	63326.2	29.2		43882.9	63326.2	69.3	B31.3
3(EXP)		61593.1	233065.3	26.4		35132.6	207643.7	16.9	B31.3
1(OPE)	150	60638.6	0	0	158	122785.7	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35132.6	207665.8	16.9		105649.8	231505.7	45.6	B31.3
1(OPE)	158	122785.7	0	0	159	129512.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105649.8	231505.7	45.6		113454.1	233171.3	48.7	B31.3
1(OPE)	159	129512.1	0	0	160	132269	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.5	63326.2	29.7	B31.3
3(EXP)		113454.1	233171.3	48.7		116686.9	232689.1	50.1	B31.3

Possible Approach:
Friction Factor 0.05

1(OPE)	160	132269	0	0	168	132269	0	0	B31.3
2(SUS)		18837.5	63326.2	29.7		18837.5	63326.2	29.7	B31.3
3(EXP)		116686.9	232689.1	50.1		116687	232689.1	50.1	B31.3
1(OPE)	168	132269	0	0	169	129512.1	0	0	B31.3
2(SUS)		18837.5	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116687	232689.1	50.1		113454.1	233171.3	48.7	B31.3
1(OPE)	169	129512.1	0	0	170	122785.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113454.1	233171.3	48.7		105649.9	231505.7	45.6	B31.3
1(OPE)	170	122785.8	0	0	180	60638.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105649.9	231505.7	45.6		35132.7	207665.8	16.9	B31.3
1(OPE)	180	60577.2	0	0	188	78156.5	0	0	B31.3
2(SUS)		43882.9	63326.2	69.3		18461.4	63326.2	29.2	B31.3
3(EXP)		35132.7	207643.7	16.9		61593.1	233065.3	26.4	B31.3
1(OPE)	188	78156.5	0	0	189	85131.1	0	0	B31.3
2(SUS)		18461.4	63326.2	29.2		18740	63326.2	29.6	B31.3
3(EXP)		61593.1	233065.3	26.4		69359.1	232786.7	29.8	B31.3
1(OPE)	189	85131.1	0	0	190	87909.7	0	0	B31.3
2(SUS)		18740	63326.2	29.6		18669.9	63326.2	29.5	B31.3
3(EXP)		69359.1	232786.7	29.8		72396.8	232856.7	31.1	B31.3
1(OPE)	190	87909.7	0	0	199	87863.9	0	0	B31.3
2(SUS)		18669.9	63326.2	29.5		18329	63326.2	28.9	B31.3
3(EXP)		72396.8	232856.7	31.1		72555.6	233197.6	31.1	B31.3
1(OPE)	199	87863.9	0	0	200	87697.1	0	0	B31.3
2(SUS)		18329	63326.2	28.9		18146.6	63326.2	28.7	B31.3
3(EXP)		72555.6	233197.6	31.1		72422.7	233380.1	31	B31.3
1(OPE)	200	87697.1	0	0	210	84104.1	0	0	B31.3
2(SUS)		18146.6	63326.2	28.7		22615	63326.2	35.7	B31.3
3(EXP)		72422.7	233380.1	31		68318.9	228911.7	29.8	B31.3
1(OPE)	210	84058.4	0	0	220	35357.5	0	0	B31.3
2(SUS)		22612.6	63326.2	35.7		24320	63326.2	38.4	B31.3
3(EXP)		68318.9	228914	29.8		18059.6	227206.7	7.9	B31.3
1(OPE)	220	35315.8	0	0	230	48129.4	0	0	B31.3
2(SUS)		24318.8	63326.2	38.4		23741.1	63326.2	37.5	B31.3
3(EXP)		18059.6	227207.8	7.9		32422	227785.6	14.2	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	19216	-12532	64719	-13641	-93259	5105	0	0	0
	2(SUS)	-88	-13955	-296	-17174	210	-1533	0	0	0
	3(EXP)	19305	1423	65016	3534	-93470	6638	0	0	0
	MAX	19305/L3	-13955/L	65016/L	-17174/L	-93470/L	6638/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	373	-34984	-1709	0	0	0	11.823	0	-54.128
	2(SUS)	406	-29233	-45	0	0	0	0.002	0	0
	3(EXP)	-33	-5751	-1664	0	0	0	11.821	0	-54.128
	MAX	406/L2	-34984/L	-1709/L1				11.823/L	-0.000/L1	-54.128/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-17073	-21644	-1934	0	0	0	-3	0	-108.257
	2(SUS)	-1207	-24153	-30	0	0	0	-0.023	0	-0.001
	3(EXP)	-15866	2509	-1904	0	0	0	-2.977	0	-108.256
	MAX	-17073/L	-24153/L	-1934/L1				-3.000/L1	-0.000/L2	-108.257/L1
45		Rigid +Y								
	1(OPE)	-2244	-49259	-1015	0	0	0	-88.428	0	-39.994
	2(SUS)	885	-51078	539	0	0	0	0.005	0	0.003
	3(EXP)	-3129	1819	-1554	0	0	0	-88.433	0	-39.997
	MAX	-3129/L3	-51078/L	-1554/L3				-88.433/L	-0.000/L2	-39.997/L3
65		Rigid +Y								
	1(OPE)	-2244	-49259	1015	0	0	0	-88.428	0	39.994
	2(SUS)	885	-51078	-539	0	0	0	0.005	0	-0.003
	3(EXP)	-3129	1819	1554	0	0	0	-88.433	0	39.997
	MAX	-3129/L3	-51078/L	1554/L3				-88.433/L	-0.000/L2	39.997/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-17073	-21644	1934	0	0	0	-3	0	108.257
	2(SUS)	-1207	-24153	30	0	0	0	-0.023	0	0.001
	3(EXP)	-15866	2509	1904	0	0	0	-2.977	0	108.257
	MAX	-17073/L	-24153/L	1934/L1				-3.000/L1	-0.000/L2	108.257/L1
90		Rigid +Y								
	1(OPE)	373	-34984	1709	0	0	0	11.823	0	54.128
	2(SUS)	406	-29233	45	0	0	0	0.002	0	0
	3(EXP)	-33	-5751	1664	0	0	0	11.821	0	54.128
	MAX	406/L2	-34984/L	1709/L1				11.823/L	-0.000/L1	54.128/L1
100		Rigid ANC								
	1(OPE)	38433	-25064	0	0	0	10211	0	0	0
	2(SUS)	-177	-27911	0	0	0	-3065	0	0	0
	3(EXP)	38609	2846	0	0	0	13276	0	0	0
	MAX	38609/L3	-27911/L	-0/L1	0/L2	-0/L1	13276/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	373	-34984	-1709	0	0	0	11.823	0	-54.128
	2(SUS)	406	-29233	-45	0	0	0	0.002	0	0
	3(EXP)	-33	-5751	-1664	0	0	0	11.821	0	-54.128
	MAX	406/L2	-34984/L	-1709/L1				11.823/L	-0.000/L1	-54.128/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-17073	-21644	-1934	0	0	0	-3	0	-108.257
	2(SUS)	-1207	-24153	-30	0	0	0	-0.023	0	-0.001
	3(EXP)	-15866	2509	-1904	0	0	0	-2.977	0	-108.257
	MAX	-17073/L	-24153/L	-1934/L1				-3.000/L1	-0.000/L2	-108.257/L1
150		Rigid +Y								
	1(OPE)	-2244	-49259	-1015	0	0	0	-88.428	0	-39.994
	2(SUS)	885	-51078	539	0	0	0	0.005	0	0.003
	3(EXP)	-3129	1819	-1554	0	0	0	-88.433	0	-39.997
	MAX	-3129/L3	-51078/L	-1554/L3				-88.433/L	-0.000/L2	-39.997/L3
180		Rigid +Y								
	1(OPE)	-2244	-49259	1015	0	0	0	-88.428	0	39.994
	2(SUS)	885	-51078	-539	0	0	0	0.005	0	-0.003
	3(EXP)	-3129	1819	1554	0	0	0	-88.433	0	39.997
	MAX	-3129/L3	-51078/L	1554/L3				-88.433/L	-0.000/L2	39.997/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-17073	-21644	1934	0	0	0	-3	0	108.257
	2(SUS)	-1207	-24153	30	0	0	0	-0.023	0	0.001
	3(EXP)	-15866	2509	1904	0	0	0	-2.977	0	108.257
	MAX	-17073/L	-24153/L	1934/L1				-3.000/L1	-0.000/L2	108.257/L1
220		Rigid +Y								
	1(OPE)	373	-34984	1709	0	0	0	11.823	0	54.128
	2(SUS)	406	-29233	45	0	0	0	0.002	0	0
	3(EXP)	-33	-5751	1664	0	0	0	11.821	0	54.128
	MAX	406/L2	-34984/L	1709/L1				11.823/L	-0.000/L1	54.128/L1
230		Rigid ANC								
	1(OPE)	19216	-12532	-64719	13641	93259	5105	0	0	0
	2(SUS)	-88	-13955	296	17174	-210	-1533	0	0	0
	3(EXP)	19305	1423	-65016	-3534	93470	6638	0	0	0
	MAX	19305/L3	-13955/L	-65016/L	17174/L3	93470/L3	6638/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.821	0	-54.128	-0.0072	-0.0836	0.034
20	-2.977	0	-108.256	0.0289	0.4065	0.068
28	-36.14	3.006	-131.923	0.078	0.7558	0.0829
29	-38.966	3.589	-133.338	0.0841	0.797	0.0861
30	-41.609	4.689	-134.409	0.0894	0.8352	0.0927
38	-45.182	6.601	-135.623	0.092	0.8738	0.0891
39	-50.986	8.705	-134.587	0.0976	0.9473	0.1019
40	-55.79	9.001	-128.686	0.0991	1.0213	0.1075
45	-88.433	0	-39.997	0.0585	1.1129	0.1173
48	-113.102	-6.993	17.358	0.0279	0.7463	0.1173
49	-117.639	-7.698	20.764	0.0239	0.6188	0.1178
50	-122.38	-7.879	19.607	0.0189	0.4845	0.1183
59	-117.639	-7.698	-20.764	-0.0239	-0.6188	0.1178
60	-113.102	-6.993	-17.358	-0.0279	-0.7463	0.1173
65	-88.433	0	39.997	-0.0585	-1.1129	0.1173
68	-55.79	9.001	128.686	-0.0991	-1.0213	0.1075
69	-50.986	8.705	134.587	-0.0976	-0.9473	0.1019
70	-45.182	6.601	135.623	-0.092	-0.8738	0.0891
78	-41.609	4.689	134.409	-0.0894	-0.8352	0.0927
79	-38.966	3.589	133.338	-0.0841	-0.797	0.0861
80	-36.14	3.006	131.923	-0.078	-0.7558	0.0829
85	-2.977	0	108.257	-0.0289	-0.4065	0.068
90	11.821	0	54.128	0.0072	0.0836	0.034
100	0	0	0	0	0	0
110	11.821	0	-54.128	-0.0072	-0.0836	0.034
120	-2.977	0	-108.257	0.0289	0.4065	0.068
128	-36.14	3.006	-131.923	0.078	0.7558	0.0829
129	-38.966	3.589	-133.338	0.0841	0.797	0.0861
130	-41.609	4.689	-134.409	0.0894	0.8352	0.0927
139	-50.986	8.705	-134.587	0.0976	0.9473	0.1019
140	-55.79	9.001	-128.686	0.0991	1.0213	0.1075
150	-88.433	0	-39.997	0.0585	1.1129	0.1173
158	-113.102	-6.993	17.359	0.0279	0.7463	0.1173
159	-117.639	-7.698	20.764	0.0239	0.6188	0.1178
160	-122.38	-7.879	19.607	0.0189	0.4845	0.1183
168	-122.38	-7.879	-19.607	-0.0189	-0.4845	0.1183
169	-117.639	-7.698	-20.764	-0.0239	-0.6188	0.1178
170	-113.102	-6.993	-17.358	-0.0279	-0.7463	0.1173
180	-88.433	0	39.997	-0.0585	-1.1129	0.1173

Possible Approach:
Friction Factor 0.05

188	-55.79	9.001	128.686	-0.0991	-1.0213	0.1075
189	-50.986	8.705	134.587	-0.0976	-0.9473	0.1019
190	-45.182	6.601	135.623	-0.092	-0.8738	0.0891
199	-38.965	3.589	133.337	-0.0841	-0.797	0.0861
200	-36.14	3.006	131.923	-0.078	-0.7558	0.0829
210	-2.977	0	108.257	-0.0289	-0.4065	0.068
220	11.821	0	54.128	0.0072	0.0836	0.034
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	0	-0.0011	-0.0005	-0.0079
20	-0.023	0	-0.001	0.0044	0.0025	-0.0157
28	-0.213	-0.031	-0.001	-0.001	0.0033	-0.0191
29	-0.21	-0.034	-0.001	-0.0009	0.0031	-0.0194
30	-0.18	-0.037	-0.003	-0.0009	0.0028	-0.0197
38	-0.115	-0.04	-0.006	-0.001	0.0026	-0.02
39	-0.031	0.011	-0.006	-0.0015	0.0019	-0.0206
40	0.006	0.146	0.001	-0.0023	0.0012	-0.0206
45	0.005	0	0.003	-0.0111	-0.0003	0.0545
48	0.005	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.737	0	-0.0185	0.0001	0.1227
50	0.005	-7.195	0	-0.018	0	0.1228
59	0.005	-6.737	0	0.0185	-0.0001	0.1227
60	0.005	-5.881	0.001	0.0177	-0.0001	0.121
65	0.005	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.146	-0.001	0.0023	-0.0012	-0.0206
69	-0.031	0.011	0.006	0.0015	-0.0019	-0.0206
70	-0.115	-0.04	0.006	0.001	-0.0026	-0.02
78	-0.18	-0.037	0.003	0.0009	-0.0028	-0.0197
79	-0.21	-0.034	0.001	0.0009	-0.0031	-0.0194
80	-0.213	-0.031	0.001	0.001	-0.0033	-0.0191
85	-0.023	0	0.001	-0.0044	-0.0025	-0.0157
90	0.002	0	0	0.0011	0.0005	-0.0079
100	0	0	0	0	0	0
110	0.002	0	0	-0.0011	-0.0005	-0.0079
120	-0.023	0	-0.001	0.0044	0.0025	-0.0157
128	-0.213	-0.031	-0.001	-0.001	0.0033	-0.0191
129	-0.21	-0.034	-0.001	-0.0009	0.0031	-0.0194
130	-0.18	-0.037	-0.003	-0.0009	0.0028	-0.0197
139	-0.031	0.011	-0.006	-0.0015	0.0019	-0.0206
140	0.006	0.146	0.001	-0.0023	0.0012	-0.0206
150	0.005	0	0.003	-0.0111	-0.0003	0.0545
158	0.005	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.737	0	-0.0185	0.0001	0.1227
160	0.005	-7.195	0	-0.018	0	0.1228
168	0.005	-7.195	0	0.018	0	0.1228
169	0.005	-6.737	0	0.0185	-0.0001	0.1227
170	0.005	-5.881	0.001	0.0177	-0.0001	0.121
180	0.005	0	-0.003	0.0111	0.0003	0.0545

Possible Approach:
Friction Factor 0.05

188	0.006	0.146	-0.001	0.0023	-0.0012	-0.0206
189	-0.031	0.011	0.006	0.0015	-0.0019	-0.0206
190	-0.115	-0.04	0.006	0.001	-0.0026	-0.02
199	-0.21	-0.034	0.001	0.0009	-0.0031	-0.0194
200	-0.213	-0.031	0.001	0.001	-0.0033	-0.0191
210	-0.023	0	0.001	-0.0044	-0.0025	-0.0157
220	0.002	0	0	0.0011	0.0005	-0.0079
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:29
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.823	0	-54.128	-0.0083	-0.0841	0.0262
20	-3	0	-108.257	0.0333	0.409	0.0523
28	-36.353	2.975	-131.924	0.077	0.7591	0.0638
29	-39.176	3.555	-133.339	0.0832	0.8001	0.0667
30	-41.789	4.652	-134.412	0.0885	0.838	0.073
38	-45.298	6.562	-135.63	0.091	0.8763	0.0692
39	-51.018	8.716	-134.592	0.096	0.9491	0.0813
40	-55.785	9.147	-128.685	0.0967	1.0224	0.0869
45	-88.428	0	-39.994	0.0474	1.1126	0.1719
48	-113.097	-12.874	17.358	0.0102	0.7464	0.2384
49	-117.634	-14.434	20.763	0.0054	0.6188	0.2405
50	-122.376	-15.075	19.607	0.0008	0.4845	0.2411
59	-117.634	-14.434	-20.763	-0.0054	-0.6188	0.2405
60	-113.097	-12.874	-17.358	-0.0102	-0.7464	0.2384
65	-88.428	0	39.994	-0.0474	-1.1126	0.1719
68	-55.785	9.147	128.685	-0.0967	-1.0224	0.0869
69	-51.018	8.716	134.592	-0.096	-0.9491	0.0813
70	-45.298	6.562	135.63	-0.091	-0.8763	0.0692
78	-41.789	4.652	134.412	-0.0885	-0.838	0.073
79	-39.176	3.555	133.339	-0.0832	-0.8001	0.0667
80	-36.353	2.975	131.924	-0.077	-0.7591	0.0638
85	-3	0	108.257	-0.0333	-0.409	0.0523
90	11.823	0	54.128	0.0083	0.0841	0.0262
100	0	0	0	0	0	0
110	11.823	0	-54.128	-0.0083	-0.0841	0.0262
120	-3	0	-108.257	0.0333	0.409	0.0523
128	-36.353	2.975	-131.923	0.077	0.7591	0.0638
129	-39.176	3.555	-133.339	0.0832	0.8001	0.0667
130	-41.789	4.652	-134.412	0.0885	0.838	0.073
139	-51.018	8.716	-134.592	0.096	0.9491	0.0813
140	-55.785	9.147	-128.685	0.0967	1.0224	0.0869
150	-88.428	0	-39.994	0.0474	1.1126	0.1719
158	-113.097	-12.874	17.358	0.0102	0.7464	0.2384
159	-117.634	-14.434	20.763	0.0054	0.6188	0.2405
160	-122.376	-15.075	19.607	0.0008	0.4845	0.2411
168	-122.376	-15.075	-19.607	-0.0008	-0.4845	0.2411
169	-117.634	-14.434	-20.763	-0.0054	-0.6188	0.2405
170	-113.097	-12.874	-17.358	-0.0102	-0.7464	0.2384
180	-88.428	0	39.994	-0.0474	-1.1126	0.1719

Possible Approach:
Friction Factor 0.05

188	-55.785	9.147	128.685	-0.0967	-1.0224	0.0869
189	-51.018	8.716	134.592	-0.096	-0.9491	0.0813
190	-45.298	6.562	135.63	-0.091	-0.8763	0.0692
199	-39.176	3.555	133.339	-0.0832	-0.8001	0.0667
200	-36.353	2.975	131.923	-0.077	-0.7591	0.0638
210	-3	0	108.257	-0.0333	-0.409	0.0523
220	11.823	0	54.128	0.0083	0.0841	0.0262
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .10
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .10
Node 20 +Y Mu = .10

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .10
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .10
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
-------------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .10
  Node  85  +Y   Mu = .10
-------------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .10
-------------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .10
   Node  120  Guide   Gap= 3.000 mm.   Mu = .10
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .10
   Node  210  Guide   Gap= 3.000 mm.   Mu = .10
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:
Friction Factor 0.10

Node 220 +Y Mu = .10

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Dir Vectors
10	ANC			.10	.000	.000	.000
15	+Y			.10	.000	1.000	.000
20	Guide		3.00	.10	.000	.000	.000
20	+Y			.10	.000	1.000	.000
45	+Y			.10	.000	1.000	.000
65	+Y			.10	.000	1.000	.000
85	Guide		3.00	.10	.000	.000	.000
85	+Y			.10	.000	1.000	.000
90	+Y			.10	.000	1.000	.000
100	ANC			.10	.000	.000	.000
110	+Y			.10	.000	1.000	.000
120	+Y			.10	.000	1.000	.000
120	Guide		3.00	.10	.000	.000	.000
150	+Y			.10	.000	1.000	.000
180	+Y			.10	.000	1.000	.000
210	+Y			.10	.000	1.000	.000
210	Guide		3.00	.10	.000	.000	.000
220	+Y			.10	.000	1.000	.000
230	ANC			.10	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.10

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.10

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.10

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 116840.9 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 25161.1 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138117.7 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	46907.2	0	0	15	34575.6	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		31316	227785.8	13.7		17414.7	227204.6	7.7	B31.3
1(OPE)	15	34658.8	0	0	20	82407.5	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		17414.7	227203.4	7.7		66671.4	228909.4	29.1	B31.3
1(OPE)	20	82497.4	0	0	28	88916	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		66671.4	228906.8	29.1		73691.4	233366.2	31.6	B31.3
1(OPE)	28	88916	0	0	29	89256.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		73691.4	233366.2	31.6		74004.1	233174.8	31.7	B31.3
1(OPE)	29	89256.2	0	0	30	89588.5	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		74004.1	233174.8	31.7		74072.2	233001	31.8	B31.3
1(OPE)	30	89588.5	0	0	38	89635	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		74072.2	233001	31.8		74187.1	232825.1	31.9	B31.3
1(OPE)	38	89635	0	0	39	86987.7	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		74187.1	232825.1	31.9		71322.8	232744.5	30.6	B31.3

Possible Approach:
Friction Factor 0.10

1(OPE)	39	86987.7	0	0	40	79955.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		71322.8	232744.5	30.6		63493	233040.4	27.2	B31.3
1(OPE)	40	79955.6	0	0	45	60564.8	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		63493	233040.4	27.2		35204.3	207641.7	17	B31.3
1(OPE)	45	60686.5	0	0	48	122927.9	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35204.3	207665.7	17		105792.6	231505.7	45.7	B31.3
1(OPE)	48	122927.9	0	0	49	129662.2	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105792.6	231505.7	45.7		113604.7	233171.3	48.7	B31.3
1(OPE)	49	129662.2	0	0	50	132422.4	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113604.7	233171.3	48.7		116840.9	232689.6	50.2	B31.3
1(OPE)	50	132422.4	0	0	59	129662.1	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116840.9	232689.6	50.2		113604.7	233171.3	48.7	B31.3
1(OPE)	59	129662.1	0	0	60	122927.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113604.7	233171.3	48.7		105792.6	231505.7	45.7	B31.3
1(OPE)	60	122927.8	0	0	65	60686.5	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105792.6	231505.7	45.7		35204.2	207665.7	17	B31.3
1(OPE)	65	60564.8	0	0	68	79955.6	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35204.2	207641.7	17		63493	233040.4	27.2	B31.3
1(OPE)	68	79955.6	0	0	69	86987.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		63493	233040.4	27.2		71322.8	232744.5	30.6	B31.3
1(OPE)	69	86987.7	0	0	70	89635	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		71322.8	232744.5	30.6		74187.2	232825.1	31.9	B31.3
1(OPE)	70	89635	0	0	78	89588.6	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		74187.2	232825.1	31.9		74072.2	233001	31.8	B31.3
1(OPE)	78	89588.6	0	0	79	89256.2	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		74072.2	233001	31.8		74004.1	233174.8	31.7	B31.3
1(OPE)	79	89256.2	0	0	80	88916.1	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		74004.1	233174.8	31.7		73691.4	233366.2	31.6	B31.3

Possible Approach:
Friction Factor 0.10
Page 10 of 20

1(OPE)	80	88916.1	0	0	85	82497.4	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		73691.4	233366.2	31.6		66671.4	228906.8	29.1	B31.3
1(OPE)	85	82407.6	0	0	90	34658.8	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		66671.4	228909.4	29.1		17414.7	227203.5	7.7	B31.3
1(OPE)	90	34575.5	0	0	100	46907.4	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		17414.7	227204.6	7.7		31316.1	227785.7	13.7	B31.3
1(OPE)	100	46907.4	0	0	110	34575.5	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		31316.2	227785.7	13.7		17414.7	227204.6	7.7	B31.3
1(OPE)	110	34658.8	0	0	120	82407.6	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		17414.7	227203.5	7.7		66671.4	228909.4	29.1	B31.3
1(OPE)	120	82497.5	0	0	128	88916.1	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		66671.4	228906.8	29.1		73691.4	233366.2	31.6	B31.3
1(OPE)	128	88916.1	0	0	129	89256.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		73691.4	233366.2	31.6		74004.1	233174.8	31.7	B31.3
1(OPE)	129	89256.2	0	0	130	89588.6	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		74004.1	233174.8	31.7		74072.2	233001	31.8	B31.3
1(OPE)	130	89588.6	0	0	139	86987.7	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		74072.2	233001	31.8		71322.8	232744.5	30.6	B31.3
1(OPE)	139	86987.7	0	0	140	79955.7	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		71322.8	232744.5	30.6		63493	233040.4	27.2	B31.3
1(OPE)	140	79955.7	0	0	150	60564.8	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		63493	233040.4	27.2		35204.2	207641.7	17	B31.3
1(OPE)	150	60686.5	0	0	158	122927.8	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35204.2	207665.7	17		105792.6	231505.7	45.7	B31.3
1(OPE)	158	122927.8	0	0	159	129662.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105792.6	231505.7	45.7		113604.7	233171.2	48.7	B31.3
1(OPE)	159	129662.1	0	0	160	132422.3	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113604.7	233171.2	48.7		116840.8	232689.6	50.2	B31.3

Possible Approach:
Friction Factor 0.10
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1(OPE)	160	132422.3	0	0	168	132422.4	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		116840.8	232689.6	50.2		116840.8	232689.6	50.2	B31.3
1(OPE)	168	132422.4	0	0	169	129662.1	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116840.8	232689.6	50.2		113604.7	233171.2	48.7	B31.3
1(OPE)	169	129662.1	0	0	170	122927.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113604.7	233171.2	48.7		105792.6	231505.7	45.7	B31.3
1(OPE)	170	122927.8	0	0	180	60686.5	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105792.6	231505.7	45.7		35204.2	207665.7	17	B31.3
1(OPE)	180	60564.8	0	0	188	79955.6	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35204.2	207641.7	17		63493	233040.4	27.2	B31.3
1(OPE)	188	79955.6	0	0	189	86987.7	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		63493	233040.4	27.2		71322.8	232744.5	30.6	B31.3
1(OPE)	189	86987.7	0	0	190	89635	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		71322.8	232744.5	30.6		74187.2	232825.1	31.9	B31.3
1(OPE)	190	89635	0	0	199	89256.2	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		74187.2	232825.1	31.9		74004.1	233174.8	31.7	B31.3
1(OPE)	199	89256.2	0	0	200	88916	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		74004.1	233174.8	31.7		73691.4	233366.2	31.6	B31.3
1(OPE)	200	88916	0	0	210	82497.4	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		73691.4	233366.2	31.6		66671.4	228906.8	29.1	B31.3
1(OPE)	210	82407.5	0	0	220	34658.8	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		66671.4	228909.4	29.1		17414.7	227203.4	7.7	B31.3
1(OPE)	220	34575.6	0	0	230	46907.2	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		17414.7	227204.6	7.7		31316	227785.8	13.7	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	18524	-12559	69450	-13708	-90021	4882	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	18633	1395	69768	3464	-90279	6407	0	0	0
	MAX	18633/L3	-13954/L	69768/L	-17172/L	-90279/L	6407/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	721	-34875	-3412	0	0	0	11.429	0	-54.124
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	254	-5639	-3364	0	0	0	11.426	0	-54.123
	MAX	721/L1	-34875/L	-3412/L1				11.429/L	-0.000/L1	-54.124/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-14256	-22049	-3623	0	0	0	-3	0	-108.25
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-12934	2091	-3520	0	0	0	-2.992	0	-108.25
	MAX	-14256/L	-24140/L	-3623/L1				-3.000/L1	-0.000/L2	-108.250/L1
45		Rigid +Y								
	1(OPE)	-4450	-48937	-2037	0	0	0	-87.555	0	-40.079
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-5413	2152	-2620	0	0	0	-87.561	0	-40.083
	MAX	-5413/L3	-51089/L	-2620/L3				-87.561/L	-0.000/L2	-40.083/L3
65		Rigid +Y								
	1(OPE)	-4450	-48937	2037	0	0	0	-87.555	0	40.079
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-5413	2152	2620	0	0	0	-87.561	0	40.083
	MAX	-5413/L3	-51089/L	2620/L3				-87.561/L	-0.000/L2	40.083/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-14256	-22049	3624	0	0	0	-3	0	108.25
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-12934	2091	3520	0	0	0	-2.992	0	108.25
	MAX	-14256/L	-24140/L	3624/L1				-3.000/L1	-0.000/L2	108.250/L1
90		Rigid +Y								
	1(OPE)	721	-34875	3412	0	0	0	11.429	0	54.124
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	254	-5639	3364	0	0	0	11.426	0	54.123
	MAX	721/L1	-34875/L	3412/L1				11.429/L	-0.000/L1	54.124/L1
100		Rigid ANC								
	1(OPE)	37048	-25118	0	0	0	9763	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	37265	2791	0	0	0	12814	0	0	0
	MAX	37265/L3	-27909/L	-0/L1	0/L2	-0/L1	12814/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	721	-34875	-3412	0	0	0	11.429	0	-54.124
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	254	-5639	-3364	0	0	0	11.426	0	-54.123
	MAX	721/L1	-34875/L	-3412/L1				11.429/L	-0.000/L1	-54.124/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-14256	-22049	-3623	0	0	0	-3	0	-108.25
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-12934	2091	-3520	0	0	0	-2.992	0	-108.25
	MAX	-14256/L	-24140/L	-3623/L1				-3.000/L1	-0.000/L2	-108.250/L1
150		Rigid +Y								
	1(OPE)	-4450	-48937	-2037	0	0	0	-87.555	0	-40.079
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-5413	2152	-2620	0	0	0	-87.561	0	-40.083
	MAX	-5413/L3	-51089/L	-2620/L3				-87.561/L	-0.000/L2	-40.083/L3
180		Rigid +Y								
	1(OPE)	-4450	-48937	2037	0	0	0	-87.555	0	40.079
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-5413	2152	2620	0	0	0	-87.561	0	40.083
	MAX	-5413/L3	-51089/L	2620/L3				-87.561/L	-0.000/L2	40.083/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-14256	-22049	3623	0	0	0	-3	0	108.25
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-12934	2091	3520	0	0	0	-2.992	0	108.25
	MAX	-14256/L	-24140/L	3623/L1				-3.000/L1	-0.000/L2	108.250/L1
220		Rigid +Y								
	1(OPE)	721	-34875	3412	0	0	0	11.429	0	54.124
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	254	-5639	3364	0	0	0	11.426	0	54.123
	MAX	721/L1	-34875/L	3412/L1				11.429/L	-0.000/L1	54.124/L1
230		Rigid ANC								
	1(OPE)	18524	-12559	-69450	13708	90021	4882	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	18633	1395	-69768	-3464	90280	6407	0	0	0
	MAX	18633/L3	-13954/L	-69768/L	17172/L3	90280/L3	6407/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.426	0	-54.123	-0.007	-0.0809	0.0328
20	-2.992	0	-108.25	0.0283	0.3962	0.0657
28	-35.459	2.966	-131.916	0.0775	0.7445	0.08
29	-38.242	3.548	-133.331	0.0838	0.7864	0.0832
30	-40.849	4.647	-134.402	0.0892	0.8254	0.0899
38	-44.376	6.559	-135.618	0.0918	0.8649	0.0863
39	-50.131	8.669	-134.602	0.0976	0.9403	0.0997
40	-54.919	8.977	-128.739	0.0992	1.0165	0.106
45	-87.561	0	-40.083	0.0586	1.1144	0.1176
48	-112.23	-7.01	17.35	0.0279	0.7473	0.1176
49	-116.768	-7.716	20.762	0.0239	0.6196	0.1181
50	-121.515	-7.898	19.607	0.0189	0.4851	0.1186
59	-116.768	-7.716	-20.762	-0.0239	-0.6196	0.1181
60	-112.23	-7.01	-17.35	-0.0279	-0.7473	0.1176
65	-87.561	0	40.083	-0.0586	-1.1144	0.1176
68	-54.919	8.977	128.739	-0.0992	-1.0165	0.106
69	-50.131	8.669	134.602	-0.0976	-0.9403	0.0997
70	-44.376	6.559	135.618	-0.0918	-0.8649	0.0863
78	-40.849	4.647	134.402	-0.0892	-0.8254	0.0899
79	-38.242	3.548	133.331	-0.0838	-0.7864	0.0832
80	-35.459	2.966	131.916	-0.0775	-0.7445	0.08
85	-2.992	0	108.25	-0.0283	-0.3962	0.0657
90	11.426	0	54.123	0.007	0.0809	0.0328
100	0	0	0	0	0	0
110	11.426	0	-54.123	-0.007	-0.0809	0.0328
120	-2.992	0	-108.25	0.0283	0.3962	0.0657
128	-35.459	2.966	-131.916	0.0775	0.7445	0.08
129	-38.242	3.548	-133.331	0.0838	0.7864	0.0832
130	-40.849	4.647	-134.402	0.0892	0.8254	0.0899
139	-50.131	8.669	-134.602	0.0976	0.9403	0.0997
140	-54.919	8.977	-128.739	0.0992	1.0165	0.106
150	-87.561	0	-40.083	0.0586	1.1144	0.1176
158	-112.229	-7.01	17.35	0.0279	0.7473	0.1176
159	-116.768	-7.716	20.762	0.0239	0.6196	0.1181
160	-121.514	-7.898	19.607	0.0189	0.4851	0.1186
168	-121.515	-7.898	-19.607	-0.0189	-0.4851	0.1186
169	-116.768	-7.716	-20.762	-0.0239	-0.6196	0.1181
170	-112.229	-7.01	-17.35	-0.0279	-0.7473	0.1176
180	-87.561	0	40.083	-0.0586	-1.1144	0.1176

Possible Approach:
Friction Factor 0.10

188	-54.919	8.977	128.739	-0.0992	-1.0165	0.106
189	-50.131	8.669	134.602	-0.0976	-0.9403	0.0997
190	-44.376	6.559	135.618	-0.0918	-0.8649	0.0863
199	-38.242	3.548	133.33	-0.0838	-0.7864	0.0832
200	-35.459	2.966	131.915	-0.0775	-0.7445	0.08
210	-2.992	0	108.25	-0.0283	-0.3962	0.0657
220	11.426	0	54.123	0.007	0.0809	0.0328
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 6, 2015 Time: 18:35
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.1
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.429	0	-54.124	-0.0081	-0.0815	0.025
20	-3	0	-108.25	0.0328	0.3987	0.05
28	-35.667	2.937	-131.916	0.0765	0.748	0.061
29	-38.449	3.515	-133.332	0.0829	0.7897	0.064
30	-41.026	4.612	-134.405	0.0883	0.8284	0.0703
38	-44.49	6.521	-135.624	0.0909	0.8676	0.0665
39	-50.161	8.682	-134.607	0.0961	0.9423	0.0792
40	-54.913	9.123	-128.737	0.0968	1.0178	0.0855
45	-87.555	0	-40.079	0.0475	1.1141	0.1721
48	-112.224	-12.89	17.35	0.0103	0.7474	0.2387
49	-116.763	-14.452	20.761	0.0054	0.6197	0.2408
50	-121.51	-15.093	19.607	0.0008	0.4852	0.2414
59	-116.763	-14.452	-20.761	-0.0054	-0.6197	0.2408
60	-112.224	-12.89	-17.35	-0.0103	-0.7474	0.2387
65	-87.555	0	40.079	-0.0475	-1.1141	0.1721
68	-54.913	9.123	128.737	-0.0968	-1.0178	0.0855
69	-50.161	8.682	134.607	-0.0961	-0.9423	0.0792
70	-44.49	6.521	135.624	-0.0909	-0.8676	0.0665
78	-41.026	4.612	134.405	-0.0883	-0.8284	0.0703
79	-38.449	3.515	133.332	-0.0829	-0.7897	0.064
80	-35.667	2.937	131.916	-0.0765	-0.748	0.061
85	-3	0	108.25	-0.0328	-0.3987	0.05
90	11.429	0	54.124	0.0081	0.0815	0.025
100	0	0	0	0	0	0
110	11.429	0	-54.124	-0.0081	-0.0815	0.025
120	-3	0	-108.25	0.0328	0.3987	0.05
128	-35.667	2.937	-131.916	0.0765	0.748	0.061
129	-38.449	3.515	-133.332	0.0829	0.7897	0.064
130	-41.026	4.612	-134.405	0.0883	0.8284	0.0703
139	-50.161	8.681	-134.607	0.0961	0.9423	0.0792
140	-54.913	9.123	-128.736	0.0968	1.0178	0.0855
150	-87.555	0	-40.079	0.0475	1.1141	0.1721
158	-112.224	-12.89	17.35	0.0103	0.7474	0.2387
159	-116.763	-14.452	20.761	0.0054	0.6197	0.2408
160	-121.51	-15.093	19.607	0.0008	0.4852	0.2414
168	-121.51	-15.093	-19.607	-0.0008	-0.4852	0.2414
169	-116.763	-14.452	-20.761	-0.0054	-0.6197	0.2408
170	-112.224	-12.89	-17.35	-0.0103	-0.7474	0.2387
180	-87.555	0	40.079	-0.0475	-1.1141	0.1721

188	-54.913	9.123	128.737	-0.0968	-1.0178	0.0855
189	-50.161	8.681	134.607	-0.0961	-0.9423	0.0792
190	-44.49	6.521	135.624	-0.0909	-0.8676	0.0665
199	-38.449	3.515	133.332	-0.0829	-0.7897	0.064
200	-35.667	2.937	131.916	-0.0765	-0.748	0.061
210	-3	0	108.25	-0.0328	-0.3987	0.05
220	11.429	0	54.124	0.0081	0.0815	0.025
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .15
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .15
Node 20 +Y Mu = .15

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .15
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .15
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .15
  Node  85  +Y   Mu = .15
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .15
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .15
   Node  120  Guide   Gap= 3.000 mm.   Mu = .15
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .15
   Node  210  Guide   Gap= 3.000 mm.   Mu = .15
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .15

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Dir Vectors
10	ANC			.15	.000	.000 .000
15	+Y			.15	.000	1.000 .000
20	Guide		3.00	.15	.000	.000 .000
20	+Y			.15	.000	1.000 .000
45	+Y			.15	.000	1.000 .000
65	+Y			.15	.000	1.000 .000
85	Guide		3.00	.15	.000	.000 .000
85	+Y			.15	.000	1.000 .000
90	+Y			.15	.000	1.000 .000
100	ANC			.15	.000	.000 .000
110	+Y			.15	.000	1.000 .000
120	+Y			.15	.000	1.000 .000
120	Guide		3.00	.15	.000	.000 .000
150	+Y			.15	.000	1.000 .000
180	+Y			.15	.000	1.000 .000
210	+Y			.15	.000	1.000 .000
210	Guide		3.00	.15	.000	.000 .000
220	+Y			.15	.000	1.000 .000
230	ANC			.15	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.15

```
    TRANSL. STIF      lbs./in.     x     1.751   =   N./cm.
    ROTATIONAL STIF   in.lb./deg.  x     0.113   =   N.m./deg
    UNIFORM LOAD      lb./in.      x     1.751   =   N./cm.
    G LOAD            g's          x     1.000   =   g's
    WIND LOAD         lbs./sq.in.  x     6.895   =   KPa
    ELEVATION         inches       x     0.025   =   m.
    COMPOUND LENGTH   inches       x    25.400   =   mm.
    DIAMETER          inches       x    25.400   =   mm.
    WALL THICKNESS    inches       x    25.400   =   mm.

 SETUP FILE PARAMETERS
 ---------------------------------------------------------------------------
 CONNECT GEOMETRY THRU CNODES =    YES
 MIN ALLOWED BEND ANGLE =          5.00000
 MAX ALLOWED BEND ANGLE =          95.0000
 BEND LENGTH ATTACHMENT PERCENT =  1.00000
 MIN ANGLE TO ADJACENT BEND PT =   5.00000
 LOOP CLOSURE TOLERANCE =          25.4000     mm.
 THERMAL BOWING HORZ TOLERANCE =   0.100000E-03
 AUTO NODE NUMBER INCREMENT=       10.0000
 Z AXIS UP=                        NO
 USE PRESSURE STIFFENING =         DEFAULT
 ALPHA TOLERANCE =                 0.500000E-01
 RESLD-FORCE =                     NO
 HGR DEF RESWGT STIF =             0.175127E+13 N./cm.
 DECOMP SNG TOL =                  0.100000E+11
 BEND AXIAL SHAPE =                YES
 FRICT STIF =                      0.175127E+07 N./cm.
 FRICT NORM FORCE VAR =            0.150000
 FRICT ANGLE VAR =                 15.0000
 FRICT SLIDE MULT =                1.00000
 ROD TOLERANCE =                   1.00000
 ROD INC =                         2.00000
 INCORE NUMERICAL CHECK =          NO
 OUTCORE NUMERICAL CHECK =         NO
 DEFAULT TRANS RESTRAINT STIFF=    0.175127E+13   N./cm.
 DEFAULT ROT RESTRAINT STIFF=      0.112985E+12  N.m./deg
 IGNORE SPRING HANGER STIFFNESS =  NO
 MISSING MASS ZPA =                EXTRACTED
 MIN WALL MILL TOLERANCE =         12.5000
 WRC-107 VERSION =                 MAR 79 1B1/2B1
 WRC-107 INTERPOLATION =           LAST VALUE
 DEFAULT AMBIENT TEMPERATURE=      21.1111      C
 BOURDON PRESSURE=                 NONE
 COEFFICIENT OF FRICTION (MU) =    0.000000
 INCLUDE SPRG STIF IN HGR OPE =    NO
 INCLUDE INSULATION IN HYDROTEST = NO
 REDUCED INTERSECTION =            B31.1(POST1980)
 USE WRC329                        NO
 NO REDUCED SIF FOR RFT AND WLT    NO
```

Possible Approach:

Friction Factor 0.15

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.15

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 116986.0 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 25682.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138266.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	45733.3	0	0	15	33873.7	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		30230.5	227785.8	13.3		16762.2	227204.6	7.4	B31.3
1(OPE)	15	33998.4	0	0	20	80793.4	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		16762.2	227203.4	7.4		65119.2	228909.4	28.4	B31.3
1(OPE)	20	80917.4	0	0	28	90113.4	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		65119.2	228906.8	28.4		74917.3	233366.2	32.1	B31.3
1(OPE)	28	90113.4	0	0	29	90623.8	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		74917.3	233366.2	32.1		75401.2	233174.8	32.3	B31.3
1(OPE)	29	90623.8	0	0	30	91102.7	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		75401.2	233174.8	32.3		75612.6	233001	32.5	B31.3
1(OPE)	30	91102.7	0	0	38	91330.2	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		75612.6	233001	32.5		75910.2	232825.1	32.6	B31.3
1(OPE)	38	91330.2	0	0	39	88813	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		75910.2	232825.1	32.6		73211.6	232744.5	31.5	B31.3

Possible Approach:
Friction Factor 0.15

1(OPE)	39	88813	0	0	40	81724.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		73211.6	232744.5	31.5		65320.3	233040.4	28	B31.3
1(OPE)	40	81724.2	0	0	45	60566.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		65320.3	233040.4	28		35279.5	207641.7	17	B31.3
1(OPE)	45	60747.1	0	0	48	123063.6	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35279.5	207665.7	17		105928.3	231505.7	45.8	B31.3
1(OPE)	48	123063.6	0	0	49	129803.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105928.3	231505.7	45.8		113747.1	233171.3	48.8	B31.3
1(OPE)	49	129803.7	0	0	50	132566.3	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113747.1	233171.3	48.8		116986	232689.6	50.3	B31.3
1(OPE)	50	132566.3	0	0	59	129803.7	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116986	232689.6	50.3		113747.1	233171.3	48.8	B31.3
1(OPE)	59	129803.7	0	0	60	123063.5	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113747.1	233171.3	48.8		105928.3	231505.7	45.8	B31.3
1(OPE)	60	123063.5	0	0	65	60747.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105928.3	231505.7	45.8		35279.4	207665.7	17	B31.3
1(OPE)	65	60566.1	0	0	68	81724.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35279.4	207641.7	17		65320.3	233040.4	28	B31.3
1(OPE)	68	81724.2	0	0	69	88813	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		65320.3	233040.4	28		73211.6	232744.5	31.5	B31.3
1(OPE)	69	88813	0	0	70	91330.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		73211.6	232744.5	31.5		75910.2	232825.1	32.6	B31.3
1(OPE)	70	91330.2	0	0	78	91102.7	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		75910.2	232825.1	32.6		75612.7	233001	32.5	B31.3
1(OPE)	78	91102.7	0	0	79	90623.9	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		75612.7	233001	32.5		75401.3	233174.8	32.3	B31.3
1(OPE)	79	90623.9	0	0	80	90113.5	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		75401.3	233174.8	32.3		74917.3	233366.2	32.1	B31.3

Possible Approach:
Friction Factor 0.15
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1(OPE)	80	90113.5	0	0	85	80917.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		74917.3	233366.2	32.1		65119.3	228906.8	28.4	B31.3
1(OPE)	85	80793.4	0	0	90	33998.3	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		65119.3	228909.4	28.4		16762.2	227203.5	7.4	B31.3
1(OPE)	90	33873.6	0	0	100	45733.4	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		16762.2	227204.6	7.4		30230.7	227785.7	13.3	B31.3
1(OPE)	100	45733.4	0	0	110	33873.6	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		30230.7	227785.7	13.3		16762.2	227204.6	7.4	B31.3
1(OPE)	110	33998.3	0	0	120	80793.5	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		16762.2	227203.5	7.4		65119.3	228909.4	28.4	B31.3
1(OPE)	120	80917.5	0	0	128	90113.5	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		65119.3	228906.8	28.4		74917.4	233366.2	32.1	B31.3
1(OPE)	128	90113.5	0	0	129	90623.9	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		74917.4	233366.2	32.1		75401.3	233174.8	32.3	B31.3
1(OPE)	129	90623.9	0	0	130	91102.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		75401.3	233174.8	32.3		75612.7	233001	32.5	B31.3
1(OPE)	130	91102.8	0	0	139	88813.1	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		75612.7	233001	32.5		73211.6	232744.5	31.5	B31.3
1(OPE)	139	88813.1	0	0	140	81724.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		73211.6	232744.5	31.5		65320.3	233040.4	28	B31.3
1(OPE)	140	81724.2	0	0	150	60566.1	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		65320.3	233040.4	28		35279.4	207641.7	17	B31.3
1(OPE)	150	60747.1	0	0	158	123063.5	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35279.4	207665.7	17		105928.3	231505.7	45.8	B31.3
1(OPE)	158	123063.5	0	0	159	129803.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		105928.3	231505.7	45.8		113747.1	233171.2	48.8	B31.3
1(OPE)	159	129803.7	0	0	160	132566.3	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		113747.1	233171.2	48.8		116986	232689.6	50.3	B31.3

Possible Approach:
Friction Factor 0.15
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1(OPE)	160	132566.3	0	0	168	132566.3	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		116986	232689.6	50.3		116986	232689.6	50.3	B31.3
1(OPE)	168	132566.3	0	0	169	129803.7	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		116986	232689.6	50.3		113747.1	233171.2	48.8	B31.3
1(OPE)	169	129803.7	0	0	170	123063.5	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		113747.1	233171.2	48.8		105928.3	231505.7	45.8	B31.3
1(OPE)	170	123063.5	0	0	180	60747.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		105928.3	231505.7	45.8		35279.5	207665.7	17	B31.3
1(OPE)	180	60566.1	0	0	188	81724.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35279.5	207641.7	17		65320.3	233040.4	28	B31.3
1(OPE)	188	81724.2	0	0	189	88813	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		65320.3	233040.4	28		73211.6	232744.5	31.5	B31.3
1(OPE)	189	88813	0	0	190	91330.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		73211.6	232744.5	31.5		75910.2	232825.1	32.6	B31.3
1(OPE)	190	91330.2	0	0	199	90623.8	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		75910.2	232825.1	32.6		75401.2	233174.8	32.3	B31.3
1(OPE)	199	90623.8	0	0	200	90113.4	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		75401.2	233174.8	32.3		74917.3	233366.2	32.1	B31.3
1(OPE)	200	90113.4	0	0	210	80917.4	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		74917.3	233366.2	32.1		65119.3	228906.8	28.4	B31.3
1(OPE)	210	80793.4	0	0	220	33998.4	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		65119.3	228909.4	28.4		16762.2	227203.4	7.4	B31.3
1(OPE)	220	33873.7	0	0	230	45733.3	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		16762.2	227204.6	7.4		30230.5	227785.8	13.3	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	17857	-12585	73754	-13773	-86889	4663	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	17965	1369	74071	3399	-87148	6188	0	0	0
	MAX	17965/L3	-13954/L	74071/L	-17172/L	-87148/L	6188/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1043	-34769	-5110	0	0	0	11.046	0	-54.12
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	576	-5533	-5062	0	0	0	11.043	0	-54.12
	MAX	1043/L1	-34769/L	-5110/L1				11.046/L	-0.000/L1	-54.120/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-11481	-22446	-5074	0	0	0	-3	0	-108.244
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-10159	1694	-4970	0	0	0	-2.992	0	-108.244
	MAX	-11481/L	-24140/L	-5074/L1				-3.000/L1	-0.000/L2	-108.244/L1
45		Rigid +Y								
	1(OPE)	-6617	-48619	-3065	0	0	0	-86.702	0	-40.161
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-7581	2469	-3648	0	0	0	-86.707	0	-40.164
	MAX	-7581/L3	-51089/L	-3648/L3				-86.707/L	-0.000/L2	-40.164/L3
65		Rigid +Y								
	1(OPE)	-6617	-48619	3065	0	0	0	-86.702	0	40.161
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-7581	2469	3648	0	0	0	-86.707	0	40.164
	MAX	-7581/L3	-51089/L	3648/L3				-86.707/L	-0.000/L2	40.164/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-11481	-22446	5074	0	0	0	-3	0	108.244
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-10159	1694	4970	0	0	0	-2.992	0	108.244
	MAX	-11481/L	-24140/L	5074/L1				-3.000/L1	-0.000/L2	108.244/L1
90		Rigid +Y								
	1(OPE)	1043	-34769	5110	0	0	0	11.046	0	54.12
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	576	-5533	5062	0	0	0	11.043	0	54.12
	MAX	1043/L1	-34769/L	5110/L1				11.046/L	-0.000/L1	54.120/L1
100		Rigid ANC								
	1(OPE)	35713	-25171	0	0	0	9325	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	35930	2738	0	0	0	12376	0	0	0
	MAX	35930/L3	-27909/L	-0/L1	0/L2	-0/L1	12376/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1043	-34769	-5110	0	0	0	11.046	0	-54.12
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	576	-5533	-5062	0	0	0	11.043	0	-54.12
	MAX	1043/L1	-34769/L	-5110/L1				11.046/L	-0.000/L1	-54.120/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-11481	-22446	-5074	0	0	0	-3	0	-108.244
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-10159	1694	-4970	0	0	0	-2.992	0	-108.244
	MAX	-11481/L	-24140/L	-5074/L1				-3.000/L1	-0.000/L2	-108.244/L1
150		Rigid +Y								
	1(OPE)	-6617	-48619	-3065	0	0	0	-86.702	0	-40.161
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-7581	2469	-3648	0	0	0	-86.707	0	-40.164
	MAX	-7581/L3	-51089/L	-3648/L3				-86.707/L	-0.000/L2	-40.164/L3
180		Rigid +Y								
	1(OPE)	-6617	-48619	3065	0	0	0	-86.702	0	40.161
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-7581	2469	3648	0	0	0	-86.707	0	40.164
	MAX	-7581/L3	-51089/L	3648/L3				-86.707/L	-0.000/L2	40.164/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-11481	-22446	5074	0	0	0	-3	0	108.244
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-10159	1694	4970	0	0	0	-2.992	0	108.244
	MAX	-11481/L	-24140/L	5074/L1				-3.000/L1	-0.000/L2	108.244/L1
220		Rigid +Y								
	1(OPE)	1043	-34769	5110	0	0	0	11.046	0	54.12
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	576	-5533	5062	0	0	0	11.043	0	54.12
	MAX	1043/L1	-34769/L	5110/L1				11.046/L	-0.000/L1	54.120/L1
230		Rigid ANC								
	1(OPE)	17857	-12585	-73754	13773	86889	4663	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	17965	1369	-74071	-3399	87148	6188	0	0	0
	MAX	17965/L3	-13954/L	-74071/L	17172/L3	87148/L3	6188/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.043	0	-54.12	-0.0069	-0.0784	0.0317
20	-2.992	0	-108.244	0.0278	0.3861	0.0634
28	-34.788	2.929	-131.909	0.0771	0.7336	0.0773
29	-37.532	3.509	-133.324	0.0835	0.7762	0.0805
30	-40.103	4.608	-134.396	0.0889	0.816	0.0873
38	-43.586	6.519	-135.612	0.0917	0.8563	0.0837
39	-49.294	8.635	-134.617	0.0976	0.9337	0.0977
40	-54.067	8.955	-128.789	0.0993	1.012	0.1046
45	-86.707	0	-40.164	0.0587	1.1159	0.1179
48	-111.376	-7.027	17.343	0.028	0.7482	0.1179
49	-115.917	-7.735	20.76	0.0239	0.6204	0.1184
50	-120.668	-7.917	19.607	0.0189	0.4857	0.1189
59	-115.917	-7.735	-20.76	-0.0239	-0.6204	0.1184
60	-111.376	-7.027	-17.343	-0.028	-0.7482	0.1179
65	-86.707	0	40.164	-0.0587	-1.1159	0.1179
68	-54.067	8.955	128.789	-0.0993	-1.012	0.1046
69	-49.294	8.635	134.617	-0.0976	-0.9337	0.0977
70	-43.586	6.519	135.612	-0.0917	-0.8563	0.0837
78	-40.103	4.608	134.396	-0.0889	-0.816	0.0873
79	-37.532	3.509	133.324	-0.0835	-0.7762	0.0805
80	-34.788	2.929	131.909	-0.0771	-0.7336	0.0773
85	-2.992	0	108.244	-0.0278	-0.3861	0.0634
90	11.043	0	54.12	0.0069	0.0784	0.0317
100	0	0	0	0	0	0
110	11.043	0	-54.12	-0.0069	-0.0784	0.0317
120	-2.992	0	-108.244	0.0278	0.3861	0.0634
128	-34.788	2.929	-131.909	0.0771	0.7336	0.0773
129	-37.532	3.509	-133.324	0.0835	0.7762	0.0805
130	-40.103	4.608	-134.396	0.0889	0.816	0.0873
139	-49.293	8.635	-134.617	0.0976	0.9337	0.0977
140	-54.067	8.955	-128.789	0.0993	1.012	0.1046
150	-86.707	0	-40.164	0.0587	1.1159	0.1179
158	-111.376	-7.027	17.343	0.028	0.7482	0.1179
159	-115.917	-7.735	20.76	0.0239	0.6204	0.1184
160	-120.668	-7.917	19.607	0.0189	0.4857	0.1189
168	-120.668	-7.917	-19.607	-0.0189	-0.4857	0.1189
169	-115.917	-7.735	-20.76	-0.0239	-0.6204	0.1184
170	-111.376	-7.027	-17.343	-0.028	-0.7482	0.1179
180	-86.707	0	40.164	-0.0587	-1.1159	0.1179

Possible Approach:
Friction Factor 0.15

188	-54.067	8.955	128.789	-0.0993	-1.012	0.1046
189	-49.293	8.635	134.617	-0.0976	-0.9337	0.0977
190	-43.586	6.519	135.612	-0.0917	-0.8563	0.0837
199	-37.532	3.509	133.324	-0.0835	-0.7762	0.0805
200	-34.788	2.929	131.909	-0.0771	-0.7336	0.0773
210	-2.992	0	108.244	-0.0278	-0.3861	0.0634
220	11.043	0	54.12	0.0069	0.0784	0.0317
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:12
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.046	0	-54.12	-0.008	-0.079	0.0239
20	-3	0	-108.244	0.0323	0.3886	0.0478
28	-34.996	2.9	-131.91	0.0761	0.7371	0.0582
29	-37.739	3.477	-133.326	0.0826	0.7795	0.0612
30	-40.281	4.573	-134.399	0.0881	0.819	0.0677
38	-43.7	6.481	-135.618	0.0907	0.8591	0.0638
39	-49.324	8.648	-134.622	0.0961	0.9357	0.0772
40	-54.061	9.101	-128.787	0.097	1.0133	0.084
45	-86.702	0	-40.161	0.0476	1.1156	0.1724
48	-111.371	-12.907	17.342	0.0103	0.7483	0.2389
49	-115.912	-14.471	20.759	0.0055	0.6204	0.241
50	-120.663	-15.112	19.607	0.0009	0.4858	0.2417
59	-115.912	-14.471	-20.759	-0.0055	-0.6204	0.241
60	-111.371	-12.907	-17.342	-0.0103	-0.7483	0.2389
65	-86.702	0	40.161	-0.0476	-1.1156	0.1724
68	-54.061	9.101	128.787	-0.097	-1.0133	0.084
69	-49.324	8.648	134.622	-0.0961	-0.9357	0.0772
70	-43.7	6.481	135.618	-0.0907	-0.8591	0.0638
78	-40.281	4.573	134.399	-0.0881	-0.819	0.0677
79	-37.739	3.477	133.326	-0.0826	-0.7795	0.0612
80	-34.996	2.9	131.91	-0.0761	-0.7371	0.0582
85	-3	0	108.244	-0.0323	-0.3886	0.0478
90	11.046	0	54.12	0.008	0.079	0.0239
100	0	0	0	0	0	0
110	11.046	0	-54.12	-0.008	-0.079	0.0239
120	-3	0	-108.244	0.0323	0.3886	0.0478
128	-34.996	2.9	-131.91	0.0761	0.7371	0.0582
129	-37.739	3.477	-133.326	0.0826	0.7795	0.0612
130	-40.28	4.573	-134.399	0.0881	0.819	0.0677
139	-49.324	8.648	-134.622	0.0961	0.9357	0.0772
140	-54.061	9.101	-128.787	0.097	1.0133	0.084
150	-86.702	0	-40.161	0.0476	1.1156	0.1724
158	-111.37	-12.907	17.342	0.0103	0.7483	0.2389
159	-115.912	-14.471	20.759	0.0055	0.6204	0.241
160	-120.663	-15.112	19.607	0.0009	0.4858	0.2417
168	-120.663	-15.112	-19.607	-0.0009	-0.4858	0.2417
169	-115.912	-14.471	-20.759	-0.0055	-0.6204	0.241
170	-111.37	-12.907	-17.342	-0.0103	-0.7483	0.2389
180	-86.702	0	40.161	-0.0476	-1.1156	0.1724

Possible Approach:
Friction Factor 0.15

188	-54.061	9.101	128.787	-0.097	-1.0133	0.084
189	-49.324	8.648	134.622	-0.0961	-0.9357	0.0772
190	-43.7	6.481	135.618	-0.0907	-0.8591	0.0638
199	-37.739	3.477	133.326	-0.0826	-0.7795	0.0612
200	-34.996	2.9	131.91	-0.0761	-0.7371	0.0582
210	-3	0	108.244	-0.0323	-0.3886	0.0478
220	11.046	0	54.12	0.008	0.079	0.0239
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .25
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .25
Node 20 +Y Mu = .25

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .25

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .25

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .25
Node 85 +Y Mu = .25

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .25

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .25
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .25
   Node  120  Guide   Gap= 3.000 mm.   Mu = .25
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .25
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .25
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .25
   Node  210  Guide   Gap= 3.000 mm.   Mu = .25
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:
Friction Factor 0.25

Node 220 +Y Mu = .25

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Len MU Dir Vectors
10	ANC			.25	.000	.000 .000
15	+Y			.25	.000	1.000 .000
20	Guide		3.00	.25	.000	.000 .000
20	+Y			.25	.000	1.000 .000
45	+Y			.25	.000	1.000 .000
65	+Y			.25	.000	1.000 .000
85	Guide		3.00	.25	.000	.000 .000
85	+Y			.25	.000	1.000 .000
90	+Y			.25	.000	1.000 .000
100	ANC			.25	.000	.000 .000
110	+Y			.25	.000	1.000 .000
120	+Y			.25	.000	1.000 .000
120	Guide		3.00	.25	.000	.000 .000
150	+Y			.25	.000	1.000 .000
180	+Y			.25	.000	1.000 .000
210	+Y			.25	.000	1.000 .000
210	Guide		3.00	.25	.000	.000 .000
220	+Y			.25	.000	1.000 .000
230	ANC			.25	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.25

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.25

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.25

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117247.4 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 26697.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138533.2 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43507.8	0	0	15	32564.5	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		28164.7	227785.8	12.4		15532.6	227204.6	6.8	B31.3
1(OPE)	15	32771.6	0	0	20	77655.9	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		15532.6	227203.4	6.8		62091.1	228909.4	27.1	B31.3
1(OPE)	20	77834.1	0	0	28	92445.9	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		62091.1	228906.8	27.1		77306.1	233366.2	33.1	B31.3
1(OPE)	28	92445.9	0	0	29	93288	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		77306.1	233366.2	33.1		78123.6	233174.8	33.5	B31.3
1(OPE)	29	93288	0	0	30	94052.2	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		78123.6	233174.8	33.5		78613.9	233001	33.7	B31.3
1(OPE)	30	94052.2	0	0	38	94633.6	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		78613.9	233001	33.7		79268.1	232825.1	34	B31.3
1(OPE)	38	94633.6	0	0	39	92372.9	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		79268.1	232825.1	34		76895.2	232744.5	33	B31.3

Possible Approach:
Friction Factor 0.25
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1(OPE)	39	92372.9	0	0	40	85172.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		76895.2	232744.5	33		68882.7	233040.4	29.6	B31.3
1(OPE)	40	85172.2	0	0	45	60608	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		68882.7	233040.4	29.6		35474.6	207641.7	17.1	B31.3
1(OPE)	45	60904.6	0	0	48	123316	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35474.6	207665.7	17.1		106180.8	231505.7	45.9	B31.3
1(OPE)	48	123316	0	0	49	130061.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106180.8	231505.7	45.9		114005.9	233171.3	48.9	B31.3
1(OPE)	49	130061.7	0	0	50	132826.4	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114005.9	233171.3	48.9		117247.4	232689.6	50.4	B31.3
1(OPE)	50	132826.4	0	0	59	130061.6	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117247.4	232689.6	50.4		114005.9	233171.3	48.9	B31.3
1(OPE)	59	130061.6	0	0	60	123316	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114005.9	233171.3	48.9		106180.8	231505.7	45.9	B31.3
1(OPE)	60	123316	0	0	65	60904.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106180.8	231505.7	45.9		35474.5	207665.7	17.1	B31.3
1(OPE)	65	60608	0	0	68	85172.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35474.5	207641.7	17.1		68882.7	233040.4	29.6	B31.3
1(OPE)	68	85172.2	0	0	69	92372.9	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		68882.7	233040.4	29.6		76895.2	232744.5	33	B31.3
1(OPE)	69	92372.9	0	0	70	94633.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		76895.2	232744.5	33		79268.1	232825.1	34	B31.3
1(OPE)	70	94633.6	0	0	78	94052.2	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		79268.1	232825.1	34		78613.9	233001	33.7	B31.3
1(OPE)	78	94052.2	0	0	79	93288	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		78613.9	233001	33.7		78123.6	233174.8	33.5	B31.3
1(OPE)	79	93288	0	0	80	92445.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		78123.6	233174.8	33.5		77306.2	233366.2	33.1	B31.3

Possible Approach:
Friction Factor 0.25
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1(OPE)	80	92445.9	0	0	85	77834.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		77306.2	233366.2	33.1		62091.1	228906.8	27.1	B31.3
1(OPE)	85	77656	0	0	90	32771.6	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		62091.1	228909.4	27.1		15532.5	227203.5	6.8	B31.3
1(OPE)	90	32564.4	0	0	100	43508	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		15532.5	227204.6	6.8		28164.8	227785.7	12.4	B31.3
1(OPE)	100	43508	0	0	110	32564.4	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		28164.8	227785.7	12.4		15532.5	227204.6	6.8	B31.3
1(OPE)	110	32771.6	0	0	120	77656	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		15532.5	227203.5	6.8		62091.2	228909.4	27.1	B31.3
1(OPE)	120	77834.2	0	0	128	92445.9	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		62091.2	228906.8	27.1		77306.2	233366.2	33.1	B31.3
1(OPE)	128	92445.9	0	0	129	93288	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		77306.2	233366.2	33.1		78123.6	233174.8	33.5	B31.3
1(OPE)	129	93288	0	0	130	94052.2	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		78123.6	233174.8	33.5		78613.9	233001	33.7	B31.3
1(OPE)	130	94052.2	0	0	139	92372.9	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		78613.9	233001	33.7		76895.2	232744.5	33	B31.3
1(OPE)	139	92372.9	0	0	140	85172.3	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		76895.2	232744.5	33		68882.7	233040.4	29.6	B31.3
1(OPE)	140	85172.3	0	0	150	60608	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		68882.7	233040.4	29.6		35474.5	207641.7	17.1	B31.3
1(OPE)	150	60904.6	0	0	158	123316	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35474.5	207665.7	17.1		106180.8	231505.7	45.9	B31.3
1(OPE)	158	123316	0	0	159	130061.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106180.8	231505.7	45.9		114005.9	233171.2	48.9	B31.3
1(OPE)	159	130061.6	0	0	160	132826.4	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114005.9	233171.2	48.9		117247.4	232689.6	50.4	B31.3

Possible Approach:
Friction Factor 0.25
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1(OPE)	160	132826.4	0	0	168	132826.4	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117247.4	232689.6	50.4		117247.4	232689.6	50.4	B31.3
1(OPE)	168	132826.4	0	0	169	130061.6	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117247.4	232689.6	50.4		114005.9	233171.2	48.9	B31.3
1(OPE)	169	130061.6	0	0	170	123316	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114005.9	233171.2	48.9		106180.8	231505.7	45.9	B31.3
1(OPE)	170	123316	0	0	180	60904.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106180.8	231505.7	45.9		35474.6	207665.7	17.1	B31.3
1(OPE)	180	60608	0	0	188	85172.2	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35474.6	207641.7	17.1		68882.7	233040.4	29.6	B31.3
1(OPE)	188	85172.2	0	0	189	92372.9	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		68882.7	233040.4	29.6		76895.2	232744.5	33	B31.3
1(OPE)	189	92372.9	0	0	190	94633.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		76895.2	232744.5	33		79268.1	232825.1	34	B31.3
1(OPE)	190	94633.6	0	0	199	93287.9	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		79268.1	232825.1	34		78123.6	233174.8	33.5	B31.3
1(OPE)	199	93287.9	0	0	200	92445.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		78123.6	233174.8	33.5		77306.1	233366.2	33.1	B31.3
1(OPE)	200	92445.9	0	0	210	77834.1	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		77306.1	233366.2	33.1		62091.1	228906.8	27.1	B31.3
1(OPE)	210	77656	0	0	220	32771.6	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		62091.1	228909.4	27.1		15532.6	227203.4	6.8	B31.3
1(OPE)	220	32564.5	0	0	230	43507.8	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		15532.6	227204.6	6.8		28164.7	227785.8	12.4	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	16591	-12636	81728	-13898	-80929	4237	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	16700	1319	82046	3274	-81188	5762	0	0	0
	MAX	16700/L3	-13954/L	82046/L3	-17172/L	-81188/L	5762/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1618	-34566	-8489	0	0	0	10.315	0	-54.113
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1152	-5329	-8440	0	0	0	10.312	0	-54.113
	MAX	1618/L1	-34566/L	-8489/L1				10.315/L	-0.000/L1	-54.113/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6053	-23218	-7275	0	0	0	-3	0	-108.233
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-4731	922	-7171	0	0	0	-2.992	0	-108.233
	MAX	-6053/L1	-24140/L	-7275/L1				-3.000/L1	-0.000/L2	-108.233/L1
45		Rigid +Y								
	1(OPE)	-10844	-48000	-5140	0	0	0	-85.051	0	-40.311
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-11808	3089	-5723	0	0	0	-85.056	0	-40.314
	MAX	-11808/L	-51089/L	-5723/L3				-85.056/L	-0.000/L2	-40.314/L3
65		Rigid +Y								
	1(OPE)	-10844	-48000	5140	0	0	0	-85.051	0	40.311
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-11808	3089	5723	0	0	0	-85.056	0	40.314
	MAX	-11808/L	-51089/L	5723/L3				-85.056/L	-0.000/L2	40.314/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6053	-23218	7275	0	0	0	-3	0	108.233
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-4731	922	7171	0	0	0	-2.992	0	108.233
	MAX	-6053/L1	-24140/L	7275/L1				-3.000/L1	-0.000/L2	108.233/L1
90		Rigid +Y								
	1(OPE)	1618	-34566	8489	0	0	0	10.315	0	54.113
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1152	-5329	8440	0	0	0	10.312	0	54.113
	MAX	1618/L1	-34566/L	8489/L1				10.315/L	-0.000/L1	54.113/L1
100		Rigid ANC								
	1(OPE)	33182	-25271	0	0	0	8474	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	33399	2637	0	0	0	11525	0	0	0
	MAX	33399/L3	-27909/L	-0/L1	0/L2	-0/L1	11525/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1618	-34566	-8489	0	0	0	10.315	0	-54.113
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1152	-5329	-8440	0	0	0	10.312	0	-54.113
	MAX	1618/L1	-34566/L	-8489/L1				10.315/L	-0.000/L1	-54.113/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6053	-23218	-7275	0	0	0	-3	0	-108.233
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	-4731	922	-7171	0	0	0	-2.992	0	-108.233
	MAX	-6053/L1	-24140/L	-7275/L1				-3.000/L1	-0.000/L2	-108.233/L1
150		Rigid +Y								
	1(OPE)	-10844	-48000	-5140	0	0	0	-85.051	0	-40.311
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-11808	3089	-5723	0	0	0	-85.056	0	-40.314
	MAX	-11808/L	-51089/L	-5723/L3				-85.056/L	-0.000/L2	-40.314/L3
180		Rigid +Y								
	1(OPE)	-10844	-48000	5140	0	0	0	-85.051	0	40.311
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-11808	3089	5723	0	0	0	-85.056	0	40.314
	MAX	-11808/L	-51089/L	5723/L3				-85.056/L	-0.000/L2	40.314/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6053	-23218	7275	0	0	0	-3	0	108.233
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	-4731	922	7171	0	0	0	-2.992	0	108.233
	MAX	-6053/L1	-24140/L	7275/L1				-3.000/L1	-0.000/L2	108.233/L1
220		Rigid +Y								
	1(OPE)	1618	-34566	8489	0	0	0	10.315	0	54.113
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1152	-5329	8440	0	0	0	10.312	0	54.113
	MAX	1618/L1	-34566/L	8489/L1				10.315/L	-0.000/L1	54.113/L1
230		Rigid ANC								
	1(OPE)	16591	-12636	-81728	13898	80929	4237	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	16700	1319	-82046	-3274	81188	5762	0	0	0
	MAX	16700/L3	-13954/L	-82046/L	17172/L3	81188/L3	5762/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.312	0	-54.113	-0.0066	-0.0736	0.0295
20	-2.992	0	-108.233	0.0268	0.3666	0.0591
28	-33.49	2.859	-131.897	0.0763	0.7125	0.072
29	-36.157	3.436	-133.313	0.0829	0.7566	0.0752
30	-38.661	4.533	-134.386	0.0886	0.7979	0.0822
38	-42.058	6.443	-135.603	0.0914	0.8399	0.0786
39	-47.674	8.571	-134.646	0.0977	0.921	0.0937
40	-52.418	8.913	-128.887	0.0997	1.0034	0.1018
45	-85.056	0	-40.314	0.0589	1.1188	0.1185
48	-109.725	-7.061	17.329	0.0281	0.7499	0.1185
49	-114.27	-7.772	20.756	0.024	0.6217	0.119
50	-119.029	-7.956	19.607	0.019	0.4868	0.1194
59	-114.27	-7.772	-20.756	-0.024	-0.6217	0.119
60	-109.725	-7.061	-17.329	-0.0281	-0.7499	0.1185
65	-85.056	0	40.314	-0.0589	-1.1188	0.1185
68	-52.418	8.913	128.887	-0.0997	-1.0034	0.1018
69	-47.674	8.571	134.646	-0.0977	-0.921	0.0937
70	-42.058	6.443	135.603	-0.0914	-0.8399	0.0786
78	-38.661	4.533	134.386	-0.0886	-0.7979	0.0822
79	-36.157	3.436	133.313	-0.0829	-0.7566	0.0752
80	-33.49	2.859	131.897	-0.0763	-0.7125	0.072
85	-2.992	0	108.233	-0.0268	-0.3666	0.0591
90	10.312	0	54.113	0.0066	0.0736	0.0295
100	0	0	0	0	0	0
110	10.312	0	-54.113	-0.0066	-0.0736	0.0295
120	-2.992	0	-108.233	0.0268	0.3666	0.0591
128	-33.49	2.859	-131.897	0.0763	0.7125	0.072
129	-36.157	3.436	-133.313	0.0829	0.7566	0.0752
130	-38.661	4.533	-134.386	0.0886	0.7979	0.0822
139	-47.674	8.571	-134.646	0.0977	0.921	0.0937
140	-52.418	8.913	-128.887	0.0997	1.0034	0.1018
150	-85.056	0	-40.314	0.0589	1.1188	0.1185
158	-109.725	-7.061	17.329	0.0281	0.7499	0.1185
159	-114.27	-7.772	20.756	0.024	0.6217	0.119
160	-119.029	-7.956	19.607	0.019	0.4868	0.1194
168	-119.029	-7.956	-19.607	-0.019	-0.4868	0.1194
169	-114.27	-7.772	-20.756	-0.024	-0.6217	0.119
170	-109.725	-7.061	-17.329	-0.0281	-0.7499	0.1185
180	-85.056	0	40.314	-0.0589	-1.1188	0.1185

Possible Approach:
Friction Factor 0.25

188	-52.418	8.913	128.887	-0.0997	-1.0034	0.1018
189	-47.674	8.571	134.646	-0.0977	-0.921	0.0937
190	-42.058	6.443	135.603	-0.0914	-0.8399	0.0786
199	-36.157	3.436	133.313	-0.0829	-0.7566	0.0752
200	-33.49	2.859	131.897	-0.0763	-0.7125	0.072
210	-2.992	0	108.233	-0.0268	-0.3666	0.0591
220	10.312	0	54.113	0.0066	0.0736	0.0295
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:25
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.25
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.315	0	-54.113	-0.0077	-0.0742	0.0217
20	-3	0	-108.233	0.0312	0.3692	0.0434
28	-33.699	2.829	-131.898	0.0753	0.716	0.0529
29	-36.364	3.404	-133.314	0.082	0.7599	0.056
30	-38.838	4.498	-134.389	0.0877	0.8009	0.0626
38	-42.171	6.406	-135.609	0.0905	0.8426	0.0587
39	-47.705	8.584	-134.651	0.0962	0.923	0.0732
40	-52.412	9.06	-128.885	0.0973	1.0047	0.0813
45	-85.051	0	-40.311	0.0478	1.1185	0.173
48	-109.72	-12.941	17.328	0.0104	0.75	0.2395
49	-114.265	-14.508	20.756	0.0056	0.6218	0.2416
50	-119.024	-15.151	19.607	0.0009	0.4868	0.2423
59	-114.265	-14.508	-20.756	-0.0056	-0.6218	0.2416
60	-109.72	-12.941	-17.328	-0.0104	-0.75	0.2395
65	-85.051	0	40.311	-0.0478	-1.1185	0.173
68	-52.412	9.06	128.885	-0.0973	-1.0047	0.0813
69	-47.705	8.584	134.651	-0.0962	-0.923	0.0732
70	-42.171	6.406	135.609	-0.0905	-0.8426	0.0587
78	-38.838	4.498	134.389	-0.0877	-0.8009	0.0626
79	-36.364	3.404	133.314	-0.082	-0.7599	0.056
80	-33.699	2.829	131.898	-0.0753	-0.716	0.0529
85	-3	0	108.233	-0.0312	-0.3692	0.0434
90	10.315	0	54.113	0.0077	0.0742	0.0217
100	0	0	0	0	0	0
110	10.315	0	-54.113	-0.0077	-0.0742	0.0217
120	-3	0	-108.233	0.0312	0.3692	0.0434
128	-33.699	2.829	-131.898	0.0753	0.716	0.0529
129	-36.364	3.404	-133.314	0.082	0.7599	0.056
130	-38.838	4.498	-134.389	0.0877	0.8009	0.0626
139	-47.705	8.584	-134.651	0.0962	0.923	0.0732
140	-52.412	9.06	-128.885	0.0973	1.0047	0.0813
150	-85.051	0	-40.311	0.0478	1.1185	0.173
158	-109.72	-12.941	17.328	0.0104	0.75	0.2395
159	-114.265	-14.508	20.756	0.0056	0.6218	0.2416
160	-119.024	-15.151	19.607	0.0009	0.4868	0.2423
168	-119.024	-15.151	-19.607	-0.0009	-0.4868	0.2423
169	-114.265	-14.508	-20.756	-0.0056	-0.6218	0.2416
170	-109.72	-12.941	-17.328	-0.0104	-0.75	0.2395
180	-85.051	0	40.311	-0.0478	-1.1185	0.173

188	-52.412	9.06	128.885	-0.0973	-1.0047	0.0813
189	-47.705	8.584	134.651	-0.0962	-0.923	0.0732
190	-42.171	6.406	135.609	-0.0905	-0.8426	0.0587
199	-36.364	3.404	133.314	-0.082	-0.7599	0.056
200	-33.698	2.829	131.898	-0.0753	-0.716	0.0529
210	-3	0	108.233	-0.0312	-0.3692	0.0434
220	10.315	0	54.113	0.0077	0.0742	0.0217
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .35
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .35
Node 20 +Y Mu = .35

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .35

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .35

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .35
Node 85 +Y Mu = .35

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .35

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

Possible Approach:
Friction Factor 0.35

```
  Node  110  +Y   Mu = .35
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .35
   Node  120  Guide   Gap= 3.000 mm.   Mu = .35
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .35
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .35
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .35
   Node  210  Guide   Gap= 3.000 mm.   Mu = .35
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .35

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Dir Vectors
10	ANC			.35	.000	.000 .000
15	+Y			.35	.000	1.000 .000
20	Guide		3.00	.35	.000	.000 .000
20	+Y			.35	.000	1.000 .000
45	+Y			.35	.000	1.000 .000
65	+Y			.35	.000	1.000 .000
85	Guide		3.00	.35	.000	.000 .000
85	+Y			.35	.000	1.000 .000
90	+Y			.35	.000	1.000 .000
100	ANC			.35	.000	.000 .000
110	+Y			.35	.000	1.000 .000
120	+Y			.35	.000	1.000 .000
120	Guide		3.00	.35	.000	.000 .000
150	+Y			.35	.000	1.000 .000
180	+Y			.35	.000	1.000 .000
210	+Y			.35	.000	1.000 .000
210	Guide		3.00	.35	.000	.000 .000
220	+Y			.35	.000	1.000 .000
230	ANC			.35	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.35

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.35

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.35

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117472.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27677.7 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138761.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	41441.1	0	0	15	31378.7	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		26229.9	227785.8	11.5		14396.5	227204.6	6.3	B31.3
1(OPE)	15	31667.8	0	0	20	74639.3	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		14396.5	227203.4	6.3		59159.8	228909.4	25.8	B31.3
1(OPE)	20	74848.5	0	0	28	94699.9	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59159.8	228906.8	25.8		79615.6	233366.2	34.1	B31.3
1(OPE)	28	94699.9	0	0	29	95862.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		79615.6	233366.2	34.1		80755.2	233174.8	34.6	B31.3
1(OPE)	29	95862.5	0	0	30	96902.4	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		80755.2	233174.8	34.6		81514.7	233001	35	B31.3
1(OPE)	30	96902.4	0	0	38	97827.1	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		81514.7	233001	35		82514.8	232825.1	35.4	B31.3
1(OPE)	38	97827.1	0	0	39	95817.4	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		82514.8	232825.1	35.4		80459.2	232744.5	34.6	B31.3

1(OPE)	39	95817.4	0	0	40	88506.5	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		80459.2	232744.5	34.6		72327.7	233040.4	31	B31.3
1(OPE)	40	88506.5	0	0	45	60699.3	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		72327.7	233040.4	31		35725.6	207641.7	17.2	B31.3
1(OPE)	45	61107.6	0	0	48	123545	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35725.6	207665.7	17.2		106409.7	231505.7	46	B31.3
1(OPE)	48	123545	0	0	49	130288.4	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106409.7	231505.7	46		114232.3	233171.3	49	B31.3
1(OPE)	49	130288.4	0	0	50	133052.2	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114232.3	233171.3	49		117472.8	232689.6	50.5	B31.3
1(OPE)	50	133052.2	0	0	59	130288.4	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117472.8	232689.6	50.5		114232.3	233171.3	49	B31.3
1(OPE)	59	130288.4	0	0	60	123544.9	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114232.3	233171.3	49		106409.7	231505.7	46	B31.3
1(OPE)	60	123544.9	0	0	65	61107.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106409.7	231505.7	46		35725.6	207665.7	17.2	B31.3
1(OPE)	65	60699.2	0	0	68	88506.6	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35725.6	207641.7	17.2		72327.7	233040.4	31	B31.3
1(OPE)	68	88506.6	0	0	69	95817.4	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		72327.7	233040.4	31		80459.2	232744.5	34.6	B31.3
1(OPE)	69	95817.4	0	0	70	97827.2	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		80459.2	232744.5	34.6		82514.8	232825.1	35.4	B31.3
1(OPE)	70	97827.2	0	0	78	96902.4	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		82514.8	232825.1	35.4		81514.7	233001	35	B31.3
1(OPE)	78	96902.4	0	0	79	95862.5	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		81514.7	233001	35		80755.3	233174.8	34.6	B31.3
1(OPE)	79	95862.5	0	0	80	94699.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		80755.3	233174.8	34.6		79615.6	233366.2	34.1	B31.3

Possible Approach:
Friction Factor 0.35
Page 10 of 20

1(OPE)	80	94699.9	0	0	85	74848.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		79615.6	233366.2	34.1		59159.9	228906.8	25.8	B31.3
1(OPE)	85	74639.4	0	0	90	31667.8	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59159.9	228909.4	25.8		14396.5	227203.5	6.3	B31.3
1(OPE)	90	31378.7	0	0	100	41441.2	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		14396.5	227204.6	6.3		26230	227785.7	11.5	B31.3
1(OPE)	100	41441.2	0	0	110	31378.7	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		26230	227785.7	11.5		14396.5	227204.6	6.3	B31.3
1(OPE)	110	31667.8	0	0	120	74639.4	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		14396.5	227203.5	6.3		59159.9	228909.4	25.8	B31.3
1(OPE)	120	74848.6	0	0	128	94699.9	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59159.9	228906.8	25.8		79615.6	233366.2	34.1	B31.3
1(OPE)	128	94699.9	0	0	129	95862.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		79615.6	233366.2	34.1		80755.3	233174.8	34.6	B31.3
1(OPE)	129	95862.5	0	0	130	96902.4	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		80755.3	233174.8	34.6		81514.8	233001	35	B31.3
1(OPE)	130	96902.4	0	0	139	95817.4	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		81514.8	233001	35		80459.2	232744.5	34.6	B31.3
1(OPE)	139	95817.4	0	0	140	88506.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		80459.2	232744.5	34.6		72327.7	233040.4	31	B31.3
1(OPE)	140	88506.6	0	0	150	60699.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		72327.7	233040.4	31		35725.6	207641.7	17.2	B31.3
1(OPE)	150	61107.6	0	0	158	123544.9	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35725.6	207665.7	17.2		106409.7	231505.7	46	B31.3
1(OPE)	158	123544.9	0	0	159	130288.4	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106409.7	231505.7	46		114232.3	233171.2	49	B31.3
1(OPE)	159	130288.4	0	0	160	133052.2	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114232.3	233171.2	49		117472.8	232689.6	50.5	B31.3

Possible Approach:
Friction Factor 0.35
Page 11 of 20

1(OPE)	160	133052.2	0	0	168	133052.2	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117472.8	232689.6	50.5		117472.8	232689.6	50.5	B31.3
1(OPE)	168	133052.2	0	0	169	130288.4	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117472.8	232689.6	50.5		114232.3	233171.2	49	B31.3
1(OPE)	169	130288.4	0	0	170	123544.9	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114232.3	233171.2	49		106409.7	231505.7	46	B31.3
1(OPE)	170	123544.9	0	0	180	61107.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106409.7	231505.7	46		35725.6	207665.7	17.2	B31.3
1(OPE)	180	60699.2	0	0	188	88506.5	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35725.6	207641.7	17.2		72327.7	233040.4	31	B31.3
1(OPE)	188	88506.5	0	0	189	95817.4	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		72327.7	233040.4	31		80459.2	232744.5	34.6	B31.3
1(OPE)	189	95817.4	0	0	190	97827.1	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		80459.2	232744.5	34.6		82514.8	232825.1	35.4	B31.3
1(OPE)	190	97827.1	0	0	199	95862.5	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		82514.8	232825.1	35.4		80755.2	233174.8	34.6	B31.3
1(OPE)	199	95862.5	0	0	200	94699.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		80755.2	233174.8	34.6		79615.6	233366.2	34.1	B31.3
1(OPE)	200	94699.8	0	0	210	74848.5	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		79615.6	233366.2	34.1		59159.8	228906.8	25.8	B31.3
1(OPE)	210	74639.3	0	0	220	31667.8	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59159.8	228909.4	25.8		14396.5	227203.4	6.3	B31.3
1(OPE)	220	31378.7	0	0	230	41441.1	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		14396.5	227204.6	6.3		26229.9	227785.8	11.5	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15412	-12683	88689	-14016	-75349	3827	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	15521	1271	89007	3156	-75608	5353	0	0	0
	MAX	15521/L3	-13954/L	89007/L	-17172/L	-75608/L	5353/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	2107	-34373	-11845	0	0	0	9.626	0	-54.107
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1641	-5136	-11796	0	0	0	9.623	0	-54.107
	MAX	2107/L1	-34373/L	-11845/L1				9.626/L1	-0.000/L1	-54.107/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-780	-23963	-8575	0	0	0	-3	0	-108.224
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	542	177	-8471	0	0	0	-2.992	0	-108.224
	MAX	-1322/L2	-24140/L	-8575/L1				-3.000/L1	-0.000/L2	-108.224/L1
45		Rigid +Y								
	1(OPE)	-14930	-47401	-7234	0	0	0	-83.471	0	-40.447
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-15894	3688	-7817	0	0	0	-83.476	0	-40.45
	MAX	-15894/L	-51089/L	-7817/L3				-83.476/L	-0.000/L2	-40.450/L3
65		Rigid +Y								
	1(OPE)	-14930	-47401	7234	0	0	0	-83.471	0	40.447
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-15894	3688	7817	0	0	0	-83.476	0	40.45
	MAX	-15894/L	-51089/L	7817/L3				-83.476/L	-0.000/L2	40.450/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-780	-23963	8575	0	0	0	-3	0	108.224
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	542	177	8471	0	0	0	-2.992	0	108.224
	MAX	-1322/L2	-24140/L	8575/L1				-3.000/L1	-0.000/L2	108.224/L1
90		Rigid +Y								
	1(OPE)	2107	-34373	11845	0	0	0	9.626	0	54.107
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1641	-5136	11796	0	0	0	9.623	0	54.107
	MAX	2107/L1	-34373/L	11845/L1				9.626/L1	-0.000/L1	54.107/L1
100		Rigid ANC								
	1(OPE)	30825	-25367	0	0	0	7655	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	31041	2542	0	0	0	10706	0	0	0
	MAX	31041/L3	-27909/L	-0/L1	0/L1	-0/L1	10706/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	2107	-34373	-11845	0	0	0	9.626	0	-54.107
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	1641	-5136	-11796	0	0	0	9.623	0	-54.107
	MAX	2107/L1	-34373/L	-11845/L1				9.626/L1	-0.000/L1	-54.107/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-780	-23963	-8575	0	0	0	-3	0	-108.224
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	542	177	-8471	0	0	0	-2.992	0	-108.224
	MAX	-1322/L2	-24140/L	-8575/L1				-3.000/L1	-0.000/L2	-108.224/L1
150		Rigid +Y								
	1(OPE)	-14930	-47401	-7234	0	0	0	-83.471	0	-40.447
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-15894	3688	-7817	0	0	0	-83.476	0	-40.45
	MAX	-15894/L	-51089/L	-7817/L3				-83.476/L	-0.000/L2	-40.450/L3
180		Rigid +Y								
	1(OPE)	-14930	-47401	7234	0	0	0	-83.471	0	40.447
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-15894	3688	7817	0	0	0	-83.476	0	40.45
	MAX	-15894/L	-51089/L	7817/L3				-83.476/L	-0.000/L2	40.450/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-780	-23963	8575	0	0	0	-3	0	108.224
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	542	177	8471	0	0	0	-2.992	0	108.224
	MAX	-1322/L2	-24140/L	8575/L1				-3.000/L1	-0.000/L2	108.224/L1
220		Rigid +Y								
	1(OPE)	2107	-34373	11845	0	0	0	9.626	0	54.107
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	1641	-5136	11796	0	0	0	9.623	0	54.107
	MAX	2107/L1	-34373/L	11845/L1				9.626/L1	-0.000/L1	54.107/L1
230		Rigid ANC								
	1(OPE)	15412	-12683	-88689	14016	75349	3827	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	15521	1271	-89007	-3156	75608	5353	0	0	0
	MAX	15521/L3	-13954/L	-89007/L	17172/L3	75608/L3	5353/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.623	0	-54.107	-0.0064	-0.069	0.0274
20	-2.992	0	-108.224	0.0258	0.348	0.0549
28	-32.248	2.792	-131.887	0.0755	0.6923	0.0669
29	-34.841	3.368	-133.303	0.0824	0.7378	0.0702
30	-37.279	4.463	-134.377	0.0883	0.7806	0.0774
38	-40.594	6.373	-135.594	0.0913	0.8242	0.0736
39	-46.124	8.513	-134.674	0.0979	0.9089	0.09
40	-50.841	8.876	-128.98	0.1001	0.9953	0.0992
45	-83.476	0	-40.45	0.0591	1.1215	0.1191
48	-108.145	-7.096	17.317	0.0282	0.7514	0.1191
49	-112.694	-7.811	20.753	0.0241	0.6229	0.1195
50	-117.46	-7.996	19.607	0.0191	0.4877	0.12
59	-112.694	-7.811	-20.753	-0.0241	-0.6229	0.1195
60	-108.145	-7.096	-17.317	-0.0282	-0.7514	0.1191
65	-83.476	0	40.45	-0.0591	-1.1215	0.1191
68	-50.841	8.876	128.98	-0.1001	-0.9953	0.0992
69	-46.124	8.513	134.674	-0.0979	-0.9089	0.09
70	-40.594	6.373	135.594	-0.0913	-0.8242	0.0736
78	-37.279	4.463	134.377	-0.0883	-0.7806	0.0774
79	-34.841	3.368	133.303	-0.0824	-0.7378	0.0702
80	-32.248	2.792	131.887	-0.0755	-0.6923	0.0669
85	-2.992	0	108.224	-0.0258	-0.348	0.0549
90	9.623	0	54.107	0.0064	0.069	0.0274
100	0	0	0	0	0	0
110	9.623	0	-54.107	-0.0064	-0.069	0.0274
120	-2.992	0	-108.224	0.0258	0.348	0.0549
128	-32.248	2.792	-131.887	0.0755	0.6923	0.0669
129	-34.841	3.368	-133.303	0.0824	0.7378	0.0702
130	-37.279	4.463	-134.377	0.0883	0.7806	0.0774
139	-46.124	8.513	-134.674	0.0979	0.9089	0.09
140	-50.841	8.876	-128.98	0.1001	0.9953	0.0992
150	-83.476	0	-40.45	0.0591	1.1215	0.1191
158	-108.145	-7.096	17.317	0.0282	0.7514	0.1191
159	-112.694	-7.811	20.753	0.0241	0.6229	0.1195
160	-117.46	-7.996	19.607	0.0191	0.4877	0.12
168	-117.46	-7.996	-19.607	-0.0191	-0.4877	0.12
169	-112.694	-7.811	-20.753	-0.0241	-0.6229	0.1195
170	-108.145	-7.096	-17.317	-0.0282	-0.7514	0.1191
180	-83.476	0	40.45	-0.0591	-1.1215	0.1191

Possible Approach:
Friction Factor 0.35

188	-50.841	8.876	128.98	-0.1001	-0.9953	0.0992
189	-46.124	8.513	134.674	-0.0979	-0.9089	0.09
190	-40.594	6.373	135.594	-0.0913	-0.8242	0.0736
199	-34.841	3.368	133.303	-0.0824	-0.7378	0.0702
200	-32.248	2.792	131.887	-0.0755	-0.6923	0.0669
210	-2.992	0	108.224	-0.0258	-0.348	0.0549
220	9.623	0	54.107	0.0064	0.069	0.0274
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:34
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.35
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.626	0	-54.107	-0.0075	-0.0696	0.0196
20	-3	0	-108.224	0.0303	0.3506	0.0392
28	-32.456	2.763	-131.888	0.0745	0.6958	0.0478
29	-35.048	3.335	-133.305	0.0815	0.7411	0.0509
30	-37.457	4.428	-134.38	0.0874	0.7836	0.0578
38	-40.708	6.335	-135.6	0.0903	0.8269	0.0538
39	-46.155	8.525	-134.679	0.0964	0.9109	0.0694
40	-50.835	9.023	-128.978	0.0977	0.9965	0.0786
45	-83.471	0	-40.447	0.048	1.1212	0.1736
48	-108.14	-12.976	17.317	0.0105	0.7514	0.2401
49	-112.689	-14.547	20.753	0.0056	0.623	0.2422
50	-117.455	-15.191	19.607	0.001	0.4878	0.2429
59	-112.689	-14.547	-20.753	-0.0056	-0.623	0.2422
60	-108.14	-12.976	-17.317	-0.0105	-0.7514	0.2401
65	-83.471	0	40.447	-0.048	-1.1212	0.1736
68	-50.835	9.023	128.978	-0.0977	-0.9965	0.0786
69	-46.155	8.525	134.679	-0.0964	-0.9109	0.0694
70	-40.708	6.335	135.6	-0.0903	-0.8269	0.0538
78	-37.456	4.428	134.38	-0.0874	-0.7836	0.0578
79	-35.048	3.335	133.305	-0.0815	-0.7411	0.0509
80	-32.456	2.763	131.888	-0.0745	-0.6958	0.0478
85	-3	0	108.224	-0.0303	-0.3506	0.0392
90	9.626	0	54.107	0.0075	0.0696	0.0196
100	0	0	0	0	0	0
110	9.626	0	-54.107	-0.0075	-0.0696	0.0196
120	-3	0	-108.224	0.0303	0.3506	0.0392
128	-32.456	2.763	-131.888	0.0745	0.6958	0.0478
129	-35.048	3.335	-133.305	0.0815	0.7411	0.0509
130	-37.456	4.428	-134.38	0.0874	0.7836	0.0578
139	-46.155	8.525	-134.679	0.0964	0.9109	0.0694
140	-50.835	9.023	-128.978	0.0977	0.9965	0.0786
150	-83.471	0	-40.447	0.048	1.1212	0.1736
158	-108.14	-12.976	17.317	0.0105	0.7514	0.2401
159	-112.688	-14.547	20.753	0.0056	0.623	0.2422
160	-117.455	-15.191	19.607	0.001	0.4878	0.2429
168	-117.455	-15.191	-19.607	-0.001	-0.4878	0.2429
169	-112.688	-14.547	-20.753	-0.0056	-0.623	0.2422
170	-108.14	-12.976	-17.317	-0.0105	-0.7514	0.2401
180	-83.471	0	40.447	-0.048	-1.1212	0.1736

Possible Approach:
Friction Factor 0.35

188	-50.835	9.023	128.978	-0.0977	-0.9965	0.0786
189	-46.155	8.525	134.679	-0.0964	-0.9109	0.0694
190	-40.708	6.335	135.6	-0.0903	-0.8269	0.0538
199	-35.048	3.335	133.305	-0.0815	-0.7411	0.0509
200	-32.456	2.763	131.888	-0.0745	-0.6958	0.0478
210	-3	0	108.224	-0.0303	-0.3506	0.0392
220	9.626	0	54.107	0.0075	0.0696	0.0196
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .40
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .40
Node 20 +Y Mu = .40

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .40
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .40
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .40
  Node  85  +Y   Mu = .40
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .40
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .40
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .40
   Node  120  Guide   Gap= 3.000 mm.   Mu = .40
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .40
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .40
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .40
   Node  210  Guide   Gap= 3.000 mm.   Mu = .40
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:
Friction Factor 0.40

Node 220 +Y Mu = .40

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.40	.000	.000	.000
15	+Y			.40	.000	1.000	.000
20	Guide		3.00	.40	.000	.000	.000
20	+Y			.40	.000	1.000	.000
45	+Y			.40	.000	1.000	.000
65	+Y			.40	.000	1.000	.000
85	Guide		3.00	.40	.000	.000	.000
85	+Y			.40	.000	1.000	.000
90	+Y			.40	.000	1.000	.000
100	ANC			.40	.000	.000	.000
110	+Y			.40	.000	1.000	.000
120	+Y			.40	.000	1.000	.000
120	Guide		3.00	.40	.000	.000	.000
150	+Y			.40	.000	1.000	.000
180	+Y			.40	.000	1.000	.000
210	+Y			.40	.000	1.000	.000
210	Guide		3.00	.40	.000	.000	.000
220	+Y			.40	.000	1.000	.000
230	ANC			.40	.000	.000	.000

INPUT UNITS USED...

```
UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =  mm.
     FORCE           pounds      x     4.448  =  N.
     MASS(dynamics)  pounds      x     0.454  =  Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =  N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =  N.m.
     STRESS          lbs./sq.in. x     6.895  =  KPa
     TEMP. SCALE     degrees F.  x     0.556  =  C
     PRESSURE        psig        x     6.895  =  KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =  KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =  kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =  kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =  kg./cu.cm.
```

Possible Approach:
Friction Factor 0.40

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.40

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.40

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117672.4 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 28392.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 138967.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42605.5	0	0	15	30293.1	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27513.9	227785.8	12.1		13238.9	227204.6	5.8	B31.3
1(OPE)	15	30623	0	0	20	74890.8	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		13238.9	227203.4	5.8		59470.6	228909.4	26	B31.3
1(OPE)	20	75128	0	0	28	96559.8	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59470.6	228906.8	26		81508	233366.2	34.9	B31.3
1(OPE)	28	96559.8	0	0	29	97819.9	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		81508	233366.2	34.9		82744.3	233174.8	35.5	B31.3
1(OPE)	29	97819.9	0	0	30	98945	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		82744.3	233174.8	35.5		83583.5	233001	35.9	B31.3
1(OPE)	30	98945	0	0	38	99971.9	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		83583.5	233001	35.9		84686.2	232825.1	36.4	B31.3
1(OPE)	38	99971.9	0	0	39	98006.5	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		84686.2	232825.1	36.4		82691.8	232744.5	35.5	B31.3

Possible Approach:
Friction Factor 0.40

1(OPE)	39	98006.5	0	0	40	90586.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		82691.8	232744.5	35.5		74442	233040.4	31.9	B31.3
1(OPE)	40	90586.6	0	0	45	60669.5	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		74442	233040.4	31.9		35728.9	207641.7	17.2	B31.3
1(OPE)	45	61111.6	0	0	48	123717.9	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35728.9	207665.7	17.2		106582.3	231505.7	46	B31.3
1(OPE)	48	123717.9	0	0	49	130477.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106582.3	231505.7	46		114424	233171.3	49.1	B31.3
1(OPE)	49	130477.7	0	0	50	133247.7	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114424	233171.3	49.1		117672.4	232689.6	50.6	B31.3
1(OPE)	50	133247.7	0	0	59	130477.7	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117672.4	232689.6	50.6		114424	233171.3	49.1	B31.3
1(OPE)	59	130477.7	0	0	60	123717.9	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114424	233171.3	49.1		106582.3	231505.7	46	B31.3
1(OPE)	60	123717.9	0	0	65	61111.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106582.3	231505.7	46		35728.9	207665.7	17.2	B31.3
1(OPE)	65	60669.5	0	0	68	90586.6	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35728.9	207641.7	17.2		74442	233040.4	31.9	B31.3
1(OPE)	68	90586.6	0	0	69	98006.5	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		74442	233040.4	31.9		82691.8	232744.5	35.5	B31.3
1(OPE)	69	98006.5	0	0	70	99971.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		82691.8	232744.5	35.5		84686.2	232825.1	36.4	B31.3
1(OPE)	70	99971.9	0	0	78	98945	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		84686.2	232825.1	36.4		83583.5	233001	35.9	B31.3
1(OPE)	78	98945	0	0	79	97819.9	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		83583.5	233001	35.9		82744.3	233174.8	35.5	B31.3
1(OPE)	79	97819.9	0	0	80	96559.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		82744.3	233174.8	35.5		81508	233366.2	34.9	B31.3

Possible Approach:
Friction Factor 0.40
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1(OPE)	80	96559.8	0	0	85	75128	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		81508	233366.2	34.9		59470.6	228906.8	26	B31.3
1(OPE)	85	74890.8	0	0	90	30623	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59470.6	228909.4	26		13238.8	227203.5	5.8	B31.3
1(OPE)	90	30293.1	0	0	100	42605.6	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		13238.8	227204.6	5.8		27513.9	227785.7	12.1	B31.3
1(OPE)	100	42605.6	0	0	110	30293.1	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27514	227785.7	12.1		13238.8	227204.6	5.8	B31.3
1(OPE)	110	30623	0	0	120	74890.8	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		13238.8	227203.5	5.8		59470.7	228909.4	26	B31.3
1(OPE)	120	75128	0	0	128	96559.8	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59470.7	228906.8	26		81508	233366.2	34.9	B31.3
1(OPE)	128	96559.8	0	0	129	97819.9	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		81508	233366.2	34.9		82744.4	233174.8	35.5	B31.3
1(OPE)	129	97819.9	0	0	130	98945.1	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		82744.4	233174.8	35.5		83583.6	233001	35.9	B31.3
1(OPE)	130	98945.1	0	0	139	98006.5	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		83583.6	233001	35.9		82691.8	232744.5	35.5	B31.3
1(OPE)	139	98006.5	0	0	140	90586.6	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		82691.8	232744.5	35.5		74442	233040.4	31.9	B31.3
1(OPE)	140	90586.6	0	0	150	60669.4	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		74442	233040.4	31.9		35728.9	207641.7	17.2	B31.3
1(OPE)	150	61111.6	0	0	158	123717.9	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35728.9	207665.7	17.2		106582.3	231505.7	46	B31.3
1(OPE)	158	123717.9	0	0	159	130477.7	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106582.3	231505.7	46		114424	233171.2	49.1	B31.3
1(OPE)	159	130477.7	0	0	160	133247.7	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114424	233171.2	49.1		117672.4	232689.6	50.6	B31.3

Possible Approach:
Friction Factor 0.40

1(OPE)	160	133247.7	0	0	168	133247.7	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117672.4	232689.6	50.6		117672.4	232689.6	50.6	B31.3
1(OPE)	168	133247.7	0	0	169	130477.7	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117672.4	232689.6	50.6		114424	233171.2	49.1	B31.3
1(OPE)	169	130477.7	0	0	170	123717.9	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114424	233171.2	49.1		106582.3	231505.7	46	B31.3
1(OPE)	170	123717.9	0	0	180	61111.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106582.3	231505.7	46		35728.9	207665.7	17.2	B31.3
1(OPE)	180	60669.4	0	0	188	90586.6	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35728.9	207641.7	17.2		74442	233040.4	31.9	B31.3
1(OPE)	188	90586.6	0	0	189	98006.5	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		74442	233040.4	31.9		82691.8	232744.5	35.5	B31.3
1(OPE)	189	98006.5	0	0	190	99971.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		82691.8	232744.5	35.5		84686.2	232825.1	36.4	B31.3
1(OPE)	190	99971.9	0	0	199	97819.9	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		84686.2	232825.1	36.4		82744.3	233174.8	35.5	B31.3
1(OPE)	199	97819.9	0	0	200	96559.8	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		82744.3	233174.8	35.5		81508	233366.2	34.9	B31.3
1(OPE)	200	96559.8	0	0	210	75128	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		81508	233366.2	34.9		59470.6	228906.8	26	B31.3
1(OPE)	210	74890.8	0	0	220	30623	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59470.6	228909.4	26		13238.9	227203.4	5.8	B31.3
1(OPE)	220	30293.1	0	0	230	42605.6	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		13238.9	227204.6	5.8		27513.9	227785.8	12.1	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15455	-12681	92851	-14010	-79081	3728	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	15563	1274	93169	3162	-79340	5254	0	0	0
	MAX	15563/L3	-13954/L	93169/L	-17172/L	-79340/L	5254/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	2636	-34384	-13498	0	0	0	10.567	0	-54.103
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2170	-5147	-13450	0	0	0	10.564	0	-54.103
	MAX	2636/L1	-34384/L	-13498/L1				10.567/L	-0.000/L1	-54.103/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	28	-24140	-9656	0	0	0	0.31	0	-108.218
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	1350	0	-9552	0	0	0	0.318	0	-108.218
	MAX	1350/L3	-24140/L	-9656/L1				0.318/L3	-0.000/L1	-108.218/L1
45		Rigid +Y								
	1(OPE)	-16801	-47215	-8625	0	0	0	-78.988	0	-40.55
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-17765	3874	-9208	0	0	0	-78.993	0	-40.553
	MAX	-17765/L	-51089/L	-9208/L3				-78.993/L	-0.000/L2	-40.553/L3
65		Rigid +Y								
	1(OPE)	-16801	-47215	8625	0	0	0	-78.988	0	40.55
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-17765	3874	9208	0	0	0	-78.993	0	40.553
	MAX	-17765/L	-51089/L	9208/L3				-78.993/L	-0.000/L2	40.553/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	28	-24140	9656	0	0	0	0.31	0	108.218
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	1350	0	9552	0	0	0	0.318	0	108.218
	MAX	1350/L3	-24140/L	9656/L1				0.318/L3	-0.000/L1	108.218/L1
90		Rigid +Y								
	1(OPE)	2636	-34384	13498	0	0	0	10.567	0	54.103
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2170	-5147	13450	0	0	0	10.564	0	54.103
	MAX	2636/L1	-34384/L	13498/L1				10.567/L	-0.000/L1	54.103/L1
100		Rigid ANC								
	1(OPE)	30910	-25361	0	0	0	7457	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	31127	2547	0	0	0	10508	0	0	0
	MAX	31127/L3	-27909/L	-0/L1	0/L2	-0/L1	10508/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	2636	-34384	-13498	0	0	0	10.567	0	-54.103
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2170	-5147	-13450	0	0	0	10.564	0	-54.103
	MAX	2636/L1	-34384/L	-13498/L1				10.567/L	-0.000/L1	-54.103/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	28	-24140	-9656	0	0	0	0.31	0	-108.218
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	1350	0	-9552	0	0	0	0.318	0	-108.218
	MAX	1350/L3	-24140/L	-9656/L1				0.318/L3	-0.000/L1	-108.218/L1
150		Rigid +Y								
	1(OPE)	-16801	-47215	-8625	0	0	0	-78.988	0	-40.55
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-17765	3874	-9208	0	0	0	-78.993	0	-40.553
	MAX	-17765/L	-51089/L	-9208/L3				-78.993/L	-0.000/L2	-40.553/L3
180		Rigid +Y								
	1(OPE)	-16801	-47215	8625	0	0	0	-78.988	0	40.55
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-17765	3874	9208	0	0	0	-78.993	0	40.553
	MAX	-17765/L	-51089/L	9208/L3				-78.993/L	-0.000/L2	40.553/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	28	-24140	9656	0	0	0	0.31	0	108.218
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	1350	0	9552	0	0	0	0.318	0	108.218
	MAX	1350/L3	-24140/L	9656/L1				0.318/L3	-0.000/L1	108.218/L1
220		Rigid +Y								
	1(OPE)	2636	-34384	13498	0	0	0	10.567	0	54.103
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2170	-5147	13450	0	0	0	10.564	0	54.103
	MAX	2636/L1	-34384/L	13498/L1				10.567/L	-0.000/L1	54.103/L1
230		Rigid ANC								
	1(OPE)	15455	-12681	-92851	14010	79081	3728	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	15563	1274	-93169	-3162	79340	5254	0	0	0
	MAX	15563/L3	-13954/L	-93169/L	17172/L3	79340/L3	5254/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.564	0	-54.103	-0.0064	-0.0832	0.0269
20	0.318	0	-108.218	0.0259	0.3289	0.0538
28	-27.96	2.807	-131.881	0.0762	0.6787	0.0656
29	-30.505	3.385	-133.296	0.0832	0.7253	0.069
30	-32.905	4.484	-134.368	0.0892	0.7691	0.0763
38	-36.174	6.397	-135.582	0.0922	0.8139	0.0725
39	-41.656	8.544	-134.68	0.0991	0.9008	0.0893
40	-46.358	8.912	-129.029	0.1013	0.9897	0.0989
45	-78.993	0	-40.553	0.0599	1.1232	0.1198
48	-103.662	-7.142	17.307	0.0285	0.7526	0.1198
49	-108.214	-7.862	20.75	0.0244	0.624	0.1203
50	-112.986	-8.047	19.607	0.0193	0.4885	0.1208
59	-108.214	-7.862	-20.75	-0.0244	-0.624	0.1203
60	-103.662	-7.142	-17.307	-0.0285	-0.7526	0.1198
65	-78.993	0	40.553	-0.0599	-1.1232	0.1198
68	-46.358	8.912	129.029	-0.1013	-0.9897	0.0989
69	-41.657	8.544	134.68	-0.0991	-0.9008	0.0893
70	-36.174	6.397	135.582	-0.0922	-0.8139	0.0725
78	-32.905	4.484	134.368	-0.0892	-0.7691	0.0763
79	-30.505	3.385	133.296	-0.0832	-0.7253	0.069
80	-27.96	2.807	131.881	-0.0762	-0.6787	0.0656
85	0.318	0	108.218	-0.0259	-0.3289	0.0538
90	10.564	0	54.103	0.0064	0.0832	0.0269
100	0	0	0	0	0	0
110	10.564	0	-54.103	-0.0064	-0.0832	0.0269
120	0.318	0	-108.218	0.0259	0.3289	0.0538
128	-27.96	2.807	-131.881	0.0762	0.6787	0.0656
129	-30.505	3.385	-133.296	0.0832	0.7253	0.069
130	-32.905	4.484	-134.368	0.0892	0.7691	0.0763
139	-41.656	8.544	-134.68	0.0991	0.9008	0.0893
140	-46.358	8.912	-129.029	0.1013	0.9897	0.0989
150	-78.993	0	-40.553	0.0599	1.1232	0.1198
158	-103.662	-7.142	17.307	0.0285	0.7526	0.1198
159	-108.214	-7.862	20.75	0.0244	0.624	0.1203
160	-112.986	-8.047	19.607	0.0193	0.4885	0.1208
168	-112.986	-8.047	-19.607	-0.0193	-0.4885	0.1208
169	-108.214	-7.862	-20.75	-0.0244	-0.624	0.1203
170	-103.662	-7.142	-17.307	-0.0285	-0.7526	0.1198
180	-78.993	0	40.553	-0.0599	-1.1232	0.1198

188	-46.358	8.912	129.029	-0.1013	-0.9897	0.0989
189	-41.656	8.544	134.68	-0.0991	-0.9008	0.0893
190	-36.174	6.397	135.582	-0.0922	-0.8139	0.0725
199	-30.505	3.385	133.296	-0.0832	-0.7253	0.069
200	-27.959	2.807	131.881	-0.0762	-0.6787	0.0656
210	0.318	0	108.218	-0.0259	-0.3289	0.0538
220	10.564	0	54.103	0.0064	0.0832	0.0269
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 8:47
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.40
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.567	0	-54.103	-0.0075	-0.0838	0.0191
20	0.31	0	-108.218	0.0303	0.3314	0.0382
28	-28.168	2.778	-131.882	0.0752	0.6822	0.0466
29	-30.712	3.353	-133.298	0.0823	0.7286	0.0497
30	-33.082	4.449	-134.371	0.0883	0.7721	0.0567
38	-36.288	6.359	-135.588	0.0913	0.8166	0.0526
39	-41.687	8.557	-134.685	0.0976	0.9028	0.0688
40	-46.352	9.059	-129.027	0.099	0.9909	0.0784
45	-78.988	0	-40.55	0.0488	1.1229	0.1744
48	-103.657	-13.023	17.306	0.0109	0.7527	0.2409
49	-108.208	-14.598	20.75	0.006	0.6241	0.243
50	-112.981	-15.242	19.607	0.0013	0.4886	0.2437
59	-108.208	-14.598	-20.75	-0.006	-0.6241	0.243
60	-103.657	-13.023	-17.306	-0.0109	-0.7527	0.2409
65	-78.988	0	40.55	-0.0488	-1.1229	0.1744
68	-46.352	9.059	129.027	-0.099	-0.9909	0.0784
69	-41.687	8.557	134.685	-0.0976	-0.9028	0.0688
70	-36.288	6.359	135.588	-0.0913	-0.8166	0.0526
78	-33.082	4.449	134.371	-0.0883	-0.7721	0.0567
79	-30.712	3.353	133.298	-0.0823	-0.7286	0.0497
80	-28.168	2.778	131.882	-0.0752	-0.6822	0.0466
85	0.31	0	108.218	-0.0303	-0.3314	0.0382
90	10.567	0	54.103	0.0075	0.0838	0.0191
100	0	0	0	0	0	0
110	10.567	0	-54.103	-0.0075	-0.0838	0.0191
120	0.31	0	-108.218	0.0303	0.3314	0.0382
128	-28.168	2.778	-131.882	0.0752	0.6822	0.0466
129	-30.712	3.353	-133.298	0.0823	0.7286	0.0497
130	-33.082	4.449	-134.371	0.0883	0.7721	0.0567
139	-41.687	8.557	-134.685	0.0976	0.9028	0.0688
140	-46.352	9.059	-129.027	0.099	0.9909	0.0784
150	-78.988	0	-40.55	0.0488	1.1229	0.1744
158	-103.656	-13.023	17.306	0.0109	0.7527	0.2409
159	-108.208	-14.598	20.75	0.006	0.6241	0.243
160	-112.981	-15.242	19.607	0.0013	0.4886	0.2437
168	-112.981	-15.242	-19.607	-0.0013	-0.4886	0.2437
169	-108.208	-14.598	-20.75	-0.006	-0.6241	0.243
170	-103.656	-13.023	-17.306	-0.0109	-0.7527	0.2409
180	-78.988	0	40.55	-0.0488	-1.1229	0.1744

188	-46.352	9.059	129.027	-0.099	-0.9909	0.0784
189	-41.687	8.557	134.685	-0.0976	-0.9028	0.0688
190	-36.288	6.359	135.588	-0.0913	-0.8166	0.0526
199	-30.712	3.353	133.298	-0.0823	-0.7286	0.0497
200	-28.168	2.778	131.882	-0.0752	-0.6822	0.0466
210	0.31	0	108.218	-0.0303	-0.3314	0.0382
220	10.567	0	54.103	0.0075	0.0838	0.0191
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .45
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .45
Node 20 +Y Mu = .45

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .45

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .45

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .45
Node 85 +Y Mu = .45

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .45

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

Possible Approach:
Friction Factor 0.45

```
  Node  110  +Y   Mu = .45
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .45
   Node  120  Guide   Gap= 3.000 mm.   Mu = .45
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .45
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .45
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .45
   Node  210  Guide   Gap= 3.000 mm.   Mu = .45
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .45

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.45	.000	.000	.000
15	+Y			.45	.000	1.000	.000
20	Guide		3.00	.45	.000	.000	.000
20	+Y			.45	.000	1.000	.000
45	+Y			.45	.000	1.000	.000
65	+Y			.45	.000	1.000	.000
85	Guide		3.00	.45	.000	.000	.000
85	+Y			.45	.000	1.000	.000
90	+Y			.45	.000	1.000	.000
100	ANC			.45	.000	.000	.000
110	+Y			.45	.000	1.000	.000
120	+Y			.45	.000	1.000	.000
120	Guide		3.00	.45	.000	.000	.000
150	+Y			.45	.000	1.000	.000
180	+Y			.45	.000	1.000	.000
210	+Y			.45	.000	1.000	.000
210	Guide		3.00	.45	.000	.000	.000
220	+Y			.45	.000	1.000	.000
230	ANC			.45	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.45

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.45

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.45

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117816.3 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 29025.5 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 139114.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43384.4	0	0	15	29321.1	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		28415.1	227785.8	12.5		12201.1	227204.6	5.4	B31.3
1(OPE)	15	29691.7	0	0	20	74972	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		12201.1	227203.4	5.4		59621.4	228909.4	26	B31.3
1(OPE)	20	75249.1	0	0	28	98198.4	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59621.4	228906.8	26		83176.7	233366.2	35.6	B31.3
1(OPE)	28	98198.4	0	0	29	99551.7	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		83176.7	233366.2	35.6		84505.6	233174.8	36.2	B31.3
1(OPE)	29	99551.7	0	0	30	100758.2	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		84505.6	233174.8	36.2		85421.1	233001	36.7	B31.3
1(OPE)	30	100758.2	0	0	38	101882.9	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		85421.1	233001	36.7		86622.1	232825.1	37.2	B31.3
1(OPE)	38	101882.9	0	0	39	99962.3	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		86622.1	232825.1	37.2		84688.8	232744.5	36.4	B31.3

Possible Approach:
Friction Factor 0.45

1(OPE)	39	99962.3	0	0	40	92442.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		84688.8	232744.5	36.4		76331	233040.4	32.8	B31.3
1(OPE)	40	92442.9	0	0	45	60702.1	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		76331	233040.4	32.8		35807.8	207641.7	17.2	B31.3
1(OPE)	45	61176.6	0	0	48	123853	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35807.8	207665.7	17.2		106717	231505.7	46.1	B31.3
1(OPE)	48	123853	0	0	49	130618.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106717	231505.7	46.1		114565.2	233171.3	49.1	B31.3
1(OPE)	49	130618.1	0	0	50	133389.9	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114565.2	233171.3	49.1		117816.3	232689.6	50.6	B31.3
1(OPE)	50	133389.9	0	0	59	130618.1	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117816.3	232689.6	50.6		114565.2	233171.3	49.1	B31.3
1(OPE)	59	130618.1	0	0	60	123853	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114565.2	233171.3	49.1		106717	231505.7	46.1	B31.3
1(OPE)	60	123853	0	0	65	61176.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106717	231505.7	46.1		35807.8	207665.7	17.2	B31.3
1(OPE)	65	60702.1	0	0	68	92442.9	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35807.8	207641.7	17.2		76331	233040.4	32.8	B31.3
1(OPE)	68	92442.9	0	0	69	99962.3	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		76331	233040.4	32.8		84688.9	232744.5	36.4	B31.3
1(OPE)	69	99962.3	0	0	70	101883	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		84688.9	232744.5	36.4		86622.1	232825.1	37.2	B31.3
1(OPE)	70	101883	0	0	78	100758.2	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		86622.1	232825.1	37.2		85421.2	233001	36.7	B31.3
1(OPE)	78	100758.2	0	0	79	99551.8	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		85421.2	233001	36.7		84505.7	233174.8	36.2	B31.3
1(OPE)	79	99551.8	0	0	80	98198.4	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		84505.7	233174.8	36.2		83176.7	233366.2	35.6	B31.3

Possible Approach:
Friction Factor 0.45

1(OPE)	80	98198.4	0	0	85	75249.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		83176.7	233366.2	35.6		59621.5	228906.8	26	B31.3
1(OPE)	85	74972	0	0	90	29691.6	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59621.5	228909.4	26		12201	227203.5	5.4	B31.3
1(OPE)	90	29321.1	0	0	100	43384.5	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		12201	227204.6	5.4		28415.2	227785.7	12.5	B31.3
1(OPE)	100	43384.6	0	0	110	29321.1	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		28415.2	227785.7	12.5		12201	227204.6	5.4	B31.3
1(OPE)	110	29691.6	0	0	120	74972.1	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		12201	227203.5	5.4		59621.5	228909.4	26	B31.3
1(OPE)	120	75249.2	0	0	128	98198.4	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		59621.5	228906.8	26		83176.8	233366.2	35.6	B31.3
1(OPE)	128	98198.4	0	0	129	99551.8	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		83176.8	233366.2	35.6		84505.7	233174.8	36.2	B31.3
1(OPE)	129	99551.8	0	0	130	100758.2	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		84505.7	233174.8	36.2		85421.2	233001	36.7	B31.3
1(OPE)	130	100758.2	0	0	139	99962.3	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		85421.2	233001	36.7		84688.9	232744.5	36.4	B31.3
1(OPE)	139	99962.3	0	0	140	92442.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		84688.9	232744.5	36.4		76331	233040.4	32.8	B31.3
1(OPE)	140	92442.9	0	0	150	60702.1	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		76331	233040.4	32.8		35807.8	207641.7	17.2	B31.3
1(OPE)	150	61176.5	0	0	158	123853	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		35807.8	207665.7	17.2		106717	231505.7	46.1	B31.3
1(OPE)	158	123853	0	0	159	130618.1	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106717	231505.7	46.1		114565.1	233171.2	49.1	B31.3
1(OPE)	159	130618.1	0	0	160	133389.8	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114565.1	233171.2	49.1		117816.2	232689.6	50.6	B31.3

Possible Approach:
Friction Factor 0.45

1(OPE)	160	133389.8	0	0	168	133389.9	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117816.2	232689.6	50.6		117816.3	232689.6	50.6	B31.3
1(OPE)	168	133389.9	0	0	169	130618.1	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117816.3	232689.6	50.6		114565.2	233171.2	49.1	B31.3
1(OPE)	169	130618.1	0	0	170	123853	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114565.2	233171.2	49.1		106717	231505.7	46.1	B31.3
1(OPE)	170	123853	0	0	180	61176.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106717	231505.7	46.1		35807.8	207665.7	17.2	B31.3
1(OPE)	180	60702.1	0	0	188	92442.9	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		35807.8	207641.7	17.2		76331	233040.4	32.8	B31.3
1(OPE)	188	92442.9	0	0	189	99962.3	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		76331	233040.4	32.8		84688.8	232744.5	36.4	B31.3
1(OPE)	189	99962.3	0	0	190	101882.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		84688.8	232744.5	36.4		86622.1	232825.1	37.2	B31.3
1(OPE)	190	101882.9	0	0	199	99551.7	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		86622.1	232825.1	37.2		84505.6	233174.8	36.2	B31.3
1(OPE)	199	99551.7	0	0	200	98198.3	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		84505.6	233174.8	36.2		83176.7	233366.2	35.6	B31.3
1(OPE)	200	98198.3	0	0	210	75249.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		83176.7	233366.2	35.6		59621.4	228906.8	26	B31.3
1(OPE)	210	74972	0	0	220	29691.7	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		59621.4	228909.4	26		12201.1	227203.4	5.4	B31.3
1(OPE)	220	29321.1	0	0	230	43384.4	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		12201.1	227204.6	5.4		28415.1	227785.8	12.5	B31.3

Possible Approach:
Friction Factor 0.45
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15395	-12679	97399	-14006	-81701	3633	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	15504	1275	97716	3166	-81960	5158	0	0	0
	MAX	15504/L3	-13954/L	97716/L	-17172/L	-81960/L	5158/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	3160	-34389	-15149	0	0	0	11.286	0	-54.099
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2694	-5153	-15101	0	0	0	11.283	0	-54.099
	MAX	3160/L1	-34389/L	-15149/L1				11.286/L	-0.000/L1	-54.099/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	883	-24314	-11198	0	0	0	3	0	-108.212
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	2205	-174	-11094	0	0	0	3.008	0	-108.211
	MAX	2205/L3	-24314/L	-11198/L1				3.008/L3	-0.000/L1	-108.212/L1
45		Rigid +Y								
	1(OPE)	-18626	-47037	-10054	0	0	0	-75.274	0	-40.629
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-19590	4052	-10637	0	0	0	-75.279	0	-40.632
	MAX	-19590/L	-51089/L	-10637/L3				-75.279/L	-0.000/L2	-40.632/L3
65		Rigid +Y								
	1(OPE)	-18626	-47037	10054	0	0	0	-75.274	0	40.629
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-19590	4052	10637	0	0	0	-75.279	0	40.632
	MAX	-19590/L	-51089/L	10637/L3				-75.279/L	-0.000/L2	40.632/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	883	-24314	11198	0	0	0	3	0	108.212
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	2205	-174	11094	0	0	0	3.008	0	108.211
	MAX	2205/L3	-24314/L	11198/L1				3.008/L3	-0.000/L1	108.212/L1
90		Rigid +Y								
	1(OPE)	3160	-34389	15149	0	0	0	11.286	0	54.099
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2694	-5153	15101	0	0	0	11.283	0	54.099
	MAX	3160/L1	-34389/L	15149/L1				11.286/L	-0.000/L1	54.099/L1
100		Rigid ANC								
	1(OPE)	30791	-25359	0	0	0	7266	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	31007	2550	0	0	0	10317	0	0	0
	MAX	31007/L3	-27909/L	-0/L1	0/L1	-0/L1	10317/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	3160	-34389	-15149	0	0	0	11.286	0	-54.099
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2694	-5153	-15101	0	0	0	11.283	0	-54.099
	MAX	3160/L1	-34389/L	-15149/L1				11.286/L	-0.000/L1	-54.099/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	883	-24314	-11198	0	0	0	3	0	-108.212
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	2205	-174	-11094	0	0	0	3.008	0	-108.211
	MAX	2205/L3	-24314/L	-11198/L1				3.008/L3	-0.000/L1	-108.212/L1
150		Rigid +Y								
	1(OPE)	-18626	-47037	-10054	0	0	0	-75.274	0	-40.629
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-19590	4052	-10637	0	0	0	-75.279	0	-40.632
	MAX	-19590/L	-51089/L	-10637/L3				-75.279/L	-0.000/L2	-40.632/L3
180		Rigid +Y								
	1(OPE)	-18626	-47037	10054	0	0	0	-75.274	0	40.629
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-19590	4052	10637	0	0	0	-75.279	0	40.632
	MAX	-19590/L	-51089/L	10637/L3				-75.279/L	-0.000/L2	40.632/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	883	-24314	11198	0	0	0	3	0	108.212
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	2205	-174	11094	0	0	0	3.008	0	108.211
	MAX	2205/L3	-24314/L	11198/L1				3.008/L3	-0.000/L1	108.212/L1
220		Rigid +Y								
	1(OPE)	3160	-34389	15149	0	0	0	11.286	0	54.099
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2694	-5153	15101	0	0	0	11.283	0	54.099
	MAX	3160/L1	-34389/L	15149/L1				11.286/L	-0.000/L1	54.099/L1
230		Rigid ANC								
	1(OPE)	15395	-12679	-97399	14006	81701	3633	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	15504	1275	-97716	-3166	81960	5158	0	0	0
	MAX	15504/L3	-13954/L	-97716/L	17172/L3	81960/L3	5158/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.283	0	-54.099	-0.0064	-0.0945	0.0264
20	3.008	0	-108.211	0.0259	0.3124	0.0529
28	-24.417	2.82	-131.874	0.0768	0.6667	0.0644
29	-26.921	3.4	-133.289	0.0839	0.7143	0.0678
30	-29.286	4.501	-134.359	0.09	0.7591	0.0753
38	-32.516	6.417	-135.57	0.0931	0.8048	0.0714
39	-37.956	8.571	-134.684	0.1001	0.8938	0.0887
40	-42.645	8.944	-129.069	0.1025	0.9849	0.0987
45	-75.279	0	-40.632	0.0605	1.1246	0.1206
48	-99.948	-7.185	17.299	0.0289	0.7535	0.1206
49	-104.502	-7.908	20.748	0.0247	0.6247	0.1211
50	-109.278	-8.094	19.607	0.0195	0.4891	0.1216
59	-104.502	-7.908	-20.748	-0.0247	-0.6247	0.1211
60	-99.948	-7.185	-17.3	-0.0289	-0.7535	0.1206
65	-75.279	0	40.632	-0.0605	-1.1246	0.1206
68	-42.645	8.944	129.069	-0.1025	-0.9849	0.0987
69	-37.956	8.571	134.684	-0.1001	-0.8938	0.0887
70	-32.516	6.417	135.57	-0.0931	-0.8048	0.0714
78	-29.286	4.501	134.359	-0.09	-0.7591	0.0753
79	-26.921	3.4	133.289	-0.0839	-0.7143	0.0678
80	-24.417	2.82	131.874	-0.0768	-0.6667	0.0644
85	3.008	0	108.211	-0.0259	-0.3124	0.0529
90	11.283	0	54.099	0.0064	0.0945	0.0264
100	0	0	0	0	0	0
110	11.283	0	-54.099	-0.0064	-0.0945	0.0264
120	3.008	0	-108.211	0.0259	0.3124	0.0529
128	-24.417	2.82	-131.874	0.0768	0.6667	0.0644
129	-26.921	3.4	-133.289	0.0839	0.7143	0.0678
130	-29.286	4.501	-134.359	0.09	0.7591	0.0753
139	-37.956	8.571	-134.684	0.1001	0.8938	0.0887
140	-42.645	8.944	-129.069	0.1025	0.9849	0.0987
150	-75.279	0	-40.632	0.0605	1.1246	0.1206
158	-99.948	-7.185	17.3	0.0289	0.7535	0.1206
159	-104.502	-7.908	20.748	0.0247	0.6247	0.1211
160	-109.278	-8.094	19.607	0.0195	0.4891	0.1216
168	-109.278	-8.094	-19.607	-0.0195	-0.4891	0.1216
169	-104.502	-7.908	-20.748	-0.0247	-0.6247	0.1211
170	-99.948	-7.185	-17.299	-0.0289	-0.7535	0.1206
180	-75.279	0	40.632	-0.0605	-1.1246	0.1206

188	-42.645	8.944	129.069	-0.1025	-0.9849	0.0987
189	-37.956	8.571	134.684	-0.1001	-0.8938	0.0887
190	-32.516	6.417	135.569	-0.0931	-0.8048	0.0714
199	-26.921	3.4	133.289	-0.0839	-0.7143	0.0678
200	-24.417	2.82	131.874	-0.0768	-0.6667	0.0644
210	3.008	0	108.211	-0.0259	-0.3124	0.0529
220	11.283	0	54.099	0.0064	0.0945	0.0264
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:30
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.45
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.286	0	-54.099	-0.0075	-0.0951	0.0186
20	3	0	-108.212	0.0304	0.3149	0.0372
28	-24.626	2.79	-131.875	0.0758	0.6702	0.0454
29	-27.128	3.367	-133.29	0.083	0.7176	0.0485
30	-29.464	4.466	-134.362	0.0892	0.7621	0.0557
38	-32.629	6.379	-135.576	0.0922	0.8076	0.0515
39	-37.987	8.583	-134.689	0.0986	0.8958	0.0682
40	-42.639	9.091	-129.067	0.1001	0.9862	0.0781
45	-75.274	0	-40.629	0.0495	1.1243	0.1751
48	-99.943	-13.066	17.299	0.0112	0.7536	0.2416
49	-104.497	-14.645	20.748	0.0062	0.6248	0.2437
50	-109.273	-15.289	19.607	0.0015	0.4892	0.2444
59	-104.497	-14.645	-20.748	-0.0062	-0.6248	0.2437
60	-99.943	-13.066	-17.299	-0.0112	-0.7536	0.2416
65	-75.274	0	40.629	-0.0495	-1.1243	0.1751
68	-42.639	9.091	129.067	-0.1001	-0.9862	0.0781
69	-37.987	8.583	134.689	-0.0986	-0.8958	0.0682
70	-32.629	6.379	135.576	-0.0922	-0.8076	0.0515
78	-29.464	4.466	134.362	-0.0892	-0.7621	0.0557
79	-27.128	3.367	133.29	-0.083	-0.7176	0.0485
80	-24.626	2.79	131.875	-0.0758	-0.6702	0.0454
85	3	0	108.212	-0.0304	-0.3149	0.0372
90	11.286	0	54.099	0.0075	0.0951	0.0186
100	0	0	0	0	0	0
110	11.286	0	-54.099	-0.0075	-0.0951	0.0186
120	3	0	-108.212	0.0304	0.3149	0.0372
128	-24.626	2.79	-131.875	0.0758	0.6702	0.0454
129	-27.128	3.367	-133.29	0.083	0.7176	0.0485
130	-29.464	4.466	-134.362	0.0892	0.7621	0.0557
139	-37.987	8.583	-134.689	0.0986	0.8958	0.0682
140	-42.639	9.091	-129.067	0.1001	0.9862	0.0781
150	-75.274	0	-40.629	0.0495	1.1243	0.1751
158	-99.942	-13.066	17.299	0.0112	0.7536	0.2416
159	-104.496	-14.645	20.748	0.0062	0.6248	0.2437
160	-109.273	-15.289	19.607	0.0015	0.4892	0.2444
168	-109.273	-15.289	-19.607	-0.0015	-0.4892	0.2444
169	-104.496	-14.645	-20.748	-0.0062	-0.6248	0.2437
170	-99.942	-13.066	-17.299	-0.0112	-0.7536	0.2416
180	-75.274	0	40.629	-0.0495	-1.1243	0.1751

Possible Approach:
Friction Factor 0.45

188	-42.639	9.091	129.067	-0.1001	-0.9862	0.0781
189	-37.987	8.583	134.689	-0.0986	-0.8958	0.0682
190	-32.629	6.379	135.576	-0.0922	-0.8076	0.0515
199	-27.128	3.367	133.29	-0.083	-0.7176	0.0485
200	-24.626	2.79	131.875	-0.0758	-0.6702	0.0454
210	3	0	108.212	-0.0304	-0.3149	0.0372
220	11.286	0	54.099	0.0075	0.0951	0.0186
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .50
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .50
Node 20 +Y Mu = .50

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .50

From 45 To 50 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,948.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .50

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .50
Node 85 +Y Mu = .50

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .50

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .50
 ------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .50
   Node  120  Guide   Gap= 3.000 mm.   Mu = .50
 ------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .50
 ------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .50
 ------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .50
   Node  210  Guide   Gap= 3.000 mm.   Mu = .50
 ------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .50

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.50	.000	.000	.000
15	+Y			.50	.000	1.000	.000
20	Guide		3.00	.50	.000	.000	.000
20	+Y			.50	.000	1.000	.000
45	+Y			.50	.000	1.000	.000
65	+Y			.50	.000	1.000	.000
85	Guide		3.00	.50	.000	.000	.000
85	+Y			.50	.000	1.000	.000
90	+Y			.50	.000	1.000	.000
100	ANC			.50	.000	.000	.000
110	+Y			.50	.000	1.000	.000
120	+Y			.50	.000	1.000	.000
120	Guide		3.00	.50	.000	.000	.000
150	+Y			.50	.000	1.000	.000
180	+Y			.50	.000	1.000	.000
210	+Y			.50	.000	1.000	.000
210	Guide		3.00	.50	.000	.000	.000
220	+Y			.50	.000	1.000	.000
230	ANC			.50	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:
Friction Factor 0.50

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:
Friction Factor 0.50

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Friction Factor 0.50

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9000.000	750.000	-19250.000
60	-9000.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9000.000	750.000	-64250.000
170	-9000.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43885.0 Allowable Stress: 63326.2
Axial Stress: 17793.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 117869.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 29459.1 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 139166.0 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42406.3	0	0	15	28759.3	0	0	B31.3
2(SUS)		23740.9	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27550.2	227785.8	12.1		11686	227204.6	5.1	B31.3
1(OPE)	15	29170.4	0	0	20	73637.8	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		11686	227203.4	5.1		58375.4	228909.4	25.5	B31.3
1(OPE)	20	73977.2	0	0	28	99200.9	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		58375.4	228906.8	25.5		84205.1	233366.2	36.1	B31.3
1(OPE)	28	99200.9	0	0	29	100693.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		84205.1	233366.2	36.1		85673.5	233174.8	36.7	B31.3
1(OPE)	29	100693.2	0	0	30	102018.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		85673.5	233174.8	36.7		86705	233001	37.2	B31.3
1(OPE)	30	102018.9	0	0	38	103292.5	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18701.5	63326.2	29.5	B31.3
3(EXP)		86705	233001	37.2		88055.8	232825.1	37.8	B31.3
1(OPE)	38	103292.5	0	0	39	101479.2	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18782.1	63326.2	29.7	B31.3
3(EXP)		88055.8	232825.1	37.8		86258.2	232744.5	37.1	B31.3

Possible Approach:
Friction Factor 0.50

1(OPE)	39	101479.2	0	0	40	93904.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		86258.2	232744.5	37.1		77841	233040.4	33.4	B31.3
1(OPE)	40	93904.9	0	0	45	60819.3	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		77841	233040.4	33.4		36012.2	207641.7	17.3	B31.3
1(OPE)	45	61342.3	0	0	48	123927.1	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		36012.2	207665.7	17.3		106791	231505.7	46.1	B31.3
1(OPE)	48	123927.1	0	0	49	130679.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106791	231505.7	46.1		114624.7	233171.3	49.2	B31.3
1(OPE)	49	130679.6	0	0	50	133446	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114624.7	233171.3	49.2		117869.8	232689.6	50.7	B31.3
1(OPE)	50	133446	0	0	59	130679.6	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117869.8	232689.6	50.7		114624.7	233171.3	49.2	B31.3
1(OPE)	59	130679.6	0	0	60	123927.1	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114624.7	233171.3	49.2		106791	231505.7	46.1	B31.3
1(OPE)	60	123927.1	0	0	65	61342.3	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106791	231505.7	46.1		36012.2	207665.7	17.3	B31.3
1(OPE)	65	60819.3	0	0	68	93904.9	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		36012.2	207641.7	17.3		77841	233040.4	33.4	B31.3
1(OPE)	68	93904.9	0	0	69	101479.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		77841	233040.4	33.4		86258.2	232744.5	37.1	B31.3
1(OPE)	69	101479.2	0	0	70	103292.5	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		86258.2	232744.5	37.1		88055.9	232825.1	37.8	B31.3
1(OPE)	70	103292.5	0	0	78	102018.9	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18525.7	63326.2	29.3	B31.3
3(EXP)		88055.9	232825.1	37.8		86705	233001	37.2	B31.3
1(OPE)	78	102018.9	0	0	79	100693.2	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18351.9	63326.2	29	B31.3
3(EXP)		86705	233001	37.2		85673.5	233174.8	36.7	B31.3
1(OPE)	79	100693.2	0	0	80	99201	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		85673.5	233174.8	36.7		84205.1	233366.2	36.1	B31.3

Possible Approach:
Friction Factor 0.50

1(OPE)	80	99201	0	0	85	73977.3	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		84205.1	233366.2	36.1		58375.5	228906.8	25.5	B31.3
1(OPE)	85	73637.9	0	0	90	29170.3	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		58375.5	228909.4	25.5		11685.9	227203.5	5.1	B31.3
1(OPE)	90	28759.3	0	0	100	42406.4	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23741	63326.2	37.5	B31.3
3(EXP)		11685.9	227204.6	5.1		27550.3	227785.7	12.1	B31.3
1(OPE)	100	42406.4	0	0	110	28759.3	0	0	B31.3
2(SUS)		23741	63326.2	37.5		24322	63326.2	38.4	B31.3
3(EXP)		27550.3	227785.7	12.1		11686	227204.6	5.1	B31.3
1(OPE)	110	29170.3	0	0	120	73637.9	0	0	B31.3
2(SUS)		24323.2	63326.2	38.4		22617.3	63326.2	35.7	B31.3
3(EXP)		11686	227203.5	5.1		58375.5	228909.4	25.5	B31.3
1(OPE)	120	73977.3	0	0	128	99201	0	0	B31.3
2(SUS)		22619.9	63326.2	35.7		18160.5	63326.2	28.7	B31.3
3(EXP)		58375.5	228906.8	25.5		84205.1	233366.2	36.1	B31.3
1(OPE)	128	99201	0	0	129	100693.2	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		18351.9	63326.2	29	B31.3
3(EXP)		84205.1	233366.2	36.1		85673.5	233174.8	36.7	B31.3
1(OPE)	129	100693.2	0	0	130	102018.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18525.7	63326.2	29.3	B31.3
3(EXP)		85673.5	233174.8	36.7		86705.1	233001	37.2	B31.3
1(OPE)	130	102018.9	0	0	139	101479.2	0	0	B31.3
2(SUS)		18525.7	63326.2	29.3		18782.1	63326.2	29.7	B31.3
3(EXP)		86705.1	233001	37.2		86258.2	232744.5	37.1	B31.3
1(OPE)	139	101479.2	0	0	140	93904.9	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18486.3	63326.2	29.2	B31.3
3(EXP)		86258.2	232744.5	37.1		77841	233040.4	33.4	B31.3
1(OPE)	140	93904.9	0	0	150	60819.3	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		43885	63326.2	69.3	B31.3
3(EXP)		77841	233040.4	33.4		36012.2	207641.7	17.3	B31.3
1(OPE)	150	61342.3	0	0	158	123927.1	0	0	B31.3
2(SUS)		43860.9	63326.2	69.3		20021	63326.2	31.6	B31.3
3(EXP)		36012.2	207665.7	17.3		106791	231505.7	46.1	B31.3
1(OPE)	158	123927.1	0	0	159	130679.6	0	0	B31.3
2(SUS)		20021	63326.2	31.6		18355.4	63326.2	29	B31.3
3(EXP)		106791	231505.7	46.1		114624.7	233171.2	49.2	B31.3
1(OPE)	159	130679.6	0	0	160	133446	0	0	B31.3
2(SUS)		18355.4	63326.2	29		18837.1	63326.2	29.7	B31.3
3(EXP)		114624.7	233171.2	49.2		117869.8	232689.6	50.7	B31.3

Possible Approach:
Friction Factor 0.50
Page 11 of 20

1(OPE)	160	133446	0	0	168	133446	0	0	B31.3
2(SUS)		18837.1	63326.2	29.7		18837	63326.2	29.7	B31.3
3(EXP)		117869.8	232689.6	50.7		117869.8	232689.6	50.7	B31.3
1(OPE)	168	133446	0	0	169	130679.6	0	0	B31.3
2(SUS)		18837	63326.2	29.7		18355.4	63326.2	29	B31.3
3(EXP)		117869.8	232689.6	50.7		114624.7	233171.2	49.2	B31.3
1(OPE)	169	130679.6	0	0	170	123927.1	0	0	B31.3
2(SUS)		18355.4	63326.2	29		20021	63326.2	31.6	B31.3
3(EXP)		114624.7	233171.2	49.2		106791	231505.7	46.1	B31.3
1(OPE)	170	123927.1	0	0	180	61342.3	0	0	B31.3
2(SUS)		20021	63326.2	31.6		43860.9	63326.2	69.3	B31.3
3(EXP)		106791	231505.7	46.1		36012.2	207665.7	17.3	B31.3
1(OPE)	180	60819.3	0	0	188	93904.9	0	0	B31.3
2(SUS)		43885	63326.2	69.3		18486.3	63326.2	29.2	B31.3
3(EXP)		36012.2	207641.7	17.3		77841	233040.4	33.4	B31.3
1(OPE)	188	93904.9	0	0	189	101479.2	0	0	B31.3
2(SUS)		18486.3	63326.2	29.2		18782.1	63326.2	29.7	B31.3
3(EXP)		77841	233040.4	33.4		86258.2	232744.5	37.1	B31.3
1(OPE)	189	101479.2	0	0	190	103292.5	0	0	B31.3
2(SUS)		18782.1	63326.2	29.7		18701.5	63326.2	29.5	B31.3
3(EXP)		86258.2	232744.5	37.1		88055.8	232825.1	37.8	B31.3
1(OPE)	190	103292.5	0	0	199	100693.2	0	0	B31.3
2(SUS)		18701.5	63326.2	29.5		18351.9	63326.2	29	B31.3
3(EXP)		88055.8	232825.1	37.8		85673.4	233174.8	36.7	B31.3
1(OPE)	199	100693.2	0	0	200	99200.9	0	0	B31.3
2(SUS)		18351.9	63326.2	29		18160.5	63326.2	28.7	B31.3
3(EXP)		85673.4	233174.8	36.7		84205	233366.2	36.1	B31.3
1(OPE)	200	99200.9	0	0	210	73977.3	0	0	B31.3
2(SUS)		18160.5	63326.2	28.7		22619.9	63326.2	35.7	B31.3
3(EXP)		84205	233366.2	36.1		58375.5	228906.8	25.5	B31.3
1(OPE)	210	73637.9	0	0	220	29170.4	0	0	B31.3
2(SUS)		22617.3	63326.2	35.7		24323.2	63326.2	38.4	B31.3
3(EXP)		58375.5	228909.4	25.5		11686	227203.4	5.1	B31.3
1(OPE)	220	28759.3	0	0	230	42406.3	0	0	B31.3
2(SUS)		24322	63326.2	38.4		23740.9	63326.2	37.5	B31.3
3(EXP)		11686	227204.6	5.1		27550.2	227785.8	12.1	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14864	-12698	102690	-14053	-79205	3460	0	0	0
	2(SUS)	-108	-13954	-318	-17172	259	-1525	0	0	0
	3(EXP)	14972	1256	103008	3119	-79464	4985	0	0	0
	MAX	14972/L3	-13954/L	103008/L	-17172/L	-79464/L	4985/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	3413	-34313	-16814	0	0	0	10.98	0	-54.095
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2946	-5077	-16765	0	0	0	10.978	0	-54.095
	MAX	3413/L1	-34313/L	-16814/L1				10.980/L	-0.000/L1	-54.095/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	3151	-24632	-13716	0	0	0	3	0	-108.204
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	4473	-492	-13612	0	0	0	3.008	0	-108.204
	MAX	4473/L3	-24632/L	-13716/L1				3.008/L3	-0.000/L1	-108.204/L1
45		Rigid +Y								
	1(OPE)	-20534	-46776	-11196	0	0	0	-74.595	0	-40.671
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-21498	4313	-11779	0	0	0	-74.6	0	-40.675
	MAX	-21498/L	-51089/L	-11779/L3				-74.600/L	-0.000/L2	-40.675/L3
65		Rigid +Y								
	1(OPE)	-20534	-46776	11196	0	0	0	-74.595	0	40.671
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-21498	4313	11779	0	0	0	-74.6	0	40.675
	MAX	-21498/L	-51089/L	11779/L3				-74.600/L	-0.000/L2	40.675/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	3151	-24632	13716	0	0	0	3	0	108.204
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	4472	-492	13612	0	0	0	3.008	0	108.204
	MAX	4472/L3	-24632/L	13716/L1				3.008/L3	-0.000/L1	108.204/L1
90		Rigid +Y								
	1(OPE)	3413	-34313	16814	0	0	0	10.98	0	54.095
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2946	-5077	16765	0	0	0	10.977	0	54.095
	MAX	3413/L1	-34313/L	16814/L1				10.980/L	-0.000/L1	54.095/L1
100		Rigid ANC								
	1(OPE)	29728	-25396	0	0	0	6919	0	0	0
	2(SUS)	-217	-27909	0	0	0	-3051	0	0	0
	3(EXP)	29945	2512	0	0	0	9970	0	0	0
	MAX	29945/L3	-27909/L	-0/L1	0/L1	-0/L1	9970/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	3413	-34313	-16814	0	0	0	10.98	0	-54.095
	2(SUS)	467	-29237	-48	0	0	0	0.003	0	0
	3(EXP)	2946	-5077	-16765	0	0	0	10.977	0	-54.095
	MAX	3413/L1	-34313/L	-16814/L1				10.980/L	-0.000/L1	-54.095/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	3151	-24632	-13716	0	0	0	3	0	-108.204
	2(SUS)	-1322	-24140	-104	0	0	0	-0.008	0	-0.001
	3(EXP)	4472	-492	-13612	0	0	0	3.008	0	-108.204
	MAX	4472/L3	-24632/L	-13716/L1				3.008/L3	-0.000/L1	-108.204/L1
150		Rigid +Y								
	1(OPE)	-20534	-46776	-11196	0	0	0	-74.595	0	-40.671
	2(SUS)	964	-51089	583	0	0	0	0.006	0	0.003
	3(EXP)	-21498	4313	-11779	0	0	0	-74.6	0	-40.675
	MAX	-21498/L	-51089/L	-11779/L3				-74.600/L	-0.000/L2	-40.675/L3
180		Rigid +Y								
	1(OPE)	-20534	-46776	11196	0	0	0	-74.595	0	40.671
	2(SUS)	964	-51089	-583	0	0	0	0.006	0	-0.003
	3(EXP)	-21498	4313	11779	0	0	0	-74.6	0	40.675
	MAX	-21498/L	-51089/L	11779/L3				-74.600/L	-0.000/L2	40.675/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	3151	-24632	13716	0	0	0	3	0	108.204
	2(SUS)	-1322	-24140	104	0	0	0	-0.008	0	0.001
	3(EXP)	4473	-492	13612	0	0	0	3.008	0	108.204
	MAX	4473/L3	-24632/L	13716/L1				3.008/L3	-0.000/L1	108.204/L1
220		Rigid +Y								
	1(OPE)	3413	-34313	16814	0	0	0	10.98	0	54.095
	2(SUS)	467	-29237	48	0	0	0	0.003	0	0
	3(EXP)	2946	-5077	16765	0	0	0	10.978	0	54.095
	MAX	3413/L1	-34313/L	16814/L1				10.980/L	-0.000/L1	54.095/L1
230		Rigid ANC								
	1(OPE)	14864	-12698	-102690	14053	79205	3460	0	0	0
	2(SUS)	-108	-13954	318	17172	-259	-1525	0	0	0
	3(EXP)	14972	1256	-103008	-3119	79464	4985	0	0	0
	MAX	14972/L3	-13954/L	-103008/L	17172/L3	79464/L3	4985/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.978	0	-54.095	-0.0063	-0.0925	0.0255
20	3.008	0	-108.204	0.0255	0.3043	0.0511
28	-23.882	2.795	-131.866	0.0765	0.6581	0.0623
29	-26.354	3.374	-133.281	0.0838	0.7063	0.0657
30	-28.691	4.475	-134.351	0.09	0.7517	0.0733
38	-31.886	6.391	-135.561	0.0931	0.7982	0.0693
39	-37.29	8.55	-134.691	0.1003	0.8888	0.0871
40	-41.967	8.933	-129.102	0.1028	0.9816	0.0976
45	-74.6	0	-40.675	0.0607	1.1257	0.1209
48	-99.269	-7.204	17.297	0.0289	0.7539	0.1209
49	-103.824	-7.93	20.748	0.0248	0.625	0.1214
50	-108.602	-8.116	19.607	0.0196	0.4893	0.1219
59	-103.824	-7.93	-20.748	-0.0248	-0.625	0.1214
60	-99.269	-7.204	-17.297	-0.0289	-0.7539	0.1209
65	-74.6	0	40.675	-0.0607	-1.1257	0.1209
68	-41.967	8.933	129.102	-0.1028	-0.9816	0.0976
69	-37.29	8.55	134.691	-0.1003	-0.8888	0.0871
70	-31.886	6.391	135.561	-0.0931	-0.7982	0.0693
78	-28.691	4.475	134.351	-0.09	-0.7517	0.0733
79	-26.354	3.374	133.281	-0.0838	-0.7063	0.0657
80	-23.882	2.795	131.866	-0.0765	-0.6581	0.0623
85	3.008	0	108.204	-0.0255	-0.3043	0.0511
90	10.977	0	54.095	0.0063	0.0925	0.0255
100	0	0	0	0	0	0
110	10.977	0	-54.095	-0.0063	-0.0925	0.0255
120	3.008	0	-108.204	0.0255	0.3043	0.0511
128	-23.882	2.795	-131.866	0.0765	0.6581	0.0623
129	-26.354	3.374	-133.281	0.0838	0.7063	0.0657
130	-28.691	4.475	-134.351	0.09	0.7517	0.0733
139	-37.29	8.55	-134.691	0.1003	0.8888	0.0871
140	-41.967	8.933	-129.102	0.1028	0.9816	0.0976
150	-74.6	0	-40.675	0.0607	1.1257	0.1209
158	-99.269	-7.204	17.297	0.0289	0.7539	0.1209
159	-103.824	-7.93	20.748	0.0248	0.625	0.1214
160	-108.602	-8.116	19.607	0.0196	0.4893	0.1219
168	-108.602	-8.116	-19.607	-0.0196	-0.4893	0.1219
169	-103.824	-7.93	-20.748	-0.0248	-0.625	0.1214
170	-99.269	-7.204	-17.297	-0.0289	-0.7539	0.1209
180	-74.6	0	40.675	-0.0607	-1.1257	0.1209

Possible Approach:
Friction Factor 0.50

188	-41.967	8.933	129.102	-0.1028	-0.9816	0.0976
189	-37.29	8.55	134.691	-0.1003	-0.8888	0.0871
190	-31.886	6.391	135.561	-0.0931	-0.7982	0.0693
199	-26.354	3.374	133.281	-0.0838	-0.7063	0.0657
200	-23.881	2.795	131.866	-0.0765	-0.6581	0.0623
210	3.008	0	108.204	-0.0255	-0.3043	0.0511
220	10.978	0	54.095	0.0063	0.0925	0.0255
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0011	-0.0006	-0.0078
20	-0.008	0	-0.001	0.0045	0.0025	-0.0156
28	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
29	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
30	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
38	-0.114	-0.038	-0.006	-0.0009	0.0027	-0.0199
39	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
40	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
45	0.006	0	0.003	-0.0111	-0.0003	0.0545
48	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
49	0.005	-6.736	0	-0.0185	0.0001	0.1226
50	0.005	-7.195	0	-0.018	0.0001	0.1228
59	0.005	-6.736	0	0.0185	-0.0001	0.1226
60	0.006	-5.881	0.001	0.0177	-0.0001	0.121
65	0.006	0	-0.003	0.0111	0.0003	0.0545
68	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
69	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
70	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
78	-0.177	-0.035	0.003	0.0009	-0.003	-0.0196
79	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
80	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
85	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
90	0.003	0	0	0.0011	0.0006	-0.0078
100	0	0	0	0	0	0
110	0.003	0	0	-0.0011	-0.0006	-0.0078
120	-0.008	0	-0.001	0.0045	0.0025	-0.0156
128	-0.208	-0.03	-0.001	-0.001	0.0035	-0.0191
129	-0.207	-0.033	-0.001	-0.0009	0.0033	-0.0193
130	-0.177	-0.035	-0.003	-0.0009	0.003	-0.0196
139	-0.031	0.013	-0.005	-0.0015	0.002	-0.0205
140	0.006	0.147	0.002	-0.0023	0.0012	-0.0205
150	0.006	0	0.003	-0.0111	-0.0003	0.0545
158	0.006	-5.881	-0.001	-0.0177	0.0001	0.121
159	0.005	-6.736	0	-0.0185	0.0001	0.1226
160	0.005	-7.195	0	-0.018	0.0001	0.1228
168	0.005	-7.195	0	0.018	-0.0001	0.1228
169	0.005	-6.736	0	0.0185	-0.0001	0.1226
170	0.006	-5.881	0.001	0.0177	-0.0001	0.121
180	0.006	0	-0.003	0.0111	0.0003	0.0545

188	0.006	0.147	-0.002	0.0023	-0.0012	-0.0205
189	-0.031	0.013	0.005	0.0015	-0.002	-0.0205
190	-0.114	-0.038	0.006	0.0009	-0.0027	-0.0199
199	-0.207	-0.033	0.001	0.0009	-0.0033	-0.0193
200	-0.208	-0.03	0.001	0.001	-0.0035	-0.0191
210	-0.008	0	0.001	-0.0045	-0.0025	-0.0156
220	0.003	0	0	0.0011	0.0006	-0.0078
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 9:44
Job Name: A335 P22_2 EXPANSION LOOP_MU 0.50
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.98	0	-54.095	-0.0074	-0.0931	0.0177
20	3	0	-108.204	0.03	0.3069	0.0355
28	-24.09	2.765	-131.867	0.0755	0.6616	0.0432
29	-26.561	3.342	-133.282	0.0829	0.7096	0.0464
30	-28.869	4.44	-134.354	0.0891	0.7547	0.0537
38	-31.999	6.354	-135.568	0.0922	0.8009	0.0495
39	-37.32	8.563	-134.696	0.0988	0.8908	0.0666
40	-41.961	9.08	-129.1	0.1004	0.9828	0.0771
45	-74.595	0	-40.671	0.0496	1.1254	0.1754
48	-99.264	-13.085	17.296	0.0113	0.754	0.2419
49	-103.818	-14.666	20.748	0.0063	0.6251	0.244
50	-108.597	-15.311	19.607	0.0015	0.4894	0.2447
59	-103.818	-14.666	-20.748	-0.0063	-0.6251	0.244
60	-99.264	-13.085	-17.296	-0.0113	-0.754	0.2419
65	-74.595	0	40.671	-0.0496	-1.1254	0.1754
68	-41.961	9.08	129.1	-0.1004	-0.9828	0.0771
69	-37.32	8.563	134.696	-0.0988	-0.8908	0.0666
70	-31.999	6.354	135.568	-0.0922	-0.8009	0.0495
78	-28.869	4.44	134.354	-0.0891	-0.7547	0.0537
79	-26.561	3.342	133.282	-0.0829	-0.7096	0.0464
80	-24.09	2.765	131.867	-0.0755	-0.6616	0.0432
85	3	0	108.204	-0.03	-0.3069	0.0355
90	10.98	0	54.095	0.0074	0.0931	0.0177
100	0	0	0	0	0	0
110	10.98	0	-54.095	-0.0074	-0.0931	0.0177
120	3	0	-108.204	0.03	0.3069	0.0355
128	-24.09	2.765	-131.867	0.0755	0.6616	0.0432
129	-26.561	3.342	-133.282	0.0829	0.7096	0.0464
130	-28.869	4.44	-134.354	0.0891	0.7547	0.0537
139	-37.32	8.563	-134.696	0.0988	0.8908	0.0666
140	-41.961	9.08	-129.1	0.1004	0.9828	0.0771
150	-74.595	0	-40.671	0.0496	1.1254	0.1754
158	-99.264	-13.085	17.296	0.0113	0.754	0.2419
159	-103.818	-14.666	20.748	0.0063	0.6251	0.244
160	-108.597	-15.311	19.607	0.0015	0.4894	0.2447
168	-108.597	-15.311	-19.607	-0.0015	-0.4894	0.2447
169	-103.818	-14.666	-20.748	-0.0063	-0.6251	0.244
170	-99.264	-13.085	-17.296	-0.0113	-0.754	0.2419
180	-74.595	0	40.671	-0.0496	-1.1254	0.1754

Possible Approach:
Friction Factor 0.50

188	-41.961	9.08	129.1	-0.1004	-0.9828	0.0771
189	-37.32	8.563	134.696	-0.0988	-0.8908	0.0666
190	-31.999	6.354	135.567	-0.0922	-0.8009	0.0495
199	-26.561	3.342	133.282	-0.0829	-0.7096	0.0464
200	-24.09	2.765	131.867	-0.0755	-0.6616	0.0432
210	3	0	108.204	-0.03	-0.3069	0.0355
220	10.98	0	54.095	0.0074	0.0931	0.0177
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -6,000.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -6,000.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -2,000.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
 GENERAL
   Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
   Angle/Node @2= .00 38
 ------------------------------------------------------------------------------
 From  40  To  45  DX= -5,052.000 mm.
 RESTRAINTS
   Node  45  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  45  To  50  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
   Angle/Node @2= .00 48
 ------------------------------------------------------------------------------
 From  50  To  60 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
 ------------------------------------------------------------------------------
 From  60  To  65  DX= 3,948.000 mm.
   Dia= 355.600 mm.   Wall= 41.550 mm.
   Insul Thk= 200.000 mm.
 RESTRAINTS
   Node  65  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  65  To  70  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
   Angle/Node @2= .00 68
 ------------------------------------------------------------------------------
 From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
   Angle/Node @2= .00 78
 ------------------------------------------------------------------------------
 From  80  To  85 DZ= -2,000.000 mm.
 RESTRAINTS
   Node  85  Guide   Gap= 3.000 mm.   Mu = .30
   Node  85  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  85  To  90 DZ= -6,000.000 mm.
 RESTRAINTS
   Node  90  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  90  To  100 DZ= -6,000.000 mm.
 RESTRAINTS
   Node  100  ANC
 ------------------------------------------------------------------------------
 From  100  To  110 DZ= -6,000.000 mm.
 RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -6,000.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -2,000.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -2,000.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -6,000.000 mm.
 RESTRAINTS
```

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -6,000.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                          v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                          App.P Sy/St Switch = ON   Sc= 137,895 KPa
                          Sh1= 63,326 KPa   Sh2= 137,895 KPa
                          Sh3= 137,895 KPa   Sh4= 137,895 KPa
                          Sh5= 137,895 KPa   Sh6= 137,895 KPa
                          Sh7= 137,895 KPa   Sh8= 137,895 KPa
                          Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 29
                          Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 39
                          Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 49
                          Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 69
                          Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 79
                          Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50
                        129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

Location of Pipe Support and Anchor Point 6.0m

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS			Len	MU		
			GAP	YIELD	Dir	
NODE	TYPE	CNODE	STIF1	STIF2	FORCE	Vectors
10	ANC			.30	.000 .000 .000	
15	+Y			.30	.000 1.000 .000	
20	Guide		3.00	.30	.000 .000 .000	
20	+Y			.30	.000 1.000 .000	
45	+Y			.30	.000 1.000 .000	
65	+Y			.30	.000 1.000 .000	
85	Guide		3.00	.30	.000 .000 .000	
85	+Y			.30	.000 1.000 .000	
90	+Y			.30	.000 1.000 .000	
100	ANC			.30	.000 .000 .000	
110	+Y			.30	.000 1.000 .000	
120	+Y			.30	.000 1.000 .000	
120	Guide		3.00	.30	.000 .000 .000	
150	+Y			.30	.000 1.000 .000	
180	+Y			.30	.000 1.000 .000	
210	+Y			.30	.000 1.000 .000	
210	Guide		3.00	.30	.000 .000 .000	
220	+Y			.30	.000 1.000 .000	
230	ANC			.30	.000 .000 .000	

```
INPUT UNITS USED...

UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =  mm.
     FORCE           pounds      x     4.448  =  N.
     MASS(dynamics)  pounds      x     0.454  =  Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =  N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =  N.m.
     STRESS          lbs./sq.in. x     6.895  =  KPa
     TEMP. SCALE     degrees F.  x     0.556  =  C
     PRESSURE        psig        x     6.895  =  KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =  KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =  kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =  kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =  kg./cu.cm.
```

Possible Approach:

Location of Pipe Support and Anchor Point 6.0m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Location of Pipe Support and Anchor Point 6.0m

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-6000.000
20	.000	.000	-12000.000
30	.000	.000	-14000.000
40	.000	750.000	-14750.000
45	-5052.000	750.000	-14750.000
50	-9000.000	750.000	-14750.000
60	-9000.000	750.000	-21250.000
65	-5052.000	750.000	-21250.000
70	.000	750.000	-21250.000
80	.000	.000	-22000.000
85	.000	.000	-24000.000
90	.000	.000	-30000.000
100	.000	.000	-36000.000
110	.000	.000	-42000.000
120	.000	.000	-48000.000
130	.000	.000	-50000.000
140	.000	750.000	-50750.000
150	-5052.000	750.000	-50750.000
160	-9000.000	750.000	-50750.000
170	-9000.000	750.000	-57250.000
180	-5052.000	750.000	-57250.000
190	.000	750.000	-57250.000
200	.000	.000	-58000.000
210	.000	.000	-60000.000
220	.000	.000	-66000.000
230	.000	.000	-72000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.4 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43928.1 Allowable Stress: 63326.2
Axial Stress: 17822.5 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 96123.0 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 25324.4 @Node 78 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 116892.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43182.4	0	0	15	32761.9	0	0	B31.3
2(SUS)		21292.5	63326.2	33.6		22536.5	63326.2	35.6	B31.3
3(EXP)		28020.6	230234.1	12.2		16460.8	228990.2	7.2	B31.3
1(OPE)	15	33031.7	0	0	20	79143.9	0	0	B31.3
2(SUS)		22538.4	63326.2	35.6		19145.8	63326.2	30.2	B31.3
3(EXP)		16460.8	228988.2	7.2		62819.6	232380.8	27	B31.3
1(OPE)	20	79308.2	0	0	28	88201.6	0	0	B31.3
2(SUS)		19150	63326.2	30.2		18106.6	63326.2	28.6	B31.3
3(EXP)		62819.6	232376.6	27		72931.1	233420	31.2	B31.3
1(OPE)	28	88201.6	0	0	29	89175.5	0	0	B31.3
2(SUS)		18106.6	63326.2	28.6		18483.1	63326.2	29.2	B31.3
3(EXP)		72931.1	233420	31.2		73977.7	233043.6	31.7	B31.3
1(OPE)	29	89175.5	0	0	30	90055.7	0	0	B31.3
2(SUS)		18483.1	63326.2	29.2		18773.1	63326.2	29.6	B31.3
3(EXP)		73977.7	233043.6	31.7		74687.9	232753.5	32.1	B31.3
1(OPE)	30	90055.7	0	0	38	90826.7	0	0	B31.3
2(SUS)		18773.1	63326.2	29.6		19114.6	63326.2	30.2	B31.3
3(EXP)		74687.9	232753.5	32.1		75608.5	232412	32.5	B31.3
1(OPE)	38	90826.7	0	0	39	89072.6	0	0	B31.3
2(SUS)		19114.6	63326.2	30.2		19321	63326.2	30.5	B31.3
3(EXP)		75608.5	232412	32.5		73891.7	232205.6	31.8	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.0m

1(OPE)	39	89072.6	0	0	40	82805.1	0	0	B31.3
2(SUS)		19321	63326.2	30.5		18751.1	63326.2	29.6	B31.3
3(EXP)		73891.7	232205.6	31.8		66902.9	232775.6	28.7	B31.3
1(OPE)	40	82805.1	0	0	45	53126.3	0	0	B31.3
2(SUS)		18751.1	63326.2	29.6		43928.1	63326.2	69.4	B31.3
3(EXP)		66902.9	232775.6	28.7		25999	207598.6	12.5	B31.3
1(OPE)	45	53466.3	0	0	48	103752.1	0	0	B31.3
2(SUS)		43873.6	63326.2	69.3		20039.6	63326.2	31.6	B31.3
3(EXP)		25999	207653	12.5		86610.6	231487.1	37.4	B31.3
1(OPE)	48	103752.1	0	0	49	109553	0	0	B31.3
2(SUS)		20039.6	63326.2	31.6		18576.5	63326.2	29.3	B31.3
3(EXP)		86610.6	231487.1	37.4		93318	232950.2	40.1	B31.3
1(OPE)	49	109553	0	0	50	111930.3	0	0	B31.3
2(SUS)		18576.5	63326.2	29.3		18511	63326.2	29.2	B31.3
3(EXP)		93318	232950.2	40.1		96096.5	233015.6	41.2	B31.3
1(OPE)	50	111930.3	0	0	59	109552.9	0	0	B31.3
2(SUS)		18511	63326.2	29.2		18576.5	63326.2	29.3	B31.3
3(EXP)		96096.5	233015.6	41.2		93318	232950.2	40.1	B31.3
1(OPE)	59	109552.9	0	0	60	103752.1	0	0	B31.3
2(SUS)		18576.5	63326.2	29.3		20039.6	63326.2	31.6	B31.3
3(EXP)		93318	232950.2	40.1		86610.6	231487.1	37.4	B31.3
1(OPE)	60	103752.1	0	0	65	53466.3	0	0	B31.3
2(SUS)		20039.6	63326.2	31.6		43873.6	63326.2	69.3	B31.3
3(EXP)		86610.6	231487.1	37.4		25999	207653	12.5	B31.3
1(OPE)	65	53126.3	0	0	68	82805.1	0	0	B31.3
2(SUS)		43928.1	63326.2	69.4		18751.1	63326.2	29.6	B31.3
3(EXP)		25999	207598.6	12.5		66902.9	232775.6	28.7	B31.3
1(OPE)	68	82805.1	0	0	69	89072.6	0	0	B31.3
2(SUS)		18751.1	63326.2	29.6		19321	63326.2	30.5	B31.3
3(EXP)		66902.9	232775.6	28.7		73891.8	232205.6	31.8	B31.3
1(OPE)	69	89072.6	0	0	70	90826.7	0	0	B31.3
2(SUS)		19321	63326.2	30.5		19114.6	63326.2	30.2	B31.3
3(EXP)		73891.8	232205.6	31.8		75608.5	232412	32.5	B31.3
1(OPE)	70	90826.7	0	0	78	90055.7	0	0	B31.3
2(SUS)		19114.6	63326.2	30.2		18773.1	63326.2	29.6	B31.3
3(EXP)		75608.5	232412	32.5		74687.9	232753.5	32.1	B31.3
1(OPE)	78	90055.7	0	0	79	89175.5	0	0	B31.3
2(SUS)		18773.1	63326.2	29.6		18483.1	63326.2	29.2	B31.3
3(EXP)		74687.9	232753.5	32.1		73977.8	233043.6	31.7	B31.3
1(OPE)	79	89175.5	0	0	80	88201.7	0	0	B31.3
2(SUS)		18483.1	63326.2	29.2		18106.6	63326.2	28.6	B31.3
3(EXP)		73977.8	233043.6	31.7		72931.1	233420	31.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.0m

1(OPE)	80	88201.7	0	0	85	79308.2	0	0	B31.3
2(SUS)		18106.6	63326.2	28.6		19150	63326.2	30.2	B31.3
3(EXP)		72931.1	233420	31.2		62819.6	232376.6	27	B31.3
1(OPE)	85	79143.9	0	0	90	33031.6	0	0	B31.3
2(SUS)		19145.8	63326.2	30.2		22538.4	63326.2	35.6	B31.3
3(EXP)		62819.6	232380.8	27		16460.7	228988.2	7.2	B31.3
1(OPE)	90	32761.9	0	0	100	43182.5	0	0	B31.3
2(SUS)		22536.4	63326.2	35.6		21292.5	63326.2	33.6	B31.3
3(EXP)		16460.7	228990.2	7.2		28020.8	230234.1	12.2	B31.3
1(OPE)	100	43182.6	0	0	110	32761.9	0	0	B31.3
2(SUS)		21292.5	63326.2	33.6		22536.4	63326.2	35.6	B31.3
3(EXP)		28020.8	230234.1	12.2		16460.7	228990.2	7.2	B31.3
1(OPE)	110	33031.6	0	0	120	79143.9	0	0	B31.3
2(SUS)		22538.4	63326.2	35.6		19145.8	63326.2	30.2	B31.3
3(EXP)		16460.7	228988.2	7.2		62819.6	232380.8	27	B31.3
1(OPE)	120	79308.2	0	0	128	88201.7	0	0	B31.3
2(SUS)		19150	63326.2	30.2		18106.6	63326.2	28.6	B31.3
3(EXP)		62819.6	232376.6	27		72931.1	233420	31.2	B31.3
1(OPE)	128	88201.7	0	0	129	89175.5	0	0	B31.3
2(SUS)		18106.6	63326.2	28.6		18483.1	63326.2	29.2	B31.3
3(EXP)		72931.1	233420	31.2		73977.8	233043.6	31.7	B31.3
1(OPE)	129	89175.5	0	0	130	90055.7	0	0	B31.3
2(SUS)		18483.1	63326.2	29.2		18773.1	63326.2	29.6	B31.3
3(EXP)		73977.8	233043.6	31.7		74687.9	232753.5	32.1	B31.3
1(OPE)	130	90055.7	0	0	139	89072.6	0	0	B31.3
2(SUS)		18773.1	63326.2	29.6		19321	63326.2	30.5	B31.3
3(EXP)		74687.9	232753.5	32.1		73891.8	232205.6	31.8	B31.3
1(OPE)	139	89072.6	0	0	140	82805.1	0	0	B31.3
2(SUS)		19321	63326.2	30.5		18751.1	63326.2	29.6	B31.3
3(EXP)		73891.8	232205.6	31.8		66902.9	232775.6	28.7	B31.3
1(OPE)	140	82805.1	0	0	150	53126.3	0	0	B31.3
2(SUS)		18751.1	63326.2	29.6		43928.1	63326.2	69.4	B31.3
3(EXP)		66902.9	232775.6	28.7		25999	207598.6	12.5	B31.3
1(OPE)	150	53466.3	0	0	158	103752.1	0	0	B31.3
2(SUS)		43873.6	63326.2	69.3		20039.6	63326.2	31.6	B31.3
3(EXP)		25999	207653	12.5		86610.6	231487.1	37.4	B31.3
1(OPE)	158	103752.1	0	0	159	109552.9	0	0	B31.3
2(SUS)		20039.6	63326.2	31.6		18576.5	63326.2	29.3	B31.3
3(EXP)		86610.6	231487.1	37.4		93318	232950.2	40.1	B31.3
1(OPE)	159	109552.9	0	0	160	111930.3	0	0	B31.3
2(SUS)		18576.5	63326.2	29.3		18511	63326.2	29.2	B31.3
3(EXP)		93318	232950.2	40.1		96096.5	233015.6	41.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.0m

1(OPE)	160	111930.3	0	0	168	111930.3	0	0	B31.3
2(SUS)		18511	63326.2	29.2		18511	63326.2	29.2	B31.3
3(EXP)		96096.5	233015.6	41.2		96096.5	233015.6	41.2	B31.3
1(OPE)	168	111930.3	0	0	169	109553	0	0	B31.3
2(SUS)		18511	63326.2	29.2		18576.5	63326.2	29.3	B31.3
3(EXP)		96096.5	233015.6	41.2		93318	232950.2	40.1	B31.3
1(OPE)	169	109553	0	0	170	103752.1	0	0	B31.3
2(SUS)		18576.5	63326.2	29.3		20039.6	63326.2	31.6	B31.3
3(EXP)		93318	232950.2	40.1		86610.6	231487.1	37.4	B31.3
1(OPE)	170	103752.1	0	0	180	53466.3	0	0	B31.3
2(SUS)		20039.6	63326.2	31.6		43873.6	63326.2	69.3	B31.3
3(EXP)		86610.6	231487.1	37.4		25999	207653	12.5	B31.3
1(OPE)	180	53126.3	0	0	188	82805.1	0	0	B31.3
2(SUS)		43928.1	63326.2	69.4		18751.1	63326.2	29.6	B31.3
3(EXP)		25999	207598.6	12.5		66902.9	232775.6	28.7	B31.3
1(OPE)	188	82805.1	0	0	189	89072.6	0	0	B31.3
2(SUS)		18751.1	63326.2	29.6		19321	63326.2	30.5	B31.3
3(EXP)		66902.9	232775.6	28.7		73891.8	232205.6	31.8	B31.3
1(OPE)	189	89072.6	0	0	190	90826.7	0	0	B31.3
2(SUS)		19321	63326.2	30.5		19114.6	63326.2	30.2	B31.3
3(EXP)		73891.8	232205.6	31.8		75608.5	232412	32.5	B31.3
1(OPE)	190	90826.7	0	0	199	89175.5	0	0	B31.3
2(SUS)		19114.6	63326.2	30.2		18483.1	63326.2	29.2	B31.3
3(EXP)		75608.5	232412	32.5		73977.7	233043.6	31.7	B31.3
1(OPE)	199	89175.5	0	0	200	88201.6	0	0	B31.3
2(SUS)		18483.1	63326.2	29.2		18106.6	63326.2	28.6	B31.3
3(EXP)		73977.7	233043.6	31.7		72931.1	233420	31.2	B31.3
1(OPE)	200	88201.6	0	0	210	79308.2	0	0	B31.3
2(SUS)		18106.6	63326.2	28.6		19150	63326.2	30.2	B31.3
3(EXP)		72931.1	233420	31.2		62819.6	232376.6	27	B31.3
1(OPE)	210	79143.9	0	0	220	33031.7	0	0	B31.3
2(SUS)		19145.8	63326.2	30.2		22538.4	63326.2	35.6	B31.3
3(EXP)		62819.6	232380.8	27		16460.8	228988.2	7.2	B31.3
1(OPE)	220	32761.9	0	0	230	43182.4	0	0	B31.3
2(SUS)		22536.5	63326.2	35.6		21292.5	63326.2	33.6	B31.3
3(EXP)		16460.8	228990.2	7.2		28020.6	230234.1	12.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.0m
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	21114	-8988	76028	-6687	-80528	3484	0	0	0
	2(SUS)	-159	-10751	-654	-10175	289	-1451	0	0	0
	3(EXP)	21272	1763	76682	3488	-80816	4935	0	0	0
	MAX	21272/L3	-10751/L	76682/L	-10175/L	-80816/L	4935/L3	0.000/L3	-0.000/L2	0.000/L3
15	Rigid +Y									
	1(OPE)	1422	-32235	-9565	0	0	0	6.438	0	-43.294
	2(SUS)	745	-25070	-80	0	0	0	0.004	0	0
	3(EXP)	677	-7165	-9486	0	0	0	6.434	0	-43.294
	MAX	1422/L1	-32235/L	-9565/L1				6.438/L1	-0.000/L1	-43.294/L1
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-8812	-12303	-6294	0	0	0	-3	0	-86.596
	2(SUS)	-2774	-14334	-169	0	0	0	-0.016	0	-0.001
	3(EXP)	-6038	2031	-6125	0	0	0	-2.984	0	-86.595
	MAX	-8812/L1	-14334/L	-6294/L1				-3.000/L1	-0.000/L2	-86.596/L1
45	Rigid +Y									
	1(OPE)	-13065	-47885	-5972	0	0	0	-62.54	0	-28.589
	2(SUS)	2188	-51255	1294	0	0	0	0.012	0	0.007
	3(EXP)	-15253	3371	-7267	0	0	0	-62.552	0	-28.596
	MAX	-15253/L	-51255/L	-7267/L3				-62.552/L	-0.000/L2	-28.596/L3
65	Rigid +Y									
	1(OPE)	-13065	-47885	5972	0	0	0	-62.54	0	28.589
	2(SUS)	2188	-51255	-1294	0	0	0	0.012	0	-0.007
	3(EXP)	-15253	3371	7267	0	0	0	-62.552	0	28.596
	MAX	-15253/L	-51255/L	7267/L3				-62.552/L	-0.000/L2	28.596/L3
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-8812	-12303	6294	0	0	0	-3	0	86.596
	2(SUS)	-2774	-14334	169	0	0	0	-0.016	0	0.001
	3(EXP)	-6038	2031	6125	0	0	0	-2.984	0	86.595
	MAX	-8812/L1	-14334/L	6294/L1				-3.000/L1	-0.000/L2	86.596/L1
90	Rigid +Y									
	1(OPE)	1422	-32235	9565	0	0	0	6.438	0	43.294
	2(SUS)	745	-25070	80	0	0	0	0.004	0	0
	3(EXP)	677	-7165	9486	0	0	0	6.434	0	43.294
	MAX	1422/L1	-32235/L	9565/L1				6.438/L1	-0.000/L1	43.294/L1
100	Rigid ANC									
	1(OPE)	42227	-17976	0	0	0	6968	0	0	0
	2(SUS)	-318	-21502	0	0	0	-2902	0	0	0
	3(EXP)	42545	3525	0	0	0	9870	0	0	0
	MAX	42545/L3	-21502/L	-0/L1	0/L2	-0/L1	9870/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1422	-32235	-9565	0	0	0	6.438	0	-43.294
	2(SUS)	745	-25070	-80	0	0	0	0.004	0	0
	3(EXP)	677	-7165	-9486	0	0	0	6.434	0	-43.294
	MAX	1422/L1	-32235/L	-9565/L1				6.438/L1	-0.000/L1	-43.294/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-8812	-12303	-6294	0	0	0	-3	0	-86.596
	2(SUS)	-2774	-14334	-169	0	0	0	-0.016	0	-0.001
	3(EXP)	-6038	2031	-6125	0	0	0	-2.984	0	-86.595
	MAX	-8812/L1	-14334/L	-6294/L1				-3.000/L1	-0.000/L2	-86.596/L1
150		Rigid +Y								
	1(OPE)	-13065	-47885	-5972	0	0	0	-62.54	0	-28.589
	2(SUS)	2188	-51255	1294	0	0	0	0.012	0	0.007
	3(EXP)	-15253	3371	-7267	0	0	0	-62.552	0	-28.596
	MAX	-15253/L	-51255/L	-7267/L3				-62.552/L	-0.000/L2	-28.596/L3
180		Rigid +Y								
	1(OPE)	-13065	-47885	5972	0	0	0	-62.54	0	28.589
	2(SUS)	2188	-51255	-1294	0	0	0	0.012	0	-0.007
	3(EXP)	-15253	3371	7267	0	0	0	-62.552	0	28.596
	MAX	-15253/L	-51255/L	7267/L3				-62.552/L	-0.000/L2	28.596/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-8812	-12303	6294	0	0	0	-3	0	86.596
	2(SUS)	-2774	-14334	169	0	0	0	-0.016	0	0.001
	3(EXP)	-6038	2031	6125	0	0	0	-2.984	0	86.595
	MAX	-8812/L1	-14334/L	6294/L1				-3.000/L1	-0.000/L2	86.596/L1
220		Rigid +Y								
	1(OPE)	1422	-32235	9565	0	0	0	6.438	0	43.294
	2(SUS)	745	-25070	80	0	0	0	0.004	0	0
	3(EXP)	677	-7165	9486	0	0	0	6.434	0	43.294
	MAX	1422/L1	-32235/L	9565/L1				6.438/L1	-0.000/L1	43.294/L1
230		Rigid ANC								
	1(OPE)	21114	-8988	-76028	6687	80528	3484	0	0	0
	2(SUS)	-159	-10751	654	10175	-289	-1451	0	0	0
	3(EXP)	21272	1763	-76682	-3488	80816	4935	0	0	0
	MAX	21272/L3	-10751/L	-76682/L	10175/L3	80816/L3	4935/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	6.434	0	-43.294	-0.0057	-0.0539	0.0202
20	-2.984	0	-86.595	0.0232	0.3057	0.0405
28	-15.224	1.117	-99.436	0.0499	0.4884	0.0465
29	-17.07	1.599	-100.871	0.0561	0.5301	0.0495
30	-18.833	2.614	-101.999	0.0615	0.5692	0.0561
38	-21.263	4.421	-103.319	0.0643	0.6092	0.0527
39	-25.676	6.494	-103.124	0.0709	0.6869	0.0676
40	-29.916	6.956	-98.97	0.0736	0.7666	0.076
45	-62.552	0	-28.596	0.0435	0.9077	0.0942
48	-87.221	-5.611	18.438	0.0207	0.6144	0.0942
49	-91.438	-6.181	21.043	0.0177	0.5096	0.0945
50	-95.542	-6.335	19.61	0.014	0.399	0.0949
59	-91.438	-6.181	-21.043	-0.0177	-0.5096	0.0945
60	-87.221	-5.611	-18.438	-0.0207	-0.6144	0.0942
65	-62.552	0	28.596	-0.0435	-0.9077	0.0942
68	-29.916	6.956	98.97	-0.0736	-0.7666	0.076
69	-25.676	6.494	103.124	-0.0709	-0.6869	0.0676
70	-21.263	4.421	103.319	-0.0643	-0.6092	0.0527
78	-18.833	2.614	101.999	-0.0615	-0.5692	0.0561
79	-17.07	1.599	100.871	-0.0561	-0.5301	0.0495
80	-15.224	1.117	99.436	-0.0499	-0.4884	0.0465
85	-2.984	0	86.595	-0.0232	-0.3057	0.0405
90	6.434	0	43.294	0.0057	0.0539	0.0202
100	0	0	0	0	0	0
110	6.434	0	-43.294	-0.0057	-0.0539	0.0202
120	-2.984	0	-86.595	0.0232	0.3057	0.0405
128	-15.224	1.117	-99.436	0.0499	0.4884	0.0465
129	-17.07	1.599	-100.871	0.0561	0.5301	0.0495
130	-18.833	2.614	-101.999	0.0615	0.5692	0.0561
139	-25.676	6.494	-103.124	0.0709	0.6869	0.0676
140	-29.916	6.956	-98.97	0.0736	0.7666	0.076
150	-62.552	0	-28.596	0.0435	0.9077	0.0942
158	-87.221	-5.611	18.438	0.0207	0.6144	0.0942
159	-91.438	-6.181	21.043	0.0177	0.5096	0.0945
160	-95.542	-6.335	19.61	0.014	0.399	0.0949
168	-95.542	-6.335	-19.61	-0.014	-0.399	0.0949
169	-91.438	-6.181	-21.043	-0.0177	-0.5096	0.0945
170	-87.221	-5.611	-18.438	-0.0207	-0.6144	0.0942
180	-62.552	0	28.596	-0.0435	-0.9077	0.0942

188	-29.916	6.956	98.97	-0.0736	-0.7666	0.076
189	-25.676	6.494	103.124	-0.0709	-0.6869	0.0676
190	-21.263	4.421	103.319	-0.0643	-0.6092	0.0527
199	-17.07	1.599	100.871	-0.0561	-0.5301	0.0495
200	-15.224	1.116	99.436	-0.0499	-0.4884	0.0465
210	-2.984	0	86.595	-0.0232	-0.3057	0.0405
220	6.434	0	43.294	0.0057	0.0539	0.0202
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.004	0	0	-0.0019	-0.0006	-0.0059
20	-0.016	0	-0.001	0.0078	0.0029	-0.0119
28	-0.13	0.224	-0.001	0.0072	0.0037	-0.0137
29	-0.134	0.25	0.004	0.0071	0.0035	-0.0139
30	-0.116	0.271	0.018	0.0069	0.0031	-0.0142
38	-0.073	0.297	0.044	0.0066	0.0028	-0.0145
39	-0.014	0.368	0.079	0.0057	0.0017	-0.0154
40	0.014	0.482	0.096	0.0046	0.0005	-0.0157
45	0.012	0	0.007	-0.007	-0.001	0.0585
48	0.012	-6.117	-0.003	-0.0157	0.0003	0.125
49	0.012	-6.994	-0.001	-0.0168	0.0003	0.1266
50	0.01	-7.453	0	-0.0167	0.0002	0.1268
59	0.012	-6.994	0.001	0.0168	-0.0003	0.1266
60	0.012	-6.117	0.003	0.0157	-0.0003	0.125
65	0.012	0	-0.007	0.007	0.001	0.0585
68	0.014	0.482	-0.096	-0.0046	-0.0005	-0.0157
69	-0.014	0.368	-0.079	-0.0057	-0.0017	-0.0154
70	-0.073	0.297	-0.044	-0.0066	-0.0028	-0.0145
78	-0.116	0.271	-0.018	-0.0069	-0.0031	-0.0142
79	-0.134	0.25	-0.004	-0.0071	-0.0035	-0.0139
80	-0.13	0.224	0.001	-0.0072	-0.0037	-0.0137
85	-0.016	0	0.001	-0.0078	-0.0029	-0.0119
90	0.004	0	0	0.0019	0.0006	-0.0059
100	0	0	0	0	0	0
110	0.004	0	0	-0.0019	-0.0006	-0.0059
120	-0.016	0	-0.001	0.0078	0.0029	-0.0119
128	-0.13	0.224	-0.001	0.0072	0.0037	-0.0137
129	-0.134	0.25	0.004	0.0071	0.0035	-0.0139
130	-0.116	0.271	0.018	0.0069	0.0031	-0.0142
139	-0.014	0.368	0.079	0.0057	0.0017	-0.0154
140	0.014	0.482	0.096	0.0046	0.0005	-0.0157
150	0.012	0	0.007	-0.007	-0.001	0.0585
158	0.012	-6.117	-0.003	-0.0157	0.0003	0.125
159	0.012	-6.994	-0.001	-0.0168	0.0003	0.1266
160	0.01	-7.453	0	-0.0167	0.0002	0.1268
168	0.01	-7.453	0	0.0167	-0.0002	0.1268
169	0.012	-6.994	0.001	0.0168	-0.0003	0.1266
170	0.012	-6.117	0.003	0.0157	-0.0003	0.125
180	0.012	0	-0.007	0.007	0.001	0.0585

188	0.014	0.482	-0.096	-0.0046	-0.0005	-0.0157
189	-0.014	0.368	-0.079	-0.0057	-0.0017	-0.0154
190	-0.073	0.297	-0.044	-0.0066	-0.0028	-0.0145
199	-0.134	0.25	-0.004	-0.0071	-0.0035	-0.0139
200	-0.13	0.224	0.001	-0.0072	-0.0037	-0.0137
210	-0.016	0	0.001	-0.0078	-0.0029	-0.0119
220	0.004	0	0	0.0019	0.0006	-0.0059
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:0
Job Name: A335 P22_2 EXPANSION LOOP_6.0M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	6.438	0	-43.294	-0.0076	-0.0545	0.0143
20	-3	0	-86.596	0.031	0.3085	0.0286
28	-15.355	1.341	-99.437	0.057	0.4921	0.0328
29	-17.204	1.849	-100.867	0.0631	0.5335	0.0356
30	-18.949	2.885	-101.981	0.0683	0.5723	0.0419
38	-21.336	4.718	-103.275	0.0709	0.612	0.0382
39	-25.69	6.862	-103.046	0.0766	0.6885	0.0522
40	-29.902	7.439	-98.874	0.0782	0.7671	0.0603
45	-62.54	0	-28.589	0.0365	0.9066	0.1526
48	-87.208	-11.728	18.435	0.005	0.6146	0.2192
49	-91.426	-13.174	21.042	0.0009	0.5099	0.2212
50	-95.532	-13.788	19.61	-0.0027	0.3992	0.2217
59	-91.426	-13.174	-21.042	-0.0009	-0.5099	0.2212
60	-87.208	-11.728	-18.435	-0.005	-0.6146	0.2192
65	-62.54	0	28.589	-0.0365	-0.9066	0.1526
68	-29.902	7.439	98.874	-0.0782	-0.7671	0.0603
69	-25.69	6.862	103.046	-0.0766	-0.6885	0.0522
70	-21.336	4.718	103.275	-0.0709	-0.612	0.0382
78	-18.949	2.885	101.981	-0.0683	-0.5723	0.0419
79	-17.204	1.849	100.867	-0.0631	-0.5335	0.0356
80	-15.355	1.341	99.437	-0.057	-0.4921	0.0328
85	-3	0	86.596	-0.031	-0.3085	0.0286
90	6.438	0	43.294	0.0076	0.0545	0.0143
100	0	0	0	0	0	0
110	6.438	0	-43.294	-0.0076	-0.0545	0.0143
120	-3	0	-86.596	0.031	0.3085	0.0286
128	-15.355	1.341	-99.437	0.057	0.4921	0.0328
129	-17.204	1.849	-100.867	0.0631	0.5335	0.0356
130	-18.949	2.885	-101.981	0.0683	0.5723	0.0419
139	-25.69	6.862	-103.046	0.0766	0.6885	0.0522
140	-29.902	7.439	-98.874	0.0782	0.7671	0.0603
150	-62.54	0	-28.589	0.0365	0.9066	0.1526
158	-87.208	-11.728	18.435	0.005	0.6146	0.2192
159	-91.426	-13.174	21.042	0.0009	0.5099	0.2212
160	-95.532	-13.788	19.61	-0.0027	0.3992	0.2217
168	-95.532	-13.788	-19.61	0.0027	-0.3992	0.2217
169	-91.426	-13.174	-21.042	-0.0009	-0.5099	0.2212
170	-87.208	-11.728	-18.435	-0.005	-0.6146	0.2192
180	-62.54	0	28.589	-0.0365	-0.9066	0.1526

188	-29.902	7.439	98.874	-0.0782	-0.7671	0.0603
189	-25.69	6.862	103.046	-0.0766	-0.6885	0.0522
190	-21.336	4.718	103.275	-0.0709	-0.612	0.0382
199	-17.204	1.849	100.867	-0.0631	-0.5335	0.0356
200	-15.355	1.341	99.437	-0.057	-0.4921	0.0328
210	-3	0	86.596	-0.031	-0.3085	0.0286
220	6.438	0	43.294	0.0076	0.0545	0.0143
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -6,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -6,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -2,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
-------------------------------------------------------------------------------
From  80  To  85 DZ= -2,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
-------------------------------------------------------------------------------
From  85  To  90 DZ= -6,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
-------------------------------------------------------------------------------
From  90  To  100 DZ= -6,500.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -6,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -6,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -2,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -2,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -6,500.000 mm.
 RESTRAINTS
```

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -6,500.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                          v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                          App.P Sy/St Switch = ON   Sc= 137,895 KPa
                          Sh1= 63,326 KPa   Sh2= 137,895 KPa
                          Sh3= 137,895 KPa   Sh4= 137,895 KPa
                          Sh5= 137,895 KPa   Sh6= 137,895 KPa
                          Sh7= 137,895 KPa   Sh8= 137,895 KPa
                          Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 29
                          Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 39
                          Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 49
                          Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 69
                          Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 79
                          Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50
                        129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

Location of Pipe Support and Anchor Point 6.5m

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	Len / GAP	MU / YIELD	Dir / STIF1	STIF2	FORCE	Vectors
10	ANC				.30	.000	.000	.000
15	+Y				.30	.000	1.000	.000
20	Guide		3.00		.30	.000	.000	.000
20	+Y				.30	.000	1.000	.000
45	+Y				.30	.000	1.000	.000
65	+Y				.30	.000	1.000	.000
85	Guide		3.00		.30	.000	.000	.000
85	+Y				.30	.000	1.000	.000
90	+Y				.30	.000	1.000	.000
100	ANC				.30	.000	.000	.000
110	+Y				.30	.000	1.000	.000
120	+Y				.30	.000	1.000	.000
120	Guide		3.00		.30	.000	.000	.000
150	+Y				.30	.000	1.000	.000
180	+Y				.30	.000	1.000	.000
210	+Y				.30	.000	1.000	.000
210	Guide		3.00		.30	.000	.000	.000
220	+Y				.30	.000	1.000	.000
230	ANC				.30	.000	.000	.000

```
INPUT UNITS USED...

UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =  mm.
     FORCE           pounds      x     4.448  =  N.
     MASS(dynamics)  pounds      x     0.454  =  Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =  N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =  N.m.
     STRESS          lbs./sq.in. x     6.895  =  KPa
     TEMP. SCALE     degrees F.  x     0.556  =  C
     PRESSURE        psig        x     6.895  =  KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =  KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =  kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =  kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =  kg./cu.cm.
```

Possible Approach:

Location of Pipe Support and Anchor Point 6.5m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:

Location of Pipe Support and Anchor Point 6.5m

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-6500.000
20	.000	.000	-13000.000
30	.000	.000	-15500.000
40	.000	750.000	-16250.000
45	-5052.000	750.000	-16250.000
50	-9000.000	750.000	-16250.000
60	-9000.000	750.000	-22750.000
65	-5052.000	750.000	-22750.000
70	.000	750.000	-22750.000
80	.000	.000	-23500.000
85	.000	.000	-26000.000
90	.000	.000	-32500.000
100	.000	.000	-39000.000
110	.000	.000	-45500.000
120	.000	.000	-52000.000
130	.000	.000	-54500.000
140	.000	750.000	-55250.000
150	-5052.000	750.000	-55250.000
160	-9000.000	750.000	-55250.000
170	-9000.000	750.000	-61750.000
180	-5052.000	750.000	-61750.000
190	.000	750.000	-61750.000
200	.000	.000	-62500.000
210	.000	.000	-65000.000
220	.000	.000	-71500.000
230	.000	.000	-78000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43910.1 Allowable Stress: 63326.2
Axial Stress: 17808.9 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 103155.2 @Node 168 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 25908.1 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 124103.9 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43189.1	0	0	15	32592.1	0	0	B31.3
2(SUS)		22025.1	63326.2	34.8		23129.6	63326.2	36.5	B31.3
3(EXP)		27998.9	229501.5	12.2		16053.8	228397	7	B31.3
1(OPE)	15	32829.8	0	0	20	78265	0	0	B31.3
2(SUS)		23131.4	63326.2	36.5		19937.9	63326.2	31.5	B31.3
3(EXP)		16053.8	228395.3	7		62269	231588.8	26.9	B31.3
1(OPE)	20	78441.4	0	0	28	89899.9	0	0	B31.3
2(SUS)		19941.6	63326.2	31.5		18132	63326.2	28.6	B31.3
3(EXP)		62269	231585	26.9		74733.4	233394.7	32	B31.3
1(OPE)	28	89899.9	0	0	29	90870.8	0	0	B31.3
2(SUS)		18132	63326.2	28.6		18447	63326.2	29.1	B31.3
3(EXP)		74733.4	233394.7	32		75730.2	233079.6	32.5	B31.3
1(OPE)	29	90870.8	0	0	30	91749.1	0	0	B31.3
2(SUS)		18447	63326.2	29.1		18684.3	63326.2	29.5	B31.3
3(EXP)		75730.2	233079.6	32.5		76388.7	232842.3	32.8	B31.3
1(OPE)	30	91749.1	0	0	38	92503.9	0	0	B31.3
2(SUS)		18684.3	63326.2	29.5		18968.7	63326.2	30	B31.3
3(EXP)		76388.7	232842.3	32.8		77248.1	232557.9	33.2	B31.3
1(OPE)	38	92503.9	0	0	39	90615.5	0	0	B31.3
2(SUS)		18968.7	63326.2	30		19134.4	63326.2	30.2	B31.3
3(EXP)		77248.1	232557.9	33.2		75330.4	232392.3	32.4	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.5m

1(OPE)	39	90615.5	0	0	40	84022.3	0	0	B31.3
2(SUS)		19134.4	63326.2	30.2		18646.9	63326.2	29.4	B31.3
3(EXP)		75330.4	232392.3	32.4		67972.3	232879.7	29.2	B31.3
1(OPE)	40	84022.3	0	0	45	55551.9	0	0	B31.3
2(SUS)		18646.9	63326.2	29.4		43910.1	63326.2	69.3	B31.3
3(EXP)		67972.3	232879.7	29.2		29262.9	207616.5	14.1	B31.3
1(OPE)	45	55891.4	0	0	48	110284.1	0	0	B31.3
2(SUS)		43870.6	63326.2	69.3		20036	63326.2	31.6	B31.3
3(EXP)		29262.9	207656.1	14.1		93142.8	231490.7	40.2	B31.3
1(OPE)	48	110284.1	0	0	49	116393.3	0	0	B31.3
2(SUS)		20036	63326.2	31.6		18538.3	63326.2	29.3	B31.3
3(EXP)		93142.8	231490.7	40.2		100212.1	232988.3	43	B31.3
1(OPE)	49	116393.3	0	0	50	118896.2	0	0	B31.3
2(SUS)		18538.3	63326.2	29.3		18567.5	63326.2	29.3	B31.3
3(EXP)		100212.1	232988.3	43		103140.5	232959.2	44.3	B31.3
1(OPE)	50	118896.2	0	0	59	116393.3	0	0	B31.3
2(SUS)		18567.5	63326.2	29.3		18538.3	63326.2	29.3	B31.3
3(EXP)		103140.5	232959.2	44.3		100212.1	232988.3	43	B31.3
1(OPE)	59	116393.3	0	0	60	110284.1	0	0	B31.3
2(SUS)		18538.3	63326.2	29.3		20036	63326.2	31.6	B31.3
3(EXP)		100212.1	232988.3	43		93142.8	231490.7	40.2	B31.3
1(OPE)	60	110284.1	0	0	65	55891.3	0	0	B31.3
2(SUS)		20036	63326.2	31.6		43870.6	63326.2	69.3	B31.3
3(EXP)		93142.8	231490.7	40.2		29262.9	207656.1	14.1	B31.3
1(OPE)	65	55551.8	0	0	68	84022.3	0	0	B31.3
2(SUS)		43910.1	63326.2	69.3		18646.9	63326.2	29.4	B31.3
3(EXP)		29262.9	207616.5	14.1		67972.3	232879.7	29.2	B31.3
1(OPE)	68	84022.3	0	0	69	90615.5	0	0	B31.3
2(SUS)		18646.9	63326.2	29.4		19134.4	63326.2	30.2	B31.3
3(EXP)		67972.3	232879.7	29.2		75330.4	232392.3	32.4	B31.3
1(OPE)	69	90615.5	0	0	70	92503.9	0	0	B31.3
2(SUS)		19134.4	63326.2	30.2		18968.7	63326.2	30	B31.3
3(EXP)		75330.4	232392.3	32.4		77248.1	232557.9	33.2	B31.3
1(OPE)	70	92503.9	0	0	78	91749.2	0	0	B31.3
2(SUS)		18968.7	63326.2	30		18684.3	63326.2	29.5	B31.3
3(EXP)		77248.1	232557.9	33.2		76388.7	232842.3	32.8	B31.3
1(OPE)	78	91749.2	0	0	79	90870.8	0	0	B31.3
2(SUS)		18684.3	63326.2	29.5		18447	63326.2	29.1	B31.3
3(EXP)		76388.7	232842.3	32.8		75730.3	233079.6	32.5	B31.3
1(OPE)	79	90870.8	0	0	80	89899.9	0	0	B31.3
2(SUS)		18447	63326.2	29.1		18132	63326.2	28.6	B31.3
3(EXP)		75730.3	233079.6	32.5		74733.4	233394.7	32	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.5m
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1(OPE)	80	89899.9	0	0	85	78441.4	0	0	B31.3
2(SUS)		18132	63326.2	28.6		19941.6	63326.2	31.5	B31.3
3(EXP)		74733.4	233394.7	32		62269	231585	26.9	B31.3
1(OPE)	85	78265	0	0	90	32829.8	0	0	B31.3
2(SUS)		19937.9	63326.2	31.5		23131.4	63326.2	36.5	B31.3
3(EXP)		62269	231588.8	26.9		16053.8	228395.3	7	B31.3
1(OPE)	90	32592	0	0	100	43189.2	0	0	B31.3
2(SUS)		23129.6	63326.2	36.5		22025.2	63326.2	34.8	B31.3
3(EXP)		16053.8	228397	7		27999	229501.5	12.2	B31.3
1(OPE)	100	43189.2	0	0	110	32592	0	0	B31.3
2(SUS)		22025.2	63326.2	34.8		23129.6	63326.2	36.5	B31.3
3(EXP)		27999	229501.5	12.2		16053.8	228397	7	B31.3
1(OPE)	110	32829.8	0	0	120	78265	0	0	B31.3
2(SUS)		23131.4	63326.2	36.5		19937.9	63326.2	31.5	B31.3
3(EXP)		16053.8	228395.3	7		62269.1	231588.8	26.9	B31.3
1(OPE)	120	78441.4	0	0	128	89900	0	0	B31.3
2(SUS)		19941.6	63326.2	31.5		18132	63326.2	28.6	B31.3
3(EXP)		62269.1	231585	26.9		74733.5	233394.7	32	B31.3
1(OPE)	128	89900	0	0	129	90870.8	0	0	B31.3
2(SUS)		18132	63326.2	28.6		18447	63326.2	29.1	B31.3
3(EXP)		74733.5	233394.7	32		75730.3	233079.6	32.5	B31.3
1(OPE)	129	90870.8	0	0	130	91749.2	0	0	B31.3
2(SUS)		18447	63326.2	29.1		18684.3	63326.2	29.5	B31.3
3(EXP)		75730.3	233079.6	32.5		76388.8	232842.3	32.8	B31.3
1(OPE)	130	91749.2	0	0	139	90615.5	0	0	B31.3
2(SUS)		18684.3	63326.2	29.5		19134.4	63326.2	30.2	B31.3
3(EXP)		76388.8	232842.3	32.8		75330.4	232392.3	32.4	B31.3
1(OPE)	139	90615.5	0	0	140	84022.3	0	0	B31.3
2(SUS)		19134.4	63326.2	30.2		18646.9	63326.2	29.4	B31.3
3(EXP)		75330.4	232392.3	32.4		67972.3	232879.7	29.2	B31.3
1(OPE)	140	84022.3	0	0	150	55551.8	0	0	B31.3
2(SUS)		18646.9	63326.2	29.4		43910.1	63326.2	69.3	B31.3
3(EXP)		67972.3	232879.7	29.2		29262.9	207616.5	14.1	B31.3
1(OPE)	150	55891.3	0	0	158	110284	0	0	B31.3
2(SUS)		43870.6	63326.2	69.3		20036	63326.2	31.6	B31.3
3(EXP)		29262.9	207656.1	14.1		93142.8	231490.7	40.2	B31.3
1(OPE)	158	110284	0	0	159	116393.3	0	0	B31.3
2(SUS)		20036	63326.2	31.6		18538.3	63326.2	29.3	B31.3
3(EXP)		93142.8	231490.7	40.2		100212.1	232988.3	43	B31.3
1(OPE)	159	116393.3	0	0	160	118896.2	0	0	B31.3
2(SUS)		18538.3	63326.2	29.3		18567.5	63326.2	29.3	B31.3
3(EXP)		100212.1	232988.3	43		103140.5	232959.2	44.3	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 6.5m
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1(OPE)	160	118896.2	0	0	168	118896.2	0	0	B31.3
2(SUS)		18567.5	63326.2	29.3		18567.5	63326.2	29.3	B31.3
3(EXP)		103140.5	232959.2	44.3		103140.5	232959.2	44.3	B31.3
1(OPE)	168	118896.2	0	0	169	116393.3	0	0	B31.3
2(SUS)		18567.5	63326.2	29.3		18538.3	63326.2	29.3	B31.3
3(EXP)		103140.5	232959.2	44.3		100212.1	232988.3	43	B31.3
1(OPE)	169	116393.3	0	0	170	110284.1	0	0	B31.3
2(SUS)		18538.3	63326.2	29.3		20036	63326.2	31.6	B31.3
3(EXP)		100212.1	232988.3	43		93142.8	231490.7	40.2	B31.3
1(OPE)	170	110284.1	0	0	180	55891.4	0	0	B31.3
2(SUS)		20036	63326.2	31.6		43870.6	63326.2	69.3	B31.3
3(EXP)		93142.8	231490.7	40.2		29262.9	207656.1	14.1	B31.3
1(OPE)	180	55551.9	0	0	188	84022.3	0	0	B31.3
2(SUS)		43910.1	63326.2	69.3		18646.9	63326.2	29.4	B31.3
3(EXP)		29262.9	207616.5	14.1		67972.3	232879.7	29.2	B31.3
1(OPE)	188	84022.3	0	0	189	90615.5	0	0	B31.3
2(SUS)		18646.9	63326.2	29.4		19134.4	63326.2	30.2	B31.3
3(EXP)		67972.3	232879.7	29.2		75330.4	232392.3	32.4	B31.3
1(OPE)	189	90615.5	0	0	190	92503.9	0	0	B31.3
2(SUS)		19134.4	63326.2	30.2		18968.7	63326.2	30	B31.3
3(EXP)		75330.4	232392.3	32.4		77248	232557.9	33.2	B31.3
1(OPE)	190	92503.9	0	0	199	90870.8	0	0	B31.3
2(SUS)		18968.7	63326.2	30		18447	63326.2	29.1	B31.3
3(EXP)		77248	232557.9	33.2		75730.2	233079.7	32.5	B31.3
1(OPE)	199	90870.8	0	0	200	89899.9	0	0	B31.3
2(SUS)		18447	63326.2	29.1		18132	63326.2	28.6	B31.3
3(EXP)		75730.2	233079.7	32.5		74733.4	233394.7	32	B31.3
1(OPE)	200	89899.9	0	0	210	78441.3	0	0	B31.3
2(SUS)		18132	63326.2	28.6		19941.6	63326.2	31.5	B31.3
3(EXP)		74733.4	233394.7	32		62269	231585	26.9	B31.3
1(OPE)	210	78264.9	0	0	220	32829.8	0	0	B31.3
2(SUS)		19937.9	63326.2	31.5		23131.4	63326.2	36.5	B31.3
3(EXP)		62269	231588.8	26.9		16053.8	228395.3	7	B31.3
1(OPE)	220	32592.1	0	0	230	43189.1	0	0	B31.3
2(SUS)		23129.6	63326.2	36.5		22025.1	63326.2	34.8	B31.3
3(EXP)		16053.8	228397	7		27998.9	229501.5	12.2	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	19306	-10210	78097	-8855	-80472	3766	0	0	0
	2(SUS)	-134	-11802	-542	-12272	271	-1387	0	0	0
	3(EXP)	19441	1591	78639	3417	-80743	5152	0	0	0
	MAX	19441/L	-11802/L	78639/L	-12272/L	-80743/L	5152/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1584	-32979	-9766	0	0	0	7.608	0	-46.901
	2(SUS)	606	-26525	-71	0	0	0	0.003	0	0
	3(EXP)	978	-6454	-9695	0	0	0	7.605	0	-46.9
	MAX	1584/L1	-32979/L	-9766/L1				7.608/L1	-0.000/L1	-46.901/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6964	-16059	-6858	0	0	0	-3	0	-93.809
	2(SUS)	-2061	-17599	-152	0	0	0	-0.012	0	-0.001
	3(EXP)	-4903	1540	-6706	0	0	0	-2.988	0	-93.808
	MAX	-6964/L1	-17599/L	-6858/L1				-3.000/L1	-0.000/L2	-93.809/L1
45		Rigid +Y								
	1(OPE)	-12986	-47832	-6106	0	0	0	-69.119	0	-32.5
	2(SUS)	1589	-51154	1091	0	0	0	0.009	0	0.006
	3(EXP)	-14575	3322	-7197	0	0	0	-69.128	0	-32.506
	MAX	-14575/L	-51154/L	-7197/L3				-69.128/L	-0.000/L2	-32.506/L3
65		Rigid +Y								
	1(OPE)	-12986	-47832	6106	0	0	0	-69.119	0	32.5
	2(SUS)	1589	-51154	-1091	0	0	0	0.009	0	-0.006
	3(EXP)	-14575	3322	7197	0	0	0	-69.128	0	32.506
	MAX	-14575/L	-51154/L	7197/L3				-69.128/L	-0.000/L2	32.506/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6964	-16059	6858	0	0	0	-3	0	93.809
	2(SUS)	-2061	-17599	152	0	0	0	-0.012	0	0.001
	3(EXP)	-4903	1540	6706	0	0	0	-2.988	0	93.808
	MAX	-6964/L1	-17599/L	6858/L1				-3.000/L1	-0.000/L2	93.809/L1
90		Rigid +Y								
	1(OPE)	1584	-32979	9766	0	0	0	7.608	0	46.901
	2(SUS)	606	-26525	71	0	0	0	0.003	0	0
	3(EXP)	978	-6454	9695	0	0	0	7.605	0	46.9
	MAX	1584/L1	-32979/L	9766/L1				7.608/L1	-0.000/L1	46.901/L1
100		Rigid ANC								
	1(OPE)	38613	-20421	0	0	0	7531	0	0	0
	2(SUS)	-269	-23603	0	0	0	-2773	0	0	0
	3(EXP)	38881	3183	0	0	0	10304	0	0	0
	MAX	38881/L	-23603/L	-0/L1	0/L2	-0/L3	10304/L	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Location of Pipe Support and Anchor Point 6.5m

110		Rigid +Y								
	1(OPE)	1584	-32979	-9766	0	0	0	7.608	0	-46.901
	2(SUS)	606	-26525	-71	0	0	0	0.003	0	0
	3(EXP)	978	-6454	-9695	0	0	0	7.605	0	-46.9
	MAX	1584/L1	-32979/L	-9766/L1				7.608/L1	-0.000/L1	-46.901/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6964	-16059	-6858	0	0	0	-3	0	-93.809
	2(SUS)	-2061	-17599	-152	0	0	0	-0.012	0	-0.001
	3(EXP)	-4903	1540	-6706	0	0	0	-2.988	0	-93.808
	MAX	-6964/L1	-17599/L	-6858/L1				-3.000/L1	-0.000/L2	-93.809/L1
150		Rigid +Y								
	1(OPE)	-12986	-47832	-6106	0	0	0	-69.119	0	-32.5
	2(SUS)	1589	-51154	1091	0	0	0	0.009	0	0.006
	3(EXP)	-14575	3322	-7197	0	0	0	-69.128	0	-32.506
	MAX	-14575/L	-51154/L	-7197/L3				-69.128/L	-0.000/L2	-32.506/L3
180		Rigid +Y								
	1(OPE)	-12986	-47832	6106	0	0	0	-69.119	0	32.5
	2(SUS)	1589	-51154	-1091	0	0	0	0.009	0	-0.006
	3(EXP)	-14575	3322	7197	0	0	0	-69.128	0	32.506
	MAX	-14575/L	-51154/L	7197/L3				-69.128/L	-0.000/L2	32.506/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6964	-16059	6858	0	0	0	-3	0	93.809
	2(SUS)	-2061	-17599	152	0	0	0	-0.012	0	0.001
	3(EXP)	-4903	1540	6706	0	0	0	-2.988	0	93.808
	MAX	-6964/L1	-17599/L	6858/L1				-3.000/L1	-0.000/L2	93.809/L1
220		Rigid +Y								
	1(OPE)	1584	-32979	9766	0	0	0	7.608	0	46.901
	2(SUS)	606	-26525	71	0	0	0	0.003	0	0
	3(EXP)	978	-6454	9695	0	0	0	7.605	0	46.9
	MAX	1584/L1	-32979/L	9766/L1				7.608/L1	-0.000/L1	46.901/L1
230		Rigid ANC								
	1(OPE)	19306	-10210	-78097	8855	80472	3766	0	0	0
	2(SUS)	-134	-11802	542	12272	-271	-1387	0	0	0
	3(EXP)	19441	1591	-78639	-3417	80743	5152	0	0	0
	MAX	19441/L1	-11802/L	-78639/L	12272/L1	80743/L1	5152/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	7.605	0	-46.9	-0.006	-0.0604	0.0229
20	-2.988	0	-93.808	0.0245	0.3245	0.0458
28	-20.433	1.621	-110.257	0.0588	0.5607	0.0538
29	-22.543	2.136	-111.685	0.0652	0.6034	0.0569
30	-24.544	3.178	-112.794	0.0707	0.6435	0.0637
38	-27.285	5.021	-114.079	0.0735	0.6844	0.0601
39	-32.087	7.116	-113.633	0.0801	0.7636	0.0753
40	-36.491	7.545	-108.95	0.0826	0.8448	0.0836
45	-69.128	0	-32.506	0.0488	0.9783	0.1015
48	-93.797	-6.051	18.069	0.0233	0.6595	0.1015
49	-98.123	-6.663	20.947	0.0199	0.547	0.1019
50	-102.445	-6.825	19.609	0.0157	0.4283	0.1023
59	-98.123	-6.663	-20.947	-0.0199	-0.547	0.1019
60	-93.797	-6.051	-18.069	-0.0233	-0.6595	0.1015
65	-69.128	0	32.506	-0.0488	-0.9783	0.1015
68	-36.491	7.545	108.95	-0.0826	-0.8448	0.0836
69	-32.087	7.116	113.633	-0.0801	-0.7636	0.0753
70	-27.285	5.021	114.079	-0.0735	-0.6844	0.0601
78	-24.544	3.178	112.794	-0.0707	-0.6435	0.0637
79	-22.543	2.136	111.685	-0.0652	-0.6034	0.0569
80	-20.433	1.621	110.257	-0.0588	-0.5607	0.0538
85	-2.988	0	93.808	-0.0245	-0.3245	0.0458
90	7.605	0	46.9	0.006	0.0604	0.0229
100	0	0	0	0	0	0
110	7.605	0	-46.9	-0.006	-0.0604	0.0229
120	-2.988	0	-93.808	0.0245	0.3245	0.0458
128	-20.433	1.621	-110.257	0.0588	0.5607	0.0538
129	-22.543	2.136	-111.685	0.0652	0.6034	0.0569
130	-24.544	3.178	-112.794	0.0707	0.6435	0.0637
139	-32.087	7.116	-113.633	0.0801	0.7636	0.0753
140	-36.491	7.545	-108.95	0.0826	0.8448	0.0836
150	-69.128	0	-32.506	0.0488	0.9783	0.1015
158	-93.797	-6.051	18.069	0.0233	0.6595	0.1015
159	-98.123	-6.663	20.947	0.0199	0.547	0.1019
160	-102.445	-6.825	19.609	0.0157	0.4283	0.1023
168	-102.445	-6.825	-19.609	-0.0157	-0.4283	0.1023
169	-98.123	-6.663	-20.947	-0.0199	-0.547	0.1019
170	-93.797	-6.051	-18.069	-0.0233	-0.6595	0.1015
180	-69.128	0	32.506	-0.0488	-0.9783	0.1015

188	-36.491	7.545	108.95	-0.0826	-0.8448	0.0836
189	-32.087	7.116	113.633	-0.0801	-0.7636	0.0753
190	-27.285	5.021	114.079	-0.0735	-0.6844	0.0601
199	-22.543	2.136	111.685	-0.0652	-0.6034	0.0569
200	-20.433	1.621	110.257	-0.0588	-0.5607	0.0538
210	-2.988	0	93.808	-0.0245	-0.3245	0.0458
220	7.605	0	46.9	0.006	0.0604	0.0229
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0018	-0.0006	-0.0062
20	-0.012	0	-0.001	0.0074	0.0026	-0.0123
28	-0.149	0.237	-0.001	0.0058	0.0034	-0.0145
29	-0.15	0.257	0.003	0.0057	0.0031	-0.0147
30	-0.129	0.274	0.014	0.0055	0.0028	-0.015
38	-0.082	0.295	0.035	0.0053	0.0025	-0.0153
39	-0.019	0.362	0.064	0.0044	0.0015	-0.016
40	0.01	0.478	0.078	0.0034	0.0005	-0.0161
45	0.009	0	0.006	-0.0077	-0.0009	0.0586
48	0.009	-6.124	-0.002	-0.0161	0.0002	0.1251
49	0.008	-7.003	-0.001	-0.0171	0.0002	0.1268
50	0.007	-7.464	0	-0.017	0.0002	0.127
59	0.008	-7.003	0.001	0.0171	-0.0002	0.1268
60	0.009	-6.124	0.002	0.0161	-0.0002	0.1251
65	0.009	0	-0.006	0.0077	0.0009	0.0586
68	0.01	0.478	-0.078	-0.0034	-0.0005	-0.0161
69	-0.019	0.362	-0.064	-0.0044	-0.0015	-0.016
70	-0.082	0.295	-0.035	-0.0053	-0.0025	-0.0153
78	-0.129	0.274	-0.014	-0.0055	-0.0028	-0.015
79	-0.15	0.257	-0.003	-0.0057	-0.0031	-0.0147
80	-0.149	0.237	0.001	-0.0058	-0.0034	-0.0145
85	-0.012	0	0.001	-0.0074	-0.0026	-0.0123
90	0.003	0	0	0.0018	0.0006	-0.0062
100	0	0	0	0	0	0
110	0.003	0	0	-0.0018	-0.0006	-0.0062
120	-0.012	0	-0.001	0.0074	0.0026	-0.0123
128	-0.149	0.237	-0.001	0.0058	0.0034	-0.0145
129	-0.15	0.257	0.003	0.0057	0.0031	-0.0147
130	-0.129	0.274	0.014	0.0055	0.0028	-0.015
139	-0.019	0.362	0.064	0.0044	0.0015	-0.016
140	0.01	0.478	0.078	0.0034	0.0005	-0.0161
150	0.009	0	0.006	-0.0077	-0.0009	0.0586
158	0.009	-6.124	-0.002	-0.0161	0.0002	0.1251
159	0.008	-7.003	-0.001	-0.0171	0.0002	0.1268
160	0.007	-7.464	0	-0.017	0.0002	0.127
168	0.007	-7.464	0	0.017	-0.0002	0.127
169	0.008	-7.003	0.001	0.0171	-0.0002	0.1268
170	0.009	-6.124	0.002	0.0161	-0.0002	0.1251
180	0.009	0	-0.006	0.0077	0.0009	0.0586

188	0.01	0.478	-0.078	-0.0034	-0.0005	-0.0161
189	-0.019	0.362	-0.064	-0.0044	-0.0015	-0.016
190	-0.082	0.295	-0.035	-0.0053	-0.0025	-0.0153
199	-0.15	0.257	-0.003	-0.0057	-0.0031	-0.0147
200	-0.149	0.237	0.001	-0.0058	-0.0034	-0.0145
210	-0.012	0	0.001	-0.0074	-0.0026	-0.0123
220	0.003	0	0	0.0018	0.0006	-0.0062
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:30
Job Name: A335 P22_2 EXPANSION LOOP_6.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	7.608	0	-46.901	-0.0079	-0.0609	0.0167
20	-3	0	-93.809	0.0319	0.3271	0.0334
28	-20.581	1.857	-110.258	0.0645	0.5641	0.0393
29	-22.693	2.393	-111.682	0.0709	0.6066	0.0422
30	-24.674	3.453	-112.78	0.0762	0.6463	0.0487
38	-27.368	5.316	-114.044	0.0788	0.6868	0.0449
39	-32.106	7.478	-113.57	0.0845	0.7651	0.0593
40	-36.481	8.023	-108.872	0.0859	0.8452	0.0675
45	-69.119	0	-32.5	0.0411	0.9774	0.1601
48	-93.788	-12.175	18.066	0.0072	0.6597	0.2267
49	-98.114	-13.665	20.947	0.0028	0.5472	0.2287
50	-102.438	-14.289	19.609	-0.0012	0.4284	0.2293
59	-98.114	-13.665	-20.947	-0.0028	-0.5472	0.2287
60	-93.788	-12.175	-18.066	-0.0072	-0.6597	0.2267
65	-69.119	0	32.5	-0.0411	-0.9774	0.1601
68	-36.481	8.023	108.872	-0.0859	-0.8452	0.0675
69	-32.106	7.478	113.57	-0.0845	-0.7651	0.0593
70	-27.368	5.316	114.044	-0.0788	-0.6868	0.0449
78	-24.674	3.453	112.78	-0.0762	-0.6463	0.0487
79	-22.693	2.393	111.682	-0.0709	-0.6066	0.0422
80	-20.581	1.857	110.258	-0.0645	-0.5641	0.0393
85	-3	0	93.809	-0.0319	-0.3271	0.0334
90	7.608	0	46.901	0.0079	0.0609	0.0167
100	0	0	0	0	0	0
110	7.608	0	-46.901	-0.0079	-0.0609	0.0167
120	-3	0	-93.809	0.0319	0.3271	0.0334
128	-20.581	1.857	-110.258	0.0645	0.5641	0.0393
129	-22.693	2.393	-111.682	0.0709	0.6066	0.0422
130	-24.674	3.453	-112.78	0.0762	0.6463	0.0487
139	-32.106	7.478	-113.57	0.0845	0.7651	0.0593
140	-36.481	8.023	-108.872	0.0859	0.8452	0.0675
150	-69.119	0	-32.5	0.0411	0.9774	0.1601
158	-93.787	-12.175	18.066	0.0072	0.6597	0.2267
159	-98.114	-13.665	20.947	0.0028	0.5472	0.2287
160	-102.438	-14.289	19.609	-0.0012	0.4284	0.2293
168	-102.438	-14.289	-19.609	0.0012	-0.4284	0.2293
169	-98.114	-13.665	-20.947	-0.0028	-0.5472	0.2287
170	-93.788	-12.175	-18.066	-0.0072	-0.6597	0.2267
180	-69.119	0	32.5	-0.0411	-0.9774	0.1601

188	-36.481	8.023	108.872	-0.0859	-0.8452	0.0675
189	-32.106	7.478	113.57	-0.0845	-0.7651	0.0593
190	-27.368	5.316	114.044	-0.0788	-0.6868	0.0449
199	-22.693	2.393	111.682	-0.0709	-0.6066	0.0422
200	-20.581	1.857	110.258	-0.0645	-0.5641	0.0393
210	-3	0	93.809	-0.0319	-0.3271	0.0334
220	7.608	0	46.901	0.0079	0.0609	0.0167
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,000.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,000.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,000.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,000.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,000.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,000.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,000.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,000.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,000.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,000.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,000.000 mm.
 RESTRAINTS
```

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -7,000.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                        v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                         App.P Sy/St Switch = ON   Sc= 137,895 KPa
                        Sh1= 63,326 KPa   Sh2= 137,895 KPa
                        Sh3= 137,895 KPa   Sh4= 137,895 KPa
                        Sh5= 137,895 KPa   Sh6= 137,895 KPa
                        Sh7= 137,895 KPa   Sh8= 137,895 KPa
                        Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 29
                        Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 39
                        Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 49
                        Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 69
                        Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 79
                        Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50
                       129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide			3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide			3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide			3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide			3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Location of Pipe Support and Anchor Point 7.0m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Location of Pipe Support and Anchor Point 7.0m

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7000.000
20	.000	.000	-14000.000
30	.000	.000	-17000.000
40	.000	750.000	-17750.000
45	-5052.000	750.000	-17750.000
50	-9000.000	750.000	-17750.000
60	-9000.000	750.000	-24250.000
65	-5052.000	750.000	-24250.000
70	.000	750.000	-24250.000
80	.000	.000	-25000.000
85	.000	.000	-28000.000
90	.000	.000	-35000.000
100	.000	.000	-42000.000
110	.000	.000	-49000.000
120	.000	.000	-56000.000
130	.000	.000	-59000.000
140	.000	750.000	-59750.000
150	-5052.000	750.000	-59750.000
160	-9000.000	750.000	-59750.000
170	-9000.000	750.000	-66250.000
180	-5052.000	750.000	-66250.000
190	.000	750.000	-66250.000
200	.000	.000	-67000.000
210	.000	.000	-70000.000
220	.000	.000	-77000.000
230	.000	.000	-84000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43896.2 Allowable Stress: 63326.2
Axial Stress: 17799.8 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 110238.8 @Node 168 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 26525.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 131366.8 @Node 168 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42624.5	0	0	15	32067.2	0	0	B31.3
2(SUS)		22842.1	63326.2	36.1		23723.1	63326.2	37.5	B31.3
3(EXP)		27447.6	228684.6	12		15319.8	227803.6	6.7	B31.3
1(OPE)	15	32351.9	0	0	20	77363.3	0	0	B31.3
2(SUS)		23724.6	63326.2	37.5		21134.6	63326.2	33.4	B31.3
3(EXP)		15319.8	227802.1	6.7		61637.2	230392.1	26.8	B31.3
1(OPE)	20	77545.9	0	0	28	91720.4	0	0	B31.3
2(SUS)		21137.8	63326.2	33.4		18119.6	63326.2	28.6	B31.3
3(EXP)		61637.2	230388.8	26.8		76597.9	233407.1	32.8	B31.3
1(OPE)	28	91720.4	0	0	29	92698.2	0	0	B31.3
2(SUS)		18119.6	63326.2	28.6		18383.1	63326.2	29	B31.3
3(EXP)		76597.9	233407.1	32.8		77571.2	233143.6	33.3	B31.3
1(OPE)	29	92698.2	0	0	30	93581.9	0	0	B31.3
2(SUS)		18383.1	63326.2	29		18588.4	63326.2	29.4	B31.3
3(EXP)		77571.2	233143.6	33.3		78200.7	232938.3	33.6	B31.3
1(OPE)	30	93581.9	0	0	38	94328.1	0	0	B31.3
2(SUS)		18588.4	63326.2	29.4		18825.3	63326.2	29.7	B31.3
3(EXP)		78200.7	232938.3	33.6		79028.2	232701.4	34	B31.3
1(OPE)	38	94328.1	0	0	39	92310	0	0	B31.3
2(SUS)		18825.3	63326.2	29.7		18956.4	63326.2	29.9	B31.3
3(EXP)		79028.2	232701.4	34		76943.7	232570.3	33.1	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

1(OPE)	39	92310	0	0	40	85386.4	0	0	B31.3
2(SUS)		18956.4	63326.2	29.9		18566.5	63326.2	29.3	B31.3
3(EXP)		76943.7	232570.3	33.1		69224.5	232960.1	29.7	B31.3
1(OPE)	40	85386.4	0	0	45	58051.9	0	0	B31.3
2(SUS)		18566.5	63326.2	29.3		43896.2	63326.2	69.3	B31.3
3(EXP)		69224.5	232960.1	29.7		32440.5	207630.5	15.6	B31.3
1(OPE)	45	58394.7	0	0	48	116849.4	0	0	B31.3
2(SUS)		43866.1	63326.2	69.3		20029.6	63326.2	31.6	B31.3
3(EXP)		32440.5	207660.5	15.6		99710.2	231497.1	43.1	B31.3
1(OPE)	48	116849.4	0	0	49	123276	0	0	B31.3
2(SUS)		20029.6	63326.2	31.6		18465.4	63326.2	29.2	B31.3
3(EXP)		99710.2	231497.1	43.1		107154.9	233061.3	46	B31.3
1(OPE)	49	123276	0	0	50	125909.1	0	0	B31.3
2(SUS)		18465.4	63326.2	29.2		18674.7	63326.2	29.5	B31.3
3(EXP)		107154.9	233061.3	46		110238.8	232851.9	47.3	B31.3
1(OPE)	50	125909.1	0	0	59	123276	0	0	B31.3
2(SUS)		18674.7	63326.2	29.5		18465.4	63326.2	29.2	B31.3
3(EXP)		110238.8	232851.9	47.3		107154.9	233061.3	46	B31.3
1(OPE)	59	123276	0	0	60	116849.4	0	0	B31.3
2(SUS)		18465.4	63326.2	29.2		20029.6	63326.2	31.6	B31.3
3(EXP)		107154.9	233061.3	46		99710.2	231497.1	43.1	B31.3
1(OPE)	60	116849.4	0	0	65	58394.7	0	0	B31.3
2(SUS)		20029.6	63326.2	31.6		43866.1	63326.2	69.3	B31.3
3(EXP)		99710.2	231497.1	43.1		32440.5	207660.5	15.6	B31.3
1(OPE)	65	58051.9	0	0	68	85386.4	0	0	B31.3
2(SUS)		43896.2	63326.2	69.3		18566.5	63326.2	29.3	B31.3
3(EXP)		32440.5	207630.5	15.6		69224.5	232960.1	29.7	B31.3
1(OPE)	68	85386.4	0	0	69	92310	0	0	B31.3
2(SUS)		18566.5	63326.2	29.3		18956.4	63326.2	29.9	B31.3
3(EXP)		69224.5	232960.1	29.7		76943.7	232570.3	33.1	B31.3
1(OPE)	69	92310	0	0	70	94328.1	0	0	B31.3
2(SUS)		18956.4	63326.2	29.9		18825.3	63326.2	29.7	B31.3
3(EXP)		76943.7	232570.3	33.1		79028.2	232701.4	34	B31.3
1(OPE)	70	94328.1	0	0	78	93581.9	0	0	B31.3
2(SUS)		18825.3	63326.2	29.7		18588.4	63326.2	29.4	B31.3
3(EXP)		79028.2	232701.4	34		78200.7	232938.3	33.6	B31.3
1(OPE)	78	93581.9	0	0	79	92698.2	0	0	B31.3
2(SUS)		18588.4	63326.2	29.4		18383.1	63326.2	29	B31.3
3(EXP)		78200.7	232938.3	33.6		77571.2	233143.6	33.3	B31.3
1(OPE)	79	92698.2	0	0	80	91720.4	0	0	B31.3
2(SUS)		18383.1	63326.2	29		18119.6	63326.2	28.6	B31.3
3(EXP)		77571.2	233143.6	33.3		76597.9	233407.1	32.8	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

1(OPE)	80	91720.4	0	0	85	77545.9	0	0	B31.3
2(SUS)		18119.6	63326.2	28.6		21137.8	63326.2	33.4	B31.3
3(EXP)		76597.9	233407.1	32.8		61637.1	230388.8	26.8	B31.3
1(OPE)	85	77363.2	0	0	90	32351.9	0	0	B31.3
2(SUS)		21134.6	63326.2	33.4		23724.6	63326.2	37.5	B31.3
3(EXP)		61637.1	230392.1	26.8		15319.8	227802.1	6.7	B31.3
1(OPE)	90	32067.1	0	0	100	42624.6	0	0	B31.3
2(SUS)		23723.1	63326.2	37.5		22842.1	63326.2	36.1	B31.3
3(EXP)		15319.8	227803.6	6.7		27447.7	228684.5	12	B31.3
1(OPE)	100	42624.6	0	0	110	32067.1	0	0	B31.3
2(SUS)		22842.1	63326.2	36.1		23723.1	63326.2	37.5	B31.3
3(EXP)		27447.7	228684.5	12		15319.8	227803.6	6.7	B31.3
1(OPE)	110	32351.9	0	0	120	77363.3	0	0	B31.3
2(SUS)		23724.6	63326.2	37.5		21134.6	63326.2	33.4	B31.3
3(EXP)		15319.8	227802.1	6.7		61637.2	230392.1	26.8	B31.3
1(OPE)	120	77545.9	0	0	128	91720.4	0	0	B31.3
2(SUS)		21137.8	63326.2	33.4		18119.6	63326.2	28.6	B31.3
3(EXP)		61637.2	230388.8	26.8		76597.9	233407.1	32.8	B31.3
1(OPE)	128	91720.4	0	0	129	92698.3	0	0	B31.3
2(SUS)		18119.6	63326.2	28.6		18383.1	63326.2	29	B31.3
3(EXP)		76597.9	233407.1	32.8		77571.2	233143.6	33.3	B31.3
1(OPE)	129	92698.3	0	0	130	93581.9	0	0	B31.3
2(SUS)		18383.1	63326.2	29		18588.4	63326.2	29.4	B31.3
3(EXP)		77571.2	233143.6	33.3		78200.7	232938.3	33.6	B31.3
1(OPE)	130	93581.9	0	0	139	92310	0	0	B31.3
2(SUS)		18588.4	63326.2	29.4		18956.4	63326.2	29.9	B31.3
3(EXP)		78200.7	232938.3	33.6		76943.8	232570.3	33.1	B31.3
1(OPE)	139	92310	0	0	140	85386.4	0	0	B31.3
2(SUS)		18956.4	63326.2	29.9		18566.5	63326.2	29.3	B31.3
3(EXP)		76943.8	232570.3	33.1		69224.6	232960.1	29.7	B31.3
1(OPE)	140	85386.4	0	0	150	58051.9	0	0	B31.3
2(SUS)		18566.5	63326.2	29.3		43896.2	63326.2	69.3	B31.3
3(EXP)		69224.6	232960.1	29.7		32440.5	207630.5	15.6	B31.3
1(OPE)	150	58394.7	0	0	158	116849.4	0	0	B31.3
2(SUS)		43866.1	63326.2	69.3		20029.6	63326.2	31.6	B31.3
3(EXP)		32440.5	207660.5	15.6		99710.2	231497.1	43.1	B31.3
1(OPE)	158	116849.4	0	0	159	123276	0	0	B31.3
2(SUS)		20029.6	63326.2	31.6		18465.4	63326.2	29.2	B31.3
3(EXP)		99710.2	231497.1	43.1		107154.8	233061.3	46	B31.3
1(OPE)	159	123276	0	0	160	125909.1	0	0	B31.3
2(SUS)		18465.4	63326.2	29.2		18674.7	63326.2	29.5	B31.3
3(EXP)		107154.8	233061.3	46		110238.7	232851.9	47.3	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

1(OPE)	160	125909.1	0	0	168	125909.1	0	0	B31.3
2(SUS)		18674.7	63326.2	29.5		18674.7	63326.2	29.5	B31.3
3(EXP)		110238.7	232851.9	47.3		110238.8	232851.9	47.3	B31.3
1(OPE)	168	125909.1	0	0	169	123276.1	0	0	B31.3
2(SUS)		18674.7	63326.2	29.5		18465.4	63326.2	29.2	B31.3
3(EXP)		110238.8	232851.9	47.3		107154.9	233061.3	46	B31.3
1(OPE)	169	123276.1	0	0	170	116849.4	0	0	B31.3
2(SUS)		18465.4	63326.2	29.2		20029.6	63326.2	31.6	B31.3
3(EXP)		107154.9	233061.3	46		99710.2	231497.1	43.1	B31.3
1(OPE)	170	116849.4	0	0	180	58394.7	0	0	B31.3
2(SUS)		20029.6	63326.2	31.6		43866.1	63326.2	69.3	B31.3
3(EXP)		99710.2	231497.1	43.1		32440.5	207660.5	15.6	B31.3
1(OPE)	180	58051.9	0	0	188	85386.4	0	0	B31.3
2(SUS)		43896.2	63326.2	69.3		18566.5	63326.2	29.3	B31.3
3(EXP)		32440.5	207630.5	15.6		69224.5	232960.1	29.7	B31.3
1(OPE)	188	85386.4	0	0	189	92310	0	0	B31.3
2(SUS)		18566.5	63326.2	29.3		18956.4	63326.2	29.9	B31.3
3(EXP)		69224.5	232960.1	29.7		76943.7	232570.3	33.1	B31.3
1(OPE)	189	92310	0	0	190	94328.1	0	0	B31.3
2(SUS)		18956.4	63326.2	29.9		18825.3	63326.2	29.7	B31.3
3(EXP)		76943.7	232570.3	33.1		79028.2	232701.4	34	B31.3
1(OPE)	190	94328.1	0	0	199	92698.2	0	0	B31.3
2(SUS)		18825.3	63326.2	29.7		18383	63326.2	29	B31.3
3(EXP)		79028.2	232701.4	34		77571.1	233143.6	33.3	B31.3
1(OPE)	199	92698.2	0	0	200	91720.4	0	0	B31.3
2(SUS)		18383	63326.2	29		18119.6	63326.2	28.6	B31.3
3(EXP)		77571.1	233143.6	33.3		76597.8	233407.1	32.8	B31.3
1(OPE)	200	91720.4	0	0	210	77545.9	0	0	B31.3
2(SUS)		18119.6	63326.2	28.6		21137.8	63326.2	33.4	B31.3
3(EXP)		76597.8	233407.1	32.8		61637.1	230388.8	26.8	B31.3
1(OPE)	210	77363.2	0	0	220	32351.9	0	0	B31.3
2(SUS)		21134.6	63326.2	33.4		23724.6	63326.2	37.5	B31.3
3(EXP)		61637.1	230392.1	26.8		15319.8	227802.1	6.7	B31.3
1(OPE)	220	32067.2	0	0	230	42624.5	0	0	B31.3
2(SUS)		23723.1	63326.2	37.5		22842.1	63326.2	36.1	B31.3
3(EXP)		15319.8	227803.6	6.7		27447.6	228684.6	12	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	17396	-11434	83233	-11278	-78874	3960	0	0	0
	2(SUS)	-118	-12872	-430	-14607	259	-1404	0	0	0
	3(EXP)	17514	1438	83663	3329	-79133	5365	0	0	0
	MAX	17514/L	-12872/L	83663/L	-14607/L	-79133/L	5365/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1723	-33724	-9969	0	0	0	8.729	0	-50.504
	2(SUS)	516	-27905	-61	0	0	0	0.003	0	0
	3(EXP)	1207	-5819	-9909	0	0	0	8.726	0	-50.504
	MAX	1723/L1	-33724/L	-9969/L1				8.729/L1	-0.000/L1	-50.504/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-5364	-19818	-7499	0	0	0	-3	0	-101.018
	2(SUS)	-1605	-20873	-131	0	0	0	-0.009	0	-0.001
	3(EXP)	-3758	1055	-7368	0	0	0	-2.991	0	-101.017
	MAX	-5364/L1	-20873/L	-7499/L1				-3.000/L1	-0.000/L2	-101.018/L1
45		Rigid +Y								
	1(OPE)	-12935	-47774	-6172	0	0	0	-76.357	0	-36.434
	2(SUS)	1207	-51101	855	0	0	0	0.007	0	0.005
	3(EXP)	-14142	3327	-7027	0	0	0	-76.364	0	-36.439
	MAX	-14142/L	-51101/L	-7027/L3				-76.364/L	-0.000/L2	-36.439/L3
65		Rigid +Y								
	1(OPE)	-12935	-47774	6172	0	0	0	-76.357	0	36.434
	2(SUS)	1207	-51101	-855	0	0	0	0.007	0	-0.005
	3(EXP)	-14142	3327	7027	0	0	0	-76.364	0	36.439
	MAX	-14142/L	-51101/L	7027/L3				-76.364/L	-0.000/L2	36.439/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-5364	-19818	7499	0	0	0	-3	0	101.018
	2(SUS)	-1605	-20873	131	0	0	0	-0.009	0	0.001
	3(EXP)	-3758	1055	7368	0	0	0	-2.991	0	101.017
	MAX	-5364/L1	-20873/L	7499/L1				-3.000/L1	-0.000/L2	101.018/L1
90		Rigid +Y								
	1(OPE)	1723	-33724	9969	0	0	0	8.729	0	50.504
	2(SUS)	516	-27905	61	0	0	0	0.003	0	0
	3(EXP)	1207	-5819	9909	0	0	0	8.726	0	50.504
	MAX	1723/L1	-33724/L	9969/L1				8.729/L1	-0.000/L1	50.504/L1
100		Rigid ANC								
	1(OPE)	34793	-22868	0	0	0	7921	0	0	0
	2(SUS)	-235	-25744	0	0	0	-2809	0	0	0
	3(EXP)	35028	2876	0	0	0	10729	0	0	0
	MAX	35028/L	-25744/L	0/L1	0/L2	-0/L1	10729/L	0.000/L3	-0.000/L2	0.000/L1

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

110		Rigid +Y								
	1(OPE)	1723	-33724	-9969	0	0	0	8.729	0	-50.504
	2(SUS)	516	-27905	-61	0	0	0	0.003	0	0
	3(EXP)	1207	-5819	-9909	0	0	0	8.726	0	-50.504
	MAX	1723/L1	-33724/L	-9969/L1				8.729/L1	-0.000/L1	-50.504/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-5364	-19818	-7499	0	0	0	-3	0	-101.018
	2(SUS)	-1605	-20873	-131	0	0	0	-0.009	0	-0.001
	3(EXP)	-3758	1055	-7368	0	0	0	-2.991	0	-101.017
	MAX	-5364/L1	-20873/L	-7499/L1				-3.000/L1	-0.000/L2	-101.018/L1
150		Rigid +Y								
	1(OPE)	-12935	-47774	-6172	0	0	0	-76.357	0	-36.434
	2(SUS)	1207	-51101	855	0	0	0	0.007	0	0.005
	3(EXP)	-14142	3327	-7027	0	0	0	-76.364	0	-36.439
	MAX	-14142/L	-51101/L	-7027/L3				-76.364/L	-0.000/L2	-36.439/L3
180		Rigid +Y								
	1(OPE)	-12935	-47774	6172	0	0	0	-76.357	0	36.434
	2(SUS)	1207	-51101	-855	0	0	0	0.007	0	-0.005
	3(EXP)	-14142	3327	7027	0	0	0	-76.364	0	36.439
	MAX	-14142/L	-51101/L	7027/L3				-76.364/L	-0.000/L2	36.439/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-5364	-19818	7499	0	0	0	-3	0	101.018
	2(SUS)	-1605	-20873	131	0	0	0	-0.009	0	0.001
	3(EXP)	-3758	1055	7368	0	0	0	-2.991	0	101.017
	MAX	-5364/L1	-20873/L	7499/L1				-3.000/L1	-0.000/L2	101.018/L1
220		Rigid +Y								
	1(OPE)	1723	-33724	9969	0	0	0	8.729	0	50.504
	2(SUS)	516	-27905	61	0	0	0	0.003	0	0
	3(EXP)	1207	-5819	9909	0	0	0	8.726	0	50.504
	MAX	1723/L1	-33724/L	9969/L1				8.729/L1	-0.000/L1	50.504/L1
230		Rigid ANC								
	1(OPE)	17396	-11434	-83233	11278	78874	3960	0	0	0
	2(SUS)	-118	-12872	430	14607	-259	-1404	0	0	0
	3(EXP)	17514	1438	-83663	-3329	79133	5365	0	0	0
	MAX	17514/L3	-12872/L	-83663/L	14607/L3	79133/L3	5365/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.726	0	-50.504	-0.0063	-0.066	0.0257
20	-2.991	0	-101.017	0.0255	0.3412	0.0513
28	-26.314	2.196	-121.074	0.0675	0.6319	0.0615
29	-28.685	2.742	-122.496	0.0741	0.6756	0.0647
30	-30.922	3.812	-123.587	0.0797	0.7167	0.0716
38	-33.971	5.689	-124.837	0.0826	0.7585	0.068
39	-39.16	7.804	-124.143	0.0891	0.8395	0.0834
40	-43.727	8.197	-118.937	0.0914	0.9222	0.0918
45	-76.364	0	-36.439	0.054	1.0491	0.1098
48	-101.033	-6.544	17.697	0.0257	0.705	0.1098
49	-105.469	-7.204	20.851	0.022	0.5846	0.1103
50	-110.011	-7.376	19.608	0.0174	0.4577	0.1107
59	-105.469	-7.204	-20.851	-0.022	-0.5846	0.1103
60	-101.033	-6.544	-17.696	-0.0257	-0.705	0.1098
65	-76.364	0	36.439	-0.054	-1.0491	0.1098
68	-43.727	8.197	118.937	-0.0914	-0.9222	0.0918
69	-39.16	7.804	124.143	-0.0891	-0.8395	0.0834
70	-33.971	5.689	124.837	-0.0826	-0.7585	0.068
78	-30.922	3.812	123.587	-0.0797	-0.7167	0.0716
79	-28.685	2.742	122.496	-0.0741	-0.6756	0.0647
80	-26.314	2.196	121.074	-0.0675	-0.6319	0.0615
85	-2.991	0	101.017	-0.0255	-0.3412	0.0513
90	8.726	0	50.504	0.0063	0.066	0.0257
100	0	0	0	0	0	0
110	8.726	0	-50.504	-0.0063	-0.066	0.0257
120	-2.991	0	-101.017	0.0255	0.3412	0.0513
128	-26.314	2.196	-121.074	0.0675	0.6319	0.0615
129	-28.685	2.742	-122.496	0.0741	0.6756	0.0647
130	-30.922	3.812	-123.587	0.0797	0.7167	0.0716
139	-39.16	7.804	-124.143	0.0891	0.8395	0.0834
140	-43.727	8.197	-118.937	0.0914	0.9222	0.0918
150	-76.364	0	-36.439	0.054	1.0491	0.1098
158	-101.033	-6.544	17.697	0.0257	0.705	0.1098
159	-105.469	-7.204	20.851	0.022	0.5846	0.1103
160	-110.011	-7.376	19.608	0.0174	0.4577	0.1107
168	-110.011	-7.376	-19.608	-0.0174	-0.4577	0.1107
169	-105.469	-7.204	-20.851	-0.022	-0.5846	0.1103
170	-101.033	-6.544	-17.696	-0.0257	-0.705	0.1098
180	-76.364	0	36.439	-0.054	-1.0491	0.1098

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

188	-43.727	8.197	118.937	-0.0914	-0.9222	0.0918
189	-39.16	7.804	124.143	-0.0891	-0.8395	0.0834
190	-33.971	5.689	124.837	-0.0826	-0.7585	0.068
199	-28.685	2.742	122.496	-0.0741	-0.6756	0.0647
200	-26.314	2.196	121.074	-0.0675	-0.6319	0.0615
210	-2.991	0	101.017	-0.0255	-0.3412	0.0513
220	8.726	0	50.504	0.0063	0.066	0.0257
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0016	-0.0006	-0.0067
20	-0.009	0	-0.001	0.0063	0.0025	-0.0134
28	-0.172	0.166	-0.001	0.0031	0.0033	-0.0161
29	-0.172	0.177	0.001	0.0031	0.003	-0.0163
30	-0.148	0.186	0.008	0.003	0.0027	-0.0166
38	-0.095	0.198	0.019	0.0028	0.0025	-0.0169
39	-0.024	0.257	0.036	0.0021	0.0016	-0.0175
40	0.008	0.378	0.047	0.0011	0.0007	-0.0176
45	0.007	0	0.005	-0.0091	-0.0006	0.0574
48	0.007	-6.054	-0.002	-0.0167	0.0002	0.124
49	0.006	-6.927	0	-0.0176	0.0002	0.1256
50	0.006	-7.389	0	-0.0174	0.0001	0.1258
59	0.006	-6.927	0	0.0176	-0.0002	0.1256
60	0.007	-6.054	0.002	0.0167	-0.0002	0.124
65	0.007	0	-0.005	0.0091	0.0006	0.0574
68	0.008	0.378	-0.047	-0.0011	-0.0007	-0.0176
69	-0.024	0.257	-0.036	-0.0021	-0.0016	-0.0175
70	-0.095	0.198	-0.019	-0.0028	-0.0025	-0.0169
78	-0.148	0.186	-0.008	-0.003	-0.0027	-0.0166
79	-0.172	0.177	-0.001	-0.0031	-0.003	-0.0163
80	-0.172	0.166	0.001	-0.0031	-0.0033	-0.0161
85	-0.009	0	0.001	-0.0063	-0.0025	-0.0134
90	0.003	0	0	0.0016	0.0006	-0.0067
100	0	0	0	0	0	0
110	0.003	0	0	-0.0016	-0.0006	-0.0067
120	-0.009	0	-0.001	0.0063	0.0025	-0.0134
128	-0.172	0.166	-0.001	0.0031	0.0033	-0.0161
129	-0.172	0.177	0.001	0.0031	0.003	-0.0163
130	-0.148	0.186	0.008	0.003	0.0027	-0.0166
139	-0.024	0.257	0.036	0.0021	0.0016	-0.0175
140	0.008	0.378	0.047	0.0011	0.0007	-0.0176
150	0.007	0	0.005	-0.0091	-0.0006	0.0574
158	0.007	-6.054	-0.002	-0.0167	0.0002	0.124
159	0.006	-6.927	0	-0.0176	0.0002	0.1256
160	0.006	-7.389	0	-0.0174	0.0001	0.1258
168	0.006	-7.389	0	0.0174	-0.0001	0.1258
169	0.006	-6.927	0	0.0176	-0.0002	0.1256
170	0.007	-6.054	0.002	0.0167	-0.0002	0.124
180	0.007	0	-0.005	0.0091	0.0006	0.0574

188	0.008	0.378	-0.047	-0.0011	-0.0007	-0.0176
189	-0.024	0.257	-0.036	-0.0021	-0.0016	-0.0175
190	-0.095	0.198	-0.019	-0.0028	-0.0025	-0.0169
199	-0.172	0.177	-0.001	-0.0031	-0.003	-0.0163
200	-0.172	0.166	0.001	-0.0031	-0.0033	-0.0161
210	-0.009	0	0.001	-0.0063	-0.0025	-0.0134
220	0.003	0	0	0.0016	0.0006	-0.0067
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 11:2
Job Name: A335 P22_2 EXPANSION LOOP_7M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.729	0	-50.504	-0.0079	-0.0666	0.0189
20	-3	0	-101.018	0.0319	0.3437	0.0379
28	-26.486	2.361	-121.075	0.0706	0.6352	0.0454
29	-28.858	2.919	-122.494	0.0771	0.6787	0.0484
30	-31.07	3.998	-123.579	0.0827	0.7194	0.055
38	-34.066	5.886	-124.818	0.0854	0.7609	0.0511
39	-39.184	8.062	-124.107	0.0912	0.8411	0.0659
40	-43.719	8.575	-118.89	0.0924	0.9229	0.0743
45	-76.357	0	-36.434	0.0449	1.0485	0.1672
48	-101.026	-12.598	17.695	0.009	0.7052	0.2338
49	-105.462	-14.131	20.851	0.0044	0.5847	0.2358
50	-110.005	-14.765	19.608	0	0.4578	0.2365
59	-105.462	-14.131	-20.851	-0.0044	-0.5847	0.2358
60	-101.026	-12.598	-17.695	-0.009	-0.7052	0.2338
65	-76.357	0	36.434	-0.0449	-1.0485	0.1672
68	-43.719	8.575	118.89	-0.0924	-0.9229	0.0743
69	-39.184	8.062	124.107	-0.0912	-0.8411	0.0659
70	-34.066	5.886	124.818	-0.0854	-0.7609	0.0511
78	-31.07	3.998	123.579	-0.0827	-0.7194	0.055
79	-28.858	2.919	122.494	-0.0771	-0.6787	0.0484
80	-26.486	2.361	121.075	-0.0706	-0.6352	0.0454
85	-3	0	101.018	-0.0319	-0.3437	0.0379
90	8.729	0	50.504	0.0079	0.0666	0.0189
100	0	0	0	0	0	0
110	8.729	0	-50.504	-0.0079	-0.0666	0.0189
120	-3	0	-101.018	0.0319	0.3437	0.0379
128	-26.486	2.361	-121.075	0.0706	0.6352	0.0454
129	-28.858	2.919	-122.494	0.0771	0.6787	0.0484
130	-31.07	3.998	-123.579	0.0827	0.7194	0.055
139	-39.184	8.062	-124.107	0.0912	0.8411	0.0659
140	-43.719	8.575	-118.89	0.0924	0.9229	0.0743
150	-76.357	0	-36.434	0.0449	1.0485	0.1672
158	-101.026	-12.598	17.695	0.009	0.7052	0.2338
159	-105.462	-14.131	20.851	0.0044	0.5847	0.2358
160	-110.005	-14.765	19.608	0	0.4578	0.2365
168	-110.005	-14.765	-19.608	0	-0.4578	0.2365
169	-105.462	-14.131	-20.851	-0.0044	-0.5847	0.2358
170	-101.026	-12.598	-17.695	-0.009	-0.7052	0.2338
180	-76.357	0	36.434	-0.0449	-1.0485	0.1672

Possible Approach:
Location of Pipe Support and Anchor Point 7.0m

188	-43.719	8.575	118.89	-0.0924	-0.9229	0.0743
189	-39.184	8.062	124.107	-0.0912	-0.8411	0.0659
190	-34.066	5.886	124.818	-0.0854	-0.7609	0.0511
199	-28.857	2.919	122.494	-0.0771	-0.6787	0.0484
200	-26.486	2.361	121.075	-0.0706	-0.6352	0.0454
210	-3	0	101.018	-0.0319	-0.3437	0.0379
220	8.729	0	50.504	0.0079	0.0666	0.0189
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -8,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -8,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -4,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -8,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -8,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -8,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -8,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -4,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -4,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -8,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -8,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:

Location of Pipe Support and Anchor Point 8.5m

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Location of Pipe Support and Anchor Point 8.5m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Location of Pipe Support and Anchor Point 8.5m

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-8500.000
20	.000	.000	-17000.000
30	.000	.000	-21500.000
40	.000	750.000	-22250.000
45	-5052.000	750.000	-22250.000
50	-9000.000	750.000	-22250.000
60	-9000.000	750.000	-28750.000
65	-5052.000	750.000	-28750.000
70	.000	750.000	-28750.000
80	.000	.000	-29500.000
85	.000	.000	-34000.000
90	.000	.000	-42500.000
100	.000	.000	-51000.000
110	.000	.000	-59500.000
120	.000	.000	-68000.000
130	.000	.000	-72500.000
140	.000	750.000	-73250.000
150	-5052.000	750.000	-73250.000
160	-9000.000	750.000	-73250.000
170	-9000.000	750.000	-79750.000
180	-5052.000	750.000	-79750.000
190	.000	750.000	-79750.000
200	.000	.000	-80500.000
210	.000	.000	-85000.000
220	.000	.000	-93500.000
230	.000	.000	-102000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43871.5 Allowable Stress: 63326.2
Axial Stress: 17786.0 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 131719.9 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 28521.0 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 153313.8 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	41712.8	0	0	15	31466.9	0	0	B31.3
2(SUS)		25775.2	63326.2	40.7		25556.6	63326.2	40.4	B31.3
3(EXP)		26175.5	225751.4	11.6		13942.2	225970.1	6.2	B31.3
1(OPE)	15	31725.8	0	0	20	74227.5	0	0	B31.3
2(SUS)		25557	63326.2	40.4		26262.8	63326.2	41.5	B31.3
3(EXP)		13942.2	225969.7	6.2		58833.7	225263.9	26.1	B31.3
1(OPE)	20	74458.2	0	0	28	97270.9	0	0	B31.3
2(SUS)		26263.6	63326.2	41.5		18621.5	63326.2	29.4	B31.3
3(EXP)		58833.7	225263	26.1		82119.8	232905.1	35.3	B31.3
1(OPE)	28	97270.9	0	0	29	98280.5	0	0	B31.3
2(SUS)		18621.5	63326.2	29.4		18652.6	63326.2	29.5	B31.3
3(EXP)		82119.8	232905.1	35.3		83087.3	232874	35.7	B31.3
1(OPE)	29	98280.5	0	0	30	99177.6	0	0	B31.3
2(SUS)		18652.6	63326.2	29.5		18733.4	63326.2	29.6	B31.3
3(EXP)		83087.3	232874	35.7		83685.4	232793.2	35.9	B31.3
1(OPE)	30	99177.6	0	0	38	99886.2	0	0	B31.3
2(SUS)		18733.4	63326.2	29.6		18704.2	63326.2	29.5	B31.3
3(EXP)		83685.4	232793.2	35.9		84488.9	232822.4	36.3	B31.3
1(OPE)	38	99886.2	0	0	39	97462.7	0	0	B31.3
2(SUS)		18704.2	63326.2	29.5		18560.2	63326.2	29.3	B31.3
3(EXP)		84488.9	232822.4	36.3		81998	232966.4	35.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m

1(OPE)	39	97462.7	0	0	40	89538.3	0	0	B31.3
2(SUS)		18560.2	63326.2	29.3		18291.5	63326.2	28.9	B31.3
3(EXP)		81998	232966.4	35.2		73241.8	233235.2	31.4	B31.3
1(OPE)	40	89538.3	0	0	45	65934.6	0	0	B31.3
2(SUS)		18291.5	63326.2	28.9		43871.5	63326.2	69.3	B31.3
3(EXP)		73241.8	233235.2	31.4		41622.6	207655.2	20	B31.3
1(OPE)	45	66293	0	0	48	136648.8	0	0	B31.3
2(SUS)		43853.6	63326.2	69.3		20002.6	63326.2	31.6	B31.3
3(EXP)		41622.6	207673.1	20		119526.5	231524	51.6	B31.3
1(OPE)	48	136648.8	0	0	49	144054.2	0	0	B31.3
2(SUS)		20002.6	63326.2	31.6		18022.9	63326.2	28.5	B31.3
3(EXP)		119526.5	231524	51.6		128148.3	233503.7	54.9	B31.3
1(OPE)	49	144054.2	0	0	50	147093	0	0	B31.3
2(SUS)		18022.9	63326.2	28.5		19336	63326.2	30.5	B31.3
3(EXP)		128148.3	233503.7	54.9		131719.9	232190.7	56.7	B31.3
1(OPE)	50	147093	0	0	59	144054.2	0	0	B31.3
2(SUS)		19336	63326.2	30.5		18022.9	63326.2	28.5	B31.3
3(EXP)		131719.9	232190.7	56.7		128148.3	233503.7	54.9	B31.3
1(OPE)	59	144054.2	0	0	60	136648.8	0	0	B31.3
2(SUS)		18022.9	63326.2	28.5		20002.6	63326.2	31.6	B31.3
3(EXP)		128148.3	233503.7	54.9		119526.5	231524	51.6	B31.3
1(OPE)	60	136648.8	0	0	65	66293	0	0	B31.3
2(SUS)		20002.6	63326.2	31.6		43853.6	63326.2	69.3	B31.3
3(EXP)		119526.5	231524	51.6		41622.6	207673.1	20	B31.3
1(OPE)	65	65934.6	0	0	68	89538.3	0	0	B31.3
2(SUS)		43871.5	63326.2	69.3		18291.5	63326.2	28.9	B31.3
3(EXP)		41622.6	207655.2	20		73241.8	233235.2	31.4	B31.3
1(OPE)	68	89538.3	0	0	69	97462.7	0	0	B31.3
2(SUS)		18291.5	63326.2	28.9		18560.2	63326.2	29.3	B31.3
3(EXP)		73241.8	233235.2	31.4		81998	232966.4	35.2	B31.3
1(OPE)	69	97462.7	0	0	70	99886.2	0	0	B31.3
2(SUS)		18560.2	63326.2	29.3		18704.2	63326.2	29.5	B31.3
3(EXP)		81998	232966.4	35.2		84488.9	232822.4	36.3	B31.3
1(OPE)	70	99886.2	0	0	78	99177.6	0	0	B31.3
2(SUS)		18704.2	63326.2	29.5		18733.4	63326.2	29.6	B31.3
3(EXP)		84488.9	232822.4	36.3		83685.4	232793.2	35.9	B31.3
1(OPE)	78	99177.6	0	0	79	98280.5	0	0	B31.3
2(SUS)		18733.4	63326.2	29.6		18652.6	63326.2	29.5	B31.3
3(EXP)		83685.4	232793.2	35.9		83087.3	232874	35.7	B31.3
1(OPE)	79	98280.5	0	0	80	97270.9	0	0	B31.3
2(SUS)		18652.6	63326.2	29.5		18621.5	63326.2	29.4	B31.3
3(EXP)		83087.3	232874	35.7		82119.8	232905.1	35.3	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m
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1(OPE)	80	97270.9	0	0	85	74458.2	0	0	B31.3
2(SUS)		18621.5	63326.2	29.4		26263.6	63326.2	41.5	B31.3
3(EXP)		82119.8	232905.1	35.3		58833.7	225263	26.1	B31.3
1(OPE)	85	74227.5	0	0	90	31725.8	0	0	B31.3
2(SUS)		26262.8	63326.2	41.5		25556.9	63326.2	40.4	B31.3
3(EXP)		58833.7	225263.9	26.1		13942.1	225969.7	6.2	B31.3
1(OPE)	90	31466.8	0	0	100	41712.9	0	0	B31.3
2(SUS)		25556.6	63326.2	40.4		25775.3	63326.2	40.7	B31.3
3(EXP)		13942.1	225970.1	6.2		26175.6	225751.4	11.6	B31.3
1(OPE)	100	41712.9	0	0	110	31466.8	0	0	B31.3
2(SUS)		25775.3	63326.2	40.7		25556.6	63326.2	40.4	B31.3
3(EXP)		26175.6	225751.4	11.6		13942.1	225970.1	6.2	B31.3
1(OPE)	110	31725.8	0	0	120	74227.5	0	0	B31.3
2(SUS)		25557	63326.2	40.4		26262.8	63326.2	41.5	B31.3
3(EXP)		13942.1	225969.7	6.2		58833.8	225263.9	26.1	B31.3
1(OPE)	120	74458.3	0	0	128	97271	0	0	B31.3
2(SUS)		26263.6	63326.2	41.5		18621.5	63326.2	29.4	B31.3
3(EXP)		58833.8	225263	26.1		82119.8	232905.2	35.3	B31.3
1(OPE)	128	97271	0	0	129	98280.5	0	0	B31.3
2(SUS)		18621.5	63326.2	29.4		18652.6	63326.2	29.5	B31.3
3(EXP)		82119.8	232905.2	35.3		83087.3	232874	35.7	B31.3
1(OPE)	129	98280.5	0	0	130	99177.7	0	0	B31.3
2(SUS)		18652.6	63326.2	29.5		18733.4	63326.2	29.6	B31.3
3(EXP)		83087.3	232874	35.7		83685.5	232793.2	35.9	B31.3
1(OPE)	130	99177.7	0	0	139	97462.7	0	0	B31.3
2(SUS)		18733.4	63326.2	29.6		18560.2	63326.2	29.3	B31.3
3(EXP)		83685.5	232793.2	35.9		81998	232966.4	35.2	B31.3
1(OPE)	139	97462.7	0	0	140	89538.3	0	0	B31.3
2(SUS)		18560.2	63326.2	29.3		18291.5	63326.2	28.9	B31.3
3(EXP)		81998	232966.4	35.2		73241.8	233235.1	31.4	B31.3
1(OPE)	140	89538.3	0	0	150	65934.6	0	0	B31.3
2(SUS)		18291.5	63326.2	28.9		43871.5	63326.2	69.3	B31.3
3(EXP)		73241.8	233235.1	31.4		41622.6	207655.2	20	B31.3
1(OPE)	150	66293	0	0	158	136648.8	0	0	B31.3
2(SUS)		43853.5	63326.2	69.3		20002.6	63326.2	31.6	B31.3
3(EXP)		41622.6	207673.1	20		119526.4	231524	51.6	B31.3
1(OPE)	158	136648.8	0	0	159	144054.2	0	0	B31.3
2(SUS)		20002.6	63326.2	31.6		18022.9	63326.2	28.5	B31.3
3(EXP)		119526.4	231524	51.6		128148.3	233503.7	54.9	B31.3
1(OPE)	159	144054.2	0	0	160	147093	0	0	B31.3
2(SUS)		18022.9	63326.2	28.5		19335.9	63326.2	30.5	B31.3
3(EXP)		128148.3	233503.7	54.9		131719.8	232190.7	56.7	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m

1(OPE)	160	147093	0	0	168	147093.1	0	0	B31.3
2(SUS)		19335.9	63326.2	30.5		19335.9	63326.2	30.5	B31.3
3(EXP)		131719.8	232190.7	56.7		131719.9	232190.7	56.7	B31.3
1(OPE)	168	147093.1	0	0	169	144054.2	0	0	B31.3
2(SUS)		19335.9	63326.2	30.5		18022.9	63326.2	28.5	B31.3
3(EXP)		131719.9	232190.7	56.7		128148.3	233503.7	54.9	B31.3
1(OPE)	169	144054.2	0	0	170	136648.8	0	0	B31.3
2(SUS)		18022.9	63326.2	28.5		20002.6	63326.2	31.6	B31.3
3(EXP)		128148.3	233503.7	54.9		119526.5	231524	51.6	B31.3
1(OPE)	170	136648.8	0	0	180	66293	0	0	B31.3
2(SUS)		20002.6	63326.2	31.6		43853.6	63326.2	69.3	B31.3
3(EXP)		119526.5	231524	51.6		41622.6	207673.1	20	B31.3
1(OPE)	180	65934.6	0	0	188	89538.3	0	0	B31.3
2(SUS)		43871.5	63326.2	69.3		18291.5	63326.2	28.9	B31.3
3(EXP)		41622.6	207655.2	20		73241.8	233235.1	31.4	B31.3
1(OPE)	188	89538.3	0	0	189	97462.7	0	0	B31.3
2(SUS)		18291.5	63326.2	28.9		18560.2	63326.2	29.3	B31.3
3(EXP)		73241.8	233235.1	31.4		81998	232966.4	35.2	B31.3
1(OPE)	189	97462.7	0	0	190	99886.2	0	0	B31.3
2(SUS)		18560.2	63326.2	29.3		18704.2	63326.2	29.5	B31.3
3(EXP)		81998	232966.4	35.2		84488.9	232822.4	36.3	B31.3
1(OPE)	190	99886.2	0	0	199	98280.5	0	0	B31.3
2(SUS)		18704.2	63326.2	29.5		18652.6	63326.2	29.5	B31.3
3(EXP)		84488.9	232822.4	36.3		83087.3	232874	35.7	B31.3
1(OPE)	199	98280.5	0	0	200	97270.9	0	0	B31.3
2(SUS)		18652.6	63326.2	29.5		18621.5	63326.2	29.4	B31.3
3(EXP)		83087.3	232874	35.7		82119.8	232905.1	35.3	B31.3
1(OPE)	200	97270.9	0	0	210	74458.2	0	0	B31.3
2(SUS)		18621.5	63326.2	29.4		26263.6	63326.2	41.5	B31.3
3(EXP)		82119.8	232905.1	35.3		58833.7	225263	26.1	B31.3
1(OPE)	210	74227.5	0	0	220	31725.8	0	0	B31.3
2(SUS)		26262.8	63326.2	41.5		25557	63326.2	40.4	B31.3
3(EXP)		58833.7	225263.9	26.1		13942.2	225969.7	6.2	B31.3
1(OPE)	220	31466.9	0	0	230	41712.8	0	0	B31.3
2(SUS)		25556.6	63326.2	40.4		25775.2	63326.2	40.7	B31.3
3(EXP)		13942.2	225970	6.2		26175.5	225751.4	11.6	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m
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CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	13402	-15085	92984	-19999	-75113	3854	0	0	0
	2(SUS)	-108	-16138	-90	-22966	297	-2134	0	0	0
	3(EXP)	13510	1053	93074	2966	-75410	5988	0	0	0
	MAX	13510/L3	-16138/L	93074/L3	-22966/L	-75410/L	5988/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	2154	-36074	-10606	0	0	0	12.451	0	-61.317
	2(SUS)	453	-31829	-15	0	0	0	0.003	0	0
	3(EXP)	1701	-4244	-10590	0	0	0	12.448	0	-61.317
	MAX	2154/L1	-36074/L	-10606/L1				12.451/L	-0.000/L1	-61.317/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-864	-30901	-9459	0	0	0	-3	0	-122.644
	2(SUS)	-1064	-30619	-34	0	0	0	-0.006	0	0
	3(EXP)	200	-282	-9425	0	0	0	-2.994	0	-122.644
	MAX	-1064/L2	-30901/L	-9459/L1				-3.000/L1	-0.000/L1	-122.644/L1
45		Rigid +Y								
	1(OPE)	-12934	-47699	-6121	0	0	0	-102.079	0	-48.31
	2(SUS)	719	-51173	-80	0	0	0	0.004	0	0
	3(EXP)	-13653	3473	-6041	0	0	0	-102.083	0	-48.31
	MAX	-13653/L	-51173/L	-6121/L1				-102.083/L	-0.000/L2	-48.310/L1
65		Rigid +Y								
	1(OPE)	-12934	-47699	6121	0	0	0	-102.079	0	48.31
	2(SUS)	719	-51173	80	0	0	0	0.004	0	0
	3(EXP)	-13653	3473	6041	0	0	0	-102.083	0	48.31
	MAX	-13653/L	-51173/L	6121/L1				-102.083/L	-0.000/L2	48.310/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-864	-30901	9459	0	0	0	-3	0	122.644
	2(SUS)	-1064	-30619	34	0	0	0	-0.006	0	0
	3(EXP)	200	-282	9425	0	0	0	-2.994	0	122.644
	MAX	-1064/L2	-30901/L	9459/L1				-3.000/L1	-0.000/L1	122.644/L1
90		Rigid +Y								
	1(OPE)	2154	-36073	10606	0	0	0	12.451	0	61.317
	2(SUS)	453	-31829	15	0	0	0	0.003	0	0
	3(EXP)	1701	-4244	10590	0	0	0	12.448	0	61.317
	MAX	2154/L1	-36073/L	10606/L1				12.451/L	-0.000/L1	61.317/L1
100		Rigid ANC								
	1(OPE)	26804	-30171	0	0	0	7709	0	0	0
	2(SUS)	-216	-32276	0	0	0	-4268	0	0	0
	3(EXP)	27020	2105	0	0	0	11976	0	0	0
	MAX	27020/L3	-32276/L	0/L3	0/L1	-0/L1	11976/L3	0.000/L3	-0.000/L2	0.000/L3

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m

110		Rigid +Y								
	1(OPE)	2154	-36074	-10606	0	0	0	12.451	0	-61.317
	2(SUS)	453	-31829	-15	0	0	0	0.003	0	0
	3(EXP)	1701	-4244	-10590	0	0	0	12.448	0	-61.317
	MAX	2154/L1	-36074/L	-10606/L1				12.451/L	-0.000/L1	-61.317/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-864	-30901	-9459	0	0	0	-3	0	-122.644
	2(SUS)	-1064	-30619	-34	0	0	0	-0.006	0	0
	3(EXP)	200	-282	-9425	0	0	0	-2.994	0	-122.644
	MAX	-1064/L2	-30901/L	-9459/L1				-3.000/L1	-0.000/L1	-122.644/L1
150		Rigid +Y								
	1(OPE)	-12934	-47699	-6121	0	0	0	-102.079	0	-48.31
	2(SUS)	719	-51173	-80	0	0	0	0.004	0	0
	3(EXP)	-13653	3473	-6041	0	0	0	-102.083	0	-48.31
	MAX	-13653/L	-51173/L	-6121/L1				-102.083/I	-0.000/L2	-48.310/L1
180		Rigid +Y								
	1(OPE)	-12934	-47699	6121	0	0	0	-102.079	0	48.31
	2(SUS)	719	-51173	80	0	0	0	0.004	0	0
	3(EXP)	-13653	3473	6041	0	0	0	-102.083	0	48.31
	MAX	-13653/L	-51173/L	6121/L1				-102.083/I	-0.000/L2	48.310/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-864	-30901	9459	0	0	0	-3	0	122.644
	2(SUS)	-1064	-30619	34	0	0	0	-0.006	0	0
	3(EXP)	200	-282	9425	0	0	0	-2.994	0	122.644
	MAX	-1064/L2	-30901/L	9459/L1				-3.000/L1	-0.000/L1	122.644/L1
220		Rigid +Y								
	1(OPE)	2154	-36074	10606	0	0	0	12.451	0	61.317
	2(SUS)	453	-31829	15	0	0	0	0.003	0	0
	3(EXP)	1701	-4244	10590	0	0	0	12.448	0	61.317
	MAX	2154/L1	-36074/L	10606/L1				12.451/L	-0.000/L1	61.317/L1
230		Rigid ANC								
	1(OPE)	13402	-15085	-92984	20000	75113	3854	0	0	0
	2(SUS)	-108	-16138	90	22966	-297	-2134	0	0	0
	3(EXP)	13510	1053	-93074	-2966	75410	5988	0	0	0
	MAX	13510/L3	-16138/L	-93074/L	22966/L3	75410/L3	5988/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	12.448	0	-61.317	-0.0068	-0.0809	0.0348
20	-2.994	0	-122.644	0.0273	0.387	0.0696
28	-47.97	4.237	-153.522	0.092	0.8434	0.0871
29	-51.119	4.871	-154.926	0.0991	0.8903	0.0905
30	-54.061	6.018	-155.966	0.1052	0.9342	0.098
38	-58.037	7.992	-157.119	0.1082	0.9789	0.0941
39	-64.387	10.154	-155.694	0.1146	1.0654	0.1105
40	-69.447	10.415	-148.932	0.1162	1.1531	0.1194
45	-102.083	0	-48.31	0.0687	1.2622	0.1382
48	-126.752	-8.236	16.57	0.0327	0.8426	0.1382
49	-131.522	-9.066	20.56	0.028	0.6985	0.1388
50	-136.729	-9.28	19.605	0.0221	0.5468	0.1393
59	-131.522	-9.066	-20.56	-0.028	-0.6985	0.1388
60	-126.752	-8.236	-16.57	-0.0327	-0.8426	0.1382
65	-102.083	0	48.31	-0.0687	-1.2622	0.1382
68	-69.447	10.415	148.932	-0.1162	-1.1531	0.1194
69	-64.387	10.154	155.694	-0.1146	-1.0654	0.1105
70	-58.037	7.992	157.119	-0.1082	-0.9789	0.0941
78	-54.061	6.018	155.966	-0.1052	-0.9342	0.098
79	-51.119	4.871	154.926	-0.0991	-0.8903	0.0905
80	-47.97	4.237	153.522	-0.092	-0.8434	0.0871
85	-2.994	0	122.644	-0.0273	-0.387	0.0696
90	12.448	0	61.317	0.0068	0.0809	0.0348
100	0	0	0	0	0	0
110	12.448	0	-61.317	-0.0068	-0.0809	0.0348
120	-2.994	0	-122.644	0.0273	0.387	0.0696
128	-47.97	4.237	-153.522	0.092	0.8434	0.0871
129	-51.119	4.871	-154.926	0.0991	0.8903	0.0905
130	-54.061	6.018	-155.966	0.1052	0.9342	0.098
139	-64.387	10.154	-155.694	0.1146	1.0654	0.1105
140	-69.447	10.415	-148.932	0.1162	1.1531	0.1194
150	-102.083	0	-48.31	0.0687	1.2622	0.1382
158	-126.752	-8.236	16.57	0.0327	0.8426	0.1382
159	-131.522	-9.066	20.56	0.028	0.6985	0.1388
160	-136.729	-9.28	19.605	0.0221	0.5468	0.1393
168	-136.729	-9.28	-19.605	-0.0221	-0.5468	0.1393
169	-131.522	-9.066	-20.56	-0.028	-0.6985	0.1388
170	-126.752	-8.236	-16.57	-0.0327	-0.8426	0.1382
180	-102.083	0	48.31	-0.0687	-1.2622	0.1382

Possible Approach:
Location of Pipe Support and Anchor Point 8.5m

188	-69.447	10.415	148.932	-0.1162	-1.1531	0.1194
189	-64.387	10.154	155.694	-0.1146	-1.0654	0.1105
190	-58.037	7.992	157.119	-0.1082	-0.9789	0.0941
199	-51.119	4.871	154.926	-0.0991	-0.8903	0.0905
200	-47.97	4.237	153.522	-0.092	-0.8434	0.0871
210	-2.994	0	122.644	-0.0273	-0.387	0.0696
220	12.448	0	61.317	0.0068	0.0809	0.0348
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	0.0005	-0.0007	-0.0124
20	-0.006	0	0	-0.0019	0.0031	-0.0248
28	-0.345	-0.968	0	-0.0135	0.0048	-0.031
29	-0.34	-1.015	-0.01	-0.0131	0.0046	-0.0313
30	-0.29	-1.054	-0.035	-0.0127	0.0044	-0.0317
38	-0.186	-1.101	-0.083	-0.0125	0.0042	-0.0321
39	-0.053	-1.069	-0.13	-0.0125	0.0037	-0.033
40	0.004	-0.874	-0.132	-0.0129	0.0031	-0.0332
45	0.004	0	0	-0.0173	0.0005	0.0414
48	0.004	-5.101	0.002	-0.0206	-0.0002	0.108
49	0.005	-5.878	0.001	-0.021	-0.0002	0.1095
50	0.006	-6.315	0	-0.02	-0.0001	0.1096
59	0.005	-5.878	-0.001	0.021	0.0002	0.1095
60	0.004	-5.101	-0.002	0.0206	0.0002	0.108
65	0.004	0	0	0.0173	-0.0005	0.0414
68	0.004	-0.874	0.132	0.0129	-0.0031	-0.0332
69	-0.053	-1.069	0.13	0.0125	-0.0037	-0.033
70	-0.186	-1.101	0.083	0.0125	-0.0042	-0.0321
78	-0.29	-1.054	0.035	0.0127	-0.0044	-0.0317
79	-0.34	-1.015	0.01	0.0131	-0.0046	-0.0313
80	-0.345	-0.968	0	0.0135	-0.0048	-0.031
85	-0.006	0	0	0.0019	-0.0031	-0.0248
90	0.003	0	0	-0.0005	0.0007	-0.0124
100	0	0	0	0	0	0
110	0.003	0	0	0.0005	-0.0007	-0.0124
120	-0.006	0	0	-0.0019	0.0031	-0.0248
128	-0.345	-0.968	0	-0.0135	0.0048	-0.031
129	-0.34	-1.015	-0.01	-0.0131	0.0046	-0.0313
130	-0.29	-1.054	-0.035	-0.0127	0.0044	-0.0317
139	-0.053	-1.069	-0.13	-0.0125	0.0037	-0.033
140	0.004	-0.874	-0.132	-0.0129	0.0031	-0.0332
150	0.004	0	0	-0.0173	0.0005	0.0414
158	0.004	-5.101	0.002	-0.0206	-0.0002	0.108
159	0.005	-5.878	0.001	-0.021	-0.0002	0.1095
160	0.006	-6.315	0	-0.02	-0.0001	0.1096
168	0.006	-6.315	0	0.02	0.0001	0.1096
169	0.005	-5.878	-0.001	0.021	0.0002	0.1095
170	0.004	-5.101	-0.002	0.0206	0.0002	0.108
180	0.004	0	0	0.0173	-0.0005	0.0414

188	0.004	-0.874	0.132	0.0129	-0.0031	-0.0332
189	-0.053	-1.069	0.13	0.0125	-0.0037	-0.033
190	-0.186	-1.101	0.083	0.0125	-0.0042	-0.0321
199	-0.34	-1.015	0.01	0.0131	-0.0046	-0.0313
200	-0.345	-0.968	0	0.0135	-0.0048	-0.031
210	-0.006	0	0	0.0019	-0.0031	-0.0248
220	0.003	0	0	-0.0005	0.0007	-0.0124
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:8
Job Name: A335 P22_2 EXPANSION LOOP_8.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	12.451	0	-61.317	-0.0063	-0.0816	0.0224
20	-3	0	-122.644	0.0254	0.39	0.0448
28	-48.315	3.268	-153.523	0.0785	0.8482	0.056
29	-51.459	3.856	-154.936	0.086	0.8949	0.0592
30	-54.351	4.964	-156.001	0.0925	0.9386	0.0662
38	-58.223	6.891	-157.202	0.0956	0.9832	0.062
39	-64.44	9.085	-155.824	0.1021	1.0691	0.0775
40	-69.442	9.541	-149.064	0.1034	1.1562	0.0863
45	-102.079	0	-48.31	0.0514	1.2627	0.1796
48	-126.748	-13.336	16.572	0.0121	0.8424	0.2461
49	-131.517	-14.943	20.56	0.007	0.6983	0.2483
50	-136.723	-15.595	19.605	0.0021	0.5467	0.249
59	-131.517	-14.943	-20.56	-0.007	-0.6983	0.2483
60	-126.748	-13.336	-16.572	-0.0121	-0.8424	0.2461
65	-102.079	0	48.31	-0.0514	-1.2627	0.1796
68	-69.442	9.541	149.064	-0.1034	-1.1562	0.0863
69	-64.44	9.085	155.824	-0.1021	-1.0691	0.0775
70	-58.223	6.891	157.202	-0.0956	-0.9832	0.062
78	-54.351	4.964	156.001	-0.0925	-0.9386	0.0662
79	-51.459	3.856	154.936	-0.086	-0.8949	0.0592
80	-48.315	3.268	153.523	-0.0785	-0.8482	0.056
85	-3	0	122.644	-0.0254	-0.39	0.0448
90	12.451	0	61.317	0.0063	0.0816	0.0224
100	0	0	0	0	0	0
110	12.451	0	-61.317	-0.0063	-0.0816	0.0224
120	-3	0	-122.644	0.0254	0.39	0.0448
128	-48.315	3.268	-153.523	0.0785	0.8482	0.056
129	-51.459	3.856	-154.936	0.086	0.8949	0.0592
130	-54.351	4.964	-156.001	0.0925	0.9386	0.0662
139	-64.44	9.085	-155.824	0.1021	1.0691	0.0775
140	-69.442	9.541	-149.064	0.1034	1.1562	0.0863
150	-102.079	0	-48.31	0.0514	1.2627	0.1796
158	-126.748	-13.336	16.572	0.0121	0.8424	0.2461
159	-131.517	-14.943	20.56	0.007	0.6983	0.2483
160	-136.723	-15.595	19.605	0.0021	0.5467	0.249
168	-136.723	-15.595	-19.605	-0.0021	-0.5467	0.249
169	-131.517	-14.943	-20.56	-0.007	-0.6983	0.2483
170	-126.748	-13.336	-16.572	-0.0121	-0.8424	0.2461
180	-102.079	0	48.31	-0.0514	-1.2627	0.1796

188	-69.442	9.541	149.064	-0.1034	-1.1562	0.0863
189	-64.44	9.085	155.824	-0.1021	-1.0691	0.0775
190	-58.223	6.891	157.202	-0.0956	-0.9832	0.062
199	-51.459	3.856	154.936	-0.086	-0.8949	0.0592
200	-48.315	3.268	153.523	-0.0785	-0.8482	0.056
210	-3	0	122.644	-0.0254	-0.39	0.0448
220	12.451	0	61.317	0.0063	0.0816	0.0224
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -9,000.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -9,000.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -5,000.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
-------------------------------------------------------------------------------
From  80  To  85 DZ= -5,000.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
-------------------------------------------------------------------------------
From  85  To  90 DZ= -9,000.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
-------------------------------------------------------------------------------
From  90  To  100 DZ= -9,000.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -9,000.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -9,000.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -5,000.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -5,000.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -9,000.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -9,000.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Location of Pipe Support and Anchor Point 9.0m

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	Len GAP	MU YIELD	Dir FORCE	Vectors
10	ANC			.30	.000	.000 .000
15	+Y			.30	.000	1.000 .000
20	Guide		3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000 .000
45	+Y			.30	.000	1.000 .000
65	+Y			.30	.000	1.000 .000
85	Guide		3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000 .000
90	+Y			.30	.000	1.000 .000
100	ANC			.30	.000	.000 .000
110	+Y			.30	.000	1.000 .000
120	+Y			.30	.000	1.000 .000
120	Guide		3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000 .000
180	+Y			.30	.000	1.000 .000
210	+Y			.30	.000	1.000 .000
210	Guide		3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000 .000
230	ANC			.30	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Location of Pipe Support and Anchor Point 9.0m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Location of Pipe Support and Anchor Point 9.0m

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-9000.000
20	.000	.000	-18000.000
30	.000	.000	-23000.000
40	.000	750.000	-23750.000
45	-5052.000	750.000	-23750.000
50	-9000.000	750.000	-23750.000
60	-9000.000	750.000	-30250.000
65	-5052.000	750.000	-30250.000
70	.000	750.000	-30250.000
80	.000	.000	-31000.000
85	.000	.000	-36000.000
90	.000	.000	-45000.000
100	.000	.000	-54000.000
110	.000	.000	-63000.000
120	.000	.000	-72000.000
130	.000	.000	-77000.000
140	.000	750.000	-77750.000
150	-5052.000	750.000	-77750.000
160	-9000.000	750.000	-77750.000
170	-9000.000	750.000	-84250.000
180	-5052.000	750.000	-84250.000
190	.000	750.000	-84250.000
200	.000	.000	-85000.000
210	.000	.000	-90000.000
220	.000	.000	-99000.000
230	.000	.000	-108000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43871.6 Allowable Stress: 63326.2
Axial Stress: 17784.0 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 138963.2 @Node 160 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 29275.1 @Node 38 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 160704.1 @Node 160 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	41884	0	0	15	31138.1	0	0	B31.3
2(SUS)		26907	63326.2	42.5		26202.4	63326.2	41.4	B31.3
3(EXP)		26146.3	224619.7	11.6		13280.2	225324.3	5.9	B31.3
1(OPE)	15	31402.8	0	0	20	73810.6	0	0	B31.3
2(SUS)		26202.3	63326.2	41.4		28378.9	63326.2	44.8	B31.3
3(EXP)		13280.2	225324.4	5.9		58306.6	223147.8	26.1	B31.3
1(OPE)	20	74062.8	0	0	28	99332.6	0	0	B31.3
2(SUS)		28378.6	63326.2	44.8		19014.7	63326.2	30	B31.3
3(EXP)		58306.6	223148	26.1		84148.3	232512	36.2	B31.3
1(OPE)	28	99332.6	0	0	29	100332	0	0	B31.3
2(SUS)		19014.7	63326.2	30		19003.3	63326.2	30	B31.3
3(EXP)		84148.3	232512	36.2		85103	232523.3	36.6	B31.3
1(OPE)	29	100332	0	0	30	101212.1	0	0	B31.3
2(SUS)		19003.3	63326.2	30		19051.8	63326.2	30.1	B31.3
3(EXP)		85103	232523.3	36.6		85681.7	232474.9	36.9	B31.3
1(OPE)	30	101212.1	0	0	38	101876.5	0	0	B31.3
2(SUS)		19051.8	63326.2	30.1		18930.4	63326.2	29.9	B31.3
3(EXP)		85681.7	232474.9	36.9		86465.6	232596.2	37.2	B31.3
1(OPE)	38	101876.5	0	0	39	99282.7	0	0	B31.3
2(SUS)		18930.4	63326.2	29.9		18659.7	63326.2	29.5	B31.3
3(EXP)		86465.6	232596.2	37.2		83825	232867	36	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.0m

1(OPE)	39	99282.7	0	0	40	91006.3	0	0	B31.3
2(SUS)		18659.7	63326.2	29.5		18198.2	63326.2	28.7	B31.3
3(EXP)		83825	232867	36		74718.9	233328.4	32	B31.3
1(OPE)	40	91006.3	0	0	45	68614.6	0	0	B31.3
2(SUS)		18198.2	63326.2	28.7		43871.6	63326.2	69.3	B31.3
3(EXP)		74718.9	233328.4	32		44522.9	207655	21.4	B31.3
1(OPE)	45	68971.8	0	0	48	143296	0	0	B31.3
2(SUS)		43855	63326.2	69.3		19997.1	63326.2	31.6	B31.3
3(EXP)		44522.9	207671.6	21.4		126181.9	231529.6	54.5	B31.3
1(OPE)	48	143296	0	0	49	151041.3	0	0	B31.3
2(SUS)		19997.1	63326.2	31.6		17811.5	63326.2	28.1	B31.3
3(EXP)		126181.9	231529.6	54.5		135219.4	233715.2	57.9	B31.3
1(OPE)	49	151041.3	0	0	50	154222.1	0	0	B31.3
2(SUS)		17811.5	63326.2	28.1		19673.4	63326.2	31.1	B31.3
3(EXP)		135219.4	233715.2	57.9		138963.2	231853.3	59.9	B31.3
1(OPE)	50	154222.1	0	0	59	151041.3	0	0	B31.3
2(SUS)		19673.4	63326.2	31.1		17811.5	63326.2	28.1	B31.3
3(EXP)		138963.2	231853.3	59.9		135219.4	233715.2	57.9	B31.3
1(OPE)	59	151041.3	0	0	60	143296	0	0	B31.3
2(SUS)		17811.5	63326.2	28.1		19997.1	63326.2	31.6	B31.3
3(EXP)		135219.4	233715.2	57.9		126181.9	231529.6	54.5	B31.3
1(OPE)	60	143296	0	0	65	68971.8	0	0	B31.3
2(SUS)		19997.1	63326.2	31.6		43855	63326.2	69.3	B31.3
3(EXP)		126181.9	231529.6	54.5		44522.9	207671.6	21.4	B31.3
1(OPE)	65	68614.6	0	0	68	91006.3	0	0	B31.3
2(SUS)		43871.6	63326.2	69.3		18198.2	63326.2	28.7	B31.3
3(EXP)		44522.9	207655	21.4		74718.9	233328.4	32	B31.3
1(OPE)	68	91006.3	0	0	69	99282.7	0	0	B31.3
2(SUS)		18198.2	63326.2	28.7		18659.7	63326.2	29.5	B31.3
3(EXP)		74718.9	233328.4	32		83825	232867	36	B31.3
1(OPE)	69	99282.7	0	0	70	101876.5	0	0	B31.3
2(SUS)		18659.7	63326.2	29.5		18930.4	63326.2	29.9	B31.3
3(EXP)		83825	232867	36		86465.6	232596.2	37.2	B31.3
1(OPE)	70	101876.5	0	0	78	101212.1	0	0	B31.3
2(SUS)		18930.4	63326.2	29.9		19051.8	63326.2	30.1	B31.3
3(EXP)		86465.6	232596.2	37.2		85681.7	232474.9	36.9	B31.3
1(OPE)	78	101212.1	0	0	79	100332	0	0	B31.3
2(SUS)		19051.8	63326.2	30.1		19003.3	63326.2	30	B31.3
3(EXP)		85681.7	232474.9	36.9		85103	232523.3	36.6	B31.3
1(OPE)	79	100332	0	0	80	99332.6	0	0	B31.3
2(SUS)		19003.3	63326.2	30		19014.7	63326.2	30	B31.3
3(EXP)		85103	232523.3	36.6		84148.3	232512	36.2	B31.3

Possible Approach:

Location of Pipe Support and Anchor Point 9.0m

1(OPE)	80	99332.6	0	0	85	74062.8	0	0	B31.3
2(SUS)		19014.7	63326.2	30		28378.6	63326.2	44.8	B31.3
3(EXP)		84148.3	232512	36.2		58306.6	223148	26.1	B31.3
1(OPE)	85	73810.6	0	0	90	31402.8	0	0	B31.3
2(SUS)		28378.9	63326.2	44.8		26202.3	63326.2	41.4	B31.3
3(EXP)		58306.6	223147.8	26.1		13280.1	225324.4	5.9	B31.3
1(OPE)	90	31138.1	0	0	100	41884.1	0	0	B31.3
2(SUS)		26202.4	63326.2	41.4		26907.1	63326.2	42.5	B31.3
3(EXP)		13280.1	225324.3	5.9		26146.4	224619.6	11.6	B31.3
1(OPE)	100	41884.1	0	0	110	31138.1	0	0	B31.3
2(SUS)		26907.1	63326.2	42.5		26202.4	63326.2	41.4	B31.3
3(EXP)		26146.4	224619.6	11.6		13280.1	225324.3	5.9	B31.3
1(OPE)	110	31402.8	0	0	120	73810.6	0	0	B31.3
2(SUS)		26202.3	63326.2	41.4		28378.9	63326.2	44.8	B31.3
3(EXP)		13280.1	225324.4	5.9		58306.6	223147.8	26.1	B31.3
1(OPE)	120	74062.8	0	0	128	99332.6	0	0	B31.3
2(SUS)		28378.6	63326.2	44.8		19014.7	63326.2	30	B31.3
3(EXP)		58306.6	223148	26.1		84148.3	232512	36.2	B31.3
1(OPE)	128	99332.6	0	0	129	100332	0	0	B31.3
2(SUS)		19014.7	63326.2	30		19003.3	63326.2	30	B31.3
3(EXP)		84148.3	232512	36.2		85103	232523.3	36.6	B31.3
1(OPE)	129	100332	0	0	130	101212.1	0	0	B31.3
2(SUS)		19003.3	63326.2	30		19051.8	63326.2	30.1	B31.3
3(EXP)		85103	232523.3	36.6		85681.7	232474.9	36.9	B31.3
1(OPE)	130	101212.1	0	0	139	99282.7	0	0	B31.3
2(SUS)		19051.8	63326.2	30.1		18659.7	63326.2	29.5	B31.3
3(EXP)		85681.7	232474.9	36.9		83825	232867	36	B31.3
1(OPE)	139	99282.7	0	0	140	91006.3	0	0	B31.3
2(SUS)		18659.7	63326.2	29.5		18198.2	63326.2	28.7	B31.3
3(EXP)		83825	232867	36		74718.9	233328.4	32	B31.3
1(OPE)	140	91006.3	0	0	150	68614.6	0	0	B31.3
2(SUS)		18198.2	63326.2	28.7		43871.6	63326.2	69.3	B31.3
3(EXP)		74718.9	233328.4	32		44522.9	207655	21.4	B31.3
1(OPE)	150	68971.8	0	0	158	143296	0	0	B31.3
2(SUS)		43855	63326.2	69.3		19997.1	63326.2	31.6	B31.3
3(EXP)		44522.9	207671.6	21.4		126181.9	231529.6	54.5	B31.3
1(OPE)	158	143296	0	0	159	151041.4	0	0	B31.3
2(SUS)		19997.1	63326.2	31.6		17811.5	63326.2	28.1	B31.3
3(EXP)		126181.9	231529.6	54.5		135219.4	233715.2	57.9	B31.3
1(OPE)	159	151041.4	0	0	160	154222.1	0	0	B31.3
2(SUS)		17811.5	63326.2	28.1		19673.4	63326.2	31.1	B31.3
3(EXP)		135219.4	233715.2	57.9		138963.2	231853.3	59.9	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.0m
Page 11 of 20

1(OPE)	160	154222.1	0	0	168	154222.1	0	0	B31.3
2(SUS)		19673.4	63326.2	31.1		19673.4	63326.2	31.1	B31.3
3(EXP)		138963.2	231853.3	59.9		138963.2	231853.3	59.9	B31.3
1(OPE)	168	154222.1	0	0	169	151041.4	0	0	B31.3
2(SUS)		19673.4	63326.2	31.1		17811.5	63326.2	28.1	B31.3
3(EXP)		138963.2	231853.3	59.9		135219.4	233715.2	57.9	B31.3
1(OPE)	169	151041.4	0	0	170	143296	0	0	B31.3
2(SUS)		17811.5	63326.2	28.1		19997.1	63326.2	31.6	B31.3
3(EXP)		135219.4	233715.2	57.9		126181.9	231529.6	54.5	B31.3
1(OPE)	170	143296	0	0	180	68971.8	0	0	B31.3
2(SUS)		19997.1	63326.2	31.6		43855	63326.2	69.3	B31.3
3(EXP)		126181.9	231529.6	54.5		44522.9	207671.7	21.4	B31.3
1(OPE)	180	68614.6	0	0	188	91006.3	0	0	B31.3
2(SUS)		43871.6	63326.2	69.3		18198.2	63326.2	28.7	B31.3
3(EXP)		44522.9	207655	21.4		74718.9	233328.4	32	B31.3
1(OPE)	188	91006.3	0	0	189	99282.7	0	0	B31.3
2(SUS)		18198.2	63326.2	28.7		18659.7	63326.2	29.5	B31.3
3(EXP)		74718.9	233328.4	32		83825	232867	36	B31.3
1(OPE)	189	99282.7	0	0	190	101876.6	0	0	B31.3
2(SUS)		18659.7	63326.2	29.5		18930.4	63326.2	29.9	B31.3
3(EXP)		83825	232867	36		86465.6	232596.2	37.2	B31.3
1(OPE)	190	101876.6	0	0	199	100332	0	0	B31.3
2(SUS)		18930.4	63326.2	29.9		19003.3	63326.2	30	B31.3
3(EXP)		86465.6	232596.2	37.2		85103	232523.3	36.6	B31.3
1(OPE)	199	100332	0	0	200	99332.6	0	0	B31.3
2(SUS)		19003.3	63326.2	30		19014.7	63326.2	30	B31.3
3(EXP)		85103	232523.3	36.6		84148.3	232512	36.2	B31.3
1(OPE)	200	99332.6	0	0	210	74062.8	0	0	B31.3
2(SUS)		19014.7	63326.2	30		28378.6	63326.2	44.8	B31.3
3(EXP)		84148.3	232512	36.2		58306.6	223148.1	26.1	B31.3
1(OPE)	210	73810.7	0	0	220	31402.9	0	0	B31.3
2(SUS)		28378.9	63326.2	44.8		26202.3	63326.2	41.4	B31.3
3(EXP)		58306.6	223147.8	26.1		13280.2	225324.4	5.9	B31.3
1(OPE)	220	31138.1	0	0	230	41884	0	0	B31.3
2(SUS)		26202.4	63326.2	41.4		26907	63326.2	42.5	B31.3
3(EXP)		13280.2	225324.3	5.9		26146.3	224619.7	11.6	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	12417	-16280	97055	-23338	-74979	3577	0	0	0
	2(SUS)	-114	-17233	28	-26182	333	-2640	0	0	0
	3(EXP)	12531	953	97028	2844	-75311	6218	0	0	0
	MAX	12531/L	-17233/L	97055/L	-26182/L	-75311/L	6218/L3	0.000/L3	-0.000/L2	0.000/L1
15	Rigid +Y									
	1(OPE)	2364	-36953	-10831	0	0	0	14.169	0	-64.92
	2(SUS)	474	-33116	5	0	0	0	0.003	0	0
	3(EXP)	1890	-3838	-10836	0	0	0	14.166	0	-64.92
	MAX	2364/L1	-36953/L	-10836/L3				14.169/L	-0.000/L1	-64.920/L3
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-143	-34433	-10329	0	0	0	-1.799	0	-129.851
	2(SUS)	-1027	-33815	11	0	0	0	-0.006	0	0
	3(EXP)	884	-619	-10340	0	0	0	-1.794	0	-129.851
	MAX	-1027/L2	-34433/L	-10340/L3				-1.799/L1	-0.000/L1	-129.851/L3
45	Rigid +Y									
	1(OPE)	-12952	-47762	-6128	0	0	0	-110.547	0	-52.302
	2(SUS)	667	-51265	-475	0	0	0	0.004	0	-0.003
	3(EXP)	-13620	3504	-5653	0	0	0	-110.551	0	-52.299
	MAX	-13620/L	-51265/L	-6128/L1				-110.551/L	-0.000/L2	-52.302/L1
65	Rigid +Y									
	1(OPE)	-12952	-47762	6128	0	0	0	-110.547	0	52.302
	2(SUS)	667	-51265	475	0	0	0	0.004	0	0.003
	3(EXP)	-13620	3504	5653	0	0	0	-110.551	0	52.299
	MAX	-13620/L	-51265/L	6128/L1				-110.551/L	-0.000/L2	52.302/L1
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-143	-34433	10329	0	0	0	-1.799	0	129.851
	2(SUS)	-1027	-33815	-11	0	0	0	-0.006	0	0
	3(EXP)	884	-619	10340	0	0	0	-1.794	0	129.851
	MAX	-1027/L2	-34433/L	10340/L3				-1.799/L1	-0.000/L1	129.851/L3
90	Rigid +Y									
	1(OPE)	2364	-36953	10831	0	0	0	14.169	0	64.92
	2(SUS)	474	-33116	-5	0	0	0	0.003	0	0
	3(EXP)	1890	-3838	10836	0	0	0	14.166	0	64.92
	MAX	2364/L1	-36953/L	10836/L3				14.169/L	-0.000/L1	64.920/L3
100	Rigid ANC									
	1(OPE)	24834	-32561	0	0	0	7155	0	0	0
	2(SUS)	-228	-34466	0	0	0	-5281	0	0	0
	3(EXP)	25062	1905	0	0	0	12435	0	0	0
	MAX	25062/L	-34466/L	0/L3	-0/L2	-0/L3	12435/L	0.000/L3	-0.000/L2	0.000/L3

110		Rigid +Y								
	1(OPE)	2364	-36953	-10831	0	0	0	14.169	0	-64.92
	2(SUS)	474	-33116	5	0	0	0	0.003	0	0
	3(EXP)	1890	-3838	-10836	0	0	0	14.166	0	-64.92
	MAX	2364/L1	-36953/L	-10836/L3				14.169/L	-0.000/L1	-64.920/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-143	-34433	-10329	0	0	0	-1.799	0	-129.851
	2(SUS)	-1027	-33815	11	0	0	0	-0.006	0	0
	3(EXP)	884	-619	-10340	0	0	0	-1.794	0	-129.851
	MAX	-1027/L2	-34433/L	-10340/L3				-1.799/L1	-0.000/L1	-129.851/L3
150		Rigid +Y								
	1(OPE)	-12952	-47762	-6128	0	0	0	-110.547	0	-52.302
	2(SUS)	667	-51265	-475	0	0	0	0.004	0	-0.003
	3(EXP)	-13619	3504	-5653	0	0	0	-110.551	0	-52.299
	MAX	-13619/L	-51265/L	-6128/L1				-110.551/I	-0.000/L2	-52.302/L1
180		Rigid +Y								
	1(OPE)	-12952	-47762	6128	0	0	0	-110.547	0	52.302
	2(SUS)	667	-51265	475	0	0	0	0.004	0	0.003
	3(EXP)	-13620	3504	5653	0	0	0	-110.551	0	52.299
	MAX	-13620/L	-51265/L	6128/L1				-110.551/I	-0.000/L2	52.302/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-143	-34433	10329	0	0	0	-1.799	0	129.851
	2(SUS)	-1027	-33815	-11	0	0	0	-0.006	0	0
	3(EXP)	884	-619	10340	0	0	0	-1.794	0	129.851
	MAX	-1027/L2	-34433/L	10340/L3				-1.799/L1	-0.000/L1	129.851/L3
220		Rigid +Y								
	1(OPE)	2364	-36953	10831	0	0	0	14.169	0	64.92
	2(SUS)	474	-33116	-5	0	0	0	0.003	0	0
	3(EXP)	1890	-3838	10836	0	0	0	14.166	0	64.92
	MAX	2364/L1	-36953/L	10836/L3				14.169/L	-0.000/L1	64.920/L3
230		Rigid ANC								
	1(OPE)	12417	-16280	-97055	23338	74979	3577	0	0	0
	2(SUS)	-114	-17233	-28	26182	-333	-2640	0	0	0
	3(EXP)	12531	953	-97028	-2844	75311	6218	0	0	0
	MAX	12531/L3	-17233/L	-97055/L	26182/L3	75311/L3	6218/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	14.166	0	-64.92	-0.0069	-0.0901	0.0382
20	-1.794	0	-129.851	0.0277	0.3972	0.0765
28	-55.087	5.018	-164.335	0.1	0.9125	0.0968
29	-58.491	5.681	-165.733	0.1073	0.9605	0.1003
30	-61.667	6.853	-166.756	0.1135	1.0055	0.108
38	-65.952	8.859	-167.877	0.1165	1.0513	0.104
39	-72.691	11.032	-166.212	0.1229	1.1397	0.1207
40	-77.914	11.241	-158.938	0.1244	1.2293	0.1298
45	-110.551	0	-52.299	0.0735	1.3335	0.1487
48	-135.22	-8.863	16.191	0.035	0.889	0.1487
49	-140.102	-9.757	20.462	0.03	0.7369	0.1493
50	-145.533	-9.989	19.604	0.0237	0.5769	0.1499
59	-140.102	-9.757	-20.461	-0.03	-0.7369	0.1493
60	-135.22	-8.863	-16.191	-0.035	-0.889	0.1487
65	-110.551	0	52.299	-0.0735	-1.3335	0.1487
68	-77.914	11.241	158.938	-0.1244	-1.2293	0.1298
69	-72.691	11.032	166.212	-0.1229	-1.1397	0.1207
70	-65.952	8.859	167.877	-0.1165	-1.0513	0.104
78	-61.667	6.853	166.756	-0.1135	-1.0055	0.108
79	-58.491	5.681	165.733	-0.1073	-0.9605	0.1003
80	-55.087	5.018	164.335	-0.1	-0.9125	0.0968
85	-1.794	0	129.851	-0.0277	-0.3972	0.0765
90	14.166	0	64.92	0.0069	0.0901	0.0382
100	0	0	0	0	0	0
110	14.166	0	-64.92	-0.0069	-0.0901	0.0382
120	-1.794	0	-129.851	0.0277	0.3972	0.0765
128	-55.087	5.018	-164.335	0.1	0.9125	0.0968
129	-58.491	5.682	-165.733	0.1073	0.9605	0.1003
130	-61.667	6.853	-166.756	0.1135	1.0055	0.108
139	-72.691	11.032	-166.212	0.1229	1.1397	0.1207
140	-77.914	11.241	-158.938	0.1244	1.2293	0.1298
150	-110.551	0	-52.299	0.0735	1.3335	0.1487
158	-135.22	-8.863	16.191	0.035	0.889	0.1487
159	-140.102	-9.757	20.461	0.03	0.7369	0.1493
160	-145.533	-9.989	19.604	0.0237	0.5769	0.1499
168	-145.533	-9.989	-19.604	-0.0237	-0.5769	0.1499
169	-140.102	-9.757	-20.462	-0.03	-0.7369	0.1493
170	-135.22	-8.863	-16.191	-0.035	-0.889	0.1487
180	-110.551	0	52.299	-0.0735	-1.3335	0.1487

188	-77.914	11.241	158.938	-0.1244	-1.2293	0.1298
189	-72.691	11.032	166.212	-0.1229	-1.1397	0.1207
190	-65.952	8.859	167.877	-0.1165	-1.0513	0.104
199	-58.491	5.681	165.733	-0.1073	-0.9605	0.1003
200	-55.087	5.018	164.335	-0.1	-0.9125	0.0968
210	-1.794	0	129.851	-0.0277	-0.3972	0.0765
220	14.166	0	64.92	0.0069	0.0901	0.0382
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	0.0016	-0.0009	-0.0162
20	-0.006	0	0	-0.0065	0.0036	-0.0325
28	-0.461	-1.803	0	-0.022	0.006	-0.0411
29	-0.452	-1.88	-0.015	-0.0213	0.0058	-0.0415
30	-0.385	-1.943	-0.057	-0.0207	0.0056	-0.0419
38	-0.247	-2.02	-0.135	-0.0203	0.0055	-0.0424
39	-0.071	-1.995	-0.214	-0.0199	0.0049	-0.0435
40	0.004	-1.744	-0.221	-0.02	0.0044	-0.0439
45	0.004	0	-0.003	-0.0215	0.001	0.0302
48	0.004	-4.433	0.003	-0.0227	-0.0004	0.0968
49	0.005	-5.141	0.001	-0.0227	-0.0003	0.0983
50	0.007	-5.558	0	-0.0214	-0.0003	0.0984
59	0.005	-5.141	-0.001	0.0227	0.0003	0.0983
60	0.004	-4.433	-0.003	0.0227	0.0004	0.0968
65	0.004	0	0.003	0.0215	-0.001	0.0302
68	0.004	-1.744	0.221	0.02	-0.0044	-0.0439
69	-0.071	-1.995	0.214	0.0199	-0.0049	-0.0435
70	-0.247	-2.02	0.135	0.0203	-0.0055	-0.0424
78	-0.385	-1.943	0.057	0.0207	-0.0056	-0.0419
79	-0.452	-1.88	0.015	0.0213	-0.0058	-0.0415
80	-0.461	-1.803	0	0.022	-0.006	-0.0411
85	-0.006	0	0	0.0065	-0.0036	-0.0325
90	0.003	0	0	-0.0016	0.0009	-0.0162
100	0	0	0	0	0	0
110	0.003	0	0	0.0016	-0.0009	-0.0162
120	-0.006	0	0	-0.0065	0.0036	-0.0325
128	-0.461	-1.803	0	-0.022	0.006	-0.0411
129	-0.452	-1.88	-0.015	-0.0213	0.0058	-0.0415
130	-0.385	-1.943	-0.057	-0.0207	0.0056	-0.0419
139	-0.071	-1.995	-0.214	-0.0199	0.0049	-0.0435
140	0.004	-1.744	-0.221	-0.02	0.0044	-0.0439
150	0.004	0	-0.003	-0.0215	0.001	0.0302
158	0.004	-4.433	0.003	-0.0227	-0.0004	0.0968
159	0.005	-5.141	0.001	-0.0227	-0.0003	0.0983
160	0.007	-5.558	0	-0.0214	-0.0003	0.0984
168	0.007	-5.558	0	0.0214	0.0003	0.0984
169	0.005	-5.141	-0.001	0.0227	0.0003	0.0983
170	0.004	-4.433	-0.003	0.0227	0.0004	0.0968
180	0.004	0	0.003	0.0215	-0.001	0.0302

188	0.004	-1.744	0.221	0.02	-0.0044	-0.0439
189	-0.071	-1.995	0.214	0.0199	-0.0049	-0.0435
190	-0.247	-2.02	0.135	0.0203	-0.0055	-0.0424
199	-0.452	-1.88	0.015	0.0213	-0.0058	-0.0415
200	-0.461	-1.803	0	0.022	-0.006	-0.0411
210	-0.006	0	0	0.0065	-0.0036	-0.0325
220	0.003	0	0	-0.0016	0.0009	-0.0162
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:18
Job Name: A335 P22_2 EXPANSION LOOP_9M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	14.169	0	-64.92	-0.0053	-0.0909	0.022
20	-1.799	0	-129.851	0.0212	0.4008	0.044
28	-55.548	3.215	-164.335	0.078	0.9185	0.0557
29	-58.943	3.802	-165.749	0.086	0.9663	0.0588
30	-62.052	4.91	-166.813	0.0928	1.0111	0.066
38	-66.199	6.839	-168.012	0.0962	1.0568	0.0615
39	-72.762	9.037	-166.426	0.103	1.1447	0.0773
40	-77.91	9.497	-159.159	0.1044	1.2337	0.0859
45	-110.547	0	-52.302	0.052	1.3345	0.179
48	-135.216	-13.297	16.194	0.0124	0.8887	0.2455
49	-140.097	-14.898	20.463	0.0073	0.7365	0.2476
50	-145.526	-15.547	19.604	0.0023	0.5766	0.2483
59	-140.097	-14.898	-20.463	-0.0073	-0.7365	0.2476
60	-135.216	-13.297	-16.194	-0.0124	-0.8887	0.2455
65	-110.547	0	52.302	-0.052	-1.3345	0.179
68	-77.91	9.497	159.159	-0.1044	-1.2337	0.0859
69	-72.762	9.037	166.426	-0.103	-1.1447	0.0773
70	-66.199	6.839	168.012	-0.0962	-1.0568	0.0615
78	-62.052	4.91	166.813	-0.0928	-1.0111	0.066
79	-58.943	3.802	165.749	-0.086	-0.9663	0.0588
80	-55.548	3.215	164.335	-0.078	-0.9185	0.0557
85	-1.799	0	129.851	-0.0212	-0.4008	0.044
90	14.169	0	64.92	0.0053	0.0909	0.022
100	0	0	0	0	0	0
110	14.169	0	-64.92	-0.0053	-0.0909	0.022
120	-1.799	0	-129.851	0.0212	0.4008	0.044
128	-55.548	3.215	-164.335	0.078	0.9185	0.0557
129	-58.943	3.802	-165.749	0.086	0.9663	0.0588
130	-62.052	4.91	-166.813	0.0928	1.0111	0.066
139	-72.762	9.037	-166.426	0.103	1.1447	0.0773
140	-77.91	9.497	-159.159	0.1044	1.2337	0.0859
150	-110.547	0	-52.302	0.052	1.3345	0.179
158	-135.216	-13.297	16.194	0.0124	0.8887	0.2455
159	-140.097	-14.898	20.463	0.0073	0.7365	0.2476
160	-145.526	-15.547	19.604	0.0023	0.5766	0.2483
168	-145.526	-15.547	-19.605	-0.0023	-0.5766	0.2483
169	-140.097	-14.898	-20.463	-0.0073	-0.7365	0.2476
170	-135.216	-13.297	-16.194	-0.0124	-0.8887	0.2455
180	-110.547	0	52.302	-0.052	-1.3345	0.179

Possible Approach:
Location of Pipe Support and Anchor Point 9.0m

188	-77.91	9.497	159.159	-0.1044	-1.2337	0.0859
189	-72.762	9.037	166.426	-0.103	-1.1447	0.0773
190	-66.199	6.839	168.012	-0.0962	-1.0568	0.0615
199	-58.943	3.802	165.749	-0.086	-0.9663	0.0588
200	-55.548	3.215	164.335	-0.078	-0.9185	0.0557
210	-1.799	0	129.851	-0.0212	-0.4008	0.044
220	14.169	0	64.92	0.0053	0.0909	0.022
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -9,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -9,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -5,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
------------------------------------------------------------------------------
From  80  To  85 DZ= -5,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
------------------------------------------------------------------------------
From  85  To  90 DZ= -9,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
------------------------------------------------------------------------------
From  90  To  100 DZ= -9,500.000 mm.
RESTRAINTS
  Node  100  ANC
------------------------------------------------------------------------------
From  100  To  110 DZ= -9,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -9,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -5,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -5,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -9,500.000 mm.
 RESTRAINTS
```

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -9,500.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                          v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                          App.P Sy/St Switch = ON   Sc= 137,895 KPa
                          Sh1= 63,326 KPa   Sh2= 137,895 KPa
                          Sh3= 137,895 KPa   Sh4= 137,895 KPa
                          Sh5= 137,895 KPa   Sh6= 137,895 KPa
                          Sh7= 137,895 KPa   Sh8= 137,895 KPa
                          Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 29
                          Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 39
                          Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 49
                          Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 69
                          Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 79
                          Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50
                        129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

Location of Pipe Support and Anchor Point 9.5m

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Location of Pipe Support and Anchor Point 9.5m

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 21.1111 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Location of Pipe Support and Anchor Point 9.5m

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-9500.000
20	.000	.000	-19000.000
30	.000	.000	-24500.000
40	.000	750.000	-25250.000
45	-5052.000	750.000	-25250.000
50	-9000.000	750.000	-25250.000
60	-9000.000	750.000	-31750.000
65	-5052.000	750.000	-31750.000
70	.000	750.000	-31750.000
80	.000	.000	-32500.000
85	.000	.000	-38000.000
90	.000	.000	-47500.000
100	.000	.000	-57000.000
110	.000	.000	-66500.000
120	.000	.000	-76000.000
130	.000	.000	-81500.000
140	.000	750.000	-82250.000
150	-5052.000	750.000	-82250.000
160	-9000.000	750.000	-82250.000
170	-9000.000	750.000	-88750.000
180	-5052.000	750.000	-88750.000
190	.000	750.000	-88750.000
200	.000	.000	-89500.000
210	.000	.000	-95000.000
220	.000	.000	-104500.000
230	.000	.000	-114000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43879.1 Allowable Stress: 63326.2
Axial Stress: 17782.8 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 146240.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 30088.4 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 168124.2 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42607.4	0	0	15	30719.7	0	0	B31.3
2(SUS)		28113.2	63326.2	44.4		26874	63326.2	42.4	B31.3
3(EXP)		26640.3	223413.4	11.9		12434.8	224652.6	5.5	B31.3
1(OPE)	15	30990.5	0	0	20	74005.2	0	0	B31.3
2(SUS)		26873.3	63326.2	42.4		30668	63326.2	48.4	B31.3
3(EXP)		12434.8	224653.3	5.5		58261	220858.6	26.4	B31.3
1(OPE)	20	74283.1	0	0	28	101544.3	0	0	B31.3
2(SUS)		30666.5	63326.2	48.4		19493.4	63326.2	30.8	B31.3
3(EXP)		58261	220860.2	26.4		86321.8	232033.3	37.2	B31.3
1(OPE)	28	101544.3	0	0	29	102519	0	0	B31.3
2(SUS)		19493.4	63326.2	30.8		19456.3	63326.2	30.7	B31.3
3(EXP)		86321.8	232033.3	37.2		87252.3	232070.3	37.6	B31.3
1(OPE)	29	102519	0	0	30	103368.1	0	0	B31.3
2(SUS)		19456.3	63326.2	30.7		19487.8	63326.2	30.8	B31.3
3(EXP)		87252.3	232070.3	37.6		87801.9	232038.9	37.8	B31.3
1(OPE)	30	103368.1	0	0	38	103968.4	0	0	B31.3
2(SUS)		19487.8	63326.2	30.8		19301.6	63326.2	30.5	B31.3
3(EXP)		87801.9	232038.9	37.8		88553.9	232225.1	38.1	B31.3
1(OPE)	38	103968.4	0	0	39	101181.1	0	0	B31.3
2(SUS)		19301.6	63326.2	30.5		18948.2	63326.2	29.9	B31.3
3(EXP)		88553.9	232225.1	38.1		85747.3	232578.4	36.9	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m

1(OPE)	39	101181.1	0	0	40	92538.8	0	0	B31.3
2(SUS)		18948.2	63326.2	29.9		18169.7	63326.2	28.7	B31.3
3(EXP)		85747.3	232578.4	36.9		76283.1	233356.9	32.7	B31.3
1(OPE)	40	92538.8	0	0	45	71318.9	0	0	B31.3
2(SUS)		18169.7	63326.2	28.7		43879.1	63326.2	69.3	B31.3
3(EXP)		76283.1	233356.9	32.7		47360.5	207647.6	22.8	B31.3
1(OPE)	45	71670.1	0	0	48	149963.4	0	0	B31.3
2(SUS)		43863	63326.2	69.3		19997.6	63326.2	31.6	B31.3
3(EXP)		47360.5	207663.6	22.8		132858.3	231529.1	57.4	B31.3
1(OPE)	48	149963.4	0	0	49	158053.5	0	0	B31.3
2(SUS)		19997.6	63326.2	31.6		17943.5	63326.2	28.3	B31.3
3(EXP)		132858.3	231529.1	57.4		142320.9	233583.1	60.9	B31.3
1(OPE)	49	158053.5	0	0	50	161378.5	0	0	B31.3
2(SUS)		17943.5	63326.2	28.3		20068.3	63326.2	31.7	B31.3
3(EXP)		142320.9	233583.1	60.9		146240.8	231458.4	63.2	B31.3
1(OPE)	50	161378.5	0	0	59	158053.5	0	0	B31.3
2(SUS)		20068.3	63326.2	31.7		17943.5	63326.2	28.3	B31.3
3(EXP)		146240.8	231458.4	63.2		142320.9	233583.1	60.9	B31.3
1(OPE)	59	158053.5	0	0	60	149963.4	0	0	B31.3
2(SUS)		17943.5	63326.2	28.3		19997.6	63326.2	31.6	B31.3
3(EXP)		142320.9	233583.1	60.9		132858.3	231529.1	57.4	B31.3
1(OPE)	60	149963.4	0	0	65	71670.1	0	0	B31.3
2(SUS)		19997.6	63326.2	31.6		43863	63326.2	69.3	B31.3
3(EXP)		132858.3	231529.1	57.4		47360.5	207663.6	22.8	B31.3
1(OPE)	65	71318.9	0	0	68	92538.8	0	0	B31.3
2(SUS)		43879.1	63326.2	69.3		18169.7	63326.2	28.7	B31.3
3(EXP)		47360.5	207647.6	22.8		76283.1	233356.9	32.7	B31.3
1(OPE)	68	92538.8	0	0	69	101181.1	0	0	B31.3
2(SUS)		18169.7	63326.2	28.7		18948.2	63326.2	29.9	B31.3
3(EXP)		76283.1	233356.9	32.7		85747.3	232578.4	36.9	B31.3
1(OPE)	69	101181.1	0	0	70	103968.4	0	0	B31.3
2(SUS)		18948.2	63326.2	29.9		19301.6	63326.2	30.5	B31.3
3(EXP)		85747.3	232578.4	36.9		88553.9	232225.1	38.1	B31.3
1(OPE)	70	103968.4	0	0	78	103368.1	0	0	B31.3
2(SUS)		19301.6	63326.2	30.5		19487.8	63326.2	30.8	B31.3
3(EXP)		88553.9	232225.1	38.1		87801.9	232038.9	37.8	B31.3
1(OPE)	78	103368.1	0	0	79	102519	0	0	B31.3
2(SUS)		19487.8	63326.2	30.8		19456.3	63326.2	30.7	B31.3
3(EXP)		87801.9	232038.9	37.8		87252.3	232070.3	37.6	B31.3
1(OPE)	79	102519	0	0	80	101544.3	0	0	B31.3
2(SUS)		19456.3	63326.2	30.7		19493.4	63326.2	30.8	B31.3
3(EXP)		87252.3	232070.3	37.6		86321.8	232033.3	37.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m

1(OPE)	80	101544.3	0	0	85	74283.1	0	0	B31.3
2(SUS)		19493.4	63326.2	30.8		30666.5	63326.2	48.4	B31.3
3(EXP)		86321.8	232033.3	37.2		58261	220860.2	26.4	B31.3
1(OPE)	85	74005.2	0	0	90	30990.5	0	0	B31.3
2(SUS)		30668	63326.2	48.4		26873.3	63326.2	42.4	B31.3
3(EXP)		58261	220858.6	26.4		12434.8	224653.3	5.5	B31.3
1(OPE)	90	30719.6	0	0	100	42607.5	0	0	B31.3
2(SUS)		26874	63326.2	42.4		28113.3	63326.2	44.4	B31.3
3(EXP)		12434.8	224652.6	5.5		26640.4	223413.3	11.9	B31.3
1(OPE)	100	42607.5	0	0	110	30719.6	0	0	B31.3
2(SUS)		28113.3	63326.2	44.4		26874	63326.2	42.4	B31.3
3(EXP)		26640.4	223413.3	11.9		12434.8	224652.7	5.5	B31.3
1(OPE)	110	30990.5	0	0	120	74005.2	0	0	B31.3
2(SUS)		26873.3	63326.2	42.4		30668	63326.2	48.4	B31.3
3(EXP)		12434.8	224653.4	5.5		58261	220858.7	26.4	B31.3
1(OPE)	120	74283.1	0	0	128	101544.3	0	0	B31.3
2(SUS)		30666.5	63326.2	48.4		19493.4	63326.2	30.8	B31.3
3(EXP)		58261	220860.2	26.4		86321.8	232033.3	37.2	B31.3
1(OPE)	128	101544.3	0	0	129	102519	0	0	B31.3
2(SUS)		19493.4	63326.2	30.8		19456.3	63326.2	30.7	B31.3
3(EXP)		86321.8	232033.3	37.2		87252.3	232070.3	37.6	B31.3
1(OPE)	129	102519	0	0	130	103368.1	0	0	B31.3
2(SUS)		19456.3	63326.2	30.7		19487.8	63326.2	30.8	B31.3
3(EXP)		87252.3	232070.3	37.6		87801.9	232038.9	37.8	B31.3
1(OPE)	130	103368.1	0	0	139	101181.1	0	0	B31.3
2(SUS)		19487.8	63326.2	30.8		18948.2	63326.2	29.9	B31.3
3(EXP)		87801.9	232038.9	37.8		85747.3	232578.4	36.9	B31.3
1(OPE)	139	101181.1	0	0	140	92538.8	0	0	B31.3
2(SUS)		18948.2	63326.2	29.9		18169.7	63326.2	28.7	B31.3
3(EXP)		85747.3	232578.4	36.9		76283.1	233356.9	32.7	B31.3
1(OPE)	140	92538.8	0	0	150	71318.9	0	0	B31.3
2(SUS)		18169.7	63326.2	28.7		43879.1	63326.2	69.3	B31.3
3(EXP)		76283.1	233356.9	32.7		47360.4	207647.6	22.8	B31.3
1(OPE)	150	71670.1	0	0	158	149963.3	0	0	B31.3
2(SUS)		43863	63326.2	69.3		19997.6	63326.2	31.6	B31.3
3(EXP)		47360.4	207663.6	22.8		132858.3	231529.1	57.4	B31.3
1(OPE)	158	149963.3	0	0	159	158053.5	0	0	B31.3
2(SUS)		19997.6	63326.2	31.6		17943.5	63326.2	28.3	B31.3
3(EXP)		132858.3	231529.1	57.4		142320.9	233583.1	60.9	B31.3
1(OPE)	159	158053.5	0	0	160	161378.4	0	0	B31.3
2(SUS)		17943.5	63326.2	28.3		20068.3	63326.2	31.7	B31.3
3(EXP)		142320.9	233583.1	60.9		146240.8	231458.4	63.2	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m

1(OPE)	160	161378.4	0	0	168	161378.4	0	0	B31.3
2(SUS)		20068.3	63326.2	31.7		20068.2	63326.2	31.7	B31.3
3(EXP)		146240.8	231458.4	63.2		146240.8	231458.4	63.2	B31.3
1(OPE)	168	161378.4	0	0	169	158053.5	0	0	B31.3
2(SUS)		20068.2	63326.2	31.7		17943.5	63326.2	28.3	B31.3
3(EXP)		146240.8	231458.4	63.2		142320.9	233583.1	60.9	B31.3
1(OPE)	169	158053.5	0	0	170	149963.3	0	0	B31.3
2(SUS)		17943.5	63326.2	28.3		19997.6	63326.2	31.6	B31.3
3(EXP)		142320.9	233583.1	60.9		132858.3	231529.1	57.4	B31.3
1(OPE)	170	149963.3	0	0	180	71670.1	0	0	B31.3
2(SUS)		19997.6	63326.2	31.6		43863	63326.2	69.3	B31.3
3(EXP)		132858.3	231529.1	57.4		47360.4	207663.6	22.8	B31.3
1(OPE)	180	71318.9	0	0	188	92538.8	0	0	B31.3
2(SUS)		43879.1	63326.2	69.3		18169.7	63326.2	28.7	B31.3
3(EXP)		47360.4	207647.6	22.8		76283.1	233356.9	32.7	B31.3
1(OPE)	188	92538.8	0	0	189	101181.1	0	0	B31.3
2(SUS)		18169.7	63326.2	28.7		18948.2	63326.2	29.9	B31.3
3(EXP)		76283.1	233356.9	32.7		85747.3	232578.4	36.9	B31.3
1(OPE)	189	101181.1	0	0	190	103968.4	0	0	B31.3
2(SUS)		18948.2	63326.2	29.9		19301.6	63326.2	30.5	B31.3
3(EXP)		85747.3	232578.4	36.9		88553.8	232225.1	38.1	B31.3
1(OPE)	190	103968.4	0	0	199	102519	0	0	B31.3
2(SUS)		19301.6	63326.2	30.5		19456.3	63326.2	30.7	B31.3
3(EXP)		88553.8	232225.1	38.1		87252.3	232070.3	37.6	B31.3
1(OPE)	199	102519	0	0	200	101544.2	0	0	B31.3
2(SUS)		19456.3	63326.2	30.7		19493.4	63326.2	30.8	B31.3
3(EXP)		87252.3	232070.3	37.6		86321.8	232033.3	37.2	B31.3
1(OPE)	200	101544.2	0	0	210	74283.1	0	0	B31.3
2(SUS)		19493.4	63326.2	30.8		30666.5	63326.2	48.4	B31.3
3(EXP)		86321.8	232033.3	37.2		58261	220860.2	26.4	B31.3
1(OPE)	210	74005.2	0	0	220	30990.5	0	0	B31.3
2(SUS)		30668	63326.2	48.4		26873.3	63326.2	42.4	B31.3
3(EXP)		58261	220858.7	26.4		12434.8	224653.3	5.5	B31.3
1(OPE)	220	30719.7	0	0	230	42607.4	0	0	B31.3
2(SUS)		26874	63326.2	42.4		28113.2	63326.2	44.4	B31.3
3(EXP)		12434.8	224652.6	5.5		26640.3	223413.4	11.9	B31.3

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m
Page 12 of 20

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	11633	-17460	101339	-26869	-76350	3177	0	0	0
	2(SUS)	-122	-18327	147	-29602	379	-3290	0	0	0
	3(EXP)	11755	867	101192	2733	-76729	6468	0	0	0
	MAX	11755/L3	-18327/L	101339/L	-29602/L	-76729/L	6468/L3	0.000/L3	-0.000/L2	0.000/L1
15	Rigid +Y									
	1(OPE)	2665	-37896	-11052	0	0	0	16.522	0	-68.522
	2(SUS)	506	-34407	28	0	0	0	0.003	0	0
	3(EXP)	2159	-3489	-11081	0	0	0	16.519	0	-68.522
	MAX	2665/L1	-37896/L	-11081/L3				16.522/L	-0.000/L1	-68.522/L3
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	89	-37865	-11359	0	0	0	1.069	0	-137.055
	2(SUS)	-1028	-36974	62	0	0	0	-0.006	0	0
	3(EXP)	1116	-891	-11421	0	0	0	1.075	0	-137.056
	MAX	1116/L3	-37865/L	-11421/L3				1.075/L3	-0.000/L1	-137.056/L3
45	Rigid +Y									
	1(OPE)	-12957	-47877	-6197	0	0	0	-117.731	0	-56.307
	2(SUS)	644	-51390	-911	0	0	0	0.004	0	-0.005
	3(EXP)	-13602	3514	-5286	0	0	0	-117.735	0	-56.301
	MAX	-13602/L	-51390/L	-6197/L1				-117.735/L	-0.000/L2	-56.307/L1
65	Rigid +Y									
	1(OPE)	-12957	-47877	6197	0	0	0	-117.731	0	56.307
	2(SUS)	644	-51390	911	0	0	0	0.004	0	0.005
	3(EXP)	-13602	3514	5286	0	0	0	-117.735	0	56.302
	MAX	-13602/L	-51390/L	6197/L1				-117.735/L	-0.000/L2	56.307/L1
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	89	-37865	11359	0	0	0	1.069	0	137.055
	2(SUS)	-1028	-36974	-62	0	0	0	-0.006	0	0
	3(EXP)	1116	-891	11421	0	0	0	1.075	0	137.056
	MAX	1116/L3	-37865/L	11421/L3				1.075/L3	-0.000/L1	137.056/L3
90	Rigid +Y									
	1(OPE)	2665	-37896	11052	0	0	0	16.522	0	68.522
	2(SUS)	506	-34407	-28	0	0	0	0.003	0	0
	3(EXP)	2159	-3489	11081	0	0	0	16.519	0	68.522
	MAX	2665/L1	-37896/L	11081/L3				16.522/L	-0.000/L1	68.522/L3
100	Rigid ANC									
	1(OPE)	23266	-34920	0	0	0	6355	0	0	0
	2(SUS)	-245	-36653	0	0	0	-6581	0	0	0
	3(EXP)	23511	1733	0	0	0	12935	0	0	0
	MAX	23511/L3	-36653/L	-0/L1	0/L2	0/L3	12935/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Location of Pipe Support and Anchor Point 9.5m

110		Rigid +Y								
	1(OPE)	2665	-37896	-11052	0	0	0	16.522	0	-68.522
	2(SUS)	506	-34407	28	0	0	0	0.003	0	0
	3(EXP)	2159	-3489	-11081	0	0	0	16.519	0	-68.522
	MAX	2665/L1	-37896/L	-11081/L3				16.522/L	-0.000/L1	-68.522/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	89	-37865	-11359	0	0	0	1.069	0	-137.055
	2(SUS)	-1028	-36974	62	0	0	0	-0.006	0	0
	3(EXP)	1116	-891	-11421	0	0	0	1.075	0	-137.056
	MAX	1116/L3	-37865/L	-11421/L3				1.075/L3	-0.000/L1	-137.056/L3
150		Rigid +Y								
	1(OPE)	-12957	-47877	-6197	0	0	0	-117.731	0	-56.307
	2(SUS)	644	-51390	-911	0	0	0	0.004	0	-0.005
	3(EXP)	-13602	3514	-5286	0	0	0	-117.735	0	-56.301
	MAX	-13602/L	-51390/L	-6197/L1				-117.735/I	-0.000/L2	-56.307/L1
180		Rigid +Y								
	1(OPE)	-12957	-47877	6197	0	0	0	-117.731	0	56.307
	2(SUS)	644	-51390	911	0	0	0	0.004	0	0.005
	3(EXP)	-13602	3514	5286	0	0	0	-117.735	0	56.301
	MAX	-13602/L	-51390/L	6197/L1				-117.735/I	-0.000/L2	56.307/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	89	-37865	11359	0	0	0	1.069	0	137.055
	2(SUS)	-1028	-36974	-62	0	0	0	-0.006	0	0
	3(EXP)	1116	-891	11421	0	0	0	1.075	0	137.056
	MAX	1116/L3	-37865/L	11421/L3				1.075/L3	-0.000/L1	137.056/L3
220		Rigid +Y								
	1(OPE)	2665	-37896	11052	0	0	0	16.522	0	68.522
	2(SUS)	506	-34407	-28	0	0	0	0.003	0	0
	3(EXP)	2159	-3489	11081	0	0	0	16.519	0	68.522
	MAX	2665/L1	-37896/L	11081/L3				16.522/L	-0.000/L1	68.522/L3
230		Rigid ANC								
	1(OPE)	11633	-17460	-101339	26869	76350	3177	0	0	0
	2(SUS)	-122	-18327	-147	29602	-379	-3290	0	0	0
	3(EXP)	11755	867	-101192	-2733	76729	6468	0	0	0
	MAX	11755/L3	-18327/L	-101339/I	29602/L3	76729/L3	6468/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	16.519	0	-68.522	-0.007	-0.105	0.042
20	1.075	0	-137.056	0.028	0.403	0.084
28	-60.921	5.86	-175.146	0.1081	0.9807	0.1073
29	-64.577	6.552	-176.539	0.1156	1.03	0.1109
30	-67.986	7.749	-177.544	0.1219	1.0761	0.1188
38	-72.581	9.787	-178.633	0.125	1.123	0.1147
39	-79.709	11.971	-176.729	0.1314	1.2135	0.1318
40	-85.098	12.123	-168.945	0.1327	1.305	0.1409
45	-117.735	0	-56.301	0.0784	1.4048	0.1599
48	-142.404	-9.53	15.809	0.0374	0.9356	0.1599
49	-147.399	-10.492	20.363	0.032	0.7755	0.1606
50	-153.055	-10.743	19.603	0.0253	0.6071	0.1612
59	-147.399	-10.492	-20.363	-0.032	-0.7755	0.1606
60	-142.404	-9.53	-15.809	-0.0374	-0.9356	0.1599
65	-117.735	0	56.302	-0.0784	-1.4048	0.1599
68	-85.098	12.123	168.945	-0.1327	-1.305	0.1409
69	-79.709	11.971	176.729	-0.1314	-1.2135	0.1318
70	-72.581	9.787	178.633	-0.125	-1.123	0.1147
78	-67.986	7.749	177.544	-0.1219	-1.0761	0.1188
79	-64.577	6.552	176.539	-0.1156	-1.03	0.1109
80	-60.921	5.86	175.146	-0.1081	-0.9807	0.1073
85	1.075	0	137.056	-0.028	-0.403	0.084
90	16.519	0	68.522	0.007	0.105	0.042
100	0	0	0	0	0	0
110	16.519	0	-68.522	-0.007	-0.105	0.042
120	1.075	0	-137.056	0.028	0.403	0.084
128	-60.921	5.86	-175.146	0.1081	0.9807	0.1073
129	-64.577	6.552	-176.539	0.1156	1.03	0.1109
130	-67.986	7.749	-177.544	0.1219	1.0761	0.1188
139	-79.709	11.97	-176.729	0.1314	1.2135	0.1318
140	-85.098	12.123	-168.945	0.1327	1.305	0.1409
150	-117.735	0	-56.301	0.0784	1.4048	0.1599
158	-142.404	-9.53	15.809	0.0374	0.9356	0.1599
159	-147.399	-10.492	20.363	0.032	0.7755	0.1606
160	-153.055	-10.743	19.603	0.0253	0.6071	0.1612
168	-153.055	-10.743	-19.603	-0.0253	-0.6071	0.1612
169	-147.399	-10.492	-20.363	-0.032	-0.7755	0.1606
170	-142.404	-9.53	-15.809	-0.0374	-0.9356	0.1599
180	-117.735	0	56.301	-0.0784	-1.4048	0.1599

188	-85.098	12.123	168.945	-0.1327	-1.305	0.1409
189	-79.709	11.97	176.729	-0.1314	-1.2135	0.1318
190	-72.581	9.787	178.633	-0.125	-1.123	0.1147
199	-64.577	6.552	176.539	-0.1156	-1.03	0.1109
200	-60.921	5.86	175.146	-0.1081	-0.9807	0.1073
210	1.075	0	137.056	-0.028	-0.403	0.084
220	16.519	0	68.522	0.007	0.105	0.042
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	0.003	-0.001	-0.0214
20	-0.006	0	0	-0.012	0.0042	-0.0427
28	-0.616	-2.943	0	-0.0319	0.0074	-0.0546
29	-0.604	-3.055	-0.022	-0.0309	0.0073	-0.0551
30	-0.514	-3.146	-0.083	-0.0301	0.0071	-0.0556
38	-0.329	-3.258	-0.195	-0.0295	0.007	-0.0563
39	-0.096	-3.237	-0.312	-0.0286	0.0065	-0.0575
40	0.004	-2.909	-0.325	-0.0283	0.006	-0.0582
45	0.004	0	-0.005	-0.0264	0.0016	0.0153
48	0.004	-3.54	0.005	-0.025	-0.0006	0.0818
49	0.005	-4.155	0.002	-0.0247	-0.0005	0.0832
50	0.008	-4.543	0	-0.023	-0.0004	0.0833
59	0.005	-4.155	-0.002	0.0247	0.0005	0.0832
60	0.004	-3.54	-0.005	0.025	0.0006	0.0818
65	0.004	0	0.005	0.0264	-0.0016	0.0153
68	0.004	-2.909	0.325	0.0283	-0.006	-0.0582
69	-0.096	-3.237	0.312	0.0286	-0.0065	-0.0575
70	-0.329	-3.258	0.195	0.0295	-0.007	-0.0563
78	-0.514	-3.146	0.083	0.0301	-0.0071	-0.0556
79	-0.604	-3.055	0.022	0.0309	-0.0073	-0.0551
80	-0.616	-2.943	0	0.0319	-0.0074	-0.0546
85	-0.006	0	0	0.012	-0.0042	-0.0427
90	0.003	0	0	-0.003	0.001	-0.0214
100	0	0	0	0	0	0
110	0.003	0	0	0.003	-0.001	-0.0214
120	-0.006	0	0	-0.012	0.0042	-0.0427
128	-0.616	-2.943	0	-0.0319	0.0074	-0.0546
129	-0.604	-3.055	-0.022	-0.0309	0.0073	-0.0551
130	-0.514	-3.146	-0.083	-0.0301	0.0071	-0.0556
139	-0.096	-3.237	-0.312	-0.0286	0.0065	-0.0575
140	0.004	-2.909	-0.325	-0.0283	0.006	-0.0582
150	0.004	0	-0.005	-0.0264	0.0016	0.0153
158	0.004	-3.54	0.005	-0.025	-0.0006	0.0818
159	0.005	-4.155	0.002	-0.0247	-0.0005	0.0832
160	0.008	-4.543	0	-0.023	-0.0004	0.0833
168	0.008	-4.543	0	0.023	0.0004	0.0833
169	0.005	-4.155	-0.002	0.0247	0.0005	0.0832
170	0.004	-3.54	-0.005	0.025	0.0006	0.0818
180	0.004	0	0.005	0.0264	-0.0016	0.0153

188	0.004	-2.909	0.325	0.0283	-0.006	-0.0582
189	-0.096	-3.237	0.312	0.0286	-0.0065	-0.0575
190	-0.329	-3.258	0.195	0.0295	-0.007	-0.0563
199	-0.604	-3.055	0.022	0.0309	-0.0073	-0.0551
200	-0.616	-2.943	0	0.0319	-0.0074	-0.0546
210	-0.006	0	0	0.012	-0.0042	-0.0427
220	0.003	0	0	-0.003	0.001	-0.0214
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 12:27
Job Name: A335 P22_2 EXPANSION LOOP_9.5M SPAN
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	16.522	0	-68.522	-0.004	-0.106	0.0206
20	1.069	0	-137.055	0.016	0.4072	0.0412
28	-61.537	2.917	-175.146	0.0762	0.9882	0.0527
29	-65.181	3.498	-176.56	0.0847	1.0373	0.0559
30	-68.5	4.603	-177.627	0.0919	1.0832	0.0631
38	-72.91	6.529	-178.828	0.0955	1.13	0.0584
39	-79.805	8.734	-177.04	0.1028	1.22	0.0743
40	-85.094	9.214	-169.27	0.1044	1.3111	0.0828
45	-117.731	0	-56.307	0.052	1.4065	0.1752
48	-142.4	-13.07	15.814	0.0124	0.9351	0.2417
49	-147.394	-14.647	20.364	0.0072	0.7749	0.2438
50	-153.047	-15.286	19.604	0.0023	0.6067	0.2445
59	-147.394	-14.647	-20.364	-0.0072	-0.7749	0.2438
60	-142.4	-13.07	-15.814	-0.0124	-0.9351	0.2417
65	-117.731	0	56.307	-0.052	-1.4065	0.1752
68	-85.094	9.214	169.27	-0.1044	-1.3111	0.0828
69	-79.805	8.734	177.04	-0.1028	-1.22	0.0743
70	-72.91	6.529	178.828	-0.0955	-1.13	0.0584
78	-68.5	4.603	177.627	-0.0919	-1.0832	0.0631
79	-65.181	3.498	176.56	-0.0847	-1.0373	0.0559
80	-61.537	2.917	175.146	-0.0762	-0.9882	0.0527
85	1.069	0	137.055	-0.016	-0.4072	0.0412
90	16.522	0	68.522	0.004	0.106	0.0206
100	0	0	0	0	0	0
110	16.522	0	-68.522	-0.004	-0.106	0.0206
120	1.069	0	-137.055	0.016	0.4072	0.0412
128	-61.537	2.917	-175.146	0.0762	0.9882	0.0527
129	-65.181	3.498	-176.56	0.0847	1.0373	0.0559
130	-68.5	4.603	-177.627	0.0919	1.0832	0.0631
139	-79.805	8.734	-177.04	0.1028	1.22	0.0743
140	-85.094	9.214	-169.27	0.1044	1.3111	0.0828
150	-117.731	0	-56.307	0.052	1.4065	0.1752
158	-142.4	-13.07	15.814	0.0124	0.9351	0.2417
159	-147.394	-14.647	20.364	0.0072	0.7749	0.2438
160	-153.047	-15.286	19.604	0.0023	0.6067	0.2445
168	-153.047	-15.286	-19.604	-0.0023	-0.6067	0.2445
169	-147.394	-14.647	-20.364	-0.0072	-0.7749	0.2438
170	-142.4	-13.07	-15.814	-0.0124	-0.9351	0.2417
180	-117.731	0	56.307	-0.052	-1.4065	0.1752

188	-85.094	9.214	169.27	-0.1044	-1.3111	0.0828
189	-79.805	8.734	177.04	-0.1028	-1.22	0.0743
190	-72.91	6.529	178.828	-0.0955	-1.13	0.0584
199	-65.181	3.498	176.56	-0.0847	-1.0373	0.0559
200	-61.537	2.917	175.146	-0.0762	-0.9882	0.0527
210	1.069	0	137.055	-0.016	-0.4072	0.0412
220	16.522	0	68.522	0.004	0.106	0.0206
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,348.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,348.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,348.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,348.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Expansion Loop Dimension A: 3348mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len Dir	MU Vectors
10	ANC			.30	.000	.000		.000
15	+Y			.30	.000	1.000		.000
20	Guide		3.00	.30	.000	.000		.000
20	+Y			.30	.000	1.000		.000
45	+Y			.30	.000	1.000		.000
65	+Y			.30	.000	1.000		.000
85	Guide		3.00	.30	.000	.000		.000
85	+Y			.30	.000	1.000		.000
90	+Y			.30	.000	1.000		.000
100	ANC			.30	.000	.000		.000
110	+Y			.30	.000	1.000		.000
120	+Y			.30	.000	1.000		.000
120	Guide		3.00	.30	.000	.000		.000
150	+Y			.30	.000	1.000		.000
180	+Y			.30	.000	1.000		.000
210	+Y			.30	.000	1.000		.000
210	Guide		3.00	.30	.000	.000		.000
220	+Y			.30	.000	1.000		.000
230	ANC			.30	.000	.000		.000

```
 INPUT UNITS USED...

 UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =  mm.
     FORCE           pounds      x     4.448  =  N.
     MASS(dynamics)  pounds      x     0.454  =  Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =  N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =  N.m.
     STRESS          lbs./sq.in. x     6.895  =  KPa
     TEMP. SCALE     degrees F.  x     0.556  =  C
     PRESSURE        psig        x     6.895  =  KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =  KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =  kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =  kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =  kg./cu.cm.
```

Possible Approach:

Expansion Loop Dimension A: 3348mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension A: 3348mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 3348mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-8400.000	750.000	-19250.000
60	-8400.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-8400.000	750.000	-64250.000
170	-8400.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 60.9 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 38565.8 Allowable Stress: 63326.2
Axial Stress: 17746.9 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 129027.2 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 28916.8 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 150671.1 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	45292.4	0	0	15	32753.3	0	0	B31.3
2(SUS)		24206.5	63326.2	38.2		23367.5	63326.2	36.9	B31.3
3(EXP)		30323.7	227320.2	13.3		16569.9	228159.1	7.3	B31.3
1(OPE)	15	32991.6	0	0	20	82291.6	0	0	B31.3
2(SUS)		23367.1	63326.2	36.9		25975	63326.2	41	B31.3
3(EXP)		16569.9	228159.5	7.3		67117.6	225551.6	29.8	B31.3
1(OPE)	20	82546.4	0	0	28	98503.3	0	0	B31.3
2(SUS)		25974.2	63326.2	41		17946.7	63326.2	28.3	B31.3
3(EXP)		67117.6	225552.5	29.8		83307.3	233580	35.7	B31.3
1(OPE)	28	98503.3	0	0	29	99408	0	0	B31.3
2(SUS)		17946.7	63326.2	28.3		18172.6	63326.2	28.7	B31.3
3(EXP)		83307.3	233580	35.7		84158.4	233354.1	36.1	B31.3
1(OPE)	29	99408	0	0	30	100208.4	0	0	B31.3
2(SUS)		18172.6	63326.2	28.7		18413.8	63326.2	29.1	B31.3
3(EXP)		84158.4	233354.1	36.1		84636.2	233112.8	36.3	B31.3
1(OPE)	30	100208.4	0	0	38	100782.8	0	0	B31.3
2(SUS)		18413.8	63326.2	29.1		18488.4	63326.2	29.2	B31.3
3(EXP)		84636.2	233112.8	36.3		85286	233038.2	36.6	B31.3
1(OPE)	38	100782.8	0	0	39	98061.6	0	0	B31.3
2(SUS)		18488.4	63326.2	29.2		18526	63326.2	29.3	B31.3
3(EXP)		85286	233038.2	36.6		82478.3	233000.7	35.4	B31.3

Possible Approach:
Expansion Loop Dimension A: 3348mm

1(OPE)	39	98061.6	0	0	40	89692.1	0	0	B31.3
2(SUS)		18526	63326.2	29.3		18152.2	63326.2	28.7	B31.3
3(EXP)		82478.3	233000.7	35.4		73283.7	233374.5	31.4	B31.3
1(OPE)	40	89692.1	0	0	45	67851.5	0	0	B31.3
2(SUS)		18152.2	63326.2	28.7		38565.8	63326.2	60.9	B31.3
3(EXP)		73283.7	233374.5	31.4		46211.4	212960.9	21.7	B31.3
1(OPE)	45	68171.9	0	0	48	132956.9	0	0	B31.3
2(SUS)		38545.4	63326.2	60.9		19997.5	63326.2	31.6	B31.3
3(EXP)		46211.4	212981.2	21.7		115813.1	231529.1	50	B31.3
1(OPE)	48	132956.9	0	0	49	140952	0	0	B31.3
2(SUS)		19997.5	63326.2	31.6		17818.3	63326.2	28.1	B31.3
3(EXP)		115813.1	231529.1	50		125156.6	233708.3	53.6	B31.3
1(OPE)	49	140952	0	0	50	144236.2	0	0	B31.3
2(SUS)		17818.3	63326.2	28.1		19660.2	63326.2	31	B31.3
3(EXP)		125156.6	233708.3	53.6		129027.2	231866.5	55.6	B31.3
1(OPE)	50	144236.2	0	0	59	140952	0	0	B31.3
2(SUS)		19660.2	63326.2	31		17818.3	63326.2	28.1	B31.3
3(EXP)		129027.2	231866.5	55.6		125156.6	233708.3	53.6	B31.3
1(OPE)	59	140952	0	0	60	132956.9	0	0	B31.3
2(SUS)		17818.3	63326.2	28.1		19997.5	63326.2	31.6	B31.3
3(EXP)		125156.6	233708.3	53.6		115813	231529.1	50	B31.3
1(OPE)	60	132956.9	0	0	65	68171.8	0	0	B31.3
2(SUS)		19997.5	63326.2	31.6		38545.4	63326.2	60.9	B31.3
3(EXP)		115813	231529.1	50		46211.4	212981.2	21.7	B31.3
1(OPE)	65	67851.4	0	0	68	89692.1	0	0	B31.3
2(SUS)		38565.8	63326.2	60.9		18152.2	63326.2	28.7	B31.3
3(EXP)		46211.4	212960.9	21.7		73283.7	233374.5	31.4	B31.3
1(OPE)	68	89692.1	0	0	69	98061.6	0	0	B31.3
2(SUS)		18152.2	63326.2	28.7		18526	63326.2	29.3	B31.3
3(EXP)		73283.7	233374.5	31.4		82478.3	233000.7	35.4	B31.3
1(OPE)	69	98061.6	0	0	70	100782.8	0	0	B31.3
2(SUS)		18526	63326.2	29.3		18488.4	63326.2	29.2	B31.3
3(EXP)		82478.3	233000.7	35.4		85286	233038.2	36.6	B31.3
1(OPE)	70	100782.8	0	0	78	100208.4	0	0	B31.3
2(SUS)		18488.4	63326.2	29.2		18413.8	63326.2	29.1	B31.3
3(EXP)		85286	233038.2	36.6		84636.2	233112.8	36.3	B31.3
1(OPE)	78	100208.4	0	0	79	99408.1	0	0	B31.3
2(SUS)		18413.8	63326.2	29.1		18172.6	63326.2	28.7	B31.3
3(EXP)		84636.2	233112.8	36.3		84158.4	233354.1	36.1	B31.3
1(OPE)	79	99408.1	0	0	80	98503.3	0	0	B31.3
2(SUS)		18172.6	63326.2	28.7		17946.7	63326.2	28.3	B31.3
3(EXP)		84158.4	233354.1	36.1		83307.4	233580	35.7	B31.3

Possible Approach:
Expansion Loop Dimension A: 3348mm

1(OPE)	80	98503.3	0	0	85	82546.4	0	0	B31.3
2(SUS)		17946.7	63326.2	28.3		25974.2	63326.2	41	B31.3
3(EXP)		83307.4	233580	35.7		67117.6	225552.5	29.8	B31.3
1(OPE)	85	82291.6	0	0	90	32991.6	0	0	B31.3
2(SUS)		25975	63326.2	41		23367.1	63326.2	36.9	B31.3
3(EXP)		67117.6	225551.6	29.8		16569.8	228159.5	7.3	B31.3
1(OPE)	90	32753.3	0	0	100	45292.5	0	0	B31.3
2(SUS)		23367.5	63326.2	36.9		24206.5	63326.2	38.2	B31.3
3(EXP)		16569.8	228159.1	7.3		30323.9	227320.1	13.3	B31.3
1(OPE)	100	45292.6	0	0	110	32753.3	0	0	B31.3
2(SUS)		24206.5	63326.2	38.2		23367.5	63326.2	36.9	B31.3
3(EXP)		30323.9	227320.1	13.3		16569.8	228159.1	7.3	B31.3
1(OPE)	110	32991.6	0	0	120	82291.7	0	0	B31.3
2(SUS)		23367.1	63326.2	36.9		25975	63326.2	41	B31.3
3(EXP)		16569.8	228159.5	7.3		67117.7	225551.7	29.8	B31.3
1(OPE)	120	82546.5	0	0	128	98503.3	0	0	B31.3
2(SUS)		25974.2	63326.2	41		17946.7	63326.2	28.3	B31.3
3(EXP)		67117.7	225552.5	29.8		83307.4	233580	35.7	B31.3
1(OPE)	128	98503.3	0	0	129	99408.1	0	0	B31.3
2(SUS)		17946.7	63326.2	28.3		18172.6	63326.2	28.7	B31.3
3(EXP)		83307.4	233580	35.7		84158.5	233354.1	36.1	B31.3
1(OPE)	129	99408.1	0	0	130	100208.4	0	0	B31.3
2(SUS)		18172.6	63326.2	28.7		18413.8	63326.2	29.1	B31.3
3(EXP)		84158.5	233354.1	36.1		84636.2	233112.8	36.3	B31.3
1(OPE)	130	100208.4	0	0	139	98061.6	0	0	B31.3
2(SUS)		18413.8	63326.2	29.1		18526	63326.2	29.3	B31.3
3(EXP)		84636.2	233112.8	36.3		82478.3	233000.7	35.4	B31.3
1(OPE)	139	98061.6	0	0	140	89692.1	0	0	B31.3
2(SUS)		18526	63326.2	29.3		18152.2	63326.2	28.7	B31.3
3(EXP)		82478.3	233000.7	35.4		73283.7	233374.5	31.4	B31.3
1(OPE)	140	89692.1	0	0	150	67851.4	0	0	B31.3
2(SUS)		18152.2	63326.2	28.7		38565.8	63326.2	60.9	B31.3
3(EXP)		73283.7	233374.5	31.4		46211.4	212960.9	21.7	B31.3
1(OPE)	150	68171.8	0	0	158	132956.9	0	0	B31.3
2(SUS)		38545.4	63326.2	60.9		19997.5	63326.2	31.6	B31.3
3(EXP)		46211.4	212981.2	21.7		115813	231529.1	50	B31.3
1(OPE)	158	132956.9	0	0	159	140952	0	0	B31.3
2(SUS)		19997.5	63326.2	31.6		17818.4	63326.2	28.1	B31.3
3(EXP)		115813	231529.1	50		125156.6	233708.3	53.6	B31.3
1(OPE)	159	140952	0	0	160	144236.2	0	0	B31.3
2(SUS)		17818.4	63326.2	28.1		19660.2	63326.2	31	B31.3
3(EXP)		125156.6	233708.3	53.6		129027.2	231866.5	55.6	B31.3

Possible Approach:
Expansion Loop Dimension A: 3348mm

1(OPE)	160	144236.2	0	0	168	144236.2	0	0	B31.3
2(SUS)		19660.2	63326.2	31		19660.2	63326.2	31	B31.3
3(EXP)		129027.2	231866.5	55.6		129027.2	231866.5	55.6	B31.3
1(OPE)	168	144236.2	0	0	169	140952	0	0	B31.3
2(SUS)		19660.2	63326.2	31		17818.4	63326.2	28.1	B31.3
3(EXP)		129027.2	231866.5	55.6		125156.6	233708.3	53.6	B31.3
1(OPE)	169	140952	0	0	170	132956.9	0	0	B31.3
2(SUS)		17818.4	63326.2	28.1		19997.5	63326.2	31.6	B31.3
3(EXP)		125156.6	233708.3	53.6		115813	231529.1	50	B31.3
1(OPE)	170	132956.9	0	0	180	68171.9	0	0	B31.3
2(SUS)		19997.5	63326.2	31.6		38545.4	63326.2	60.9	B31.3
3(EXP)		115813	231529.1	50		46211.4	212981.2	21.7	B31.3
1(OPE)	180	67851.4	0	0	188	89692.1	0	0	B31.3
2(SUS)		38565.8	63326.2	60.9		18152.2	63326.2	28.7	B31.3
3(EXP)		46211.4	212960.9	21.7		73283.7	233374.5	31.4	B31.3
1(OPE)	188	89692.1	0	0	189	98061.6	0	0	B31.3
2(SUS)		18152.2	63326.2	28.7		18526	63326.2	29.3	B31.3
3(EXP)		73283.7	233374.5	31.4		82478.3	233000.7	35.4	B31.3
1(OPE)	189	98061.6	0	0	190	100782.8	0	0	B31.3
2(SUS)		18526	63326.2	29.3		18488.4	63326.2	29.2	B31.3
3(EXP)		82478.3	233000.7	35.4		85286	233038.2	36.6	B31.3
1(OPE)	190	100782.8	0	0	199	99408	0	0	B31.3
2(SUS)		18488.4	63326.2	29.2		18172.6	63326.2	28.7	B31.3
3(EXP)		85286	233038.2	36.6		84158.4	233354.1	36.1	B31.3
1(OPE)	199	99408	0	0	200	98503.2	0	0	B31.3
2(SUS)		18172.6	63326.2	28.7		17946.7	63326.2	28.3	B31.3
3(EXP)		84158.4	233354.1	36.1		83307.3	233580	35.7	B31.3
1(OPE)	200	98503.2	0	0	210	82546.4	0	0	B31.3
2(SUS)		17946.7	63326.2	28.3		25974.2	63326.2	41	B31.3
3(EXP)		83307.3	233580	35.7		67117.6	225552.5	29.8	B31.3
1(OPE)	210	82291.6	0	0	220	32991.6	0	0	B31.3
2(SUS)		25975	63326.2	41		23367.1	63326.2	36.9	B31.3
3(EXP)		67117.6	225551.7	29.8		16569.9	228159.5	7.3	B31.3
1(OPE)	220	32753.3	0	0	230	45292.4	0	0	B31.3
2(SUS)		23367.5	63326.2	36.9		24206.5	63326.2	38.2	B31.3
3(EXP)		16569.9	228159.1	7.3		30323.7	227320.2	13.3	B31.3

Possible Approach:
Expansion Loop Dimension A: 3348mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	17776	-12964	96393	-14713	-87091	4081	0	0	0
	2(SUS)	-131	-14494	99	-18512	314	-2064	0	0	0
	3(EXP)	17908	1530	96294	3799	-87405	6145	0	0	0
	MAX	17908/L3	-14494/L	96393/L	-18512/L	-87405/L	6145/L3	0.000/L3	-0.000/L2	0.000/L1
15		Rigid +Y								
	1(OPE)	2013	-33238	-9766	0	0	0	11.15	0	-54.1
	2(SUS)	562	-27054	15	0	0	0	0.003	0	0
	3(EXP)	1451	-6184	-9781	0	0	0	11.147	0	-54.1
	MAX	2013/L1	-33238/L	-9781/L3				11.150/L	-0.000/L1	-54.100/L3
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6655	-27325	-10123	0	0	0	-3	0	-108.209
	2(SUS)	-1247	-28691	32	0	0	0	-0.007	0	0
	3(EXP)	-5409	1366	-10155	0	0	0	-2.993	0	-108.209
	MAX	-6655/L1	-28691/L	-10155/L3				-3.000/L1	-0.000/L2	-108.209/L3
45		Rigid +Y								
	1(OPE)	-11951	-42624	-4549	0	0	0	-88.476	0	-33.674
	2(SUS)	816	-45912	-691	0	0	0	0.005	0	-0.004
	3(EXP)	-12767	3287	-3858	0	0	0	-88.481	0	-33.67
	MAX	-12767/L	-45912/L	-4549/L1				-88.481/L	-0.000/L2	-33.674/L1
65		Rigid +Y								
	1(OPE)	-11951	-42624	4549	0	0	0	-88.476	0	33.674
	2(SUS)	816	-45912	691	0	0	0	0.005	0	0.004
	3(EXP)	-12767	3287	3858	0	0	0	-88.481	0	33.67
	MAX	-12767/L	-45912/L	4549/L1				-88.481/L	-0.000/L2	33.674/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-6655	-27325	10123	0	0	0	-3	0	108.209
	2(SUS)	-1247	-28691	-32	0	0	0	-0.007	0	0
	3(EXP)	-5409	1366	10155	0	0	0	-2.993	0	108.209
	MAX	-6655/L1	-28691/L	10155/L3				-3.000/L1	-0.000/L2	108.209/L3
90		Rigid +Y								
	1(OPE)	2013	-33238	9766	0	0	0	11.15	0	54.1
	2(SUS)	562	-27054	-15	0	0	0	0.003	0	0
	3(EXP)	1451	-6184	9781	0	0	0	11.147	0	54.1
	MAX	2013/L1	-33238/L	9781/L3				11.150/L	-0.000/L1	54.100/L3
100		Rigid ANC								
	1(OPE)	35553	-25928	0	0	0	8161	0	0	0
	2(SUS)	-263	-28989	0	0	0	-4128	0	0	0
	3(EXP)	35816	3060	0	0	0	12290	0	0	0
	MAX	35816/L3	-28989/L	-0/L1	0/L2	-0/L1	12290/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 3348mm

110		Rigid +Y								
	1(OPE)	2013	-33238	-9766	0	0	0	11.15	0	-54.1
	2(SUS)	562	-27054	15	0	0	0	0.003	0	0
	3(EXP)	1451	-6184	-9781	0	0	0	11.147	0	-54.1
	MAX	2013/L1	-33238/L	-9781/L3				11.150/L	-0.000/L1	-54.100/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6655	-27325	-10123	0	0	0	-3	0	-108.209
	2(SUS)	-1247	-28691	32	0	0	0	-0.007	0	0
	3(EXP)	-5409	1366	-10155	0	0	0	-2.993	0	-108.209
	MAX	-6655/L1	-28691/L	-10155/L3				-3.000/L1	-0.000/L2	-108.209/L3
150		Rigid +Y								
	1(OPE)	-11951	-42624	-4549	0	0	0	-88.476	0	-33.674
	2(SUS)	816	-45912	-691	0	0	0	0.005	0	-0.004
	3(EXP)	-12767	3287	-3858	0	0	0	-88.481	0	-33.67
	MAX	-12767/L	-45912/L	-4549/L1				-88.481/L	-0.000/L2	-33.674/L1
180		Rigid +Y								
	1(OPE)	-11951	-42624	4549	0	0	0	-88.476	0	33.674
	2(SUS)	816	-45912	691	0	0	0	0.005	0	0.004
	3(EXP)	-12767	3287	3858	0	0	0	-88.481	0	33.67
	MAX	-12767/L	-45912/L	4549/L1				-88.481/L	-0.000/L2	33.674/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-6655	-27325	10123	0	0	0	-3	0	108.209
	2(SUS)	-1247	-28691	-32	0	0	0	-0.007	0	0
	3(EXP)	-5409	1366	10155	0	0	0	-2.993	0	108.209
	MAX	-6655/L1	-28691/L	10155/L3				-3.000/L1	-0.000/L2	108.209/L3
220		Rigid +Y								
	1(OPE)	2013	-33238	9766	0	0	0	11.15	0	54.1
	2(SUS)	562	-27054	-15	0	0	0	0.003	0	0
	3(EXP)	1451	-6184	9781	0	0	0	11.147	0	54.1
	MAX	2013/L1	-33238/L	9781/L3				11.150/L	-0.000/L1	54.100/L3
230		Rigid ANC								
	1(OPE)	17776	-12964	-96393	14713	87091	4081	0	0	0
	2(SUS)	-131	-14494	-99	18512	-314	-2064	0	0	0
	3(EXP)	17908	1530	-96294	-3799	87405	6145	0	0	0
	MAX	17908/L3	-14494/L	-96393/L	18512/L3	87405/L3	6145/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.147	0	-54.1	-0.0077	-0.0803	0.0315
20	-2.993	0	-108.209	0.0311	0.3936	0.063
28	-35.783	3.301	-131.87	0.0876	0.7664	0.0767
29	-38.651	3.921	-133.277	0.0951	0.8139	0.0803
30	-41.343	5.057	-134.324	0.1016	0.8583	0.0878
38	-44.995	7.017	-135.49	0.1047	0.9035	0.0838
39	-50.948	9.192	-134.284	0.1113	0.9906	0.1001
40	-55.844	9.516	-128.019	0.1129	1.0787	0.1087
45	-88.481	0	-33.67	0.0641	1.172	0.1265
48	-108.815	-6.213	16.712	0.0336	0.8243	0.1265
49	-113.542	-6.963	20.594	0.0288	0.684	0.1271
50	-118.666	-7.142	19.604	0.0227	0.5356	0.1276
59	-113.542	-6.963	-20.594	-0.0288	-0.684	0.1271
60	-108.815	-6.213	-16.712	-0.0336	-0.8243	0.1265
65	-88.481	0	33.67	-0.0641	-1.172	0.1265
68	-55.844	9.516	128.019	-0.1129	-1.0787	0.1087
69	-50.948	9.192	134.284	-0.1113	-0.9906	0.1001
70	-44.995	7.017	135.49	-0.1047	-0.9035	0.0838
78	-41.343	5.057	134.324	-0.1016	-0.8583	0.0878
79	-38.651	3.921	133.277	-0.0951	-0.8139	0.0803
80	-35.783	3.301	131.87	-0.0876	-0.7664	0.0767
85	-2.993	0	108.209	-0.0311	-0.3936	0.063
90	11.147	0	54.1	0.0077	0.0803	0.0315
100	0	0	0	0	0	0
110	11.147	0	-54.1	-0.0077	-0.0803	0.0315
120	-2.993	0	-108.209	0.0311	0.3936	0.063
128	-35.783	3.301	-131.87	0.0876	0.7664	0.0767
129	-38.651	3.921	-133.277	0.0951	0.8139	0.0803
130	-41.343	5.057	-134.324	0.1016	0.8583	0.0878
139	-50.948	9.192	-134.284	0.1113	0.9906	0.1001
140	-55.843	9.516	-128.019	0.1129	1.0787	0.1087
150	-88.481	0	-33.67	0.0641	1.172	0.1265
158	-108.815	-6.213	16.712	0.0336	0.8243	0.1265
159	-113.542	-6.963	20.594	0.0288	0.684	0.1271
160	-118.665	-7.142	19.604	0.0227	0.5356	0.1276
168	-118.666	-7.142	-19.604	-0.0227	-0.5356	0.1276
169	-113.542	-6.963	-20.594	-0.0288	-0.684	0.1271
170	-108.815	-6.213	-16.712	-0.0336	-0.8243	0.1265
180	-88.481	0	33.67	-0.0641	-1.172	0.1265

Possible Approach:
Expansion Loop Dimension A: 3348mm

188	-55.844	9.516	128.019	-0.1129	-1.0787	0.1087
189	-50.948	9.192	134.284	-0.1113	-0.9906	0.1001
190	-44.995	7.017	135.49	-0.1047	-0.9035	0.0838
199	-38.651	3.921	133.277	-0.0951	-0.8139	0.0803
200	-35.783	3.301	131.87	-0.0876	-0.7664	0.0767
210	-2.993	0	108.209	-0.0311	-0.3936	0.063
220	11.147	0	54.1	0.0077	0.0803	0.0315
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	0.0016	-0.0007	-0.0106
20	-0.007	0	0	-0.0065	0.003	-0.0212
28	-0.265	-0.982	0	-0.0203	0.0051	-0.0258
29	-0.265	-1.054	-0.014	-0.0202	0.0051	-0.0261
30	-0.227	-1.115	-0.055	-0.02	0.005	-0.0264
38	-0.145	-1.19	-0.13	-0.0199	0.0049	-0.0268
39	-0.04	-1.207	-0.209	-0.0198	0.0046	-0.0277
40	0.005	-1.06	-0.219	-0.0199	0.0042	-0.0283
45	0.005	0	-0.004	-0.0215	0.001	0.0263
48	0.005	-2.758	0.003	-0.0226	-0.0003	0.0716
49	0.006	-3.3	0.001	-0.0226	-0.0003	0.0731
50	0.007	-3.648	0	-0.0213	-0.0002	0.0732
59	0.006	-3.3	-0.001	0.0226	0.0003	0.0731
60	0.005	-2.758	-0.003	0.0226	0.0003	0.0716
65	0.005	0	0.004	0.0215	-0.001	0.0263
68	0.005	-1.06	0.219	0.0199	-0.0042	-0.0283
69	-0.04	-1.207	0.209	0.0198	-0.0046	-0.0277
70	-0.145	-1.19	0.13	0.0199	-0.0049	-0.0268
78	-0.227	-1.115	0.055	0.02	-0.005	-0.0264
79	-0.265	-1.054	0.014	0.0202	-0.0051	-0.0261
80	-0.265	-0.982	0	0.0203	-0.0051	-0.0258
85	-0.007	0	0	0.0065	-0.003	-0.0212
90	0.003	0	0	-0.0016	0.0007	-0.0106
100	0	0	0	0	0	0
110	0.003	0	0	0.0016	-0.0007	-0.0106
120	-0.007	0	0	-0.0065	0.003	-0.0212
128	-0.265	-0.982	0	-0.0203	0.0051	-0.0258
129	-0.265	-1.054	-0.014	-0.0202	0.0051	-0.0261
130	-0.227	-1.115	-0.055	-0.02	0.005	-0.0264
139	-0.04	-1.207	-0.209	-0.0198	0.0046	-0.0277
140	0.005	-1.06	-0.219	-0.0199	0.0042	-0.0283
150	0.005	0	-0.004	-0.0215	0.001	0.0263
158	0.005	-2.758	0.003	-0.0226	-0.0003	0.0716
159	0.006	-3.3	0.001	-0.0226	-0.0003	0.0731
160	0.007	-3.648	0	-0.0213	-0.0002	0.0732
168	0.007	-3.648	0	0.0213	0.0002	0.0732
169	0.006	-3.3	-0.001	0.0226	0.0003	0.0731
170	0.005	-2.758	-0.003	0.0226	0.0003	0.0716
180	0.005	0	0.004	0.0215	-0.001	0.0263

Possible Approach:
Expansion Loop Dimension A: 3348mm

188	0.005	-1.06	0.219	0.0199	-0.0042	-0.0283
189	-0.04	-1.207	0.209	0.0198	-0.0046	-0.0277
190	-0.145	-1.19	0.13	0.0199	-0.0049	-0.0268
199	-0.265	-1.054	0.014	0.0202	-0.0051	-0.0261
200	-0.265	-0.982	0	0.0203	-0.0051	-0.0258
210	-0.007	0	0	0.0065	-0.003	-0.0212
220	0.003	0	0	-0.0016	0.0007	-0.0106
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:7
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	11.15	0	-54.1	-0.0061	-0.081	0.0209
20	-3	0	-108.209	0.0246	0.3967	0.0418
28	-36.048	2.32	-131.87	0.0673	0.7716	0.051
29	-38.916	2.867	-133.291	0.0749	0.819	0.0542
30	-41.57	3.942	-134.378	0.0815	0.8633	0.0613
38	-45.14	5.827	-135.62	0.0848	0.9084	0.057
39	-50.989	7.985	-134.494	0.0915	0.9952	0.0724
40	-55.838	8.457	-128.238	0.0931	1.0828	0.0804
45	-88.476	0	-33.674	0.0425	1.173	0.1528
48	-108.811	-8.971	16.715	0.0111	0.824	0.1981
49	-113.537	-10.264	20.595	0.0061	0.6837	0.2002
50	-118.658	-10.79	19.604	0.0014	0.5354	0.2009
59	-113.537	-10.264	-20.595	-0.0061	-0.6837	0.2002
60	-108.811	-8.971	-16.715	-0.0111	-0.824	0.1981
65	-88.476	0	33.674	-0.0425	-1.173	0.1528
68	-55.838	8.457	128.238	-0.0931	-1.0828	0.0804
69	-50.988	7.985	134.494	-0.0915	-0.9952	0.0724
70	-45.14	5.827	135.62	-0.0848	-0.9084	0.057
78	-41.57	3.942	134.378	-0.0815	-0.8633	0.0613
79	-38.916	2.867	133.291	-0.0749	-0.819	0.0542
80	-36.048	2.32	131.87	-0.0673	-0.7716	0.051
85	-3	0	108.209	-0.0246	-0.3967	0.0418
90	11.15	0	54.1	0.0061	0.081	0.0209
100	0	0	0	0	0	0
110	11.15	0	-54.1	-0.0061	-0.081	0.0209
120	-3	0	-108.209	0.0246	0.3967	0.0418
128	-36.048	2.32	-131.87	0.0673	0.7716	0.051
129	-38.916	2.867	-133.291	0.0749	0.819	0.0542
130	-41.57	3.942	-134.378	0.0815	0.8633	0.0613
139	-50.988	7.985	-134.494	0.0915	0.9952	0.0724
140	-55.838	8.457	-128.238	0.0931	1.0828	0.0804
150	-88.476	0	-33.674	0.0425	1.173	0.1528
158	-108.81	-8.971	16.715	0.0111	0.824	0.1981
159	-113.537	-10.264	20.595	0.0061	0.6837	0.2002
160	-118.658	-10.79	19.604	0.0014	0.5354	0.2009
168	-118.658	-10.79	-19.604	-0.0014	-0.5354	0.2009
169	-113.537	-10.264	-20.595	-0.0061	-0.6837	0.2002
170	-108.81	-8.971	-16.715	-0.0111	-0.824	0.1981
180	-88.476	0	33.674	-0.0425	-1.173	0.1528

Possible Approach:
Expansion Loop Dimension A: 3348mm

188	-55.838	8.457	128.238	-0.0931	-1.0828	0.0804
189	-50.988	7.985	134.494	-0.0915	-0.9952	0.0724
190	-45.14	5.827	135.62	-0.0848	-0.9084	0.057
199	-38.916	2.867	133.291	-0.0749	-0.819	0.0542
200	-36.048	2.32	131.87	-0.0673	-0.7716	0.051
210	-3	0	108.209	-0.0246	-0.3967	0.0418
220	11.15	0	54.1	0.0061	0.081	0.0209
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .30

From 45 To 50 DX= -3,548.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 3,548.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .30

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .30
Node 85 +Y Mu = .30

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .30

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

Possible Approach:

Expansion Loop Dimension A: 3548mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,548.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,548.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Expansion Loop Dimension A: 3548mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len Dir	MU Vectors
10	ANC			.30	.000	.000		.000
15	+Y			.30	.000	1.000		.000
20	Guide		3.00	.30	.000	.000		.000
20	+Y			.30	.000	1.000		.000
45	+Y			.30	.000	1.000		.000
65	+Y			.30	.000	1.000		.000
85	Guide		3.00	.30	.000	.000		.000
85	+Y			.30	.000	1.000		.000
90	+Y			.30	.000	1.000		.000
100	ANC			.30	.000	.000		.000
110	+Y			.30	.000	1.000		.000
120	+Y			.30	.000	1.000		.000
120	Guide		3.00	.30	.000	.000		.000
150	+Y			.30	.000	1.000		.000
180	+Y			.30	.000	1.000		.000
210	+Y			.30	.000	1.000		.000
210	Guide		3.00	.30	.000	.000		.000
220	+Y			.30	.000	1.000		.000
230	ANC			.30	.000	.000		.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension A: 3548mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension A: 3548mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 3548mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-8600.000	750.000	-19250.000
60	-8600.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-8600.000	750.000	-64250.000
170	-8600.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 63.6 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 40281.3 Allowable Stress: 63326.2
Axial Stress: 17762.0 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 124979.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 28343.5 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 146493.2 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	44268.8	0	0	15	32438.3	0	0	B31.3
2(SUS)		24056.7	63326.2	38		23674.2	63326.2	37.4	B31.3
3(EXP)		29185	227469.9	12.8		15985.6	227852.5	7	B31.3
1(OPE)	15	32679.6	0	0	20	80041.8	0	0	B31.3
2(SUS)		23674.3	63326.2	37.4		24894.3	63326.2	39.3	B31.3
3(EXP)		15985.6	227852.3	7		64744.7	226632.4	28.6	B31.3
1(OPE)	20	80271.8	0	0	28	96842.4	0	0	B31.3
2(SUS)		24894.6	63326.2	39.3		17987.3	63326.2	28.4	B31.3
3(EXP)		64744.7	226632.1	28.6		81667.5	233539.3	35	B31.3
1(OPE)	28	96842.4	0	0	29	97791.3	0	0	B31.3
2(SUS)		17987.3	63326.2	28.4		18213.6	63326.2	28.8	B31.3
3(EXP)		81667.5	233539.3	35		82573.5	233313.1	35.4	B31.3
1(OPE)	29	97791.3	0	0	30	98636.1	0	0	B31.3
2(SUS)		18213.6	63326.2	28.8		18430.5	63326.2	29.1	B31.3
3(EXP)		82573.5	233313.1	35.4		83112.1	233096.2	35.7	B31.3
1(OPE)	30	98636.1	0	0	38	99284.9	0	0	B31.3
2(SUS)		18430.5	63326.2	29.1		18523.6	63326.2	29.3	B31.3
3(EXP)		83112.1	233096.2	35.7		83835.6	233003	36	B31.3
1(OPE)	38	99284.9	0	0	39	96780.7	0	0	B31.3
2(SUS)		18523.6	63326.2	29.3		18521.3	63326.2	29.2	B31.3
3(EXP)		83835.6	233003	36		81251.1	233005.3	34.9	B31.3

Possible Approach:
Expansion Loop Dimension A: 3548mm

1(OPE)	39	96780.7	0	0	40	88808.3	0	0	B31.3
2(SUS)		18521.3	63326.2	29.2		18153.1	63326.2	28.7	B31.3
3(EXP)		81251.1	233005.3	34.9		72460.8	233373.5	31	B31.3
1(OPE)	40	88808.3	0	0	45	64851.8	0	0	B31.3
2(SUS)		18153.1	63326.2	28.7		40281.3	63326.2	63.6	B31.3
3(EXP)		72460.8	233373.5	31		42294.3	211245.4	20	B31.3
1(OPE)	45	65186.8	0	0	48	129663	0	0	B31.3
2(SUS)		40259.7	63326.2	63.6		20001.5	63326.2	31.6	B31.3
3(EXP)		42294.3	211266.9	20		112529.5	231525.1	48.6	B31.3
1(OPE)	48	129663	0	0	49	137214.7	0	0	B31.3
2(SUS)		20001.5	63326.2	31.6		17991.1	63326.2	28.4	B31.3
3(EXP)		112529.5	231525.1	48.6		121333	233535.6	52	B31.3
1(OPE)	49	137214.7	0	0	50	140314.9	0	0	B31.3
2(SUS)		17991.1	63326.2	28.4		19387	63326.2	30.6	B31.3
3(EXP)		121333	233535.6	52		124979.8	232139.6	53.8	B31.3
1(OPE)	50	140314.9	0	0	59	137214.7	0	0	B31.3
2(SUS)		19387	63326.2	30.6		17991.1	63326.2	28.4	B31.3
3(EXP)		124979.8	232139.6	53.8		121332.9	233535.6	52	B31.3
1(OPE)	59	137214.7	0	0	60	129663	0	0	B31.3
2(SUS)		17991.1	63326.2	28.4		20001.5	63326.2	31.6	B31.3
3(EXP)		121332.9	233535.6	52		112529.5	231525.1	48.6	B31.3
1(OPE)	60	129663	0	0	65	65186.8	0	0	B31.3
2(SUS)		20001.5	63326.2	31.6		40259.7	63326.2	63.6	B31.3
3(EXP)		112529.5	231525.1	48.6		42294.2	211266.9	20	B31.3
1(OPE)	65	64851.8	0	0	68	88808.3	0	0	B31.3
2(SUS)		40281.3	63326.2	63.6		18153.1	63326.2	28.7	B31.3
3(EXP)		42294.2	211245.4	20		72460.8	233373.5	31	B31.3
1(OPE)	68	88808.3	0	0	69	96780.7	0	0	B31.3
2(SUS)		18153.1	63326.2	28.7		18521.3	63326.2	29.2	B31.3
3(EXP)		72460.8	233373.5	31		81251.1	233005.3	34.9	B31.3
1(OPE)	69	96780.7	0	0	70	99284.9	0	0	B31.3
2(SUS)		18521.3	63326.2	29.2		18523.6	63326.2	29.3	B31.3
3(EXP)		81251.1	233005.3	34.9		83835.6	233003	36	B31.3
1(OPE)	70	99284.9	0	0	78	98636.2	0	0	B31.3
2(SUS)		18523.6	63326.2	29.3		18430.5	63326.2	29.1	B31.3
3(EXP)		83835.6	233003	36		83112.1	233096.2	35.7	B31.3
1(OPE)	78	98636.2	0	0	79	97791.3	0	0	B31.3
2(SUS)		18430.4	63326.2	29.1		18213.6	63326.2	28.8	B31.3
3(EXP)		83112.1	233096.2	35.7		82573.5	233313.1	35.4	B31.3
1(OPE)	79	97791.3	0	0	80	96842.4	0	0	B31.3
2(SUS)		18213.6	63326.2	28.8		17987.3	63326.2	28.4	B31.3
3(EXP)		82573.5	233313.1	35.4		81667.6	233539.3	35	B31.3

Possible Approach:
Expansion Loop Dimension A: 3548mm

1(OPE)	80	96842.4	0	0	85	80271.8	0	0	B31.3
2(SUS)		17987.3	63326.2	28.4		24894.6	63326.2	39.3	B31.3
3(EXP)		81667.6	233539.3	35		64744.8	226632.1	28.6	B31.3
1(OPE)	85	80041.8	0	0	90	32679.6	0	0	B31.3
2(SUS)		24894.3	63326.2	39.3		23674.3	63326.2	37.4	B31.3
3(EXP)		64744.8	226632.4	28.6		15985.6	227852.3	7	B31.3
1(OPE)	90	32438.3	0	0	100	44268.9	0	0	B31.3
2(SUS)		23674.2	63326.2	37.4		24056.8	63326.2	38	B31.3
3(EXP)		15985.6	227852.5	7		29185.1	227469.9	12.8	B31.3
1(OPE)	100	44268.9	0	0	110	32438.3	0	0	B31.3
2(SUS)		24056.8	63326.2	38		23674.2	63326.2	37.4	B31.3
3(EXP)		29185.1	227469.9	12.8		15985.6	227852.5	7	B31.3
1(OPE)	110	32679.6	0	0	120	80041.9	0	0	B31.3
2(SUS)		23674.3	63326.2	37.4		24894.3	63326.2	39.3	B31.3
3(EXP)		15985.6	227852.3	7		64744.8	226632.4	28.6	B31.3
1(OPE)	120	80271.9	0	0	128	96842.4	0	0	B31.3
2(SUS)		24894.6	63326.2	39.3		17987.3	63326.2	28.4	B31.3
3(EXP)		64744.8	226632.1	28.6		81667.6	233539.3	35	B31.3
1(OPE)	128	96842.4	0	0	129	97791.4	0	0	B31.3
2(SUS)		17987.3	63326.2	28.4		18213.6	63326.2	28.8	B31.3
3(EXP)		81667.6	233539.3	35		82573.5	233313.1	35.4	B31.3
1(OPE)	129	97791.4	0	0	130	98636.2	0	0	B31.3
2(SUS)		18213.6	63326.2	28.8		18430.5	63326.2	29.1	B31.3
3(EXP)		82573.5	233313.1	35.4		83112.1	233096.2	35.7	B31.3
1(OPE)	130	98636.2	0	0	139	96780.7	0	0	B31.3
2(SUS)		18430.5	63326.2	29.1		18521.3	63326.2	29.2	B31.3
3(EXP)		83112.1	233096.2	35.7		81251.1	233005.3	34.9	B31.3
1(OPE)	139	96780.7	0	0	140	88808.3	0	0	B31.3
2(SUS)		18521.3	63326.2	29.2		18153.1	63326.2	28.7	B31.3
3(EXP)		81251.1	233005.3	34.9		72460.8	233373.5	31	B31.3
1(OPE)	140	88808.3	0	0	150	64851.8	0	0	B31.3
2(SUS)		18153.1	63326.2	28.7		40281.3	63326.2	63.6	B31.3
3(EXP)		72460.8	233373.5	31		42294.2	211245.4	20	B31.3
1(OPE)	150	65186.8	0	0	158	129663	0	0	B31.3
2(SUS)		40259.7	63326.2	63.6		20001.5	63326.2	31.6	B31.3
3(EXP)		42294.2	211266.9	20		112529.4	231525.1	48.6	B31.3
1(OPE)	158	129663	0	0	159	137214.7	0	0	B31.3
2(SUS)		20001.5	63326.2	31.6		17991.1	63326.2	28.4	B31.3
3(EXP)		112529.4	231525.1	48.6		121332.9	233535.6	52	B31.3
1(OPE)	159	137214.7	0	0	160	140314.8	0	0	B31.3
2(SUS)		17991.1	63326.2	28.4		19387	63326.2	30.6	B31.3
3(EXP)		121332.9	233535.6	52		124979.8	232139.6	53.8	B31.3

Possible Approach:
Expansion Loop Dimension A: 3548mm

1(OPE)	160	140314.8	0	0	168	140314.8	0	0	B31.3
2(SUS)		19387	63326.2	30.6		19387	63326.2	30.6	B31.3
3(EXP)		124979.8	232139.6	53.8		124979.8	232139.6	53.8	B31.3
1(OPE)	168	140314.8	0	0	169	137214.7	0	0	B31.3
2(SUS)		19387	63326.2	30.6		17991.1	63326.2	28.4	B31.3
3(EXP)		124979.8	232139.6	53.8		121332.9	233535.6	52	B31.3
1(OPE)	169	137214.7	0	0	170	129663	0	0	B31.3
2(SUS)		17991.1	63326.2	28.4		20001.5	63326.2	31.6	B31.3
3(EXP)		121332.9	233535.6	52		112529.5	231525.1	48.6	B31.3
1(OPE)	170	129663	0	0	180	65186.8	0	0	B31.3
2(SUS)		20001.5	63326.2	31.6		40259.7	63326.2	63.6	B31.3
3(EXP)		112529.5	231525.1	48.6		42294.2	211266.9	20	B31.3
1(OPE)	180	64851.8	0	0	188	88808.3	0	0	B31.3
2(SUS)		40281.3	63326.2	63.6		18153.1	63326.2	28.7	B31.3
3(EXP)		42294.2	211245.4	20		72460.8	233373.5	31	B31.3
1(OPE)	188	88808.3	0	0	189	96780.7	0	0	B31.3
2(SUS)		18153.1	63326.2	28.7		18521.3	63326.2	29.2	B31.3
3(EXP)		72460.8	233373.5	31		81251.1	233005.3	34.9	B31.3
1(OPE)	189	96780.7	0	0	190	99284.9	0	0	B31.3
2(SUS)		18521.3	63326.2	29.2		18523.6	63326.2	29.3	B31.3
3(EXP)		81251.1	233005.3	34.9		83835.6	233003	36	B31.3
1(OPE)	190	99284.9	0	0	199	97791.3	0	0	B31.3
2(SUS)		18523.6	63326.2	29.3		18213.6	63326.2	28.8	B31.3
3(EXP)		83835.6	233003	36		82573.4	233313.1	35.4	B31.3
1(OPE)	199	97791.3	0	0	200	96842.4	0	0	B31.3
2(SUS)		18213.6	63326.2	28.8		17987.3	63326.2	28.4	B31.3
3(EXP)		82573.4	233313.1	35.4		81667.5	233539.3	35	B31.3
1(OPE)	200	96842.4	0	0	210	80271.8	0	0	B31.3
2(SUS)		17987.3	63326.2	28.4		24894.6	63326.2	39.3	B31.3
3(EXP)		81667.5	233539.3	35		64744.8	226632.1	28.6	B31.3
1(OPE)	210	80041.8	0	0	220	32679.6	0	0	B31.3
2(SUS)		24894.3	63326.2	39.3		23674.4	63326.2	37.4	B31.3
3(EXP)		64744.8	226632.4	28.6		15985.6	227852.3	7	B31.3
1(OPE)	220	32438.3	0	0	230	44268.8	0	0	B31.3
2(SUS)		23674.2	63326.2	37.4		24056.7	63326.2	38	B31.3
3(EXP)		15985.6	227852.5	7		29185	227469.9	12.8	B31.3

Possible Approach:
Expansion Loop Dimension A: 3548mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	17130	-12877	92276	-14497	-83829	4028	0	0	0
	2(SUS)	-124	-14321	-38	-18081	296	-1892	0	0	0
	3(EXP)	17254	1444	92314	3584	-84125	5921	0	0	0
	MAX	17254/L3	-14321/L	92314/L	-18081/L	-84125/L	5921/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1959	-33590	-9885	0	0	0	10.72	0	-54.104
	2(SUS)	532	-27756	-6	0	0	0	0.003	0	0
	3(EXP)	1427	-5834	-9879	0	0	0	10.717	0	-54.104
	MAX	1959/L1	-33590/L	-9885/L1				10.720/L	-0.000/L1	-54.104/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-5354	-26171	-9389	0	0	0	-3	0	-108.216
	2(SUS)	-1272	-27222	-12	0	0	0	-0.007	0	0
	3(EXP)	-4082	1051	-9377	0	0	0	-2.993	0	-108.216
	MAX	-5354/L1	-27222/L	-9389/L1				-3.000/L1	-0.000/L2	-108.216/L1
45		Rigid +Y								
	1(OPE)	-12270	-44269	-5082	0	0	0	-86.951	0	-36.011
	2(SUS)	865	-47609	-249	0	0	0	0.005	0	-0.001
	3(EXP)	-13135	3339	-4833	0	0	0	-86.956	0	-36.01
	MAX	-13135/L	-47609/L	-5082/L1				-86.956/L	-0.000/L2	-36.011/L1
65		Rigid +Y								
	1(OPE)	-12270	-44269	5082	0	0	0	-86.951	0	36.011
	2(SUS)	865	-47609	249	0	0	0	0.005	0	0.001
	3(EXP)	-13135	3339	4833	0	0	0	-86.956	0	36.01
	MAX	-13135/L	-47609/L	5082/L1				-86.956/L	-0.000/L2	36.011/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-5354	-26171	9389	0	0	0	-3	0	108.216
	2(SUS)	-1272	-27222	12	0	0	0	-0.007	0	0
	3(EXP)	-4082	1051	9377	0	0	0	-2.993	0	108.216
	MAX	-5354/L1	-27222/L	9389/L1				-3.000/L1	-0.000/L2	108.216/L1
90		Rigid +Y								
	1(OPE)	1959	-33590	9885	0	0	0	10.72	0	54.104
	2(SUS)	532	-27756	6	0	0	0	0.003	0	0
	3(EXP)	1427	-5834	9879	0	0	0	10.717	0	54.104
	MAX	1959/L1	-33590/L	9885/L1				10.720/L	-0.000/L1	54.104/L1
100		Rigid ANC								
	1(OPE)	34259	-25754	0	0	0	8056	0	0	0
	2(SUS)	-248	-28641	0	0	0	-3785	0	0	0
	3(EXP)	34508	2887	0	0	0	11841	0	0	0
	MAX	34508/L3	-28641/L	-0/L1	0/L2	-0/L1	11841/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 3548mm

110		Rigid +Y								
	1(OPE)	1959	-33590	-9885	0	0	0	10.72	0	-54.104
	2(SUS)	532	-27756	-6	0	0	0	0.003	0	0
	3(EXP)	1427	-5834	-9879	0	0	0	10.717	0	-54.104
	MAX	1959/L1	-33590/L	-9885/L1				10.720/L	-0.000/L1	-54.104/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-5354	-26171	-9389	0	0	0	-3	0	-108.216
	2(SUS)	-1272	-27222	-12	0	0	0	-0.007	0	0
	3(EXP)	-4082	1051	-9377	0	0	0	-2.993	0	-108.216
	MAX	-5354/L1	-27222/L	-9389/L1				-3.000/L1	-0.000/L2	-108.216/L1
150		Rigid +Y								
	1(OPE)	-12270	-44269	-5082	0	0	0	-86.951	0	-36.011
	2(SUS)	865	-47609	-249	0	0	0	0.005	0	-0.001
	3(EXP)	-13135	3339	-4833	0	0	0	-86.956	0	-36.009
	MAX	-13135/L	-47609/L	-5082/L1				-86.956/L	-0.000/L2	-36.011/L1
180		Rigid +Y								
	1(OPE)	-12270	-44269	5082	0	0	0	-86.951	0	36.011
	2(SUS)	865	-47609	249	0	0	0	0.005	0	0.001
	3(EXP)	-13135	3339	4833	0	0	0	-86.956	0	36.01
	MAX	-13135/L	-47609/L	5082/L1				-86.956/L	-0.000/L2	36.011/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-5354	-26171	9389	0	0	0	-3	0	108.216
	2(SUS)	-1272	-27222	12	0	0	0	-0.007	0	0
	3(EXP)	-4082	1051	9377	0	0	0	-2.993	0	108.216
	MAX	-5354/L1	-27222/L	9389/L1				-3.000/L1	-0.000/L2	108.216/L1
220		Rigid +Y								
	1(OPE)	1959	-33590	9885	0	0	0	10.72	0	54.104
	2(SUS)	532	-27756	6	0	0	0	0.003	0	0
	3(EXP)	1427	-5834	9879	0	0	0	10.717	0	54.104
	MAX	1959/L1	-33590/L	9885/L1				10.720/L	-0.000/L1	54.104/L1
230		Rigid ANC								
	1(OPE)	17130	-12877	-92276	14497	83829	4028	0	0	0
	2(SUS)	-124	-14321	38	18081	-296	-1892	0	0	0
	3(EXP)	17254	1444	-92314	-3584	84125	5921	0	0	0
	MAX	17254/L3	-14321/L	-92314/L	18081/L3	84125/L3	5921/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.717	0	-54.104	-0.0073	-0.077	0.0303
20	-2.993	0	-108.216	0.0293	0.3804	0.0607
28	-34.725	3.127	-131.878	0.0834	0.7434	0.0739
29	-37.508	3.731	-133.288	0.0906	0.79	0.0774
30	-40.12	4.852	-134.345	0.0968	0.8336	0.0847
38	-43.665	6.795	-135.529	0.0999	0.878	0.0809
39	-49.482	8.955	-134.419	0.1064	0.9637	0.097
40	-54.319	9.29	-128.345	0.1082	1.0506	0.1057
45	-86.956	0	-36.01	0.0623	1.1547	0.1237
48	-108.735	-6.508	16.924	0.0316	0.7987	0.1237
49	-113.4	-7.245	20.65	0.027	0.6626	0.1242
50	-118.398	-7.426	19.605	0.0214	0.5188	0.1248
59	-113.4	-7.245	-20.65	-0.027	-0.6626	0.1242
60	-108.735	-6.508	-16.924	-0.0316	-0.7987	0.1237
65	-86.956	0	36.01	-0.0623	-1.1547	0.1237
68	-54.319	9.29	128.345	-0.1082	-1.0506	0.1057
69	-49.482	8.955	134.419	-0.1064	-0.9637	0.097
70	-43.665	6.795	135.529	-0.0999	-0.878	0.0809
78	-40.12	4.852	134.345	-0.0968	-0.8336	0.0847
79	-37.508	3.731	133.288	-0.0906	-0.79	0.0774
80	-34.725	3.127	131.878	-0.0834	-0.7434	0.0739
85	-2.993	0	108.216	-0.0293	-0.3804	0.0607
90	10.717	0	54.104	0.0073	0.077	0.0303
100	0	0	0	0	0	0
110	10.717	0	-54.104	-0.0073	-0.077	0.0303
120	-2.993	0	-108.216	0.0293	0.3804	0.0607
128	-34.725	3.127	-131.878	0.0834	0.7434	0.0739
129	-37.508	3.731	-133.288	0.0906	0.79	0.0774
130	-40.12	4.852	-134.345	0.0968	0.8336	0.0847
139	-49.482	8.955	-134.419	0.1064	0.9637	0.097
140	-54.319	9.29	-128.345	0.1082	1.0506	0.1057
150	-86.956	0	-36.009	0.0623	1.1547	0.1237
158	-108.735	-6.508	16.924	0.0316	0.7987	0.1237
159	-113.4	-7.245	20.65	0.027	0.6626	0.1242
160	-118.398	-7.426	19.605	0.0214	0.5188	0.1248
168	-118.398	-7.426	-19.605	-0.0214	-0.5188	0.1248
169	-113.4	-7.245	-20.65	-0.027	-0.6626	0.1242
170	-108.735	-6.508	-16.924	-0.0316	-0.7987	0.1237
180	-86.956	0	36.01	-0.0623	-1.1547	0.1237

Possible Approach:
Expansion Loop Dimension A: 3548mm

188	-54.319	9.29	128.345	-0.1082	-1.0506	0.1057
189	-49.482	8.955	134.419	-0.1064	-0.9637	0.097
190	-43.665	6.795	135.529	-0.0999	-0.878	0.0809
199	-37.508	3.731	133.288	-0.0906	-0.79	0.0774
200	-34.725	3.127	131.878	-0.0834	-0.7434	0.0739
210	-2.993	0	108.216	-0.0293	-0.3804	0.0607
220	10.717	0	54.104	0.0073	0.077	0.0303
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	0.0007	-0.0007	-0.0097
20	-0.007	0	0	-0.003	0.0029	-0.0194
28	-0.247	-0.676	0	-0.0141	0.0046	-0.0236
29	-0.246	-0.726	-0.01	-0.014	0.0045	-0.0239
30	-0.211	-0.768	-0.038	-0.0139	0.0043	-0.0243
38	-0.135	-0.82	-0.09	-0.0138	0.0042	-0.0246
39	-0.037	-0.816	-0.144	-0.0139	0.0037	-0.0254
40	0.005	-0.672	-0.148	-0.0143	0.0032	-0.0258
45	0.005	0	-0.001	-0.0183	0.0006	0.0354
48	0.005	-3.663	0.002	-0.0209	-0.0002	0.0872
49	0.006	-4.305	0.001	-0.0212	-0.0002	0.0888
50	0.007	-4.687	0	-0.0202	-0.0002	0.0889
59	0.006	-4.305	-0.001	0.0212	0.0002	0.0888
60	0.005	-3.663	-0.002	0.0209	0.0002	0.0872
65	0.005	0	0.001	0.0183	-0.0006	0.0354
68	0.005	-0.672	0.148	0.0143	-0.0032	-0.0258
69	-0.037	-0.816	0.144	0.0139	-0.0037	-0.0254
70	-0.135	-0.82	0.09	0.0138	-0.0042	-0.0246
78	-0.211	-0.768	0.038	0.0139	-0.0043	-0.0243
79	-0.246	-0.726	0.01	0.014	-0.0045	-0.0239
80	-0.247	-0.676	0	0.0141	-0.0046	-0.0236
85	-0.007	0	0	0.003	-0.0029	-0.0194
90	0.003	0	0	-0.0007	0.0007	-0.0097
100	0	0	0	0	0	0
110	0.003	0	0	0.0007	-0.0007	-0.0097
120	-0.007	0	0	-0.003	0.0029	-0.0194
128	-0.247	-0.676	0	-0.0141	0.0046	-0.0236
129	-0.246	-0.726	-0.01	-0.014	0.0045	-0.0239
130	-0.211	-0.768	-0.038	-0.0139	0.0043	-0.0243
139	-0.037	-0.816	-0.144	-0.0139	0.0037	-0.0254
140	0.005	-0.672	-0.148	-0.0143	0.0032	-0.0258
150	0.005	0	-0.001	-0.0183	0.0006	0.0354
158	0.005	-3.663	0.002	-0.0209	-0.0002	0.0872
159	0.006	-4.305	0.001	-0.0212	-0.0002	0.0888
160	0.007	-4.687	0	-0.0202	-0.0002	0.0889
168	0.007	-4.687	0	0.0202	0.0002	0.0889
169	0.006	-4.305	-0.001	0.0212	0.0002	0.0888
170	0.005	-3.663	-0.002	0.0209	0.0002	0.0872
180	0.005	0	0.001	0.0183	-0.0006	0.0354

Possible Approach:
Expansion Loop Dimension A: 3548mm

188	0.005	-0.672	0.148	0.0143	-0.0032	-0.0258
189	-0.037	-0.816	0.144	0.0139	-0.0037	-0.0254
190	-0.135	-0.82	0.09	0.0138	-0.0042	-0.0246
199	-0.246	-0.726	0.01	0.014	-0.0045	-0.0239
200	-0.247	-0.676	0	0.0141	-0.0046	-0.0236
210	-0.007	0	0	0.003	-0.0029	-0.0194
220	0.003	0	0	-0.0007	0.0007	-0.0097
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:59
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.72	0	-54.104	-0.0065	-0.0777	0.0206
20	-3	0	-108.216	0.0263	0.3833	0.0413
28	-34.972	2.451	-131.878	0.0692	0.748	0.0503
29	-37.754	3.005	-133.298	0.0766	0.7945	0.0535
30	-40.331	4.084	-134.383	0.0829	0.8379	0.0605
38	-43.8	5.975	-135.62	0.086	0.8822	0.0563
39	-49.52	8.139	-134.563	0.0925	0.9675	0.0716
40	-54.314	8.618	-128.493	0.0939	1.0538	0.0798
45	-86.951	0	-36.011	0.044	1.1553	0.1591
48	-108.73	-10.171	16.926	0.0107	0.7985	0.2109
49	-113.394	-11.55	20.65	0.0058	0.6624	0.213
50	-118.391	-12.113	19.605	0.0011	0.5187	0.2137
59	-113.394	-11.55	-20.65	-0.0058	-0.6624	0.213
60	-108.73	-10.171	-16.926	-0.0107	-0.7985	0.2109
65	-86.951	0	36.011	-0.044	-1.1553	0.1591
68	-54.314	8.618	128.493	-0.0939	-1.0538	0.0798
69	-49.52	8.139	134.563	-0.0925	-0.9675	0.0716
70	-43.8	5.975	135.62	-0.086	-0.8822	0.0563
78	-40.331	4.084	134.383	-0.0829	-0.8379	0.0605
79	-37.754	3.005	133.298	-0.0766	-0.7945	0.0535
80	-34.972	2.451	131.878	-0.0692	-0.748	0.0503
85	-3	0	108.216	-0.0263	-0.3833	0.0413
90	10.72	0	54.104	0.0065	0.0777	0.0206
100	0	0	0	0	0	0
110	10.72	0	-54.104	-0.0065	-0.0777	0.0206
120	-3	0	-108.216	0.0263	0.3833	0.0413
128	-34.972	2.451	-131.878	0.0692	0.748	0.0503
129	-37.754	3.005	-133.298	0.0766	0.7945	0.0535
130	-40.331	4.084	-134.383	0.0829	0.8379	0.0605
139	-49.52	8.139	-134.563	0.0925	0.9674	0.0716
140	-54.314	8.618	-128.493	0.0939	1.0538	0.0798
150	-86.951	0	-36.011	0.044	1.1553	0.1591
158	-108.73	-10.171	16.926	0.0107	0.7985	0.2109
159	-113.394	-11.55	20.65	0.0058	0.6624	0.213
160	-118.391	-12.113	19.605	0.0011	0.5187	0.2137
168	-118.391	-12.113	-19.605	-0.0011	-0.5187	0.2137
169	-113.394	-11.55	-20.65	-0.0058	-0.6624	0.213
170	-108.73	-10.171	-16.926	-0.0107	-0.7985	0.2109
180	-86.951	0	36.011	-0.044	-1.1553	0.1591

Possible Approach:
Expansion Loop Dimension A: 3548mm

188	-54.314	8.618	128.493	-0.0939	-1.0538	0.0798
189	-49.52	8.139	134.563	-0.0925	-0.9674	0.0716
190	-43.8	5.975	135.62	-0.086	-0.8822	0.0563
199	-37.754	3.005	133.298	-0.0766	-0.7945	0.0535
200	-34.972	2.451	131.878	-0.0692	-0.748	0.0503
210	-3	0	108.216	-0.0263	-0.3833	0.0413
220	10.72	0	54.104	0.0065	0.0777	0.0206
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,748.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,748.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,748.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,748.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:

Expansion Loop Dimension A: 3748mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension A: 3748mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension A: 3748mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 3748mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-8800.000	750.000	-19250.000
60	-8800.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-8800.000	750.000	-64250.000
170	-8800.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 66.4 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 42054.6 Allowable Stress: 63326.2
Axial Stress: 17777.5 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 121090.4 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27753.8 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 142485.0 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43344.5	0	0	15	32181.3	0	0	B31.3
2(SUS)		23901.5	63326.2	37.7		23992.4	63326.2	37.9	B31.3
3(EXP)		28161.9	227625.1	12.4		15458.7	227534.3	6.8	B31.3
1(OPE)	15	32425.9	0	0	20	78037.6	0	0	B31.3
2(SUS)		23993	63326.2	37.9		23774.8	63326.2	37.5	B31.3
3(EXP)		15458.7	227533.6	6.8		62629.2	227751.8	27.5	B31.3
1(OPE)	20	78251.2	0	0	28	95169.4	0	0	B31.3
2(SUS)		23776.3	63326.2	37.5		18063.4	63326.2	28.5	B31.3
3(EXP)		62629.2	227750.4	27.5		80022	233463.3	34.3	B31.3
1(OPE)	28	95169.4	0	0	29	96146.1	0	0	B31.3
2(SUS)		18063.4	63326.2	28.5		18275.2	63326.2	28.9	B31.3
3(EXP)		80022	233463.3	34.3		80965.5	233251.5	34.7	B31.3
1(OPE)	29	96146.1	0	0	30	97020.6	0	0	B31.3
2(SUS)		18275.2	63326.2	28.9		18468.7	63326.2	29.2	B31.3
3(EXP)		80965.5	233251.5	34.7		81549.1	233057.9	35	B31.3
1(OPE)	30	97020.6	0	0	38	97723.6	0	0	B31.3
2(SUS)		18468.7	63326.2	29.2		18597.1	63326.2	29.4	B31.3
3(EXP)		81549.1	233057.9	35		82326.3	232929.6	35.3	B31.3
1(OPE)	38	97723.6	0	0	39	95410.4	0	0	B31.3
2(SUS)		18597.1	63326.2	29.4		18612.7	63326.2	29.4	B31.3
3(EXP)		82326.3	232929.6	35.3		79934.3	232914	34.3	B31.3

Possible Approach:
Expansion Loop Dimension A: 3748mm

1(OPE)	39	95410.4	0	0	40	87809.8	0	0	B31.3
2(SUS)		18612.7	63326.2	29.4		18280.7	63326.2	28.9	B31.3
3(EXP)		79934.3	232914	34.3		71518.7	233246	30.7	B31.3
1(OPE)	40	87809.8	0	0	45	62459.7	0	0	B31.3
2(SUS)		18280.7	63326.2	28.9		42054.6	63326.2	66.4	B31.3
3(EXP)		71518.7	233246	30.7		38766.2	209472.1	18.5	B31.3
1(OPE)	45	62803.8	0	0	48	126486.2	0	0	B31.3
2(SUS)		42031.8	63326.2	66.4		20009.4	63326.2	31.6	B31.3
3(EXP)		38766.2	209494.8	18.5		109355.3	231517.3	47.2	B31.3
1(OPE)	48	126486.2	0	0	49	133621.6	0	0	B31.3
2(SUS)		20009.4	63326.2	31.6		18171	63326.2	28.7	B31.3
3(EXP)		109355.3	231517.3	47.2		117653.1	233355.7	50.4	B31.3
1(OPE)	49	133621.6	0	0	50	136548.7	0	0	B31.3
2(SUS)		18171	63326.2	28.7		19112.6	63326.2	30.2	B31.3
3(EXP)		117653.1	233355.7	50.4		121090.4	232414.1	52.1	B31.3
1(OPE)	50	136548.7	0	0	59	133621.6	0	0	B31.3
2(SUS)		19112.6	63326.2	30.2		18171	63326.2	28.7	B31.3
3(EXP)		121090.4	232414.1	52.1		117653	233355.7	50.4	B31.3
1(OPE)	59	133621.6	0	0	60	126486.2	0	0	B31.3
2(SUS)		18171	63326.2	28.7		20009.4	63326.2	31.6	B31.3
3(EXP)		117653	233355.7	50.4		109355.3	231517.3	47.2	B31.3
1(OPE)	60	126486.2	0	0	65	62803.7	0	0	B31.3
2(SUS)		20009.4	63326.2	31.6		42031.8	63326.2	66.4	B31.3
3(EXP)		109355.3	231517.3	47.2		38766.2	209494.8	18.5	B31.3
1(OPE)	65	62459.7	0	0	68	87809.8	0	0	B31.3
2(SUS)		42054.6	63326.2	66.4		18280.7	63326.2	28.9	B31.3
3(EXP)		38766.2	209472.1	18.5		71518.8	233245.9	30.7	B31.3
1(OPE)	68	87809.8	0	0	69	95410.4	0	0	B31.3
2(SUS)		18280.7	63326.2	28.9		18612.7	63326.2	29.4	B31.3
3(EXP)		71518.8	233245.9	30.7		79934.3	232914	34.3	B31.3
1(OPE)	69	95410.4	0	0	70	97723.6	0	0	B31.3
2(SUS)		18612.7	63326.2	29.4		18597.1	63326.2	29.4	B31.3
3(EXP)		79934.3	232914	34.3		82326.4	232929.6	35.3	B31.3
1(OPE)	70	97723.6	0	0	78	97020.6	0	0	B31.3
2(SUS)		18597.1	63326.2	29.4		18468.7	63326.2	29.2	B31.3
3(EXP)		82326.4	232929.6	35.3		81549.1	233057.9	35	B31.3
1(OPE)	78	97020.6	0	0	79	96146.1	0	0	B31.3
2(SUS)		18468.7	63326.2	29.2		18275.2	63326.2	28.9	B31.3
3(EXP)		81549.1	233057.9	35		80965.5	233251.5	34.7	B31.3
1(OPE)	79	96146.1	0	0	80	95169.4	0	0	B31.3
2(SUS)		18275.2	63326.2	28.9		18063.4	63326.2	28.5	B31.3
3(EXP)		80965.5	233251.5	34.7		80022	233463.3	34.3	B31.3

Possible Approach:
Expansion Loop Dimension A: 3748mm

1(OPE)	80	95169.4	0	0	85	78251.3	0	0	B31.3
2(SUS)		18063.4	63326.2	28.5		23776.3	63326.2	37.5	B31.3
3(EXP)		80022	233463.3	34.3		62629.3	227750.4	27.5	B31.3
1(OPE)	85	78037.7	0	0	90	32425.8	0	0	B31.3
2(SUS)		23774.8	63326.2	37.5		23993	63326.2	37.9	B31.3
3(EXP)		62629.3	227751.8	27.5		15458.7	227533.6	6.8	B31.3
1(OPE)	90	32181.3	0	0	100	43344.6	0	0	B31.3
2(SUS)		23992.3	63326.2	37.9		23901.6	63326.2	37.7	B31.3
3(EXP)		15458.7	227534.3	6.8		28162	227625.1	12.4	B31.3
1(OPE)	100	43344.7	0	0	110	32181.3	0	0	B31.3
2(SUS)		23901.6	63326.2	37.7		23992.3	63326.2	37.9	B31.3
3(EXP)		28162	227625.1	12.4		15458.7	227534.3	6.8	B31.3
1(OPE)	110	32425.9	0	0	120	78037.7	0	0	B31.3
2(SUS)		23993	63326.2	37.9		23774.8	63326.2	37.5	B31.3
3(EXP)		15458.7	227533.6	6.8		62629.3	227751.9	27.5	B31.3
1(OPE)	120	78251.3	0	0	128	95169.5	0	0	B31.3
2(SUS)		23776.2	63326.2	37.5		18063.4	63326.2	28.5	B31.3
3(EXP)		62629.3	227750.4	27.5		80022	233463.3	34.3	B31.3
1(OPE)	128	95169.5	0	0	129	96146.1	0	0	B31.3
2(SUS)		18063.4	63326.2	28.5		18275.2	63326.2	28.9	B31.3
3(EXP)		80022	233463.3	34.3		80965.6	233251.5	34.7	B31.3
1(OPE)	129	96146.1	0	0	130	97020.7	0	0	B31.3
2(SUS)		18275.2	63326.2	28.9		18468.7	63326.2	29.2	B31.3
3(EXP)		80965.6	233251.5	34.7		81549.1	233057.9	35	B31.3
1(OPE)	130	97020.7	0	0	139	95410.4	0	0	B31.3
2(SUS)		18468.7	63326.2	29.2		18612.7	63326.2	29.4	B31.3
3(EXP)		81549.1	233057.9	35		79934.3	232914	34.3	B31.3
1(OPE)	139	95410.4	0	0	140	87809.8	0	0	B31.3
2(SUS)		18612.7	63326.2	29.4		18280.7	63326.2	28.9	B31.3
3(EXP)		79934.3	232914	34.3		71518.8	233245.9	30.7	B31.3
1(OPE)	140	87809.8	0	0	150	62459.6	0	0	B31.3
2(SUS)		18280.7	63326.2	28.9		42054.6	63326.2	66.4	B31.3
3(EXP)		71518.8	233245.9	30.7		38766.2	209472.1	18.5	B31.3
1(OPE)	150	62803.7	0	0	158	126486.1	0	0	B31.3
2(SUS)		42031.8	63326.2	66.4		20009.4	63326.2	31.6	B31.3
3(EXP)		38766.2	209494.8	18.5		109355.3	231517.3	47.2	B31.3
1(OPE)	158	126486.1	0	0	159	133621.6	0	0	B31.3
2(SUS)		20009.4	63326.2	31.6		18171	63326.2	28.7	B31.3
3(EXP)		109355.3	231517.3	47.2		117653	233355.7	50.4	B31.3
1(OPE)	159	133621.6	0	0	160	136548.7	0	0	B31.3
2(SUS)		18171	63326.2	28.7		19112.6	63326.2	30.2	B31.3
3(EXP)		117653	233355.7	50.4		121090.4	232414.1	52.1	B31.3

Possible Approach:
Expansion Loop Dimension A: 3748mm

1(OPE)	160	136548.7	0	0	168	136548.7	0	0	B31.3
2(SUS)		19112.6	63326.2	30.2		19112.6	63326.2	30.2	B31.3
3(EXP)		121090.4	232414.1	52.1		121090.4	232414.1	52.1	B31.3
1(OPE)	168	136548.7	0	0	169	133621.6	0	0	B31.3
2(SUS)		19112.6	63326.2	30.2		18171	63326.2	28.7	B31.3
3(EXP)		121090.4	232414.1	52.1		117653	233355.7	50.4	B31.3
1(OPE)	169	133621.6	0	0	170	126486.2	0	0	B31.3
2(SUS)		18171	63326.2	28.7		20009.4	63326.2	31.6	B31.3
3(EXP)		117653	233355.7	50.4		109355.3	231517.3	47.2	B31.3
1(OPE)	170	126486.2	0	0	180	62803.7	0	0	B31.3
2(SUS)		20009.4	63326.2	31.6		42031.8	63326.2	66.4	B31.3
3(EXP)		109355.3	231517.3	47.2		38766.2	209494.8	18.5	B31.3
1(OPE)	180	62459.7	0	0	188	87809.8	0	0	B31.3
2(SUS)		42054.6	63326.2	66.4		18280.7	63326.2	28.9	B31.3
3(EXP)		38766.2	209472.1	18.5		71518.7	233245.9	30.7	B31.3
1(OPE)	188	87809.8	0	0	189	95410.4	0	0	B31.3
2(SUS)		18280.7	63326.2	28.9		18612.7	63326.2	29.4	B31.3
3(EXP)		71518.7	233245.9	30.7		79934.3	232914	34.3	B31.3
1(OPE)	189	95410.4	0	0	190	97723.6	0	0	B31.3
2(SUS)		18612.7	63326.2	29.4		18597.1	63326.2	29.4	B31.3
3(EXP)		79934.3	232914	34.3		82326.3	232929.6	35.3	B31.3
1(OPE)	190	97723.6	0	0	199	96146	0	0	B31.3
2(SUS)		18597.1	63326.2	29.4		18275.2	63326.2	28.9	B31.3
3(EXP)		82326.3	232929.6	35.3		80965.5	233251.5	34.7	B31.3
1(OPE)	199	96146	0	0	200	95169.4	0	0	B31.3
2(SUS)		18275.2	63326.2	28.9		18063.4	63326.2	28.5	B31.3
3(EXP)		80965.5	233251.5	34.7		80022	233463.3	34.3	B31.3
1(OPE)	200	95169.4	0	0	210	78251.2	0	0	B31.3
2(SUS)		18063.4	63326.2	28.5		23776.2	63326.2	37.5	B31.3
3(EXP)		80022	233463.3	34.3		62629.2	227750.4	27.5	B31.3
1(OPE)	210	78037.6	0	0	220	32425.9	0	0	B31.3
2(SUS)		23774.8	63326.2	37.5		23993	63326.2	37.9	B31.3
3(EXP)		62629.2	227751.9	27.5		15458.7	227533.6	6.8	B31.3
1(OPE)	220	32181.3	0	0	230	43344.5	0	0	B31.3
2(SUS)		23992.4	63326.2	37.9		23901.5	63326.2	37.7	B31.3
3(EXP)		15458.7	227534.3	6.8		28161.9	227625.1	12.4	B31.3

Possible Approach:
Expansion Loop Dimension A: 3748mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	16548	-12775	88687	-14243	-80900	4019	0	0	0
	2(SUS)	-116	-14141	-177	-17635	278	-1713	0	0	0
	3(EXP)	16665	1366	88864	3392	-81178	5731	0	0	0
	MAX	16665/L	-14141/L	88864/L	-17635/L	-81178/L	5731/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1914	-34004	-10020	0	0	0	10.334	0	-54.107
	2(SUS)	500	-28483	-27	0	0	0	0.003	0	0
	3(EXP)	1414	-5521	-9993	0	0	0	10.332	0	-54.107
	MAX	1914/L1	-34004/L	-10020/L1				10.334/L	-0.000/L1	-54.107/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-4358	-24914	-8717	0	0	0	-3	0	-108.223
	2(SUS)	-1297	-25705	-58	0	0	0	-0.007	0	0
	3(EXP)	-3061	791	-8659	0	0	0	-2.993	0	-108.222
	MAX	-4358/L1	-25705/L	-8717/L1				-3.000/L1	-0.000/L2	-108.223/L1
45		Rigid +Y								
	1(OPE)	-12591	-45970	-5627	0	0	0	-85.569	0	-38.243
	2(SUS)	914	-49334	175	0	0	0	0.005	0	0.001
	3(EXP)	-13505	3364	-5802	0	0	0	-85.575	0	-38.244
	MAX	-13505/L	-49334/L	-5802/L3				-85.575/L	-0.000/L2	-38.244/L3
65		Rigid +Y								
	1(OPE)	-12591	-45970	5627	0	0	0	-85.569	0	38.243
	2(SUS)	914	-49334	-175	0	0	0	0.005	0	-0.001
	3(EXP)	-13505	3364	5802	0	0	0	-85.574	0	38.244
	MAX	-13505/L	-49334/L	5802/L3				-85.574/L	-0.000/L2	38.244/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-4358	-24914	8717	0	0	0	-3	0	108.223
	2(SUS)	-1297	-25705	58	0	0	0	-0.007	0	0
	3(EXP)	-3061	791	8659	0	0	0	-2.993	0	108.222
	MAX	-4358/L1	-25705/L	8717/L1				-3.000/L1	-0.000/L2	108.223/L1
90		Rigid +Y								
	1(OPE)	1914	-34004	10020	0	0	0	10.334	0	54.107
	2(SUS)	500	-28483	27	0	0	0	0.003	0	0
	3(EXP)	1414	-5521	9993	0	0	0	10.332	0	54.107
	MAX	1914/L1	-34004/L	10020/L1				10.334/L	-0.000/L1	54.107/L1
100		Rigid ANC								
	1(OPE)	33097	-25549	0	0	0	8037	0	0	0
	2(SUS)	-233	-28281	0	0	0	-3426	0	0	0
	3(EXP)	33330	2732	0	0	0	11463	0	0	0
	MAX	33330/L	-28281/L	-0/L1	0/L2	-0/L1	11463/L	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 3748mm

110		Rigid +Y								
	1(OPE)	1914	-34004	-10020	0	0	0	10.334	0	-54.107
	2(SUS)	500	-28483	-27	0	0	0	0.003	0	0
	3(EXP)	1414	-5521	-9993	0	0	0	10.332	0	-54.107
	MAX	1914/L1	-34004/L	-10020/L1				10.334/L	-0.000/L1	-54.107/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-4358	-24914	-8717	0	0	0	-3	0	-108.223
	2(SUS)	-1297	-25705	-58	0	0	0	-0.007	0	0
	3(EXP)	-3061	791	-8659	0	0	0	-2.993	0	-108.222
	MAX	-4358/L1	-25705/L	-8717/L1				-3.000/L1	-0.000/L2	-108.223/L1
150		Rigid +Y								
	1(OPE)	-12591	-45970	-5627	0	0	0	-85.569	0	-38.243
	2(SUS)	914	-49334	175	0	0	0	0.005	0	0.001
	3(EXP)	-13505	3364	-5802	0	0	0	-85.574	0	-38.244
	MAX	-13505/L	-49334/L	-5802/L3				-85.574/L	-0.000/L2	-38.244/L3
180		Rigid +Y								
	1(OPE)	-12591	-45970	5627	0	0	0	-85.569	0	38.243
	2(SUS)	914	-49334	-175	0	0	0	0.005	0	-0.001
	3(EXP)	-13505	3364	5802	0	0	0	-85.574	0	38.244
	MAX	-13505/L	-49334/L	5802/L3				-85.574/L	-0.000/L2	38.244/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-4358	-24914	8717	0	0	0	-3	0	108.223
	2(SUS)	-1297	-25705	58	0	0	0	-0.007	0	0
	3(EXP)	-3061	791	8659	0	0	0	-2.993	0	108.222
	MAX	-4358/L1	-25705/L	8717/L1				-3.000/L1	-0.000/L2	108.223/L1
220		Rigid +Y								
	1(OPE)	1914	-34004	10020	0	0	0	10.334	0	54.107
	2(SUS)	500	-28483	27	0	0	0	0.003	0	0
	3(EXP)	1414	-5521	9993	0	0	0	10.332	0	54.107
	MAX	1914/L1	-34004/L	10020/L1				10.334/L	-0.000/L1	54.107/L1
230		Rigid ANC								
	1(OPE)	16548	-12775	-88687	14243	80900	4019	0	0	0
	2(SUS)	-116	-14141	177	17634	-278	-1713	0	0	0
	3(EXP)	16665	1366	-88864	-3392	81178	5731	0	0	0
	MAX	16665/L3	-14141/L	-88864/L	17634/L3	81178/L3	5731/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.332	0	-54.107	-0.0069	-0.0741	0.0294
20	-2.993	0	-108.222	0.0277	0.3685	0.0587
28	-33.772	2.97	-131.885	0.0795	0.7223	0.0716
29	-36.476	3.56	-133.298	0.0864	0.768	0.0749
30	-39.016	4.668	-134.364	0.0924	0.8108	0.0822
38	-42.464	6.593	-135.565	0.0954	0.8544	0.0784
39	-48.156	8.74	-134.543	0.102	0.9387	0.0943
40	-52.938	9.084	-128.648	0.1039	1.0243	0.103
45	-85.575	0	-38.244	0.0606	1.1373	0.1211
48	-108.798	-6.796	17.128	0.0298	0.7742	0.1211
49	-113.403	-7.521	20.703	0.0255	0.6421	0.1216
50	-118.281	-7.703	19.606	0.0201	0.5027	0.1222
59	-113.403	-7.521	-20.703	-0.0255	-0.6421	0.1216
60	-108.798	-6.796	-17.128	-0.0298	-0.7742	0.1211
65	-85.574	0	38.244	-0.0606	-1.1373	0.1211
68	-52.938	9.084	128.648	-0.1039	-1.0243	0.103
69	-48.156	8.74	134.543	-0.102	-0.9387	0.0943
70	-42.464	6.593	135.565	-0.0954	-0.8544	0.0784
78	-39.016	4.668	134.364	-0.0924	-0.8108	0.0822
79	-36.476	3.56	133.298	-0.0864	-0.768	0.0749
80	-33.772	2.97	131.885	-0.0795	-0.7223	0.0716
85	-2.993	0	108.222	-0.0277	-0.3685	0.0587
90	10.332	0	54.107	0.0069	0.0741	0.0294
100	0	0	0	0	0	0
110	10.332	0	-54.107	-0.0069	-0.0741	0.0294
120	-2.993	0	-108.222	0.0277	0.3685	0.0587
128	-33.772	2.97	-131.885	0.0795	0.7223	0.0716
129	-36.476	3.56	-133.298	0.0864	0.768	0.0749
130	-39.016	4.668	-134.364	0.0924	0.8108	0.0822
139	-48.155	8.74	-134.543	0.102	0.9387	0.0943
140	-52.938	9.084	-128.648	0.1039	1.0243	0.103
150	-85.574	0	-38.244	0.0606	1.1373	0.1211
158	-108.798	-6.796	17.128	0.0298	0.7742	0.1211
159	-113.403	-7.521	20.703	0.0255	0.6421	0.1216
160	-118.281	-7.703	19.606	0.0201	0.5027	0.1222
168	-118.281	-7.703	-19.606	-0.0201	-0.5027	0.1222
169	-113.403	-7.521	-20.703	-0.0255	-0.6421	0.1216
170	-108.798	-6.796	-17.128	-0.0298	-0.7742	0.1211
180	-85.574	0	38.244	-0.0606	-1.1373	0.1211

Possible Approach:
Expansion Loop Dimension A: 3748mm

188	-52.938	9.084	128.648	-0.1039	-1.0243	0.103
189	-48.155	8.74	134.543	-0.102	-0.9387	0.0943
190	-42.464	6.593	135.565	-0.0954	-0.8544	0.0784
199	-36.476	3.56	133.298	-0.0864	-0.768	0.0749
200	-33.772	2.97	131.885	-0.0795	-0.7223	0.0716
210	-2.993	0	108.222	-0.0277	-0.3685	0.0587
220	10.332	0	54.107	0.0069	0.0741	0.0294
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0002	-0.0006	-0.0088
20	-0.007	0	0	0.0007	0.0027	-0.0176
28	-0.228	-0.358	0	-0.0077	0.0041	-0.0214
29	-0.227	-0.385	-0.006	-0.0076	0.0039	-0.0217
30	-0.195	-0.408	-0.021	-0.0075	0.0037	-0.022
38	-0.125	-0.436	-0.049	-0.0075	0.0035	-0.0223
39	-0.034	-0.409	-0.076	-0.0079	0.0029	-0.023
40	0.006	-0.27	-0.075	-0.0084	0.0022	-0.0232
45	0.005	0	0.001	-0.0148	0.0002	0.0448
48	0.005	-4.702	0.001	-0.0193	-0.0001	0.1037
49	0.005	-5.447	0	-0.0199	-0.0001	0.1053
50	0.006	-5.867	0	-0.0191	-0.0001	0.1054
59	0.005	-5.447	0	0.0199	0.0001	0.1053
60	0.005	-4.702	-0.001	0.0193	0.0001	0.1037
65	0.005	0	-0.001	0.0148	-0.0002	0.0448
68	0.006	-0.27	0.075	0.0084	-0.0022	-0.0232
69	-0.034	-0.409	0.076	0.0079	-0.0029	-0.023
70	-0.125	-0.436	0.049	0.0075	-0.0035	-0.0223
78	-0.195	-0.408	0.021	0.0075	-0.0037	-0.022
79	-0.227	-0.385	0.006	0.0076	-0.0039	-0.0217
80	-0.228	-0.358	0	0.0077	-0.0041	-0.0214
85	-0.007	0	0	-0.0007	-0.0027	-0.0176
90	0.003	0	0	0.0002	0.0006	-0.0088
100	0	0	0	0	0	0
110	0.003	0	0	-0.0002	-0.0006	-0.0088
120	-0.007	0	0	0.0007	0.0027	-0.0176
128	-0.228	-0.358	0	-0.0077	0.0041	-0.0214
129	-0.227	-0.385	-0.006	-0.0076	0.0039	-0.0217
130	-0.195	-0.408	-0.021	-0.0075	0.0037	-0.022
139	-0.034	-0.409	-0.076	-0.0079	0.0029	-0.023
140	0.006	-0.27	-0.075	-0.0084	0.0022	-0.0232
150	0.005	0	0.001	-0.0148	0.0002	0.0448
158	0.005	-4.702	0.001	-0.0193	-0.0001	0.1037
159	0.005	-5.447	0	-0.0199	-0.0001	0.1053
160	0.006	-5.867	0	-0.0191	-0.0001	0.1054
168	0.006	-5.867	0	0.0191	0.0001	0.1054
169	0.005	-5.447	0	0.0199	0.0001	0.1053
170	0.005	-4.702	-0.001	0.0193	0.0001	0.1037
180	0.005	0	-0.001	0.0148	-0.0002	0.0448

Possible Approach:
Expansion Loop Dimension A: 3748mm

188	0.006	-0.27	0.075	0.0084	-0.0022	-0.0232
189	-0.034	-0.409	0.076	0.0079	-0.0029	-0.023
190	-0.125	-0.436	0.049	0.0075	-0.0035	-0.0223
199	-0.227	-0.385	0.006	0.0076	-0.0039	-0.0217
200	-0.228	-0.358	0	0.0077	-0.0041	-0.0214
210	-0.007	0	0	-0.0007	-0.0027	-0.0176
220	0.003	0	0	0.0002	0.0006	-0.0088
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 16:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 3748
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.334	0	-54.107	-0.007	-0.0747	0.0206
20	-3	0	-108.223	0.0284	0.3713	0.0412
28	-34	2.611	-131.886	0.0718	0.7264	0.0502
29	-36.703	3.174	-133.304	0.0789	0.7719	0.0533
30	-39.21	4.26	-134.384	0.0849	0.8145	0.0602
38	-42.588	6.157	-135.614	0.0879	0.8579	0.0561
39	-48.19	8.331	-134.619	0.0941	0.9416	0.0713
40	-52.932	8.814	-128.723	0.0954	1.0266	0.0797
45	-85.569	0	-38.243	0.0458	1.1375	0.1659
48	-108.793	-11.497	17.128	0.0105	0.7741	0.2248
49	-113.398	-12.968	20.703	0.0056	0.642	0.2269
50	-118.275	-13.57	19.606	0.001	0.5027	0.2276
59	-113.398	-12.968	-20.703	-0.0056	-0.642	0.2269
60	-108.793	-11.497	-17.128	-0.0105	-0.7741	0.2248
65	-85.569	0	38.243	-0.0458	-1.1375	0.1659
68	-52.932	8.814	128.723	-0.0954	-1.0266	0.0797
69	-48.19	8.331	134.619	-0.0941	-0.9416	0.0713
70	-42.588	6.157	135.614	-0.0879	-0.8579	0.0561
78	-39.21	4.26	134.384	-0.0849	-0.8145	0.0602
79	-36.703	3.174	133.304	-0.0789	-0.7719	0.0533
80	-34	2.611	131.886	-0.0718	-0.7264	0.0502
85	-3	0	108.223	-0.0284	-0.3713	0.0412
90	10.334	0	54.107	0.007	0.0747	0.0206
100	0	0	0	0	0	0
110	10.334	0	-54.107	-0.007	-0.0747	0.0206
120	-3	0	-108.223	0.0284	0.3713	0.0412
128	-34	2.611	-131.886	0.0718	0.7264	0.0502
129	-36.703	3.174	-133.304	0.0789	0.7719	0.0533
130	-39.21	4.26	-134.384	0.0849	0.8145	0.0602
139	-48.189	8.331	-134.619	0.0941	0.9416	0.0713
140	-52.932	8.814	-128.723	0.0954	1.0266	0.0797
150	-85.569	0	-38.243	0.0458	1.1375	0.1659
158	-108.793	-11.497	17.128	0.0105	0.7741	0.2248
159	-113.397	-12.968	20.703	0.0056	0.642	0.2269
160	-118.275	-13.57	19.606	0.001	0.5027	0.2276
168	-118.275	-13.57	-19.606	-0.001	-0.5027	0.2276
169	-113.397	-12.968	-20.703	-0.0056	-0.642	0.2269
170	-108.793	-11.497	-17.128	-0.0105	-0.7741	0.2248
180	-85.569	0	38.243	-0.0458	-1.1375	0.1659

Possible Approach:
Expansion Loop Dimension A: 3748mm

188	-52.932	8.814	128.723	-0.0954	-1.0266	0.0797
189	-48.19	8.331	134.619	-0.0941	-0.9416	0.0713
190	-42.588	6.157	135.614	-0.0879	-0.8579	0.0561
199	-36.703	3.174	133.304	-0.0789	-0.7719	0.0533
200	-34	2.611	131.886	-0.0718	-0.7264	0.0502
210	-3	0	108.223	-0.0284	-0.3713	0.0412
220	10.334	0	54.107	0.007	0.0747	0.0206
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -4,148.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 4,148.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,148.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,148.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Expansion Loop Dimension A: 4148mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000 .000
15	+Y			.30	.000	1.000 .000
20	Guide		3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000 .000
45	+Y			.30	.000	1.000 .000
65	+Y			.30	.000	1.000 .000
85	Guide		3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000 .000
90	+Y			.30	.000	1.000 .000
100	ANC			.30	.000	.000 .000
110	+Y			.30	.000	1.000 .000
120	+Y			.30	.000	1.000 .000
120	Guide		3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000 .000
180	+Y			.30	.000	1.000 .000
210	+Y			.30	.000	1.000 .000
210	Guide		3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000 .000
230	ANC			.30	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension A: 4148mm

```
    TRANSL. STIF      lbs./in.     x     1.751   =   N./cm.
    ROTATIONAL STIF   in.lb./deg.  x     0.113   =   N.m./deg
    UNIFORM LOAD      lb./in.      x     1.751   =   N./cm.
    G LOAD            g's          x     1.000   =   g's
    WIND LOAD         lbs./sq.in.  x     6.895   =   KPa
    ELEVATION         inches       x     0.025   =   m.
    COMPOUND LENGTH   inches       x    25.400   =   mm.
    DIAMETER          inches       x    25.400   =   mm.
    WALL THICKNESS    inches       x    25.400   =   mm.

 SETUP FILE PARAMETERS
 ---------------------------------------------------------------------------
 CONNECT GEOMETRY THRU CNODES =    YES
 MIN ALLOWED BEND ANGLE =          5.00000
 MAX ALLOWED BEND ANGLE =          95.0000
 BEND LENGTH ATTACHMENT PERCENT =  1.00000
 MIN ANGLE TO ADJACENT BEND PT =   5.00000
 LOOP CLOSURE TOLERANCE =          25.4000     mm.
 THERMAL BOWING HORZ TOLERANCE =   0.100000E-03
 AUTO NODE NUMBER INCREMENT=       10.0000
 Z AXIS UP=                        NO
 USE PRESSURE STIFFENING =         DEFAULT
 ALPHA TOLERANCE =                 0.500000E-01
 RESLD-FORCE =                     NO
 HGR DEF RESWGT STIF =             0.175127E+13 N./cm.
 DECOMP SNG TOL =                  0.100000E+11
 BEND AXIAL SHAPE =                YES
 FRICT STIF =                      0.175127E+07 N./cm.
 FRICT NORM FORCE VAR =            0.150000
 FRICT ANGLE VAR =                 15.0000
 FRICT SLIDE MULT =                1.00000
 ROD TOLERANCE =                   1.00000
 ROD INC =                         2.00000
 INCORE NUMERICAL CHECK =          NO
 OUTCORE NUMERICAL CHECK =         NO
 DEFAULT TRANS RESTRAINT STIFF=    0.175127E+13   N./cm.
 DEFAULT ROT RESTRAINT STIFF=      0.112985E+12  N.m./deg
 IGNORE SPRING HANGER STIFFNESS =  NO
 MISSING MASS ZPA =                EXTRACTED
 MIN WALL MILL TOLERANCE =         12.5000
 WRC-107 VERSION =                 MAR 79 1B1/2B1
 WRC-107 INTERPOLATION =           LAST VALUE
 DEFAULT AMBIENT TEMPERATURE=      28.0000      C
 BOURDON PRESSURE=                 NONE
 COEFFICIENT OF FRICTION (MU) =    0.000000
 INCLUDE SPRG STIF IN HGR OPE =    NO
 INCLUDE INSULATION IN HYDROTEST = NO
 REDUCED INTERSECTION =            B31.1(POST1980)
 USE WRC329                        NO
 NO REDUCED SIF FOR RFT AND WLT    NO
```

Possible Approach:

Expansion Loop Dimension A: 4148mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 4148mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9200.000	750.000	-19250.000
60	-9200.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9200.000	750.000	-64250.000
170	-9200.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 72.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 45771.8 Allowable Stress: 63326.2
Axial Stress: 17809.7 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 113805.1 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 26685.3 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 134982.0 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	41598	0	0	15	31763.4	0	0	B31.3
2(SUS)		23574.9	63326.2	37.2		24663.2	63326.2	38.9	B31.3
3(EXP)		26241.7	227951.8	11.5		14468.2	226863.5	6.4	B31.3
1(OPE)	15	32015.6	0	0	20	74325.1	0	0	B31.3
2(SUS)		24664.9	63326.2	38.9		21423.5	63326.2	33.8	B31.3
3(EXP)		14468.2	226861.7	6.4		58692.4	230103.1	25.5	B31.3
1(OPE)	20	74505.3	0	0	28	92076.4	0	0	B31.3
2(SUS)		21427.3	63326.2	33.8		18270.6	63326.2	28.9	B31.3
3(EXP)		58692.4	230099.4	25.5		77007.7	233256.1	33	B31.3
1(OPE)	28	92076.4	0	0	29	93106.6	0	0	B31.3
2(SUS)		18270.6	63326.2	28.9		18439.2	63326.2	29.1	B31.3
3(EXP)		77007.7	233256.1	33		78022.8	233087.4	33.5	B31.3
1(OPE)	29	93106.6	0	0	30	94037.5	0	0	B31.3
2(SUS)		18439.2	63326.2	29.1		18597.8	63326.2	29.4	B31.3
3(EXP)		78022.8	233087.4	33.5		78689.2	232928.9	33.8	B31.3
1(OPE)	30	94037.5	0	0	38	94840.7	0	0	B31.3
2(SUS)		18597.8	63326.2	29.4		18829.1	63326.2	29.7	B31.3
3(EXP)		78689.2	232928.9	33.8		79566.6	232697.6	34.2	B31.3
1(OPE)	38	94840.7	0	0	39	92873.9	0	0	B31.3
2(SUS)		18829.1	63326.2	29.7		19002.9	63326.2	30	B31.3
3(EXP)		79566.6	232697.6	34.2		77519.7	232523.7	33.3	B31.3

Possible Approach:
Expansion Loop Dimension A: 4148mm

1(OPE)	39	92873.9	0	0	40	85938	0	0	B31.3
2(SUS)		19002.9	63326.2	30		18733.1	63326.2	29.6	B31.3
3(EXP)		77519.7	232523.7	33.3		69761.9	232793.5	30	B31.3
1(OPE)	40	85938	0	0	45	59387.3	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		45771.8	63326.2	72.3	B31.3
3(EXP)		69761.9	232793.5	30		32743.6	205754.9	15.9	B31.3
1(OPE)	45	59748.9	0	0	48	120496.8	0	0	B31.3
2(SUS)		45746.5	63326.2	72.2		20036.4	63326.2	31.6	B31.3
3(EXP)		32743.6	205780.2	15.9		103350.8	231490.3	44.6	B31.3
1(OPE)	48	120496.8	0	0	49	126876.3	0	0	B31.3
2(SUS)		20036.4	63326.2	31.6		18544	63326.2	29.3	B31.3
3(EXP)		103350.8	231490.3	44.6		110732.9	232982.7	47.5	B31.3
1(OPE)	49	126876.3	0	0	50	129488.2	0	0	B31.3
2(SUS)		18544	63326.2	29.3		18561.1	63326.2	29.3	B31.3
3(EXP)		110732.9	232982.7	47.5		113790.9	232965.5	48.8	B31.3
1(OPE)	50	129488.2	0	0	59	126876.3	0	0	B31.3
2(SUS)		18561.1	63326.2	29.3		18544	63326.2	29.3	B31.3
3(EXP)		113790.9	232965.5	48.8		110732.9	232982.7	47.5	B31.3
1(OPE)	59	126876.3	0	0	60	120496.8	0	0	B31.3
2(SUS)		18544	63326.2	29.3		20036.4	63326.2	31.6	B31.3
3(EXP)		110732.9	232982.7	47.5		103350.8	231490.3	44.6	B31.3
1(OPE)	60	120496.8	0	0	65	59748.9	0	0	B31.3
2(SUS)		20036.4	63326.2	31.6		45746.5	63326.2	72.2	B31.3
3(EXP)		103350.8	231490.3	44.6		32743.5	205780.2	15.9	B31.3
1(OPE)	65	59387.3	0	0	68	85938	0	0	B31.3
2(SUS)		45771.8	63326.2	72.3		18733.1	63326.2	29.6	B31.3
3(EXP)		32743.5	205754.9	15.9		69762	232793.5	30	B31.3
1(OPE)	68	85938	0	0	69	92873.9	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		19002.9	63326.2	30	B31.3
3(EXP)		69762	232793.5	30		77519.7	232523.7	33.3	B31.3
1(OPE)	69	92873.9	0	0	70	94840.7	0	0	B31.3
2(SUS)		19002.9	63326.2	30		18829.1	63326.2	29.7	B31.3
3(EXP)		77519.7	232523.7	33.3		79566.6	232697.6	34.2	B31.3
1(OPE)	70	94840.7	0	0	78	94037.6	0	0	B31.3
2(SUS)		18829.1	63326.2	29.7		18597.8	63326.2	29.4	B31.3
3(EXP)		79566.6	232697.6	34.2		78689.2	232928.9	33.8	B31.3
1(OPE)	78	94037.6	0	0	79	93106.6	0	0	B31.3
2(SUS)		18597.8	63326.2	29.4		18439.2	63326.2	29.1	B31.3
3(EXP)		78689.2	232928.9	33.8		78022.8	233087.4	33.5	B31.3
1(OPE)	79	93106.6	0	0	80	92076.4	0	0	B31.3
2(SUS)		18439.2	63326.2	29.1		18270.6	63326.2	28.9	B31.3
3(EXP)		78022.8	233087.4	33.5		77007.7	233256.1	33	B31.3

Possible Approach:
Expansion Loop Dimension A: 4148mm

1(OPE)	80	92076.4	0	0	85	74505.4	0	0	B31.3
2(SUS)		18270.6	63326.2	28.9		21427.3	63326.2	33.8	B31.3
3(EXP)		77007.7	233256.1	33		58692.5	230099.4	25.5	B31.3
1(OPE)	85	74325.2	0	0	90	32015.6	0	0	B31.3
2(SUS)		21423.5	63326.2	33.8		24664.9	63326.2	38.9	B31.3
3(EXP)		58692.5	230103.1	25.5		14468.2	226861.7	6.4	B31.3
1(OPE)	90	31763.4	0	0	100	41598.1	0	0	B31.3
2(SUS)		24663.2	63326.2	38.9		23574.9	63326.2	37.2	B31.3
3(EXP)		14468.2	226863.5	6.4		26241.8	227951.8	11.5	B31.3
1(OPE)	100	41598.1	0	0	110	31763.4	0	0	B31.3
2(SUS)		23574.9	63326.2	37.2		24663.2	63326.2	38.9	B31.3
3(EXP)		26241.8	227951.8	11.5		14468.2	226863.5	6.4	B31.3
1(OPE)	110	32015.6	0	0	120	74325.2	0	0	B31.3
2(SUS)		24664.9	63326.2	38.9		21423.5	63326.2	33.8	B31.3
3(EXP)		14468.2	226861.7	6.4		58692.5	230103.2	25.5	B31.3
1(OPE)	120	74505.4	0	0	128	92076.5	0	0	B31.3
2(SUS)		21427.2	63326.2	33.8		18270.6	63326.2	28.9	B31.3
3(EXP)		58692.5	230099.4	25.5		77007.8	233256.1	33	B31.3
1(OPE)	128	92076.5	0	0	129	93106.6	0	0	B31.3
2(SUS)		18270.6	63326.2	28.9		18439.2	63326.2	29.1	B31.3
3(EXP)		77007.8	233256.1	33		78022.9	233087.4	33.5	B31.3
1(OPE)	129	93106.6	0	0	130	94037.6	0	0	B31.3
2(SUS)		18439.2	63326.2	29.1		18597.8	63326.2	29.4	B31.3
3(EXP)		78022.9	233087.4	33.5		78689.3	232928.9	33.8	B31.3
1(OPE)	130	94037.6	0	0	139	92873.9	0	0	B31.3
2(SUS)		18597.8	63326.2	29.4		19003	63326.2	30	B31.3
3(EXP)		78689.3	232928.9	33.8		77519.7	232523.7	33.3	B31.3
1(OPE)	139	92873.9	0	0	140	85938	0	0	B31.3
2(SUS)		19003	63326.2	30		18733.1	63326.2	29.6	B31.3
3(EXP)		77519.7	232523.7	33.3		69762	232793.5	30	B31.3
1(OPE)	140	85938	0	0	150	59387.3	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		45771.8	63326.2	72.3	B31.3
3(EXP)		69762	232793.5	30		32743.5	205754.9	15.9	B31.3
1(OPE)	150	59748.9	0	0	158	120496.7	0	0	B31.3
2(SUS)		45746.5	63326.2	72.2		20036.4	63326.2	31.6	B31.3
3(EXP)		32743.5	205780.2	15.9		103350.8	231490.3	44.6	B31.3
1(OPE)	158	120496.7	0	0	159	126876.3	0	0	B31.3
2(SUS)		20036.4	63326.2	31.6		18544	63326.2	29.3	B31.3
3(EXP)		103350.8	231490.3	44.6		110732.9	232982.7	47.5	B31.3
1(OPE)	159	126876.3	0	0	160	129488.2	0	0	B31.3
2(SUS)		18544	63326.2	29.3		18561.1	63326.2	29.3	B31.3
3(EXP)		110732.9	232982.7	47.5		113790.9	232965.5	48.8	B31.3

Possible Approach:
Expansion Loop Dimension A: 4148mm

1(OPE)	160	129488.2	0	0	168	129488.2	0	0	B31.3
2(SUS)		18561.1	63326.2	29.3		18561.1	63326.2	29.3	B31.3
3(EXP)		113790.9	232965.5	48.8		113790.9	232965.5	48.8	B31.3
1(OPE)	168	129488.2	0	0	169	126876.3	0	0	B31.3
2(SUS)		18561.1	63326.2	29.3		18544	63326.2	29.3	B31.3
3(EXP)		113790.9	232965.5	48.8		110732.9	232982.7	47.5	B31.3
1(OPE)	169	126876.3	0	0	170	120496.8	0	0	B31.3
2(SUS)		18544	63326.2	29.3		20036.4	63326.2	31.6	B31.3
3(EXP)		110732.9	232982.7	47.5		103350.8	231490.3	44.6	B31.3
1(OPE)	170	120496.8	0	0	180	59748.9	0	0	B31.3
2(SUS)		20036.4	63326.2	31.6		45746.5	63326.2	72.2	B31.3
3(EXP)		103350.8	231490.3	44.6		32743.5	205780.2	15.9	B31.3
1(OPE)	180	59387.3	0	0	188	85938	0	0	B31.3
2(SUS)		45771.8	63326.2	72.3		18733.1	63326.2	29.6	B31.3
3(EXP)		32743.5	205754.9	15.9		69761.9	232793.5	30	B31.3
1(OPE)	188	85938	0	0	189	92873.9	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		19003	63326.2	30	B31.3
3(EXP)		69761.9	232793.5	30		77519.7	232523.7	33.3	B31.3
1(OPE)	189	92873.9	0	0	190	94840.7	0	0	B31.3
2(SUS)		19003	63326.2	30		18829.1	63326.2	29.7	B31.3
3(EXP)		77519.7	232523.7	33.3		79566.6	232697.6	34.2	B31.3
1(OPE)	190	94840.7	0	0	199	93106.6	0	0	B31.3
2(SUS)		18829.1	63326.2	29.7		18439.2	63326.2	29.1	B31.3
3(EXP)		79566.6	232697.6	34.2		78022.8	233087.4	33.5	B31.3
1(OPE)	199	93106.6	0	0	200	92076.4	0	0	B31.3
2(SUS)		18439.2	63326.2	29.1		18270.6	63326.2	28.9	B31.3
3(EXP)		78022.8	233087.4	33.5		77007.7	233256.1	33	B31.3
1(OPE)	200	92076.4	0	0	210	74505.3	0	0	B31.3
2(SUS)		18270.6	63326.2	28.9		21427.2	63326.2	33.8	B31.3
3(EXP)		77007.7	233256.1	33		58692.4	230099.4	25.5	B31.3
1(OPE)	210	74325.2	0	0	220	32015.6	0	0	B31.3
2(SUS)		21423.5	63326.2	33.8		24664.9	63326.2	38.9	B31.3
3(EXP)		58692.4	230103.2	25.5		14468.3	226861.7	6.4	B31.3
1(OPE)	220	31763.5	0	0	230	41598	0	0	B31.3
2(SUS)		24663.2	63326.2	38.9		23574.9	63326.2	37.2	B31.3
3(EXP)		14468.3	226863.5	6.4		26241.7	227951.8	11.5	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15457	-12533	82253	-13643	-75405	4062	0	0	0
	2(SUS)	-100	-13762	-460	-16693	239	-1330	0	0	0
	3(EXP)	15557	1228	82713	3050	-75644	5392	0	0	0
	MAX	15557/L	-13762/L	82713/L	-16693/L	-75644/L	5392/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1835	-34980	-10332	0	0	0	9.611	0	-54.113
	2(SUS)	431	-30015	-70	0	0	0	0.002	0	0
	3(EXP)	1404	-4965	-10262	0	0	0	9.609	0	-54.112
	MAX	1835/L1	-34980/L	-10332/L1				9.611/L1	-0.000/L1	-54.113/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2469	-22210	-7346	0	0	0	-3	0	-108.234
	2(SUS)	-1346	-22527	-151	0	0	0	-0.008	0	-0.001
	3(EXP)	-1123	317	-7195	0	0	0	-2.992	0	-108.233
	MAX	-2469/L1	-22527/L	-7346/L1				-3.000/L1	-0.000/L2	-108.234/L1
45		Rigid +Y								
	1(OPE)	-13210	-49452	-6753	0	0	0	-82.997	0	-42.429
	2(SUS)	1014	-52871	977	0	0	0	0.006	0	0.006
	3(EXP)	-14224	3419	-7730	0	0	0	-83.003	0	-42.434
	MAX	-14224/L	-52871/L	-7730/L3				-83.003/L	-0.000/L2	-42.434/L3
65		Rigid +Y								
	1(OPE)	-13210	-49452	6753	0	0	0	-82.997	0	42.429
	2(SUS)	1014	-52871	-977	0	0	0	0.006	0	-0.006
	3(EXP)	-14224	3419	7730	0	0	0	-83.002	0	42.434
	MAX	-14224/L	-52871/L	7730/L3				-83.002/L	-0.000/L2	42.434/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2469	-22210	7346	0	0	0	-3	0	108.234
	2(SUS)	-1346	-22527	151	0	0	0	-0.008	0	0.001
	3(EXP)	-1123	317	7195	0	0	0	-2.992	0	108.233
	MAX	-2469/L1	-22527/L	7346/L1				-3.000/L1	-0.000/L2	108.234/L1
90		Rigid +Y								
	1(OPE)	1835	-34980	10332	0	0	0	9.611	0	54.113
	2(SUS)	431	-30015	70	0	0	0	0.002	0	0
	3(EXP)	1404	-4965	10262	0	0	0	9.609	0	54.112
	MAX	1835/L1	-34980/L	10332/L1				9.611/L1	-0.000/L1	54.113/L1
100		Rigid ANC								
	1(OPE)	30915	-25066	0	0	0	8124	0	0	0
	2(SUS)	-200	-27523	0	0	0	-2660	0	0	0
	3(EXP)	31115	2457	0	0	0	10785	0	0	0
	MAX	31115/L3	-27523/L	-0/L1	0/L1	-0/L1	10785/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 4148mm

110		Rigid +Y								
	1(OPE)	1835	-34980	-10332	0	0	0	9.611	0	-54.113
	2(SUS)	431	-30015	-70	0	0	0	0.002	0	0
	3(EXP)	1404	-4965	-10262	0	0	0	9.609	0	-54.112
	MAX	1835/L1	-34980/L	-10332/L1				9.611/L1	-0.000/L1	-54.113/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2469	-22210	-7346	0	0	0	-3	0	-108.234
	2(SUS)	-1346	-22527	-151	0	0	0	-0.008	0	-0.001
	3(EXP)	-1123	317	-7195	0	0	0	-2.992	0	-108.233
	MAX	-2469/L1	-22527/L	-7346/L1				-3.000/L1	-0.000/L2	-108.234/L1
150		Rigid +Y								
	1(OPE)	-13210	-49452	-6753	0	0	0	-82.997	0	-42.429
	2(SUS)	1014	-52871	977	0	0	0	0.006	0	0.006
	3(EXP)	-14224	3419	-7730	0	0	0	-83.002	0	-42.434
	MAX	-14224/L	-52871/L	-7730/L3				-83.002/L	-0.000/L2	-42.434/L3
180		Rigid +Y								
	1(OPE)	-13210	-49452	6753	0	0	0	-82.997	0	42.429
	2(SUS)	1014	-52871	-977	0	0	0	0.006	0	-0.006
	3(EXP)	-14224	3419	7730	0	0	0	-83.002	0	42.434
	MAX	-14224/L	-52871/L	7730/L3				-83.002/L	-0.000/L2	42.434/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2469	-22210	7346	0	0	0	-3	0	108.234
	2(SUS)	-1346	-22527	151	0	0	0	-0.008	0	0.001
	3(EXP)	-1123	317	7195	0	0	0	-2.992	0	108.233
	MAX	-2469/L1	-22527/L	7346/L1				-3.000/L1	-0.000/L2	108.234/L1
220		Rigid +Y								
	1(OPE)	1835	-34980	10332	0	0	0	9.611	0	54.113
	2(SUS)	431	-30015	70	0	0	0	0.002	0	0
	3(EXP)	1404	-4965	10262	0	0	0	9.609	0	54.112
	MAX	1835/L1	-34980/L	10332/L1				9.611/L1	-0.000/L1	54.113/L1
230		Rigid ANC								
	1(OPE)	15457	-12533	-82253	13643	75405	4062	0	0	0
	2(SUS)	-100	-13762	460	16693	-239	-1330	0	0	0
	3(EXP)	15557	1228	-82713	-3050	75644	5392	0	0	0
	MAX	15557/L3	-13762/L	-82713/L	16693/L3	75644/L3	5392/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.609	0	-54.112	-0.0062	-0.0686	0.0276
20	-2.992	0	-108.233	0.0249	0.3464	0.0553
28	-31.994	2.691	-131.898	0.0726	0.6832	0.0673
29	-34.553	3.256	-133.316	0.0791	0.7272	0.0706
30	-36.957	4.341	-134.397	0.0847	0.7685	0.0775
38	-40.225	6.237	-135.629	0.0876	0.8106	0.0739
39	-45.685	8.359	-134.769	0.094	0.8922	0.0895
40	-50.366	8.72	-129.204	0.0962	0.9755	0.0981
45	-83.003	0	-42.434	0.0575	1.1032	0.1166
48	-109.116	-7.356	17.51	0.0266	0.7281	0.1166
49	-113.608	-8.059	20.804	0.0228	0.6035	0.1171
50	-118.26	-8.245	19.608	0.018	0.4725	0.1175
59	-113.608	-8.059	-20.804	-0.0228	-0.6035	0.1171
60	-109.116	-7.356	-17.51	-0.0266	-0.7281	0.1166
65	-83.002	0	42.434	-0.0575	-1.1032	0.1166
68	-50.366	8.72	129.204	-0.0962	-0.9755	0.0981
69	-45.685	8.359	134.769	-0.094	-0.8922	0.0895
70	-40.225	6.237	135.629	-0.0876	-0.8106	0.0739
78	-36.957	4.341	134.397	-0.0847	-0.7685	0.0775
79	-34.553	3.256	133.316	-0.0791	-0.7272	0.0706
80	-31.994	2.691	131.898	-0.0726	-0.6832	0.0673
85	-2.992	0	108.233	-0.0249	-0.3464	0.0553
90	9.609	0	54.112	0.0062	0.0686	0.0276
100	0	0	0	0	0	0
110	9.609	0	-54.112	-0.0062	-0.0686	0.0276
120	-2.992	0	-108.233	0.0249	0.3464	0.0553
128	-31.994	2.691	-131.898	0.0726	0.6832	0.0673
129	-34.553	3.255	-133.316	0.0791	0.7272	0.0706
130	-36.957	4.341	-134.397	0.0847	0.7685	0.0775
139	-45.685	8.359	-134.769	0.094	0.8922	0.0895
140	-50.366	8.72	-129.204	0.0962	0.9755	0.0981
150	-83.002	0	-42.434	0.0575	1.1032	0.1166
158	-109.116	-7.356	17.51	0.0266	0.7281	0.1166
159	-113.608	-8.059	20.804	0.0228	0.6035	0.1171
160	-118.26	-8.245	19.608	0.018	0.4725	0.1175
168	-118.26	-8.245	-19.608	-0.018	-0.4724	0.1175
169	-113.608	-8.059	-20.804	-0.0228	-0.6035	0.1171
170	-109.116	-7.356	-17.51	-0.0266	-0.7281	0.1166
180	-83.002	0	42.434	-0.0575	-1.1032	0.1166

Possible Approach:
Expansion Loop Dimension A: 4148mm

188	-50.366	8.72	129.204	-0.0962	-0.9755	0.0981
189	-45.685	8.359	134.769	-0.094	-0.8922	0.0895
190	-40.225	6.236	135.629	-0.0876	-0.8106	0.0739
199	-34.553	3.255	133.316	-0.0791	-0.7272	0.0706
200	-31.994	2.691	131.898	-0.0726	-0.6832	0.0673
210	-2.992	0	108.233	-0.0249	-0.3464	0.0553
220	9.609	0	54.112	0.0062	0.0686	0.0276
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	0	-0.0021	-0.0005	-0.0068
20	-0.008	0	-0.001	0.0084	0.0024	-0.0136
28	-0.188	0.311	-0.001	0.006	0.0029	-0.0166
29	-0.186	0.333	0.003	0.0061	0.0026	-0.0168
30	-0.159	0.351	0.016	0.006	0.0023	-0.0171
38	-0.102	0.374	0.038	0.0059	0.002	-0.0174
39	-0.027	0.45	0.068	0.0051	0.0011	-0.0179
40	0.006	0.578	0.082	0.004	0.0002	-0.0177
45	0.006	0	0.006	-0.0071	-0.0008	0.0646
48	0.006	-7.208	-0.002	-0.016	0.0002	0.1392
49	0.005	-8.18	-0.001	-0.017	0.0002	0.1409
50	0.004	-8.68	0	-0.0169	0.0002	0.1411
59	0.005	-8.18	0.001	0.017	-0.0002	0.1409
60	0.006	-7.208	0.002	0.016	-0.0002	0.1392
65	0.006	0	-0.006	0.0071	0.0008	0.0646
68	0.006	0.578	-0.082	-0.004	-0.0002	-0.0177
69	-0.027	0.45	-0.068	-0.0051	-0.0011	-0.0179
70	-0.102	0.374	-0.038	-0.0059	-0.002	-0.0174
78	-0.159	0.351	-0.016	-0.006	-0.0023	-0.0171
79	-0.186	0.333	-0.003	-0.0061	-0.0026	-0.0168
80	-0.188	0.311	0.001	-0.006	-0.0029	-0.0166
85	-0.008	0	0.001	-0.0084	-0.0024	-0.0136
90	0.002	0	0	0.0021	0.0005	-0.0068
100	0	0	0	0	0	0
110	0.002	0	0	-0.0021	-0.0005	-0.0068
120	-0.008	0	-0.001	0.0084	0.0024	-0.0136
128	-0.188	0.311	-0.001	0.006	0.0029	-0.0166
129	-0.186	0.333	0.003	0.0061	0.0026	-0.0168
130	-0.159	0.351	0.016	0.006	0.0023	-0.0171
139	-0.027	0.45	0.068	0.0051	0.0011	-0.0179
140	0.006	0.578	0.082	0.004	0.0002	-0.0177
150	0.006	0	0.006	-0.0071	-0.0008	0.0646
158	0.006	-7.208	-0.002	-0.016	0.0002	0.1392
159	0.005	-8.18	-0.001	-0.017	0.0002	0.1409
160	0.004	-8.68	0	-0.0169	0.0002	0.1411
168	0.004	-8.68	0	0.0169	-0.0002	0.1411
169	0.005	-8.18	0.001	0.017	-0.0002	0.1409
170	0.006	-7.208	0.002	0.016	-0.0002	0.1392
180	0.006	0	-0.006	0.0071	0.0008	0.0646

Possible Approach:
Expansion Loop Dimension A: 4148mm

188	0.006	0.578	-0.082	-0.004	-0.0002	-0.0177
189	-0.027	0.45	-0.068	-0.0051	-0.0011	-0.0179
190	-0.102	0.374	-0.038	-0.0059	-0.002	-0.0174
199	-0.186	0.333	-0.003	-0.0061	-0.0026	-0.0168
200	-0.188	0.311	0.001	-0.006	-0.0029	-0.0166
210	-0.008	0	0.001	-0.0084	-0.0024	-0.0136
220	0.002	0	0	0.0021	0.0005	-0.0068
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:19
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4148
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.611	0	-54.113	-0.0082	-0.0692	0.0208
20	-3	0	-108.234	0.0333	0.3488	0.0416
28	-32.182	3.002	-131.899	0.0785	0.6861	0.0507
29	-34.738	3.588	-133.313	0.0852	0.7298	0.0537
30	-37.116	4.692	-134.382	0.0908	0.7708	0.0604
38	-40.327	6.611	-135.59	0.0935	0.8125	0.0566
39	-45.712	8.808	-134.7	0.0991	0.8933	0.0716
40	-50.36	9.298	-129.123	0.1002	0.9757	0.0804
45	-82.997	0	-42.429	0.0504	1.1024	0.1812
48	-109.111	-14.564	17.508	0.0106	0.7283	0.2558
49	-113.603	-16.239	20.803	0.0057	0.6037	0.2579
50	-118.256	-16.925	19.608	0.0011	0.4726	0.2586
59	-113.603	-16.239	-20.803	-0.0057	-0.6037	0.2579
60	-109.11	-14.564	-17.508	-0.0106	-0.7283	0.2558
65	-82.997	0	42.429	-0.0504	-1.1024	0.1812
68	-50.36	9.298	129.123	-0.1002	-0.9757	0.0804
69	-45.712	8.808	134.7	-0.0991	-0.8933	0.0716
70	-40.327	6.611	135.59	-0.0935	-0.8125	0.0566
78	-37.116	4.692	134.382	-0.0908	-0.7708	0.0604
79	-34.738	3.588	133.313	-0.0852	-0.7298	0.0537
80	-32.182	3.002	131.899	-0.0785	-0.6861	0.0507
85	-3	0	108.234	-0.0333	-0.3488	0.0416
90	9.611	0	54.113	0.0082	0.0692	0.0208
100	0	0	0	0	0	0
110	9.611	0	-54.113	-0.0082	-0.0692	0.0208
120	-3	0	-108.234	0.0333	0.3488	0.0416
128	-32.182	3.002	-131.899	0.0785	0.6861	0.0507
129	-34.738	3.588	-133.313	0.0852	0.7298	0.0537
130	-37.116	4.692	-134.381	0.0908	0.7708	0.0604
139	-45.712	8.808	-134.7	0.0991	0.8933	0.0716
140	-50.36	9.298	-129.123	0.1002	0.9757	0.0804
150	-82.997	0	-42.429	0.0504	1.1024	0.1812
158	-109.11	-14.564	17.508	0.0106	0.7283	0.2558
159	-113.603	-16.239	20.803	0.0057	0.6037	0.2579
160	-118.256	-16.925	19.608	0.0011	0.4726	0.2586
168	-118.256	-16.925	-19.608	-0.0011	-0.4726	0.2586
169	-113.603	-16.239	-20.803	-0.0057	-0.6037	0.2579
170	-109.11	-14.564	-17.508	-0.0106	-0.7283	0.2558
180	-82.997	0	42.429	-0.0504	-1.1024	0.1812

Possible Approach:
Expansion Loop Dimension A: 4148mm

188	-50.36	9.298	129.123	-0.1002	-0.9757	0.0804
189	-45.712	8.808	134.7	-0.0991	-0.8933	0.0716
190	-40.327	6.611	135.59	-0.0935	-0.8125	0.0566
199	-34.738	3.588	133.313	-0.0852	-0.7298	0.0537
200	-32.182	3.002	131.899	-0.0785	-0.6861	0.0507
210	-3	0	108.234	-0.0333	-0.3488	0.0416
220	9.611	0	54.113	0.0082	0.0692	0.0208
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -4,348.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 4,348.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension A: 4348mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,348.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,348.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -7,500.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                        v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                         App.P Sy/St Switch = ON   Sc= 137,895 KPa
                        Sh1= 63,326 KPa   Sh2= 137,895 KPa
                        Sh3= 137,895 KPa   Sh4= 137,895 KPa
                        Sh5= 137,895 KPa   Sh6= 137,895 KPa
                        Sh7= 137,895 KPa   Sh8= 137,895 KPa
                        Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 29
                        Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 39
                        Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 49
                        Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00 69
                        Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50 79
                        Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                        Bend Angle= 45.000   Angle/Node @1= 22.50
                       129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

Expansion Loop Dimension A: 4348mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide			3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide			3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide			3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide			3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension A: 4348mm

```
    TRANSL. STIF      lbs./in.     x     1.751   =   N./cm.
    ROTATIONAL STIF   in.lb./deg.  x     0.113   =   N.m./deg
    UNIFORM LOAD      lb./in.      x     1.751   =   N./cm.
    G LOAD            g's          x     1.000   =   g's
    WIND LOAD         lbs./sq.in.  x     6.895   =   KPa
    ELEVATION         inches       x     0.025   =   m.
    COMPOUND LENGTH   inches       x    25.400   =   mm.
    DIAMETER          inches       x    25.400   =   mm.
    WALL THICKNESS    inches       x    25.400   =   mm.

 SETUP FILE PARAMETERS
 ------------------------------------------------------------------------------
 CONNECT GEOMETRY THRU CNODES =    YES
 MIN ALLOWED BEND ANGLE =          5.00000
 MAX ALLOWED BEND ANGLE =          95.0000
 BEND LENGTH ATTACHMENT PERCENT =  1.00000
 MIN ANGLE TO ADJACENT BEND PT =   5.00000
 LOOP CLOSURE TOLERANCE =          25.4000     mm.
 THERMAL BOWING HORZ TOLERANCE =   0.100000E-03
 AUTO NODE NUMBER INCREMENT=       10.0000
 Z AXIS UP=                        NO
 USE PRESSURE STIFFENING =         DEFAULT
 ALPHA TOLERANCE =                 0.500000E-01
 RESLD-FORCE =                     NO
 HGR DEF RESWGT STIF =             0.175127E+13 N./cm.
 DECOMP SNG TOL =                  0.100000E+11
 BEND AXIAL SHAPE =                YES
 FRICT STIF =                      0.175127E+07 N./cm.
 FRICT NORM FORCE VAR =            0.150000
 FRICT ANGLE VAR =                 15.0000
 FRICT SLIDE MULT =                1.00000
 ROD TOLERANCE =                   1.00000
 ROD INC =                         2.00000
 INCORE NUMERICAL CHECK =          NO
 OUTCORE NUMERICAL CHECK =         NO
 DEFAULT TRANS RESTRAINT STIFF=    0.175127E+13   N./cm.
 DEFAULT ROT RESTRAINT STIFF=      0.112985E+12  N.m./deg
 IGNORE SPRING HANGER STIFFNESS =  NO
 MISSING MASS ZPA =                EXTRACTED
 MIN WALL MILL TOLERANCE =         12.5000
 WRC-107 VERSION =                 MAR 79 1B1/2B1
 WRC-107 INTERPOLATION =           LAST VALUE
 DEFAULT AMBIENT TEMPERATURE=      28.0000      C
 BOURDON PRESSURE=                 NONE
 COEFFICIENT OF FRICTION (MU) =    0.000000
 INCLUDE SPRG STIF IN HGR OPE =    NO
 INCLUDE INSULATION IN HYDROTEST = NO
 REDUCED INTERSECTION =            B31.1(POST1980)
 USE WRC329                        NO
 NO REDUCED SIF FOR RFT AND WLT    NO
```

Possible Approach:

Expansion Loop Dimension A: 4348mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 4348mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9400.000	750.000	-19250.000
60	-9400.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9400.000	750.000	-64250.000
170	-9400.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 75.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 47714.5 Allowable Stress: 63326.2
Axial Stress: 17826.5 @Node 38 LOADCASE: 2 (SUS) W+P1
Bending Stress: 110416.6 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 26240.2 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 131464.5 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	40772.5	0	0	15	31603.5	0	0	B31.3
2(SUS)		23403.4	63326.2	37		25015.9	63326.2	39.5	B31.3
3(EXP)		25340.2	228123.2	11.1		14002.4	226510.7	6.2	B31.3
1(OPE)	15	31859.9	0	0	20	72615.5	0	0	B31.3
2(SUS)		25018.2	63326.2	39.5		20199.2	63326.2	31.9	B31.3
3(EXP)		14002.4	226508.4	6.2		56860.3	231327.4	24.6	B31.3
1(OPE)	20	72778.6	0	0	28	90647.4	0	0	B31.3
2(SUS)		20204.2	63326.2	31.9		18389.9	63326.2	29	B31.3
3(EXP)		56860.3	231322.5	24.6		75628.9	233136.7	32.4	B31.3
1(OPE)	28	90647.4	0	0	29	91703.4	0	0	B31.3
2(SUS)		18389.9	63326.2	29		18534.1	63326.2	29.3	B31.3
3(EXP)		75628.9	233136.7	32.4		76678.2	232992.6	32.9	B31.3
1(OPE)	29	91703.4	0	0	30	92661.3	0	0	B31.3
2(SUS)		18534.1	63326.2	29.3		18681.4	63326.2	29.5	B31.3
3(EXP)		76678.2	232992.6	32.9		77382.9	232845.3	33.2	B31.3
1(OPE)	30	92661.3	0	0	38	93510.9	0	0	B31.3
2(SUS)		18681.4	63326.2	29.5		18973.1	63326.2	30	B31.3
3(EXP)		77382.9	232845.3	33.2		78307.1	232553.6	33.7	B31.3
1(OPE)	38	93510.9	0	0	39	91701.7	0	0	B31.3
2(SUS)		18973.1	63326.2	30		19256	63326.2	30.4	B31.3
3(EXP)		78307.1	232553.6	33.7		76415	232270.7	32.9	B31.3

Possible Approach:
Expansion Loop Dimension A: 4348mm

1(OPE)	39	91701.7	0	0	40	85063.4	0	0	B31.3
2(SUS)		19256	63326.2	30.4		19005.5	63326.2	30	B31.3
3(EXP)		76415	232270.7	32.9		68945	232521.2	29.7	B31.3
1(OPE)	40	85063.4	0	0	45	58643.8	0	0	B31.3
2(SUS)		19005.5	63326.2	30		47714.5	63326.2	75.3	B31.3
3(EXP)		68945	232521.2	29.7		30187.9	203812.2	14.8	B31.3
1(OPE)	45	59014	0	0	48	117669.7	0	0	B31.3
2(SUS)		47688	63326.2	75.3		20055.6	63326.2	31.7	B31.3
3(EXP)		30187.9	203838.7	14.8		100507	231471.1	43.4	B31.3
1(OPE)	48	117669.7	0	0	49	123705.4	0	0	B31.3
2(SUS)		20055.6	63326.2	31.7		18736.5	63326.2	29.6	B31.3
3(EXP)		100507	231471.1	43.4		107473.8	232790.1	46.2	B31.3
1(OPE)	49	123705.4	0	0	50	126173.4	0	0	B31.3
2(SUS)		18736.5	63326.2	29.6		18286.7	63326.2	28.9	B31.3
3(EXP)		107473.8	232790.1	46.2		110359.7	233240	47.3	B31.3
1(OPE)	50	126173.4	0	0	59	123705.4	0	0	B31.3
2(SUS)		18286.7	63326.2	28.9		18736.5	63326.2	29.6	B31.3
3(EXP)		110359.7	233240	47.3		107473.8	232790.1	46.2	B31.3
1(OPE)	59	123705.4	0	0	60	117669.6	0	0	B31.3
2(SUS)		18736.5	63326.2	29.6		20055.6	63326.2	31.7	B31.3
3(EXP)		107473.8	232790.1	46.2		100507	231471.1	43.4	B31.3
1(OPE)	60	117669.6	0	0	65	59014	0	0	B31.3
2(SUS)		20055.6	63326.2	31.7		47687.9	63326.2	75.3	B31.3
3(EXP)		100507	231471.1	43.4		30187.9	203838.7	14.8	B31.3
1(OPE)	65	58643.8	0	0	68	85063.4	0	0	B31.3
2(SUS)		47714.5	63326.2	75.3		19005.5	63326.2	30	B31.3
3(EXP)		30187.9	203812.2	14.8		68945	232521.2	29.7	B31.3
1(OPE)	68	85063.4	0	0	69	91701.7	0	0	B31.3
2(SUS)		19005.5	63326.2	30		19256	63326.2	30.4	B31.3
3(EXP)		68945	232521.2	29.7		76415	232270.7	32.9	B31.3
1(OPE)	69	91701.7	0	0	70	93510.9	0	0	B31.3
2(SUS)		19256	63326.2	30.4		18973.1	63326.2	30	B31.3
3(EXP)		76415	232270.7	32.9		78307.1	232553.6	33.7	B31.3
1(OPE)	70	93510.9	0	0	78	92661.3	0	0	B31.3
2(SUS)		18973.1	63326.2	30		18681.4	63326.2	29.5	B31.3
3(EXP)		78307.1	232553.6	33.7		77383	232845.3	33.2	B31.3
1(OPE)	78	92661.3	0	0	79	91703.4	0	0	B31.3
2(SUS)		18681.4	63326.2	29.5		18534.1	63326.2	29.3	B31.3
3(EXP)		77383	232845.3	33.2		76678.2	232992.6	32.9	B31.3
1(OPE)	79	91703.4	0	0	80	90647.4	0	0	B31.3
2(SUS)		18534.1	63326.2	29.3		18389.9	63326.2	29	B31.3
3(EXP)		76678.2	232992.6	32.9		75628.9	233136.7	32.4	B31.3

Possible Approach:
Expansion Loop Dimension A: 4348mm

1(OPE)	80	90647.4	0	0	85	72778.7	0	0	B31.3
2(SUS)		18389.9	63326.2	29		20204.2	63326.2	31.9	B31.3
3(EXP)		75628.9	233136.7	32.4		56860.3	231322.5	24.6	B31.3
1(OPE)	85	72615.5	0	0	90	31859.9	0	0	B31.3
2(SUS)		20199.2	63326.2	31.9		25018.2	63326.2	39.5	B31.3
3(EXP)		56860.3	231327.4	24.6		14002.3	226508.4	6.2	B31.3
1(OPE)	90	31603.4	0	0	100	40772.6	0	0	B31.3
2(SUS)		25015.9	63326.2	39.5		23403.5	63326.2	37	B31.3
3(EXP)		14002.3	226510.7	6.2		25340.3	228123.2	11.1	B31.3
1(OPE)	100	40772.6	0	0	110	31603.4	0	0	B31.3
2(SUS)		23403.5	63326.2	37		25015.9	63326.2	39.5	B31.3
3(EXP)		25340.4	228123.2	11.1		14002.3	226510.7	6.2	B31.3
1(OPE)	110	31859.9	0	0	120	72615.6	0	0	B31.3
2(SUS)		25018.2	63326.2	39.5		20199.2	63326.2	31.9	B31.3
3(EXP)		14002.3	226508.4	6.2		56860.3	231327.4	24.6	B31.3
1(OPE)	120	72778.7	0	0	128	90647.4	0	0	B31.3
2(SUS)		20204.2	63326.2	31.9		18389.9	63326.2	29	B31.3
3(EXP)		56860.3	231322.5	24.6		75628.9	233136.7	32.4	B31.3
1(OPE)	128	90647.4	0	0	129	91703.4	0	0	B31.3
2(SUS)		18389.9	63326.2	29		18534.1	63326.2	29.3	B31.3
3(EXP)		75628.9	233136.7	32.4		76678.3	232992.6	32.9	B31.3
1(OPE)	129	91703.4	0	0	130	92661.3	0	0	B31.3
2(SUS)		18534.1	63326.2	29.3		18681.4	63326.2	29.5	B31.3
3(EXP)		76678.3	232992.6	32.9		77383	232845.3	33.2	B31.3
1(OPE)	130	92661.3	0	0	139	91701.7	0	0	B31.3
2(SUS)		18681.4	63326.2	29.5		19256	63326.2	30.4	B31.3
3(EXP)		77383	232845.3	33.2		76415	232270.7	32.9	B31.3
1(OPE)	139	91701.7	0	0	140	85063.4	0	0	B31.3
2(SUS)		19256	63326.2	30.4		19005.5	63326.2	30	B31.3
3(EXP)		76415	232270.7	32.9		68945.1	232521.2	29.7	B31.3
1(OPE)	140	85063.4	0	0	150	58643.8	0	0	B31.3
2(SUS)		19005.5	63326.2	30		47714.5	63326.2	75.3	B31.3
3(EXP)		68945.1	232521.2	29.7		30187.9	203812.2	14.8	B31.3
1(OPE)	150	59014	0	0	158	117669.6	0	0	B31.3
2(SUS)		47688	63326.2	75.3		20055.6	63326.2	31.7	B31.3
3(EXP)		30187.9	203838.7	14.8		100506.9	231471.1	43.4	B31.3
1(OPE)	158	117669.6	0	0	159	123705.4	0	0	B31.3
2(SUS)		20055.6	63326.2	31.7		18736.5	63326.2	29.6	B31.3
3(EXP)		100506.9	231471.1	43.4		107473.7	232790.1	46.2	B31.3
1(OPE)	159	123705.4	0	0	160	126173.4	0	0	B31.3
2(SUS)		18736.5	63326.2	29.6		18286.7	63326.2	28.9	B31.3
3(EXP)		107473.7	232790.1	46.2		110359.7	233240	47.3	B31.3

Possible Approach:
Expansion Loop Dimension A: 4348mm

1(OPE)	160	126173.4	0	0	168	126173.4	0	0	B31.3
2(SUS)		18286.7	63326.2	28.9		18286.7	63326.2	28.9	B31.3
3(EXP)		110359.7	233240	47.3		110359.7	233240	47.3	B31.3
1(OPE)	168	126173.4	0	0	169	123705.4	0	0	B31.3
2(SUS)		18286.7	63326.2	28.9		18736.5	63326.2	29.6	B31.3
3(EXP)		110359.7	233240	47.3		107473.8	232790.1	46.2	B31.3
1(OPE)	169	123705.4	0	0	170	117669.6	0	0	B31.3
2(SUS)		18736.5	63326.2	29.6		20055.6	63326.2	31.7	B31.3
3(EXP)		107473.8	232790.1	46.2		100507	231471.1	43.4	B31.3
1(OPE)	170	117669.6	0	0	180	59014	0	0	B31.3
2(SUS)		20055.6	63326.2	31.7		47688	63326.2	75.3	B31.3
3(EXP)		100507	231471.1	43.4		30187.9	203838.7	14.8	B31.3
1(OPE)	180	58643.8	0	0	188	85063.4	0	0	B31.3
2(SUS)		47714.5	63326.2	75.3		19005.5	63326.2	30	B31.3
3(EXP)		30187.9	203812.2	14.8		68945	232521.2	29.7	B31.3
1(OPE)	188	85063.4	0	0	189	91701.7	0	0	B31.3
2(SUS)		19005.5	63326.2	30		19256	63326.2	30.4	B31.3
3(EXP)		68945	232521.2	29.7		76415	232270.7	32.9	B31.3
1(OPE)	189	91701.7	0	0	190	93510.9	0	0	B31.3
2(SUS)		19256	63326.2	30.4		18973.1	63326.2	30	B31.3
3(EXP)		76415	232270.7	32.9		78307.1	232553.6	33.7	B31.3
1(OPE)	190	93510.9	0	0	199	91703.4	0	0	B31.3
2(SUS)		18973.1	63326.2	30		18534.1	63326.2	29.3	B31.3
3(EXP)		78307.1	232553.6	33.7		76678.2	232992.6	32.9	B31.3
1(OPE)	199	91703.4	0	0	200	90647.4	0	0	B31.3
2(SUS)		18534.1	63326.2	29.3		18389.9	63326.2	29	B31.3
3(EXP)		76678.2	232992.6	32.9		75628.9	233136.7	32.4	B31.3
1(OPE)	200	90647.4	0	0	210	72778.6	0	0	B31.3
2(SUS)		18389.9	63326.2	29		20204.2	63326.2	31.9	B31.3
3(EXP)		75628.9	233136.7	32.4		56860.3	231322.5	24.6	B31.3
1(OPE)	210	72615.5	0	0	220	31859.9	0	0	B31.3
2(SUS)		20199.2	63326.2	31.9		25018.2	63326.2	39.5	B31.3
3(EXP)		56860.3	231327.4	24.6		14002.4	226508.4	6.2	B31.3
1(OPE)	220	31603.5	0	0	230	40772.5	0	0	B31.3
2(SUS)		25016	63326.2	39.5		23403.4	63326.2	37	B31.3
3(EXP)		14002.4	226510.7	6.2		25340.2	228123.2	11.1	B31.3

Possible Approach:
Expansion Loop Dimension A: 4348mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14945	-12395	79367	-13300	-72827	4113	0	0	0
	2(SUS)	-91	-13562	-604	-16199	218	-1127	0	0	0
	3(EXP)	15036	1167	79971	2899	-73044	5241	0	0	0
	MAX	15036/L3	-13562/L	79971/L	-16199/L	-73044/L	5241/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1801	-35538	-10508	0	0	0	9.272	0	-54.115
	2(SUS)	395	-30820	-92	0	0	0	0.002	0	-0.001
	3(EXP)	1406	-4718	-10416	0	0	0	9.27	0	-54.115
	MAX	1801/L1	-35538/L	-10508/L1				9.272/L1	-0.000/L1	-54.115/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-1571	-20764	-6646	0	0	0	-3	0	-108.239
	2(SUS)	-1369	-20867	-198	0	0	0	-0.008	0	-0.001
	3(EXP)	-202	102	-6449	0	0	0	-2.992	0	-108.238
	MAX	-1571/L1	-20867/L	-6646/L1				-3.000/L1	-0.000/L2	-108.239/L1
45		Rigid +Y								
	1(OPE)	-13509	-51234	-7331	0	0	0	-81.799	0	-44.39
	2(SUS)	1065	-54682	1359	0	0	0	0.006	0	0.008
	3(EXP)	-14574	3448	-8690	0	0	0	-81.805	0	-44.398
	MAX	-14574/L	-54682/L	-8690/L3				-81.805/L	-0.000/L2	-44.398/L3
65		Rigid +Y								
	1(OPE)	-13509	-51234	7331	0	0	0	-81.799	0	44.39
	2(SUS)	1065	-54682	-1359	0	0	0	0.006	0	-0.008
	3(EXP)	-14574	3448	8690	0	0	0	-81.805	0	44.398
	MAX	-14574/L	-54682/L	8690/L3				-81.805/L	-0.000/L2	44.398/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-1571	-20764	6646	0	0	0	-3	0	108.239
	2(SUS)	-1369	-20867	198	0	0	0	-0.008	0	0.001
	3(EXP)	-202	102	6449	0	0	0	-2.992	0	108.238
	MAX	-1571/L1	-20867/L	6646/L1				-3.000/L1	-0.000/L2	108.239/L1
90		Rigid +Y								
	1(OPE)	1801	-35538	10508	0	0	0	9.272	0	54.115
	2(SUS)	395	-30820	92	0	0	0	0.002	0	0.001
	3(EXP)	1406	-4718	10416	0	0	0	9.27	0	54.115
	MAX	1801/L1	-35538/L	10508/L1				9.272/L1	-0.000/L1	54.115/L1
100		Rigid ANC								
	1(OPE)	29890	-24790	0	0	0	8227	0	0	0
	2(SUS)	-182	-27125	0	0	0	-2254	0	0	0
	3(EXP)	30073	2335	0	0	0	10481	0	0	0
	MAX	30073/L3	-27125/L	-0/L1	0/L1	-0/L1	10481/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 4348mm

110		Rigid +Y								
	1(OPE)	1801	-35538	-10508	0	0	0	9.272	0	-54.115
	2(SUS)	395	-30820	-92	0	0	0	0.002	0	-0.001
	3(EXP)	1406	-4718	-10416	0	0	0	9.27	0	-54.115
	MAX	1801/L1	-35538/L	-10508/L1				9.272/L1	-0.000/L1	-54.115/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-1571	-20764	-6646	0	0	0	-3	0	-108.239
	2(SUS)	-1369	-20867	-198	0	0	0	-0.008	0	-0.001
	3(EXP)	-202	102	-6449	0	0	0	-2.992	0	-108.238
	MAX	-1571/L1	-20867/L	-6646/L1				-3.000/L1	-0.000/L2	-108.239/L1
150		Rigid +Y								
	1(OPE)	-13509	-51234	-7331	0	0	0	-81.799	0	-44.39
	2(SUS)	1065	-54682	1359	0	0	0	0.006	0	0.008
	3(EXP)	-14574	3448	-8690	0	0	0	-81.805	0	-44.398
	MAX	-14574/L	-54682/L	-8690/L3				-81.805/L	-0.000/L2	-44.398/L3
180		Rigid +Y								
	1(OPE)	-13509	-51234	7331	0	0	0	-81.799	0	44.39
	2(SUS)	1065	-54682	-1359	0	0	0	0.006	0	-0.008
	3(EXP)	-14574	3448	8690	0	0	0	-81.805	0	44.398
	MAX	-14574/L	-54682/L	8690/L3				-81.805/L	-0.000/L2	44.398/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-1571	-20764	6646	0	0	0	-3	0	108.239
	2(SUS)	-1369	-20867	198	0	0	0	-0.008	0	0.001
	3(EXP)	-202	102	6449	0	0	0	-2.992	0	108.238
	MAX	-1571/L1	-20867/L	6646/L1				-3.000/L1	-0.000/L2	108.239/L1
220		Rigid +Y								
	1(OPE)	1801	-35538	10508	0	0	0	9.272	0	54.115
	2(SUS)	395	-30820	92	0	0	0	0.002	0	0.001
	3(EXP)	1406	-4718	10416	0	0	0	9.27	0	54.115
	MAX	1801/L1	-35538/L	10508/L1				9.272/L1	-0.000/L1	54.115/L1
230		Rigid ANC								
	1(OPE)	14945	-12395	-79367	13300	72827	4113	0	0	0
	2(SUS)	-91	-13562	604	16199	-218	-1127	0	0	0
	3(EXP)	15036	1167	-79971	-2899	73045	5241	0	0	0
	MAX	15036/L3	-13562/L	-79971/L	16199/L3	73045/L3	5241/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.27	0	-54.115	-0.0059	-0.0661	0.0269
20	-2.992	0	-108.238	0.0237	0.3361	0.0537
28	-31.165	2.568	-131.904	0.0695	0.665	0.0654
29	-33.656	3.121	-133.324	0.0759	0.7082	0.0686
30	-35.998	4.196	-134.412	0.0814	0.7488	0.0755
38	-39.182	6.079	-135.657	0.0841	0.7902	0.0719
39	-44.534	8.191	-134.871	0.0905	0.8706	0.0874
40	-49.169	8.559	-129.46	0.0928	0.9528	0.096
45	-81.805	0	-44.398	0.0561	1.0866	0.1146
48	-109.364	-7.631	17.69	0.0252	0.7064	0.1146
49	-113.802	-8.324	20.851	0.0216	0.5853	0.1151
50	-118.348	-8.511	19.609	0.017	0.4582	0.1155
59	-113.802	-8.324	-20.851	-0.0216	-0.5853	0.1151
60	-109.364	-7.631	-17.69	-0.0252	-0.7064	0.1146
65	-81.805	0	44.398	-0.0561	-1.0866	0.1146
68	-49.169	8.559	129.46	-0.0928	-0.9528	0.096
69	-44.534	8.191	134.871	-0.0905	-0.8706	0.0874
70	-39.182	6.079	135.657	-0.0841	-0.7902	0.0719
78	-35.998	4.196	134.412	-0.0814	-0.7488	0.0755
79	-33.655	3.121	133.324	-0.0759	-0.7082	0.0686
80	-31.165	2.568	131.904	-0.0695	-0.665	0.0654
85	-2.992	0	108.238	-0.0237	-0.3361	0.0537
90	9.27	0	54.115	0.0059	0.0661	0.0269
100	0	0	0	0	0	0
110	9.27	0	-54.115	-0.0059	-0.0661	0.0269
120	-2.992	0	-108.238	0.0237	0.3361	0.0537
128	-31.165	2.568	-131.904	0.0695	0.665	0.0654
129	-33.655	3.121	-133.324	0.0759	0.7082	0.0686
130	-35.998	4.196	-134.412	0.0814	0.7488	0.0755
139	-44.534	8.191	-134.871	0.0905	0.8706	0.0874
140	-49.169	8.559	-129.46	0.0928	0.9528	0.096
150	-81.805	0	-44.398	0.0561	1.0866	0.1146
158	-109.364	-7.631	17.69	0.0252	0.7064	0.1146
159	-113.802	-8.324	20.851	0.0216	0.5853	0.1151
160	-118.348	-8.511	19.609	0.017	0.4582	0.1155
168	-118.348	-8.511	-19.609	-0.017	-0.4582	0.1155
169	-113.802	-8.324	-20.851	-0.0216	-0.5853	0.1151
170	-109.364	-7.631	-17.69	-0.0252	-0.7064	0.1146
180	-81.805	0	44.398	-0.0561	-1.0866	0.1146

Possible Approach:
Expansion Loop Dimension A: 4348mm

188	-49.169	8.559	129.46	-0.0928	-0.9528	0.096
189	-44.534	8.191	134.871	-0.0905	-0.8706	0.0874
190	-39.182	6.079	135.657	-0.0841	-0.7902	0.0719
199	-33.655	3.121	133.324	-0.0759	-0.7082	0.0686
200	-31.164	2.568	131.904	-0.0695	-0.665	0.0654
210	-2.992	0	108.238	-0.0237	-0.3361	0.0537
220	9.27	0	54.115	0.0059	0.0661	0.0269
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	-0.001	-0.0031	-0.0005	-0.0058
20	-0.008	0	-0.001	0.0124	0.0022	-0.0116
28	-0.166	0.663	-0.001	0.0131	0.0023	-0.0141
29	-0.164	0.711	0.008	0.0132	0.0019	-0.0143
30	-0.14	0.751	0.035	0.0132	0.0015	-0.0145
38	-0.09	0.801	0.085	0.013	0.0011	-0.0147
39	-0.023	0.902	0.145	0.0119	0.0001	-0.0152
40	0.007	1.025	0.164	0.0106	-0.0009	-0.0148
45	0.006	0	0.008	-0.0029	-0.0014	0.0749
48	0.006	-8.693	-0.004	-0.0144	0.0004	0.1583
49	0.005	-9.787	-0.001	-0.0156	0.0004	0.16
50	0.003	-10.33	0	-0.0158	0.0003	0.1602
59	0.005	-9.787	0.001	0.0156	-0.0004	0.16
60	0.006	-8.693	0.004	0.0144	-0.0004	0.1583
65	0.006	0	-0.008	0.0029	0.0014	0.0749
68	0.007	1.025	-0.164	-0.0106	0.0009	-0.0148
69	-0.023	0.902	-0.145	-0.0119	-0.0001	-0.0152
70	-0.09	0.801	-0.085	-0.013	-0.0011	-0.0147
78	-0.14	0.751	-0.035	-0.0132	-0.0015	-0.0145
79	-0.164	0.711	-0.008	-0.0132	-0.0019	-0.0143
80	-0.166	0.663	0.001	-0.0131	-0.0023	-0.0141
85	-0.008	0	0.001	-0.0124	-0.0022	-0.0116
90	0.002	0	0.001	0.0031	0.0005	-0.0058
100	0	0	0	0	0	0
110	0.002	0	-0.001	-0.0031	-0.0005	-0.0058
120	-0.008	0	-0.001	0.0124	0.0022	-0.0116
128	-0.166	0.663	-0.001	0.0131	0.0023	-0.0141
129	-0.164	0.711	0.008	0.0132	0.0019	-0.0143
130	-0.14	0.751	0.035	0.0132	0.0015	-0.0145
139	-0.023	0.902	0.145	0.0119	0.0001	-0.0152
140	0.007	1.025	0.164	0.0106	-0.0009	-0.0148
150	0.006	0	0.008	-0.0029	-0.0014	0.0749
158	0.006	-8.693	-0.004	-0.0144	0.0004	0.1583
159	0.005	-9.787	-0.001	-0.0156	0.0004	0.16
160	0.003	-10.33	0	-0.0158	0.0003	0.1602
168	0.003	-10.33	0	0.0158	-0.0003	0.1602
169	0.005	-9.787	0.001	0.0156	-0.0004	0.16
170	0.006	-8.693	0.004	0.0144	-0.0004	0.1583
180	0.006	0	-0.008	0.0029	0.0014	0.0749

Possible Approach:
Expansion Loop Dimension A: 4348mm

188	0.007	1.025	-0.164	-0.0106	0.0009	-0.0148
189	-0.023	0.902	-0.145	-0.0119	-0.0001	-0.0152
190	-0.09	0.801	-0.085	-0.013	-0.0011	-0.0147
199	-0.164	0.711	-0.008	-0.0132	-0.0019	-0.0143
200	-0.166	0.663	0.001	-0.0131	-0.0023	-0.0141
210	-0.008	0	0.001	-0.0124	-0.0022	-0.0116
220	0.002	0	0.001	0.0031	0.0005	-0.0058
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4348
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.272	0	-54.115	-0.0089	-0.0666	0.0211
20	-3	0	-108.239	0.0361	0.3382	0.0422
28	-31.331	3.231	-131.905	0.0827	0.6672	0.0514
29	-33.819	3.832	-133.317	0.0891	0.7101	0.0543
30	-36.138	4.947	-134.377	0.0945	0.7503	0.061
38	-39.272	6.88	-135.572	0.0971	0.7914	0.0572
39	-44.558	9.092	-134.726	0.1025	0.8707	0.0722
40	-49.162	9.584	-129.296	0.1034	0.9519	0.0812
45	-81.799	0	-44.39	0.0532	1.0852	0.1896
48	-109.358	-16.324	17.686	0.0108	0.7068	0.273
49	-113.798	-18.11	20.85	0.0059	0.5857	0.2751
50	-118.346	-18.842	19.609	0.0012	0.4585	0.2757
59	-113.798	-18.11	-20.85	-0.0059	-0.5857	0.2751
60	-109.358	-16.324	-17.686	-0.0108	-0.7068	0.273
65	-81.799	0	44.39	-0.0532	-1.0852	0.1896
68	-49.162	9.584	129.296	-0.1034	-0.9519	0.0812
69	-44.558	9.092	134.726	-0.1025	-0.8707	0.0722
70	-39.272	6.88	135.572	-0.0971	-0.7914	0.0572
78	-36.138	4.947	134.377	-0.0945	-0.7503	0.061
79	-33.819	3.832	133.317	-0.0891	-0.7101	0.0543
80	-31.331	3.231	131.905	-0.0827	-0.6672	0.0514
85	-3	0	108.239	-0.0361	-0.3382	0.0422
90	9.272	0	54.115	0.0089	0.0666	0.0211
100	0	0	0	0	0	0
110	9.272	0	-54.115	-0.0089	-0.0666	0.0211
120	-3	0	-108.239	0.0361	0.3382	0.0422
128	-31.331	3.231	-131.905	0.0827	0.6672	0.0514
129	-33.819	3.832	-133.317	0.0891	0.7101	0.0543
130	-36.138	4.947	-134.377	0.0945	0.7503	0.061
139	-44.558	9.092	-134.726	0.1025	0.8707	0.0722
140	-49.162	9.584	-129.296	0.1034	0.9519	0.0812
150	-81.799	0	-44.39	0.0532	1.0852	0.1896
158	-109.358	-16.324	17.686	0.0108	0.7068	0.273
159	-113.797	-18.11	20.85	0.0059	0.5857	0.2751
160	-118.346	-18.842	19.609	0.0012	0.4585	0.2757
168	-118.346	-18.842	-19.609	-0.0012	-0.4585	0.2757
169	-113.797	-18.11	-20.85	-0.0059	-0.5857	0.2751
170	-109.358	-16.324	-17.686	-0.0108	-0.7068	0.273
180	-81.799	0	44.39	-0.0532	-1.0852	0.1896

Possible Approach:
Expansion Loop Dimension A: 4348mm

188	-49.162	9.584	129.296	-0.1034	-0.9519	0.0812
189	-44.558	9.092	134.726	-0.1025	-0.8707	0.0722
190	-39.272	6.88	135.572	-0.0971	-0.7914	0.0572
199	-33.819	3.832	133.316	-0.0891	-0.7101	0.0543
200	-31.331	3.231	131.905	-0.0827	-0.6672	0.0514
210	-3	0	108.239	-0.0361	-0.3382	0.0422
220	9.272	0	54.115	0.0089	0.0666	0.0211
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -4,548.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 4,548.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,548.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,548.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:

Expansion Loop Dimension A: 4548mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension A: 4548mm

```
    TRANSL. STIF      lbs./in.     x     1.751   =   N./cm.
    ROTATIONAL STIF   in.lb./deg.  x     0.113   =   N.m./deg
    UNIFORM LOAD      lb./in.      x     1.751   =   N./cm.
    G LOAD            g's          x     1.000   =   g's
    WIND LOAD         lbs./sq.in.  x     6.895   =   KPa
    ELEVATION         inches       x     0.025   =   m.
    COMPOUND LENGTH   inches       x    25.400   =   mm.
    DIAMETER          inches       x    25.400   =   mm.
    WALL THICKNESS    inches       x    25.400   =   mm.

 SETUP FILE PARAMETERS
 ---------------------------------------------------------------------------
 CONNECT GEOMETRY THRU CNODES =    YES
 MIN ALLOWED BEND ANGLE =          5.00000
 MAX ALLOWED BEND ANGLE =          95.0000
 BEND LENGTH ATTACHMENT PERCENT =  1.00000
 MIN ANGLE TO ADJACENT BEND PT =   5.00000
 LOOP CLOSURE TOLERANCE =          25.4000     mm.
 THERMAL BOWING HORZ TOLERANCE =   0.100000E-03
 AUTO NODE NUMBER INCREMENT=       10.0000
 Z AXIS UP=                        NO
 USE PRESSURE STIFFENING =         DEFAULT
 ALPHA TOLERANCE =                 0.500000E-01
 RESLD-FORCE =                     NO
 HGR DEF RESWGT STIF =             0.175127E+13 N./cm.
 DECOMP SNG TOL =                  0.100000E+11
 BEND AXIAL SHAPE =                YES
 FRICT STIF =                      0.175127E+07 N./cm.
 FRICT NORM FORCE VAR =            0.150000
 FRICT ANGLE VAR =                 15.0000
 FRICT SLIDE MULT =                1.00000
 ROD TOLERANCE =                   1.00000
 ROD INC =                         2.00000
 INCORE NUMERICAL CHECK =          NO
 OUTCORE NUMERICAL CHECK =         NO
 DEFAULT TRANS RESTRAINT STIFF=    0.175127E+13   N./cm.
 DEFAULT ROT RESTRAINT STIFF=      0.112985E+12  N.m./deg
 IGNORE SPRING HANGER STIFFNESS =  NO
 MISSING MASS ZPA =                EXTRACTED
 MIN WALL MILL TOLERANCE =         12.5000
 WRC-107 VERSION =                 MAR 79 1B1/2B1
 WRC-107 INTERPOLATION =           LAST VALUE
 DEFAULT AMBIENT TEMPERATURE=      28.0000      C
 BOURDON PRESSURE=                 NONE
 COEFFICIENT OF FRICTION (MU) =    0.000000
 INCLUDE SPRG STIF IN HGR OPE =    NO
 INCLUDE INSULATION IN HYDROTEST = NO
 REDUCED INTERSECTION =            B31.1(POST1980)
 USE WRC329                        NO
 NO REDUCED SIF FOR RFT AND WLT    NO
```

Possible Approach:

Expansion Loop Dimension A: 4548mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension A: 4548mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9600.000	750.000	-19250.000
60	-9600.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9600.000	750.000	-64250.000
170	-9600.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 78.5 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 49712.7 Allowable Stress: 63326.2
Axial Stress: 17849.4 @Node 70 LOADCASE: 2 (SUS) W+P1
Bending Stress: 107164.1 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 25820.3 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 128089.6 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	39977.8	0	0	15	31477.6	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		24475.2	228300.1	10.7		13554.7	226146.4	6	B31.3
1(OPE)	15	31738.7	0	0	20	71005.1	0	0	B31.3
2(SUS)		25383.2	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		13554.7	226143.5	6		55112.3	232552.1	23.7	B31.3
1(OPE)	20	71149.9	0	0	28	89291.3	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		55112.3	232546	23.7		74329.6	233009.8	31.9	B31.3
1(OPE)	28	89291.3	0	0	29	90372.6	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		74329.6	233009.8	31.9		75412.2	232892.3	32.4	B31.3
1(OPE)	29	90372.6	0	0	30	91356.7	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		75412.2	232892.3	32.4		76153.6	232753.1	32.7	B31.3
1(OPE)	30	91356.7	0	0	38	92250.8	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19128.6	63326.2	30.2	B31.3
3(EXP)		76153.6	232753.1	32.7		77122.5	232398	33.2	B31.3
1(OPE)	38	92250.8	0	0	39	90590	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		19530	63326.2	30.8	B31.3
3(EXP)		77122.5	232398	33.2		75374.5	231996.7	32.5	B31.3

Possible Approach:
Expansion Loop Dimension A: 4548mm

1(OPE)	39	90590	0	0	40	84229	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		75374.5	231996.7	32.5		68167.9	232229.9	29.4	B31.3
1(OPE)	40	84229	0	0	45	58376.3	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		68167.9	232229.9	29.4		27900.7	201814	13.8	B31.3
1(OPE)	45	58755	0	0	48	114945.7	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		27900.7	201841.8	13.8		97760.6	231448	42.2	B31.3
1(OPE)	48	114945.7	0	0	49	120657.9	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97760.6	231448	42.2		104337.4	232593.7	44.9	B31.3
1(OPE)	49	120657.9	0	0	50	122990.2	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104337.4	232593.7	44.9		107061.8	233504.9	45.8	B31.3
1(OPE)	50	122990.2	0	0	59	120657.9	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		107061.8	233504.9	45.8		104337.4	232593.7	44.9	B31.3
1(OPE)	59	120657.9	0	0	60	114945.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104337.4	232593.7	44.9		97760.5	231448	42.2	B31.3
1(OPE)	60	114945.6	0	0	65	58755	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97760.5	231448	42.2		27900.6	201841.8	13.8	B31.3
1(OPE)	65	58376.3	0	0	68	84229	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		27900.6	201814	13.8		68167.9	232229.9	29.4	B31.3
1(OPE)	68	84229	0	0	69	90590	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		68167.9	232229.9	29.4		75374.5	231996.7	32.5	B31.3
1(OPE)	69	90590	0	0	70	92250.8	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		75374.5	231996.7	32.5		77122.6	232398	33.2	B31.3
1(OPE)	70	92250.8	0	0	78	91356.8	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18773.6	63326.2	29.6	B31.3
3(EXP)		77122.6	232398	33.2		76153.6	232753.1	32.7	B31.3
1(OPE)	78	91356.8	0	0	79	90372.6	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		18634.3	63326.2	29.4	B31.3
3(EXP)		76153.6	232753.1	32.7		75412.2	232892.3	32.4	B31.3
1(OPE)	79	90372.6	0	0	80	89291.3	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		75412.2	232892.3	32.4		74329.7	233009.8	31.9	B31.3

Possible Approach:
Expansion Loop Dimension A: 4548mm

1(OPE)	80	89291.3	0	0	85	71149.9	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		74329.7	233009.8	31.9		55112.4	232546	23.7	B31.3
1(OPE)	85	71005.1	0	0	90	31738.7	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.1	63326.2	40.1	B31.3
3(EXP)		55112.4	232552.1	23.7		13554.6	226143.5	6	B31.3
1(OPE)	90	31477.6	0	0	100	39977.9	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		13554.6	226146.4	6		24475.3	228300	10.7	B31.3
1(OPE)	100	39977.9	0	0	110	31477.6	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		24475.3	228300	10.7		13554.6	226146.4	6	B31.3
1(OPE)	110	31738.7	0	0	120	71005.1	0	0	B31.3
2(SUS)		25383.1	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		13554.6	226143.5	6		55112.4	232552.1	23.7	B31.3
1(OPE)	120	71150	0	0	128	89291.3	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		55112.4	232546	23.7		74329.7	233009.8	31.9	B31.3
1(OPE)	128	89291.3	0	0	129	90372.7	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		74329.7	233009.8	31.9		75412.3	232892.3	32.4	B31.3
1(OPE)	129	90372.7	0	0	130	91356.8	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		75412.3	232892.3	32.4		76153.6	232753.1	32.7	B31.3
1(OPE)	130	91356.8	0	0	139	90590	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19530	63326.2	30.8	B31.3
3(EXP)		76153.6	232753.1	32.7		75374.5	231996.7	32.5	B31.3
1(OPE)	139	90590	0	0	140	84229	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		75374.5	231996.7	32.5		68167.9	232229.9	29.4	B31.3
1(OPE)	140	84229	0	0	150	58376.3	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		68167.9	232229.9	29.4		27900.6	201814	13.8	B31.3
1(OPE)	150	58755	0	0	158	114945.6	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		27900.6	201841.8	13.8		97760.5	231448	42.2	B31.3
1(OPE)	158	114945.6	0	0	159	120657.9	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97760.5	231448	42.2		104337.3	232593.7	44.9	B31.3
1(OPE)	159	120657.9	0	0	160	122990.1	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104337.3	232593.7	44.9		107061.7	233504.9	45.8	B31.3

Possible Approach:
Expansion Loop Dimension A: 4548mm

1(OPE)	160	122990.1	0	0	168	122990.2	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18021.7	63326.2	28.5	B31.3
3(EXP)		107061.7	233504.9	45.8		107061.7	233504.9	45.8	B31.3
1(OPE)	168	122990.2	0	0	169	120657.9	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		107061.7	233504.9	45.8		104337.4	232593.7	44.9	B31.3
1(OPE)	169	120657.9	0	0	170	114945.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104337.4	232593.7	44.9		97760.5	231448	42.2	B31.3
1(OPE)	170	114945.6	0	0	180	58755	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97760.5	231448	42.2		27900.7	201841.8	13.8	B31.3
1(OPE)	180	58376.3	0	0	188	84229	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		27900.7	201814	13.8		68167.9	232229.9	29.4	B31.3
1(OPE)	188	84229	0	0	189	90590	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		68167.9	232229.9	29.4		75374.5	231996.7	32.5	B31.3
1(OPE)	189	90590	0	0	190	92250.8	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		75374.5	231996.7	32.5		77122.5	232398	33.2	B31.3
1(OPE)	190	92250.8	0	0	199	90372.6	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18634.3	63326.2	29.4	B31.3
3(EXP)		77122.5	232398	33.2		75412.2	232892.3	32.4	B31.3
1(OPE)	199	90372.6	0	0	200	89291.3	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		75412.2	232892.3	32.4		74329.6	233009.8	31.9	B31.3
1(OPE)	200	89291.3	0	0	210	71149.9	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		74329.6	233009.8	31.9		55112.4	232546	23.7	B31.3
1(OPE)	210	71005.1	0	0	220	31738.7	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.2	63326.2	40.1	B31.3
3(EXP)		55112.4	232552.1	23.7		13554.7	226143.5	6	B31.3
1(OPE)	220	31477.6	0	0	230	39977.8	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		13554.7	226146.3	6		24475.2	228300.1	10.7	B31.3

Possible Approach:
Expansion Loop Dimension A: 4548mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14454	-12246	76635	-12929	-70354	4183	0	0	0
	2(SUS)	-82	-13357	-750	-15688	196	-916	0	0	0
	3(EXP)	14536	1111	77385	2759	-70550	5099	0	0	0
	MAX	14536/L1	-13357/L	77385/L1	-15688/L	-70550/L	5099/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1769	-36142	-10697	0	0	0	8.947	0	-54.117
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	1412	-4491	-10583	0	0	0	8.945	0	-54.117
	MAX	1769/L1	-36142/L	-10697/L1				8.947/L1	-0.000/L1	-54.117/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-701	-19258	-5937	0	0	0	-3	0	-108.244
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	690	-100	-5692	0	0	0	-2.992	0	-108.243
	MAX	-1391/L2	-19258/L	-5937/L1				-3.000/L1	-0.000/L1	-108.244/L1
45		Rigid +Y								
	1(OPE)	-13803	-53042	-7918	0	0	0	-80.657	0	-46.269
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-14919	3479	-9649	0	0	0	-80.663	0	-46.279
	MAX	-14919/L	-56522/L	-9649/L3				-80.663/L	-0.000/L2	-46.279/L3
65		Rigid +Y								
	1(OPE)	-13803	-53042	7918	0	0	0	-80.657	0	46.269
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-14919	3479	9649	0	0	0	-80.663	0	46.279
	MAX	-14919/L	-56522/L	9649/L3				-80.663/L	-0.000/L2	46.279/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-701	-19258	5937	0	0	0	-3	0	108.244
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	690	-100	5692	0	0	0	-2.992	0	108.243
	MAX	-1391/L2	-19258/L	5937/L1				-3.000/L1	-0.000/L1	108.244/L1
90		Rigid +Y								
	1(OPE)	1769	-36142	10697	0	0	0	8.947	0	54.117
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	1412	-4491	10583	0	0	0	8.945	0	54.117
	MAX	1769/L1	-36142/L	10697/L1				8.947/L1	-0.000/L1	54.117/L1
100		Rigid ANC								
	1(OPE)	28907	-24491	0	0	0	8367	0	0	0
	2(SUS)	-164	-26714	0	0	0	-1832	0	0	0
	3(EXP)	29072	2222	0	0	0	10199	0	0	0
	MAX	29072/L1	-26714/L	-0/L1	0/L1	-0/L3	10199/L1	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension A: 4548mm

110		Rigid +Y								
	1(OPE)	1769	-36142	-10697	0	0	0	8.947	0	-54.117
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	1412	-4491	-10583	0	0	0	8.945	0	-54.117
	MAX	1769/L1	-36142/L	-10697/L1				8.947/L1	-0.000/L1	-54.117/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-701	-19258	-5937	0	0	0	-3	0	-108.244
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	690	-100	-5692	0	0	0	-2.992	0	-108.243
	MAX	-1391/L2	-19258/L	-5937/L1				-3.000/L1	-0.000/L1	-108.244/L1
150		Rigid +Y								
	1(OPE)	-13803	-53042	-7918	0	0	0	-80.657	0	-46.269
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-14919	3479	-9649	0	0	0	-80.663	0	-46.279
	MAX	-14919/L	-56522/L	-9649/L3				-80.663/L	-0.000/L2	-46.279/L3
180		Rigid +Y								
	1(OPE)	-13803	-53042	7918	0	0	0	-80.657	0	46.269
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-14919	3479	9649	0	0	0	-80.663	0	46.279
	MAX	-14919/L	-56522/L	9649/L3				-80.663/L	-0.000/L2	46.279/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-701	-19258	5937	0	0	0	-3	0	108.244
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	690	-100	5692	0	0	0	-2.992	0	108.243
	MAX	-1391/L2	-19258/L	5937/L1				-3.000/L1	-0.000/L1	108.244/L1
220		Rigid +Y								
	1(OPE)	1769	-36142	10697	0	0	0	8.947	0	54.117
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	1412	-4491	10583	0	0	0	8.945	0	54.117
	MAX	1769/L1	-36142/L	10697/L1				8.947/L1	-0.000/L1	54.117/L1
230		Rigid ANC								
	1(OPE)	14454	-12246	-76635	12929	70354	4183	0	0	0
	2(SUS)	-82	-13357	750	15688	-196	-916	0	0	0
	3(EXP)	14536	1111	-77385	-2759	70550	5099	0	0	0
	MAX	14536/L3	-13357/L	-77385/L	15688/L3	70550/L3	5099/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.945	0	-54.117	-0.0056	-0.0636	0.0261
20	-2.992	0	-108.243	0.0226	0.3262	0.0523
28	-30.372	2.455	-131.909	0.0667	0.6476	0.0637
29	-32.799	2.997	-133.332	0.0729	0.6901	0.0668
30	-35.081	4.063	-134.426	0.0783	0.7301	0.0735
38	-38.186	5.934	-135.683	0.081	0.7708	0.0701
39	-43.437	8.036	-134.967	0.0873	0.85	0.0854
40	-48.027	8.411	-129.701	0.0897	0.9313	0.094
45	-80.663	0	-46.279	0.0549	1.0702	0.1128
48	-109.667	-7.903	17.863	0.0239	0.6855	0.1128
49	-114.054	-8.588	20.896	0.0205	0.5679	0.1132
50	-118.498	-8.777	19.61	0.0162	0.4445	0.1136
59	-114.054	-8.588	-20.896	-0.0205	-0.5679	0.1132
60	-109.667	-7.903	-17.863	-0.0239	-0.6855	0.1128
65	-80.663	0	46.279	-0.0549	-1.0702	0.1128
68	-48.027	8.411	129.701	-0.0897	-0.9313	0.094
69	-43.437	8.036	134.967	-0.0873	-0.85	0.0854
70	-38.186	5.934	135.683	-0.081	-0.7708	0.0701
78	-35.081	4.063	134.426	-0.0783	-0.7301	0.0735
79	-32.799	2.997	133.332	-0.0729	-0.6901	0.0668
80	-30.372	2.455	131.909	-0.0667	-0.6476	0.0637
85	-2.992	0	108.243	-0.0226	-0.3262	0.0523
90	8.945	0	54.117	0.0056	0.0636	0.0261
100	0	0	0	0	0	0
110	8.945	0	-54.117	-0.0056	-0.0636	0.0261
120	-2.992	0	-108.243	0.0226	0.3262	0.0523
128	-30.372	2.455	-131.909	0.0667	0.6476	0.0637
129	-32.799	2.997	-133.332	0.0729	0.6901	0.0668
130	-35.081	4.063	-134.426	0.0783	0.7301	0.0735
139	-43.437	8.036	-134.967	0.0873	0.85	0.0854
140	-48.027	8.411	-129.701	0.0897	0.9313	0.094
150	-80.663	0	-46.279	0.0549	1.0702	0.1128
158	-109.667	-7.903	17.863	0.0239	0.6855	0.1128
159	-114.054	-8.588	20.896	0.0205	0.5679	0.1132
160	-118.498	-8.777	19.61	0.0162	0.4445	0.1136
168	-118.498	-8.777	-19.61	-0.0162	-0.4445	0.1136
169	-114.054	-8.588	-20.896	-0.0205	-0.5679	0.1132
170	-109.667	-7.903	-17.863	-0.0239	-0.6855	0.1128
180	-80.663	0	46.279	-0.0549	-1.0702	0.1128

Possible Approach:
Expansion Loop Dimension A: 4548mm

188	-48.027	8.411	129.701	-0.0897	-0.9313	0.094
189	-43.437	8.036	134.967	-0.0873	-0.85	0.0854
190	-38.186	5.934	135.683	-0.081	-0.7708	0.0701
199	-32.799	2.997	133.332	-0.0729	-0.6901	0.0668
200	-30.372	2.455	131.909	-0.0667	-0.6476	0.0637
210	-2.992	0	108.243	-0.0226	-0.3262	0.0523
220	8.945	0	54.117	0.0056	0.0636	0.0261
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
20	-0.008	0	-0.001	0.0166	0.002	-0.0094
28	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
29	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
30	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
38	-0.078	1.242	0.132	0.0203	0.0003	-0.012
39	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
40	0.007	1.487	0.25	0.0175	-0.002	-0.0117
45	0.006	0	0.01	0.0015	-0.002	0.0856
48	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
49	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
50	0.001	-12.155	0	-0.0147	0.0005	0.1803
59	0.005	-11.565	0.002	0.0142	-0.0006	0.18
60	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
65	0.006	0	-0.01	-0.0015	0.002	0.0856
68	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
69	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
70	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
78	-0.12	1.164	-0.055	-0.0206	-0.0008	-0.0118
79	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
80	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
85	-0.008	0	0.001	-0.0166	-0.002	-0.0094
90	0.002	0	0.001	0.0041	0.0004	-0.0047
100	0	0	0	0	0	0
110	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
120	-0.008	0	-0.001	0.0166	0.002	-0.0094
128	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
129	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
130	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
139	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
140	0.007	1.487	0.25	0.0175	-0.002	-0.0117
150	0.006	0	0.01	0.0015	-0.002	0.0856
158	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
159	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
160	0.001	-12.155	0	-0.0147	0.0005	0.1803
168	0.001	-12.155	0	0.0147	-0.0005	0.1803
169	0.005	-11.565	0.002	0.0142	-0.0006	0.18
170	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
180	0.006	0	-0.01	-0.0015	0.002	0.0856

Possible Approach:
Expansion Loop Dimension A: 4548mm

188	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
189	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
190	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
199	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
200	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
210	-0.008	0	0.001	-0.0166	-0.002	-0.0094
220	0.002	0	0.001	0.0041	0.0004	-0.0047
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 7, 2015 Time: 17:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.947	0	-54.117	-0.0097	-0.0641	0.0214
20	-3	0	-108.244	0.0392	0.3281	0.0429
28	-30.516	3.481	-131.911	0.0873	0.6492	0.0522
29	-32.94	4.098	-133.319	0.0936	0.6913	0.0552
30	-35.202	5.227	-134.371	0.0988	0.7308	0.0617
38	-38.264	7.176	-135.55	0.1013	0.7711	0.0581
39	-43.456	9.405	-134.743	0.1064	0.8492	0.073
40	-48.02	9.898	-129.452	0.1071	0.9293	0.0823
45	-80.657	0	-46.269	0.0563	1.0682	0.1984
48	-109.66	-18.247	17.857	0.0112	0.6861	0.2911
49	-114.049	-20.152	20.894	0.0063	0.5685	0.2933
50	-118.497	-20.931	19.61	0.0015	0.445	0.2939
59	-114.049	-20.152	-20.894	-0.0063	-0.5685	0.2933
60	-109.66	-18.247	-17.857	-0.0112	-0.6861	0.2911
65	-80.657	0	46.269	-0.0563	-1.0682	0.1984
68	-48.02	9.898	129.452	-0.1071	-0.9293	0.0823
69	-43.456	9.405	134.743	-0.1064	-0.8492	0.073
70	-38.264	7.176	135.55	-0.1013	-0.7711	0.0581
78	-35.202	5.227	134.371	-0.0988	-0.7308	0.0617
79	-32.94	4.098	133.319	-0.0936	-0.6913	0.0552
80	-30.516	3.481	131.911	-0.0873	-0.6492	0.0522
85	-3	0	108.244	-0.0392	-0.3281	0.0429
90	8.947	0	54.117	0.0097	0.0641	0.0214
100	0	0	0	0	0	0
110	8.947	0	-54.117	-0.0097	-0.0641	0.0214
120	-3	0	-108.244	0.0392	0.3281	0.0429
128	-30.516	3.481	-131.911	0.0873	0.6492	0.0522
129	-32.94	4.098	-133.319	0.0936	0.6913	0.0552
130	-35.202	5.227	-134.371	0.0988	0.7308	0.0617
139	-43.456	9.405	-134.743	0.1064	0.8492	0.073
140	-48.02	9.898	-129.452	0.1071	0.9293	0.0823
150	-80.657	0	-46.269	0.0563	1.0682	0.1984
158	-109.66	-18.247	17.857	0.0112	0.6861	0.2911
159	-114.049	-20.152	20.894	0.0063	0.5685	0.2933
160	-118.497	-20.931	19.61	0.0015	0.445	0.2939
168	-118.497	-20.931	-19.61	-0.0015	-0.445	0.2939
169	-114.049	-20.152	-20.894	-0.0063	-0.5685	0.2933
170	-109.66	-18.247	-17.857	-0.0112	-0.6861	0.2911
180	-80.657	0	46.269	-0.0563	-1.0682	0.1984

Possible Approach:
Expansion Loop Dimension A: 4548mm

188	-48.02	9.898	129.452	-0.1071	-0.9293	0.0823
189	-43.456	9.405	134.743	-0.1064	-0.8492	0.073
190	-38.264	7.176	135.55	-0.1013	-0.7711	0.0581
199	-32.94	4.098	133.319	-0.0936	-0.6913	0.0552
200	-30.516	3.481	131.911	-0.0873	-0.6492	0.0522
210	-3	0	108.244	-0.0392	-0.3281	0.0429
220	8.947	0	54.117	0.0097	0.0641	0.0214
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,700.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,100.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,700.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6100mm C: 3700mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,700.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,100.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,700.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6100mm C: 3700mm

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:

Expansion Loop Dimension B: 6100mm C: 3700mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension B: 6100mm C: 3700mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension B: 6100mm C: 3700mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18700.000
40	.000	750.000	-19450.000
45	-5052.000	750.000	-19450.000
50	-9000.000	750.000	-19450.000
60	-9000.000	750.000	-25550.000
65	-5052.000	750.000	-25550.000
70	.000	750.000	-25550.000
80	.000	.000	-26300.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63700.000
140	.000	750.000	-64450.000
150	-5052.000	750.000	-64450.000
160	-9000.000	750.000	-64450.000
170	-9000.000	750.000	-70550.000
180	-5052.000	750.000	-70550.000
190	.000	750.000	-70550.000
200	.000	.000	-71300.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 67.6 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 42827.5 Allowable Stress: 63326.2
Axial Stress: 17783.3 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 120962.2 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27034.2 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 142302.7 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42056.6	0	0	15	31578.2	0	0	B31.3
2(SUS)		23907.6	63326.2	37.8		23983.8	63326.2	37.9	B31.3
3(EXP)		26784.6	227619	11.8		14791.3	227542.8	6.5	B31.3
1(OPE)	15	31820.2	0	0	20	75074.5	0	0	B31.3
2(SUS)		23984.6	63326.2	37.9		23810.1	63326.2	37.6	B31.3
3(EXP)		14791.3	227542.1	6.5		59589.4	227716.5	26.2	B31.3
1(OPE)	20	75286.1	0	0	28	93175.6	0	0	B31.3
2(SUS)		23811.8	63326.2	37.6		18303.1	63326.2	28.9	B31.3
3(EXP)		59589.4	227714.8	26.2		77981.4	233223.6	33.4	B31.3
1(OPE)	28	93175.6	0	0	29	94147.8	0	0	B31.3
2(SUS)		18303.1	63326.2	28.9		18425.8	63326.2	29.1	B31.3
3(EXP)		77981.4	233223.6	33.4		78926.1	233100.8	33.9	B31.3
1(OPE)	29	94147.8	0	0	30	95014.6	0	0	B31.3
2(SUS)		18425.8	63326.2	29.1		18560.9	63326.2	29.3	B31.3
3(EXP)		78926.1	233100.8	33.9		79518.2	232965.8	34.1	B31.3
1(OPE)	30	95014.6	0	0	38	95714.8	0	0	B31.3
2(SUS)		18560.9	63326.2	29.3		18631.8	63326.2	29.4	B31.3
3(EXP)		79518.2	232965.8	34.1		80306.2	232894.8	34.5	B31.3
1(OPE)	38	95714.8	0	0	39	93484.5	0	0	B31.3
2(SUS)		18631.8	63326.2	29.4		18602	63326.2	29.4	B31.3
3(EXP)		80306.2	232894.8	34.5		78016	232924.6	33.5	B31.3

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

1(OPE)	39	93484.5	0	0	40	86103.5	0	0	B31.3
2(SUS)		18602	63326.2	29.4		18327	63326.2	28.9	B31.3
3(EXP)		78016	232924.6	33.5		69841	233199.6	29.9	B31.3
1(OPE)	40	86103.5	0	0	45	61746.6	0	0	B31.3
2(SUS)		18327	63326.2	28.9		42827.5	63326.2	67.6	B31.3
3(EXP)		69841	233199.6	29.9		37497.8	208699.2	18	B31.3
1(OPE)	45	62090	0	0	48	126785.2	0	0	B31.3
2(SUS)		42805.2	63326.2	67.6		19863.6	63326.2	31.4	B31.3
3(EXP)		37497.8	208721.4	18		109667.2	231663	47.3	B31.3
1(OPE)	48	126785.2	0	0	49	133661.6	0	0	B31.3
2(SUS)		19863.6	63326.2	31.4		18081.6	63326.2	28.6	B31.3
3(EXP)		109667.2	231663	47.3		117653.8	233445	50.4	B31.3
1(OPE)	49	133661.6	0	0	50	136484.2	0	0	B31.3
2(SUS)		18081.6	63326.2	28.6		19096.2	63326.2	30.2	B31.3
3(EXP)		117653.8	233445	50.4		120962.2	232430.4	52	B31.3
1(OPE)	50	136484.2	0	0	59	133661.6	0	0	B31.3
2(SUS)		19096.2	63326.2	30.2		18081.6	63326.2	28.6	B31.3
3(EXP)		120962.2	232430.4	52		117653.8	233445	50.4	B31.3
1(OPE)	59	133661.6	0	0	60	126785.2	0	0	B31.3
2(SUS)		18081.6	63326.2	28.6		19863.6	63326.2	31.4	B31.3
3(EXP)		117653.8	233445	50.4		109667.2	231663	47.3	B31.3
1(OPE)	60	126785.2	0	0	65	62090	0	0	B31.3
2(SUS)		19863.6	63326.2	31.4		42805.2	63326.2	67.6	B31.3
3(EXP)		109667.2	231663	47.3		37497.7	208721.4	18	B31.3
1(OPE)	65	61746.6	0	0	68	86103.6	0	0	B31.3
2(SUS)		42827.5	63326.2	67.6		18327	63326.2	28.9	B31.3
3(EXP)		37497.7	208699.2	18		69841	233199.6	29.9	B31.3
1(OPE)	68	86103.6	0	0	69	93484.5	0	0	B31.3
2(SUS)		18327	63326.2	28.9		18602	63326.2	29.4	B31.3
3(EXP)		69841	233199.6	29.9		78016	232924.6	33.5	B31.3
1(OPE)	69	93484.5	0	0	70	95714.8	0	0	B31.3
2(SUS)		18602	63326.2	29.4		18631.8	63326.2	29.4	B31.3
3(EXP)		78016	232924.6	33.5		80306.3	232894.8	34.5	B31.3
1(OPE)	70	95714.8	0	0	78	95014.6	0	0	B31.3
2(SUS)		18631.8	63326.2	29.4		18560.9	63326.2	29.3	B31.3
3(EXP)		80306.3	232894.8	34.5		79518.3	232965.8	34.1	B31.3
1(OPE)	78	95014.6	0	0	79	94147.8	0	0	B31.3
2(SUS)		18560.9	63326.2	29.3		18425.8	63326.2	29.1	B31.3
3(EXP)		79518.3	232965.8	34.1		78926.1	233100.8	33.9	B31.3
1(OPE)	79	94147.8	0	0	80	93175.6	0	0	B31.3
2(SUS)		18425.8	63326.2	29.1		18303.1	63326.2	28.9	B31.3
3(EXP)		78926.1	233100.8	33.9		77981.4	233223.6	33.4	B31.3

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

1(OPE)	80	93175.6	0	0	85	75286.1	0	0	B31.3
2(SUS)		18303.1	63326.2	28.9		23811.8	63326.2	37.6	B31.3
3(EXP)		77981.4	233223.6	33.4		59589.4	227714.8	26.2	B31.3
1(OPE)	85	75074.6	0	0	90	31820.2	0	0	B31.3
2(SUS)		23810.1	63326.2	37.6		23984.6	63326.2	37.9	B31.3
3(EXP)		59589.4	227716.5	26.2		14791.2	227542.1	6.5	B31.3
1(OPE)	90	31578.2	0	0	100	42056.7	0	0	B31.3
2(SUS)		23983.8	63326.2	37.9		23907.7	63326.2	37.8	B31.3
3(EXP)		14791.2	227542.9	6.5		26784.8	227619	11.8	B31.3
1(OPE)	100	42056.7	0	0	110	31578.2	0	0	B31.3
2(SUS)		23907.7	63326.2	37.8		23983.8	63326.2	37.9	B31.3
3(EXP)		26784.8	227619	11.8		14791.2	227542.8	6.5	B31.3
1(OPE)	110	31820.2	0	0	120	75074.6	0	0	B31.3
2(SUS)		23984.6	63326.2	37.9		23810.1	63326.2	37.6	B31.3
3(EXP)		14791.2	227542.1	6.5		59589.5	227716.5	26.2	B31.3
1(OPE)	120	75286.2	0	0	128	93175.6	0	0	B31.3
2(SUS)		23811.8	63326.2	37.6		18303.1	63326.2	28.9	B31.3
3(EXP)		59589.5	227714.8	26.2		77981.4	233223.6	33.4	B31.3
1(OPE)	128	93175.6	0	0	129	94147.9	0	0	B31.3
2(SUS)		18303.1	63326.2	28.9		18425.8	63326.2	29.1	B31.3
3(EXP)		77981.4	233223.6	33.4		78926.1	233100.8	33.9	B31.3
1(OPE)	129	94147.9	0	0	130	95014.6	0	0	B31.3
2(SUS)		18425.8	63326.2	29.1		18560.9	63326.2	29.3	B31.3
3(EXP)		78926.1	233100.8	33.9		79518.3	232965.8	34.1	B31.3
1(OPE)	130	95014.6	0	0	139	93484.5	0	0	B31.3
2(SUS)		18560.9	63326.2	29.3		18602	63326.2	29.4	B31.3
3(EXP)		79518.3	232965.8	34.1		78016	232924.6	33.5	B31.3
1(OPE)	139	93484.5	0	0	140	86103.6	0	0	B31.3
2(SUS)		18602	63326.2	29.4		18327	63326.2	28.9	B31.3
3(EXP)		78016	232924.6	33.5		69841	233199.6	29.9	B31.3
1(OPE)	140	86103.6	0	0	150	61746.5	0	0	B31.3
2(SUS)		18327	63326.2	28.9		42827.5	63326.2	67.6	B31.3
3(EXP)		69841	233199.6	29.9		37497.7	208699.2	18	B31.3
1(OPE)	150	62090	0	0	158	126785.1	0	0	B31.3
2(SUS)		42805.2	63326.2	67.6		19863.6	63326.2	31.4	B31.3
3(EXP)		37497.7	208721.4	18		109667.2	231663	47.3	B31.3
1(OPE)	158	126785.1	0	0	159	133661.6	0	0	B31.3
2(SUS)		19863.6	63326.2	31.4		18081.6	63326.2	28.6	B31.3
3(EXP)		109667.2	231663	47.3		117653.7	233445	50.4	B31.3
1(OPE)	159	133661.6	0	0	160	136484.1	0	0	B31.3
2(SUS)		18081.6	63326.2	28.6		19096.2	63326.2	30.2	B31.3
3(EXP)		117653.7	233445	50.4		120962.2	232430.4	52	B31.3

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

1(OPE)	160	136484.1	0	0	168	136484.1	0	0	B31.3
2(SUS)		19096.2	63326.2	30.2		19096.2	63326.2	30.2	B31.3
3(EXP)		120962.2	232430.4	52		120962.2	232430.4	52	B31.3
1(OPE)	168	136484.1	0	0	169	133661.6	0	0	B31.3
2(SUS)		19096.2	63326.2	30.2		18081.6	63326.2	28.6	B31.3
3(EXP)		120962.2	232430.4	52		117653.8	233445	50.4	B31.3
1(OPE)	169	133661.6	0	0	170	126785.2	0	0	B31.3
2(SUS)		18081.6	63326.2	28.6		19863.6	63326.2	31.4	B31.3
3(EXP)		117653.8	233445	50.4		109667.2	231663	47.3	B31.3
1(OPE)	170	126785.2	0	0	180	62090	0	0	B31.3
2(SUS)		19863.6	63326.2	31.4		42805.2	63326.2	67.6	B31.3
3(EXP)		109667.2	231663	47.3		37497.8	208721.4	18	B31.3
1(OPE)	180	61746.6	0	0	188	86103.5	0	0	B31.3
2(SUS)		42827.5	63326.2	67.6		18327	63326.2	28.9	B31.3
3(EXP)		37497.8	208699.2	18		69841	233199.6	29.9	B31.3
1(OPE)	188	86103.5	0	0	189	93484.5	0	0	B31.3
2(SUS)		18327	63326.2	28.9		18602	63326.2	29.4	B31.3
3(EXP)		69841	233199.6	29.9		78016	232924.6	33.5	B31.3
1(OPE)	189	93484.5	0	0	190	95714.8	0	0	B31.3
2(SUS)		18602	63326.2	29.4		18631.8	63326.2	29.4	B31.3
3(EXP)		78016	232924.6	33.5		80306.2	232894.8	34.5	B31.3
1(OPE)	190	95714.8	0	0	199	94147.8	0	0	B31.3
2(SUS)		18631.8	63326.2	29.4		18425.8	63326.2	29.1	B31.3
3(EXP)		80306.2	232894.8	34.5		78926.1	233100.8	33.9	B31.3
1(OPE)	199	94147.8	0	0	200	93175.6	0	0	B31.3
2(SUS)		18425.8	63326.2	29.1		18303.1	63326.2	28.9	B31.3
3(EXP)		78926.1	233100.8	33.9		77981.4	233223.6	33.4	B31.3
1(OPE)	200	93175.6	0	0	210	75286.1	0	0	B31.3
2(SUS)		18303.1	63326.2	28.9		23811.8	63326.2	37.6	B31.3
3(EXP)		77981.4	233223.6	33.4		59589.4	227714.9	26.2	B31.3
1(OPE)	210	75074.5	0	0	220	31820.2	0	0	B31.3
2(SUS)		23810.1	63326.2	37.6		23984.6	63326.2	37.9	B31.3
3(EXP)		59589.4	227716.5	26.2		14791.3	227542.1	6.5	B31.3
1(OPE)	220	31578.2	0	0	230	42056.6	0	0	B31.3
2(SUS)		23983.8	63326.2	37.9		23907.6	63326.2	37.8	B31.3
3(EXP)		14791.3	227542.8	6.5		26784.6	227619	11.8	B31.3

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15764	-12877	86572	-14496	-76913	3972	0	0	0
	2(SUS)	-116	-14146	-208	-17648	277	-1766	0	0	0
	3(EXP)	15880	1270	86780	3152	-77190	5738	0	0	0
	MAX	15880/L	-14146/L	86780/L	-17648/L	-77190/L	5738/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1797	-33592	-9916	0	0	0	9.805	0	-54.109
	2(SUS)	498	-28461	-32	0	0	0	0.003	0	0
	3(EXP)	1299	-5131	-9884	0	0	0	9.802	0	-54.109
	MAX	1797/L1	-33592/L	-9916/L1				9.805/L1	-0.000/L1	-54.109/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3484	-25531	-8638	0	0	0	-3	0	-108.226
	2(SUS)	-1275	-26033	-68	0	0	0	-0.007	0	0
	3(EXP)	-2209	503	-8570	0	0	0	-2.993	0	-108.226
	MAX	-3484/L1	-26033/L	-8638/L1				-3.000/L1	-0.000/L2	-108.226/L1
45		Rigid +Y								
	1(OPE)	-12566	-46421	-6003	0	0	0	-86.444	0	-41.294
	2(SUS)	893	-49779	263	0	0	0	0.005	0	0.001
	3(EXP)	-13459	3358	-6265	0	0	0	-86.449	0	-41.295
	MAX	-13459/L	-49779/L	-6265/L3				-86.449/L	-0.000/L2	-41.295/L3
65		Rigid +Y								
	1(OPE)	-12566	-46421	6003	0	0	0	-86.444	0	41.294
	2(SUS)	893	-49779	-263	0	0	0	0.005	0	-0.001
	3(EXP)	-13459	3358	6265	0	0	0	-86.449	0	41.295
	MAX	-13459/L	-49779/L	6265/L3				-86.449/L	-0.000/L2	41.295/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3484	-25531	8638	0	0	0	-3	0	108.226
	2(SUS)	-1275	-26033	68	0	0	0	-0.007	0	0
	3(EXP)	-2210	503	8570	0	0	0	-2.993	0	108.226
	MAX	-3484/L1	-26033/L	8638/L1				-3.000/L1	-0.000/L2	108.226/L1
90		Rigid +Y								
	1(OPE)	1797	-33592	9916	0	0	0	9.805	0	54.109
	2(SUS)	498	-28461	32	0	0	0	0.003	0	0
	3(EXP)	1299	-5131	9884	0	0	0	9.802	0	54.109
	MAX	1797/L1	-33592/L	9916/L1				9.805/L1	-0.000/L1	54.109/L1
100		Rigid ANC								
	1(OPE)	31528	-25753	0	0	0	7944	0	0	0
	2(SUS)	-232	-28292	0	0	0	-3532	0	0	0
	3(EXP)	31761	2539	0	0	0	11476	0	0	0
	MAX	31761/L	-28292/L	-0/L1	0/L1	-0/L1	11476/L	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

110		Rigid +Y								
	1(OPE)	1797	-33592	-9916	0	0	0	9.805	0	-54.109
	2(SUS)	498	-28461	-32	0	0	0	0.003	0	0
	3(EXP)	1299	-5131	-9884	0	0	0	9.802	0	-54.109
	MAX	1797/L1	-33592/L	-9916/L1				9.805/L1	-0.000/L1	-54.109/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3484	-25531	-8638	0	0	0	-3	0	-108.226
	2(SUS)	-1275	-26033	-68	0	0	0	-0.007	0	0
	3(EXP)	-2210	503	-8570	0	0	0	-2.993	0	-108.226
	MAX	-3484/L1	-26033/L	-8638/L1				-3.000/L1	-0.000/L2	-108.226/L1
150		Rigid +Y								
	1(OPE)	-12566	-46421	-6003	0	0	0	-86.444	0	-41.294
	2(SUS)	893	-49779	263	0	0	0	0.005	0	0.001
	3(EXP)	-13459	3358	-6265	0	0	0	-86.449	0	-41.295
	MAX	-13459/L	-49779/L	-6265/L3				-86.449/L	-0.000/L2	-41.295/L3
180		Rigid +Y								
	1(OPE)	-12566	-46421	6003	0	0	0	-86.444	0	41.294
	2(SUS)	893	-49779	-263	0	0	0	0.005	0	-0.001
	3(EXP)	-13459	3358	6265	0	0	0	-86.449	0	41.295
	MAX	-13459/L	-49779/L	6265/L3				-86.449/L	-0.000/L2	41.295/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3484	-25531	8638	0	0	0	-3	0	108.226
	2(SUS)	-1275	-26033	68	0	0	0	-0.007	0	0
	3(EXP)	-2209	503	8570	0	0	0	-2.993	0	108.226
	MAX	-3484/L1	-26033/L	8638/L1				-3.000/L1	-0.000/L2	108.226/L1
220		Rigid +Y								
	1(OPE)	1797	-33592	9916	0	0	0	9.805	0	54.109
	2(SUS)	498	-28461	32	0	0	0	0.003	0	0
	3(EXP)	1299	-5131	9884	0	0	0	9.802	0	54.109
	MAX	1797/L1	-33592/L	9916/L1				9.805/L1	-0.000/L1	54.109/L1
230		Rigid ANC								
	1(OPE)	15764	-12877	-86572	14496	76913	3972	0	0	0
	2(SUS)	-116	-14146	208	17648	-277	-1766	0	0	0
	3(EXP)	15880	1270	-86780	-3152	77190	5738	0	0	0
	MAX	15880/L1	-14146/L	-86780/L	17648/L1	77190/L1	5738/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.802	0	-54.109	-0.0064	-0.07	0.0294
20	-2.993	0	-108.226	0.0258	0.3518	0.0588
28	-34.831	3.038	-133.333	0.0781	0.7139	0.0724
29	-37.503	3.622	-134.747	0.0849	0.7584	0.0757
30	-40.014	4.726	-135.816	0.0907	0.8001	0.0828
38	-43.422	6.644	-137.024	0.0936	0.8426	0.0792
39	-49.057	8.78	-136.048	0.0999	0.9249	0.0948
40	-53.812	9.117	-130.255	0.1018	1.0085	0.1034
45	-86.449	0	-41.295	0.0595	1.12	0.1215
48	-111.118	-7.243	16.035	0.0276	0.7368	0.1215
49	-115.62	-7.976	19.363	0.0234	0.6045	0.122
50	-120.251	-8.173	18.163	0.0182	0.4652	0.1225
59	-115.62	-7.976	-19.363	-0.0234	-0.6045	0.122
60	-111.118	-7.243	-16.035	-0.0276	-0.7368	0.1215
65	-86.449	0	41.295	-0.0595	-1.12	0.1215
68	-53.812	9.117	130.255	-0.1018	-1.0085	0.1034
69	-49.057	8.78	136.048	-0.0999	-0.9249	0.0948
70	-43.422	6.644	137.024	-0.0936	-0.8426	0.0792
78	-40.014	4.726	135.816	-0.0907	-0.8001	0.0828
79	-37.503	3.622	134.747	-0.0849	-0.7584	0.0757
80	-34.831	3.038	133.333	-0.0781	-0.7139	0.0724
85	-2.993	0	108.226	-0.0258	-0.3518	0.0588
90	9.802	0	54.109	0.0064	0.07	0.0294
100	0	0	0	0	0	0
110	9.802	0	-54.109	-0.0064	-0.07	0.0294
120	-2.993	0	-108.226	0.0258	0.3518	0.0588
128	-34.831	3.038	-133.333	0.0781	0.7139	0.0724
129	-37.503	3.622	-134.747	0.0849	0.7584	0.0757
130	-40.014	4.726	-135.816	0.0907	0.8001	0.0828
139	-49.057	8.78	-136.048	0.0999	0.9249	0.0948
140	-53.812	9.117	-130.255	0.1018	1.0085	0.1034
150	-86.449	0	-41.295	0.0595	1.12	0.1215
158	-111.118	-7.243	16.035	0.0276	0.7368	0.1215
159	-115.62	-7.976	19.363	0.0234	0.6045	0.122
160	-120.25	-8.173	18.163	0.0182	0.4652	0.1225
168	-120.25	-8.173	-18.163	-0.0182	-0.4652	0.1225
169	-115.62	-7.976	-19.363	-0.0234	-0.6045	0.122
170	-111.118	-7.243	-16.035	-0.0276	-0.7368	0.1215
180	-86.449	0	41.295	-0.0595	-1.12	0.1215

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

188	-53.812	9.117	130.255	-0.1018	-1.0085	0.1034
189	-49.057	8.78	136.048	-0.0999	-0.9249	0.0948
190	-43.422	6.644	137.024	-0.0936	-0.8426	0.0792
199	-37.503	3.622	134.747	-0.0849	-0.7584	0.0757
200	-34.831	3.038	133.333	-0.0781	-0.7139	0.0724
210	-2.993	0	108.226	-0.0258	-0.3518	0.0588
220	9.802	0	54.109	0.0064	0.07	0.0294
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0001	-0.0006	-0.009
20	-0.007	0	0	0.0006	0.0027	-0.0181
28	-0.242	-0.378	-0.001	-0.0069	0.004	-0.0223
29	-0.24	-0.402	-0.005	-0.0067	0.0038	-0.0226
30	-0.206	-0.421	-0.018	-0.0065	0.0036	-0.0229
38	-0.132	-0.445	-0.042	-0.0064	0.0034	-0.0232
39	-0.036	-0.41	-0.064	-0.0066	0.0027	-0.024
40	0.006	-0.262	-0.061	-0.007	0.0021	-0.0242
45	0.005	0	0.001	-0.0123	0.0001	0.0468
48	0.005	-5.301	0.001	-0.0162	-0.0001	0.1102
49	0.005	-6.081	0	-0.0167	-0.0001	0.1117
50	0.006	-6.496	0	-0.0159	0	0.1118
59	0.005	-6.081	0	0.0167	0.0001	0.1117
60	0.005	-5.301	-0.001	0.0162	0.0001	0.1102
65	0.005	0	-0.001	0.0123	-0.0001	0.0468
68	0.006	-0.262	0.061	0.007	-0.0021	-0.0242
69	-0.036	-0.41	0.064	0.0066	-0.0027	-0.024
70	-0.132	-0.445	0.042	0.0064	-0.0034	-0.0232
78	-0.206	-0.421	0.018	0.0065	-0.0036	-0.0229
79	-0.24	-0.402	0.005	0.0067	-0.0038	-0.0226
80	-0.242	-0.378	0.001	0.0069	-0.004	-0.0223
85	-0.007	0	0	-0.0006	-0.0027	-0.0181
90	0.003	0	0	0.0001	0.0006	-0.009
100	0	0	0	0	0	0
110	0.003	0	0	-0.0001	-0.0006	-0.009
120	-0.007	0	0	0.0006	0.0027	-0.0181
128	-0.242	-0.378	-0.001	-0.0069	0.004	-0.0223
129	-0.24	-0.402	-0.005	-0.0067	0.0038	-0.0226
130	-0.206	-0.421	-0.018	-0.0065	0.0036	-0.0229
139	-0.036	-0.41	-0.064	-0.0066	0.0027	-0.024
140	0.006	-0.262	-0.061	-0.007	0.0021	-0.0242
150	0.005	0	0.001	-0.0123	0.0001	0.0468
158	0.005	-5.301	0.001	-0.0162	-0.0001	0.1102
159	0.005	-6.081	0	-0.0167	-0.0001	0.1117
160	0.006	-6.496	0	-0.0159	0	0.1118
168	0.006	-6.496	0	0.0159	0	0.1118
169	0.005	-6.081	0	0.0167	0.0001	0.1117
170	0.005	-5.301	-0.001	0.0162	0.0001	0.1102
180	0.005	0	-0.001	0.0123	-0.0001	0.0468

Possible Approach:
Expansion Loop Dimension B: 6100mm C: 3700mm

188	0.006	-0.262	0.061	0.007	-0.0021	-0.0242
189	-0.036	-0.41	0.064	0.0066	-0.0027	-0.024
190	-0.132	-0.445	0.042	0.0064	-0.0034	-0.0232
199	-0.24	-0.402	0.005	0.0067	-0.0038	-0.0226
200	-0.242	-0.378	0.001	0.0069	-0.004	-0.0223
210	-0.007	0	0	-0.0006	-0.0027	-0.0181
220	0.003	0	0	0.0001	0.0006	-0.009
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:9
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.805	0	-54.109	-0.0065	-0.0706	0.0204
20	-3	0	-108.226	0.0263	0.3545	0.0407
28	-35.073	2.66	-133.333	0.0712	0.7179	0.0501
29	-37.744	3.221	-134.752	0.0782	0.7622	0.0532
30	-40.219	4.304	-135.834	0.0842	0.8037	0.0599
38	-43.554	6.199	-137.067	0.0872	0.846	0.0559
39	-49.094	8.37	-136.112	0.0934	0.9276	0.0708
40	-53.807	8.855	-130.316	0.0947	1.0106	0.0792
45	-86.444	0	-41.294	0.0473	1.1201	0.1683
48	-111.113	-12.544	16.036	0.0114	0.7367	0.2317
49	-115.615	-14.057	19.363	0.0067	0.6044	0.2337
50	-120.245	-14.669	18.163	0.0023	0.4652	0.2343
59	-115.615	-14.057	-19.363	-0.0067	-0.6044	0.2337
60	-111.113	-12.544	-16.036	-0.0114	-0.7367	0.2317
65	-86.444	0	41.294	-0.0473	-1.1201	0.1683
68	-53.807	8.855	130.316	-0.0947	-1.0106	0.0792
69	-49.094	8.37	136.112	-0.0934	-0.9276	0.0708
70	-43.554	6.199	137.067	-0.0872	-0.846	0.0559
78	-40.219	4.304	135.834	-0.0842	-0.8037	0.0599
79	-37.744	3.221	134.752	-0.0782	-0.7622	0.0532
80	-35.073	2.66	133.333	-0.0712	-0.7179	0.0501
85	-3	0	108.226	-0.0263	-0.3545	0.0407
90	9.805	0	54.109	0.0065	0.0706	0.0204
100	0	0	0	0	0	0
110	9.805	0	-54.109	-0.0065	-0.0706	0.0204
120	-3	0	-108.226	0.0263	0.3545	0.0407
128	-35.073	2.66	-133.333	0.0712	0.7179	0.0501
129	-37.744	3.221	-134.752	0.0782	0.7622	0.0532
130	-40.219	4.304	-135.834	0.0842	0.8037	0.0599
139	-49.094	8.37	-136.111	0.0934	0.9276	0.0708
140	-53.807	8.855	-130.316	0.0947	1.0106	0.0792
150	-86.444	0	-41.294	0.0473	1.1201	0.1683
158	-111.113	-12.544	16.036	0.0114	0.7367	0.2317
159	-115.615	-14.057	19.363	0.0067	0.6044	0.2337
160	-120.245	-14.669	18.163	0.0023	0.4652	0.2343
168	-120.245	-14.669	-18.163	-0.0023	-0.4652	0.2343
169	-115.615	-14.057	-19.363	-0.0067	-0.6044	0.2337
170	-111.113	-12.544	-16.036	-0.0114	-0.7367	0.2317
180	-86.444	0	41.294	-0.0473	-1.1201	0.1683

188	-53.807	8.855	130.316	-0.0947	-1.0106	0.0792
189	-49.094	8.37	136.112	-0.0934	-0.9276	0.0708
190	-43.554	6.199	137.067	-0.0872	-0.846	0.0559
199	-37.744	3.221	134.752	-0.0782	-0.7622	0.0532
200	-35.073	2.66	133.333	-0.0712	-0.7179	0.0501
210	-3	0	108.226	-0.0263	-0.3545	0.0407
220	9.805	0	54.109	0.0065	0.0706	0.0204
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,600.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,300.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,600.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,600.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,300.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,600.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

```
  Node  220  +Y   Mu = .30
-------------------------------------------------------------------------------
From  220  To  230 DZ= -7,500.000 mm.
RESTRAINTS
  Node  230  ANC



MATERIAL Changes:
  10          15          Mat= (185)A335 P22   E= 210,694,720 KPa
                          v = .292   Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
  10          15          B31.3 (2010)       Cycle Max Switch = ---
                          App.P Sy/St Switch = ON   Sc= 137,895 KPa
                          Sh1= 63,326 KPa   Sh2= 137,895 KPa
                          Sh3= 137,895 KPa   Sh4= 137,895 KPa
                          Sh5= 137,895 KPa   Sh6= 137,895 KPa
                          Sh7= 137,895 KPa   Sh8= 137,895 KPa
                          Sh9= 137,895 KPa   Sy= 206,843 KPa



BEND ELEMENTS
  20          30          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 29
                          Angle/Node @2= .00 28
  30          40          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 39
                          Angle/Node @2= .00 38
  45          50          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 49
                          Angle/Node @2= .00 48
  50          60          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 59
  65          70          Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00 69
                          Angle/Node @2= .00 68
  70          80          Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50 79
                          Angle/Node @2= .00 78
 120          130           Radius= 533.400 mm. (LONG)
                          Bend Angle= 45.000   Angle/Node @1= 22.50
                        129   Angle/Node @2= .00 128
 130          140           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
       139
 150          160           Radius= 533.400 mm. (LONG)
                          Bend Angle= 90.000   Angle/Node @1= 45.00
```

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	Len FORCE	MU Dir Vectors
10	ANC			.30	.000	.000 .000
15	+Y			.30	.000	1.000 .000
20	Guide		3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000 .000
45	+Y			.30	.000	1.000 .000
65	+Y			.30	.000	1.000 .000
85	Guide		3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000 .000
90	+Y			.30	.000	1.000 .000
100	ANC			.30	.000	.000 .000
110	+Y			.30	.000	1.000 .000
120	+Y			.30	.000	1.000 .000
120	Guide		3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000 .000
180	+Y			.30	.000	1.000 .000
210	+Y			.30	.000	1.000 .000
210	Guide		3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000 .000
230	ANC			.30	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18600.000
40	.000	750.000	-19350.000
45	-5052.000	750.000	-19350.000
50	-9000.000	750.000	-19350.000
60	-9000.000	750.000	-25650.000
65	-5052.000	750.000	-25650.000
70	.000	750.000	-25650.000
80	.000	.000	-26400.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63600.000
140	.000	750.000	-64350.000
150	-5052.000	750.000	-64350.000
160	-9000.000	750.000	-64350.000
170	-9000.000	750.000	-70650.000
180	-5052.000	750.000	-70650.000
190	.000	750.000	-70650.000
200	.000	.000	-71400.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 68.5 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43355.6 Allowable Stress: 63326.2
Axial Stress: 17788.3 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 119134.0 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27110.5 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 140447.8 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42250.8	0	0	15	31766.7	0	0	B31.3
2(SUS)		23822.6	63326.2	37.6		24156	63326.2	38.1	B31.3
3(EXP)		26978	227704.1	11.8		14869.3	227370.6	6.5	B31.3
1(OPE)	15	32011.9	0	0	20	75590.9	0	0	B31.3
2(SUS)		24157	63326.2	38.1		23201.6	63326.2	36.6	B31.3
3(EXP)		14869.3	227369.6	6.5		60093.5	228325	26.3	B31.3
1(OPE)	20	75795.1	0	0	28	93374.3	0	0	B31.3
2(SUS)		23203.8	63326.2	36.6		18218.3	63326.2	28.8	B31.3
3(EXP)		60093.5	228322.9	26.3		78221.7	233308.3	33.5	B31.3
1(OPE)	28	93374.3	0	0	29	94362.3	0	0	B31.3
2(SUS)		18218.3	63326.2	28.8		18371.8	63326.2	29	B31.3
3(EXP)		78221.7	233308.3	33.5		79183.8	233154.9	34	B31.3
1(OPE)	29	94362.3	0	0	30	95247.4	0	0	B31.3
2(SUS)		18371.8	63326.2	29		18525.1	63326.2	29.3	B31.3
3(EXP)		79183.8	233154.9	34		79792.7	233001.6	34.2	B31.3
1(OPE)	30	95247.4	0	0	38	95974.9	0	0	B31.3
2(SUS)		18525.1	63326.2	29.3		18648.1	63326.2	29.4	B31.3
3(EXP)		79792.7	233001.6	34.2		80600.8	232878.6	34.6	B31.3
1(OPE)	38	95974.9	0	0	39	93793.2	0	0	B31.3
2(SUS)		18648.1	63326.2	29.4		18676.4	63326.2	29.5	B31.3
3(EXP)		80600.8	232878.6	34.6		78349.2	232850.3	33.6	B31.3

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

1(OPE)	39	93793.2	0	0	40	86476.1	0	0	B31.3
2(SUS)		18676.4	63326.2	29.5		18404	63326.2	29.1	B31.3
3(EXP)		78349.2	232850.3	33.6		70226.6	233122.7	30.1	B31.3
1(OPE)	40	86476.1	0	0	45	61173.7	0	0	B31.3
2(SUS)		18404	63326.2	29.1		43355.6	63326.2	68.5	B31.3
3(EXP)		70226.6	233122.7	30.1		36533.6	208171.1	17.5	B31.3
1(OPE)	45	61521.8	0	0	48	125082.3	0	0	B31.3
2(SUS)		43332.5	63326.2	68.4		19941.4	63326.2	31.5	B31.3
3(EXP)		36533.6	208194.1	17.5		107955.7	231585.2	46.6	B31.3
1(OPE)	48	125082.3	0	0	49	131892.1	0	0	B31.3
2(SUS)		19941.4	63326.2	31.5		18219.3	63326.2	28.8	B31.3
3(EXP)		107955.7	231585.2	46.6		115859.8	233307.3	49.7	B31.3
1(OPE)	49	131892.1	0	0	50	134685.3	0	0	B31.3
2(SUS)		18219.3	63326.2	28.8		18964.8	63326.2	29.9	B31.3
3(EXP)		115859.8	233307.3	49.7		119134	232561.9	51.2	B31.3
1(OPE)	50	134685.3	0	0	59	131892.1	0	0	B31.3
2(SUS)		18964.8	63326.2	29.9		18219.3	63326.2	28.8	B31.3
3(EXP)		119134	232561.9	51.2		115859.8	233307.3	49.7	B31.3
1(OPE)	59	131892.1	0	0	60	125082.3	0	0	B31.3
2(SUS)		18219.3	63326.2	28.8		19941.4	63326.2	31.5	B31.3
3(EXP)		115859.8	233307.3	49.7		107955.7	231585.2	46.6	B31.3
1(OPE)	60	125082.3	0	0	65	61521.8	0	0	B31.3
2(SUS)		19941.4	63326.2	31.5		43332.5	63326.2	68.4	B31.3
3(EXP)		107955.7	231585.2	46.6		36533.6	208194.1	17.5	B31.3
1(OPE)	65	61173.7	0	0	68	86476.1	0	0	B31.3
2(SUS)		43355.6	63326.2	68.5		18404	63326.2	29.1	B31.3
3(EXP)		36533.6	208171.1	17.5		70226.6	233122.7	30.1	B31.3
1(OPE)	68	86476.1	0	0	69	93793.2	0	0	B31.3
2(SUS)		18404	63326.2	29.1		18676.4	63326.2	29.5	B31.3
3(EXP)		70226.6	233122.7	30.1		78349.2	232850.3	33.6	B31.3
1(OPE)	69	93793.2	0	0	70	95974.9	0	0	B31.3
2(SUS)		18676.4	63326.2	29.5		18648.1	63326.2	29.4	B31.3
3(EXP)		78349.2	232850.3	33.6		80600.8	232878.6	34.6	B31.3
1(OPE)	70	95974.9	0	0	78	95247.4	0	0	B31.3
2(SUS)		18648.1	63326.2	29.4		18525.1	63326.2	29.3	B31.3
3(EXP)		80600.8	232878.6	34.6		79792.7	233001.6	34.2	B31.3
1(OPE)	78	95247.4	0	0	79	94362.3	0	0	B31.3
2(SUS)		18525.1	63326.2	29.3		18371.8	63326.2	29	B31.3
3(EXP)		79792.7	233001.6	34.2		79183.8	233154.9	34	B31.3
1(OPE)	79	94362.3	0	0	80	93374.4	0	0	B31.3
2(SUS)		18371.8	63326.2	29		18218.3	63326.2	28.8	B31.3
3(EXP)		79183.8	233154.9	34		78221.7	233308.3	33.5	B31.3

Possible Approach:

Expansion Loop Dimension B: 6300mm C: 3600mm

1(OPE)	80	93374.4	0	0	85	75795.2	0	0	B31.3
2(SUS)		18218.3	63326.2	28.8		23203.8	63326.2	36.6	B31.3
3(EXP)		78221.7	233308.3	33.5		60093.6	228322.9	26.3	B31.3
1(OPE)	85	75590.9	0	0	90	32011.8	0	0	B31.3
2(SUS)		23201.6	63326.2	36.6		24157	63326.2	38.1	B31.3
3(EXP)		60093.6	228325	26.3		14869.3	227369.6	6.5	B31.3
1(OPE)	90	31766.6	0	0	100	42250.9	0	0	B31.3
2(SUS)		24156	63326.2	38.1		23822.6	63326.2	37.6	B31.3
3(EXP)		14869.3	227370.6	6.5		26978.1	227704	11.8	B31.3
1(OPE)	100	42250.9	0	0	110	31766.7	0	0	B31.3
2(SUS)		23822.6	63326.2	37.6		24156	63326.2	38.1	B31.3
3(EXP)		26978.1	227704	11.8		14869.3	227370.6	6.5	B31.3
1(OPE)	110	32011.8	0	0	120	75590.9	0	0	B31.3
2(SUS)		24157	63326.2	38.1		23201.6	63326.2	36.6	B31.3
3(EXP)		14869.3	227369.6	6.5		60093.6	228325	26.3	B31.3
1(OPE)	120	75795.2	0	0	128	93374.4	0	0	B31.3
2(SUS)		23203.8	63326.2	36.6		18218.3	63326.2	28.8	B31.3
3(EXP)		60093.6	228322.9	26.3		78221.7	233308.3	33.5	B31.3
1(OPE)	128	93374.4	0	0	129	94362.3	0	0	B31.3
2(SUS)		18218.3	63326.2	28.8		18371.8	63326.2	29	B31.3
3(EXP)		78221.7	233308.3	33.5		79183.8	233154.9	34	B31.3
1(OPE)	129	94362.3	0	0	130	95247.4	0	0	B31.3
2(SUS)		18371.8	63326.2	29		18525.1	63326.2	29.3	B31.3
3(EXP)		79183.8	233154.9	34		79792.8	233001.6	34.2	B31.3
1(OPE)	130	95247.4	0	0	139	93793.2	0	0	B31.3
2(SUS)		18525.1	63326.2	29.3		18676.4	63326.2	29.5	B31.3
3(EXP)		79792.8	233001.6	34.2		78349.2	232850.2	33.6	B31.3
1(OPE)	139	93793.2	0	0	140	86476.1	0	0	B31.3
2(SUS)		18676.4	63326.2	29.5		18404	63326.2	29.1	B31.3
3(EXP)		78349.2	232850.2	33.6		70226.6	233122.7	30.1	B31.3
1(OPE)	140	86476.1	0	0	150	61173.7	0	0	B31.3
2(SUS)		18404	63326.2	29.1		43355.6	63326.2	68.5	B31.3
3(EXP)		70226.6	233122.7	30.1		36533.6	208171.1	17.5	B31.3
1(OPE)	150	61521.8	0	0	158	125082.3	0	0	B31.3
2(SUS)		43332.5	63326.2	68.4		19941.4	63326.2	31.5	B31.3
3(EXP)		36533.6	208194.1	17.5		107955.7	231585.2	46.6	B31.3
1(OPE)	158	125082.3	0	0	159	131892.1	0	0	B31.3
2(SUS)		19941.4	63326.2	31.5		18219.3	63326.2	28.8	B31.3
3(EXP)		107955.7	231585.2	46.6		115859.8	233307.3	49.7	B31.3
1(OPE)	159	131892.1	0	0	160	134685.3	0	0	B31.3
2(SUS)		18219.3	63326.2	28.8		18964.8	63326.2	29.9	B31.3
3(EXP)		115859.8	233307.3	49.7		119134	232561.9	51.2	B31.3

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

1(OPE)	160	134685.3	0	0	168	134685.3	0	0	B31.3
2(SUS)		18964.8	63326.2	29.9		18964.8	63326.2	29.9	B31.3
3(EXP)		119134	232561.9	51.2		119134	232561.9	51.2	B31.3
1(OPE)	168	134685.3	0	0	169	131892.1	0	0	B31.3
2(SUS)		18964.8	63326.2	29.9		18219.3	63326.2	28.8	B31.3
3(EXP)		119134	232561.9	51.2		115859.8	233307.3	49.7	B31.3
1(OPE)	169	131892.1	0	0	170	125082.3	0	0	B31.3
2(SUS)		18219.3	63326.2	28.8		19941.4	63326.2	31.5	B31.3
3(EXP)		115859.8	233307.3	49.7		107955.7	231585.2	46.6	B31.3
1(OPE)	170	125082.3	0	0	180	61521.8	0	0	B31.3
2(SUS)		19941.4	63326.2	31.5		43332.5	63326.2	68.4	B31.3
3(EXP)		107955.7	231585.2	46.6		36533.6	208194.1	17.5	B31.3
1(OPE)	180	61173.7	0	0	188	86476.1	0	0	B31.3
2(SUS)		43355.6	63326.2	68.5		18404	63326.2	29.1	B31.3
3(EXP)		36533.6	208171.1	17.5		70226.6	233122.7	30.1	B31.3
1(OPE)	188	86476.1	0	0	189	93793.2	0	0	B31.3
2(SUS)		18404	63326.2	29.1		18676.4	63326.2	29.5	B31.3
3(EXP)		70226.6	233122.7	30.1		78349.2	232850.2	33.6	B31.3
1(OPE)	189	93793.2	0	0	190	95974.9	0	0	B31.3
2(SUS)		18676.4	63326.2	29.5		18648.1	63326.2	29.4	B31.3
3(EXP)		78349.2	232850.2	33.6		80600.8	232878.6	34.6	B31.3
1(OPE)	190	95974.9	0	0	199	94362.3	0	0	B31.3
2(SUS)		18648.1	63326.2	29.4		18371.8	63326.2	29	B31.3
3(EXP)		80600.8	232878.6	34.6		79183.7	233154.9	34	B31.3
1(OPE)	199	94362.3	0	0	200	93374.3	0	0	B31.3
2(SUS)		18371.8	63326.2	29		18218.3	63326.2	28.8	B31.3
3(EXP)		79183.7	233154.9	34		78221.7	233308.3	33.5	B31.3
1(OPE)	200	93374.3	0	0	210	75795.1	0	0	B31.3
2(SUS)		18218.3	63326.2	28.8		23203.8	63326.2	36.6	B31.3
3(EXP)		78221.7	233308.3	33.5		60093.6	228322.9	26.3	B31.3
1(OPE)	210	75590.9	0	0	220	32011.9	0	0	B31.3
2(SUS)		23201.6	63326.2	36.6		24157	63326.2	38.1	B31.3
3(EXP)		60093.6	228325	26.3		14869.3	227369.6	6.5	B31.3
1(OPE)	220	31766.7	0	0	230	42250.8	0	0	B31.3
2(SUS)		24156	63326.2	38.1		23822.6	63326.2	37.6	B31.3
3(EXP)		14869.3	227370.6	6.5		26978	227704.1	11.8	B31.3

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	15875	-12767	85952	-14223	-77489	4009	0	0	0
	2(SUS)	-112	-14048	-263	-17405	267	-1638	0	0	0
	3(EXP)	15987	1282	86216	3183	-77757	5647	0	0	0
	MAX	15987/L3	-14048/L	86216/L	-17405/L	-77757/L	5647/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1835	-34036	-10045	0	0	0	9.883	0	-54.109
	2(SUS)	481	-28856	-40	0	0	0	0.003	0	0
	3(EXP)	1354	-5180	-10005	0	0	0	9.88	0	-54.109
	MAX	1835/L1	-34036/L	-10045/L1				9.883/L1	-0.000/L1	-54.109/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3439	-24559	-8335	0	0	0	-3	0	-108.227
	2(SUS)	-1295	-25083	-86	0	0	0	-0.007	0	0
	3(EXP)	-2144	524	-8249	0	0	0	-2.993	0	-108.227
	MAX	-3439/L1	-25083/L	-8335/L1				-3.000/L1	-0.000/L2	-108.227/L1
45		Rigid +Y								
	1(OPE)	-12734	-47058	-6094	0	0	0	-85.344	0	-40.84
	2(SUS)	926	-50432	426	0	0	0	0.005	0	0.002
	3(EXP)	-13660	3374	-6519	0	0	0	-85.349	0	-40.843
	MAX	-13660/L	-50432/L	-6519/L3				-85.349/L	-0.000/L2	-40.843/L3
65		Rigid +Y								
	1(OPE)	-12734	-47058	6094	0	0	0	-85.344	0	40.84
	2(SUS)	926	-50432	-426	0	0	0	0.005	0	-0.002
	3(EXP)	-13660	3374	6519	0	0	0	-85.349	0	40.843
	MAX	-13660/L	-50432/L	6519/L3				-85.349/L	-0.000/L2	40.843/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3439	-24559	8335	0	0	0	-3	0	108.227
	2(SUS)	-1295	-25083	86	0	0	0	-0.007	0	0
	3(EXP)	-2144	524	8249	0	0	0	-2.993	0	108.227
	MAX	-3439/L1	-25083/L	8335/L1				-3.000/L1	-0.000/L2	108.227/L1
90		Rigid +Y								
	1(OPE)	1835	-34036	10045	0	0	0	9.883	0	54.109
	2(SUS)	481	-28856	40	0	0	0	0.003	0	0
	3(EXP)	1354	-5180	10005	0	0	0	9.88	0	54.109
	MAX	1835/L1	-34036/L	10045/L1				9.883/L1	-0.000/L1	54.109/L1
100		Rigid ANC								
	1(OPE)	31750	-25533	0	0	0	8017	0	0	0
	2(SUS)	-224	-28097	0	0	0	-3276	0	0	0
	3(EXP)	31974	2564	0	0	0	11293	0	0	0
	MAX	31974/L3	-28097/L	-0/L1	0/L2	-0/L1	11293/L3	0.000/L3	-0.000/L2	-0.000/L1

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

110		Rigid +Y								
	1(OPE)	1835	-34036	-10045	0	0	0	9.883	0	-54.109
	2(SUS)	481	-28856	-40	0	0	0	0.003	0	0
	3(EXP)	1354	-5180	-10005	0	0	0	9.88	0	-54.109
	MAX	1835/L1	-34036/L	-10045/L1				9.883/L1	-0.000/L1	-54.109/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3439	-24559	-8335	0	0	0	-3	0	-108.227
	2(SUS)	-1295	-25083	-86	0	0	0	-0.007	0	0
	3(EXP)	-2144	524	-8249	0	0	0	-2.993	0	-108.227
	MAX	-3439/L1	-25083/L	-8335/L1				-3.000/L1	-0.000/L2	-108.227/L1
150		Rigid +Y								
	1(OPE)	-12734	-47058	-6094	0	0	0	-85.344	0	-40.84
	2(SUS)	926	-50432	426	0	0	0	0.005	0	0.002
	3(EXP)	-13660	3374	-6519	0	0	0	-85.349	0	-40.843
	MAX	-13660/L	-50432/L	-6519/L3				-85.349/L	-0.000/L2	-40.843/L3
180		Rigid +Y								
	1(OPE)	-12734	-47058	6094	0	0	0	-85.344	0	40.84
	2(SUS)	926	-50432	-426	0	0	0	0.005	0	-0.002
	3(EXP)	-13660	3374	6519	0	0	0	-85.349	0	40.843
	MAX	-13660/L	-50432/L	6519/L3				-85.349/L	-0.000/L2	40.843/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3439	-24559	8335	0	0	0	-3	0	108.227
	2(SUS)	-1295	-25083	86	0	0	0	-0.007	0	0
	3(EXP)	-2144	524	8249	0	0	0	-2.993	0	108.227
	MAX	-3439/L1	-25083/L	8335/L1				-3.000/L1	-0.000/L2	108.227/L1
220		Rigid +Y								
	1(OPE)	1835	-34036	10045	0	0	0	9.883	0	54.109
	2(SUS)	481	-28856	40	0	0	0	0.003	0	0
	3(EXP)	1354	-5180	10005	0	0	0	9.88	0	54.109
	MAX	1835/L1	-34036/L	10045/L1				9.883/L1	-0.000/L1	54.109/L1
230		Rigid ANC								
	1(OPE)	15875	-12767	-85952	14223	77489	4009	0	0	0
	2(SUS)	-112	-14048	263	17405	-267	-1638	0	0	0
	3(EXP)	15987	1282	-86216	-3183	77757	5647	0	0	0
	MAX	15987/L3	-14048/L	-86216/L	17405/L3	77757/L3	5647/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.88	0	-54.109	-0.0064	-0.0706	0.0289
20	-2.993	0	-108.227	0.026	0.3545	0.0579
28	-33.843	2.931	-132.612	0.077	0.7081	0.0709
29	-36.494	3.511	-134.027	0.0837	0.7527	0.0742
30	-38.984	4.611	-135.098	0.0895	0.7946	0.0813
38	-42.366	6.525	-136.311	0.0924	0.8373	0.0776
39	-47.97	8.66	-135.354	0.0989	0.9198	0.0933
40	-52.712	9.005	-129.595	0.1008	1.0038	0.1019
45	-85.349	0	-40.843	0.0593	1.1201	0.1201
48	-110.018	-7.16	16.678	0.0279	0.7438	0.1201
49	-114.542	-7.883	20.058	0.0237	0.6135	0.1206
50	-119.24	-8.073	18.885	0.0186	0.4764	0.1211
59	-114.542	-7.883	-20.058	-0.0237	-0.6135	0.1206
60	-110.018	-7.16	-16.678	-0.0279	-0.7438	0.1201
65	-85.349	0	40.843	-0.0593	-1.1201	0.1201
68	-52.712	9.005	129.595	-0.1008	-1.0038	0.1019
69	-47.97	8.66	135.354	-0.0989	-0.9198	0.0933
70	-42.366	6.525	136.311	-0.0924	-0.8373	0.0776
78	-38.984	4.611	135.098	-0.0895	-0.7946	0.0813
79	-36.494	3.511	134.027	-0.0837	-0.7527	0.0742
80	-33.843	2.931	132.612	-0.077	-0.7081	0.0709
85	-2.993	0	108.227	-0.026	-0.3545	0.0579
90	9.88	0	54.109	0.0064	0.0706	0.0289
100	0	0	0	0	0	0
110	9.88	0	-54.109	-0.0064	-0.0706	0.0289
120	-2.993	0	-108.227	0.026	0.3545	0.0579
128	-33.843	2.931	-132.612	0.077	0.7081	0.0709
129	-36.494	3.511	-134.027	0.0837	0.7527	0.0742
130	-38.984	4.611	-135.098	0.0895	0.7946	0.0813
139	-47.969	8.66	-135.354	0.0989	0.9198	0.0933
140	-52.712	9.005	-129.595	0.1008	1.0038	0.1019
150	-85.349	0	-40.843	0.0593	1.1201	0.1201
158	-110.018	-7.16	16.678	0.0279	0.7438	0.1201
159	-114.542	-7.883	20.058	0.0237	0.6135	0.1206
160	-119.24	-8.073	18.885	0.0186	0.4764	0.1211
168	-119.24	-8.073	-18.885	-0.0186	-0.4764	0.1211
169	-114.542	-7.883	-20.058	-0.0237	-0.6135	0.1206
170	-110.018	-7.16	-16.678	-0.0279	-0.7438	0.1201
180	-85.349	0	40.843	-0.0593	-1.1201	0.1201

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

188	-52.712	9.005	129.595	-0.1008	-1.0038	0.1019
189	-47.97	8.66	135.354	-0.0989	-0.9198	0.0933
190	-42.366	6.525	136.311	-0.0924	-0.8373	0.0776
199	-36.494	3.511	134.027	-0.0837	-0.7527	0.0742
200	-33.842	2.931	132.612	-0.077	-0.7081	0.0709
210	-2.993	0	108.227	-0.026	-0.3545	0.0579
220	9.88	0	54.109	0.0064	0.0706	0.0289
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0006	-0.0006	-0.0084
20	-0.007	0	0	0.0026	0.0026	-0.0168
28	-0.224	-0.194	-0.001	-0.0039	0.0037	-0.0206
29	-0.223	-0.208	-0.003	-0.0037	0.0035	-0.0208
30	-0.191	-0.218	-0.01	-0.0036	0.0033	-0.0211
38	-0.122	-0.232	-0.024	-0.0036	0.003	-0.0215
39	-0.033	-0.188	-0.034	-0.004	0.0024	-0.0221
40	0.006	-0.048	-0.029	-0.0046	0.0016	-0.0222
45	0.005	0	0.002	-0.0116	-0.0001	0.0508
48	0.005	-5.598	0	-0.0169	0	0.1157
49	0.005	-6.417	0	-0.0175	0	0.1173
50	0.005	-6.854	0	-0.0169	0	0.1174
59	0.005	-6.417	0	0.0175	0	0.1173
60	0.005	-5.598	0	0.0169	0	0.1157
65	0.005	0	-0.002	0.0116	0.0001	0.0508
68	0.006	-0.048	0.029	0.0046	-0.0016	-0.0222
69	-0.033	-0.188	0.034	0.004	-0.0024	-0.0221
70	-0.122	-0.232	0.024	0.0036	-0.003	-0.0215
78	-0.191	-0.218	0.01	0.0036	-0.0033	-0.0211
79	-0.223	-0.208	0.003	0.0037	-0.0035	-0.0208
80	-0.224	-0.194	0.001	0.0039	-0.0037	-0.0206
85	-0.007	0	0	-0.0026	-0.0026	-0.0168
90	0.003	0	0	0.0006	0.0006	-0.0084
100	0	0	0	0	0	0
110	0.003	0	0	-0.0006	-0.0006	-0.0084
120	-0.007	0	0	0.0026	0.0026	-0.0168
128	-0.224	-0.194	-0.001	-0.0039	0.0037	-0.0206
129	-0.223	-0.208	-0.003	-0.0037	0.0035	-0.0208
130	-0.191	-0.218	-0.01	-0.0036	0.0033	-0.0211
139	-0.033	-0.188	-0.034	-0.004	0.0024	-0.0221
140	0.006	-0.048	-0.029	-0.0046	0.0016	-0.0222
150	0.005	0	0.002	-0.0116	-0.0001	0.0508
158	0.005	-5.598	0	-0.0169	0	0.1157
159	0.005	-6.417	0	-0.0175	0	0.1173
160	0.005	-6.854	0	-0.0169	0	0.1174
168	0.005	-6.854	0	0.0169	0	0.1174
169	0.005	-6.417	0	0.0175	0	0.1173
170	0.005	-5.598	0	0.0169	0	0.1157
180	0.005	0	-0.002	0.0116	0.0001	0.0508

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

188	0.006	-0.048	0.029	0.0046	-0.0016	-0.0222
189	-0.033	-0.188	0.034	0.004	-0.0024	-0.0221
190	-0.122	-0.232	0.024	0.0036	-0.003	-0.0215
199	-0.223	-0.208	0.003	0.0037	-0.0035	-0.0208
200	-0.224	-0.194	0.001	0.0039	-0.0037	-0.0206
210	-0.007	0	0	-0.0026	-0.0026	-0.0168
220	0.003	0	0	0.0006	0.0006	-0.0084
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 9:16
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.883	0	-54.109	-0.0071	-0.0712	0.0205
20	-3	0	-108.227	0.0286	0.3571	0.0411
28	-34.067	2.736	-132.613	0.0731	0.7118	0.0503
29	-36.716	3.303	-134.031	0.08	0.7563	0.0534
30	-39.174	4.392	-135.109	0.086	0.7979	0.0602
38	-42.488	6.293	-136.335	0.0889	0.8403	0.0562
39	-48.003	8.471	-135.388	0.0949	0.9222	0.0712
40	-52.706	8.956	-129.624	0.0962	1.0055	0.0797
45	-85.344	0	-40.84	0.0476	1.12	0.1709
48	-110.012	-12.758	16.678	0.011	0.7438	0.2359
49	-114.537	-14.299	20.058	0.0062	0.6136	0.2379
50	-119.235	-14.927	18.885	0.0017	0.4764	0.2386
59	-114.537	-14.299	-20.058	-0.0062	-0.6136	0.2379
60	-110.012	-12.758	-16.678	-0.011	-0.7438	0.2359
65	-85.344	0	40.84	-0.0476	-1.12	0.1709
68	-52.706	8.956	129.624	-0.0962	-1.0055	0.0797
69	-48.003	8.471	135.388	-0.0949	-0.9222	0.0712
70	-42.488	6.293	136.335	-0.0889	-0.8403	0.0562
78	-39.174	4.392	135.109	-0.086	-0.7979	0.0602
79	-36.716	3.303	134.031	-0.08	-0.7563	0.0534
80	-34.067	2.736	132.613	-0.0731	-0.7118	0.0503
85	-3	0	108.227	-0.0286	-0.3571	0.0411
90	9.883	0	54.109	0.0071	0.0712	0.0205
100	0	0	0	0	0	0
110	9.883	0	-54.109	-0.0071	-0.0712	0.0205
120	-3	0	-108.227	0.0286	0.3571	0.0411
128	-34.067	2.736	-132.613	0.0731	0.7118	0.0503
129	-36.716	3.303	-134.031	0.08	0.7563	0.0534
130	-39.174	4.392	-135.109	0.086	0.7979	0.0602
139	-48.003	8.471	-135.388	0.0949	0.9222	0.0712
140	-52.706	8.956	-129.624	0.0962	1.0055	0.0797
150	-85.344	0	-40.84	0.0476	1.12	0.1709
158	-110.012	-12.758	16.678	0.011	0.7438	0.2359
159	-114.537	-14.299	20.058	0.0062	0.6136	0.2379
160	-119.235	-14.927	18.885	0.0017	0.4764	0.2386
168	-119.235	-14.927	-18.885	-0.0017	-0.4764	0.2386
169	-114.537	-14.299	-20.058	-0.0062	-0.6136	0.2379
170	-110.012	-12.758	-16.678	-0.011	-0.7438	0.2359
180	-85.344	0	40.84	-0.0476	-1.12	0.1709

Possible Approach:
Expansion Loop Dimension B: 6300mm C: 3600mm

188	-52.706	8.956	129.624	-0.0962	-1.0055	0.0797
189	-48.003	8.471	135.388	-0.0949	-0.9222	0.0712
190	-42.488	6.293	136.335	-0.0889	-0.8403	0.0562
199	-36.716	3.303	134.031	-0.08	-0.7563	0.0534
200	-34.067	2.736	132.613	-0.0731	-0.7118	0.0503
210	-3	0	108.227	-0.0286	-0.3571	0.0411
220	9.883	0	54.109	0.0071	0.0712	0.0205
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,400.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,700.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,400.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6700mm C: 3400mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,400.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,700.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,400.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6700mm C: 3400mm

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	FORCE	Dir Vectors
10	ANC			.30	.000	.000 .000
15	+Y			.30	.000	1.000 .000
20	Guide		3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000 .000
45	+Y			.30	.000	1.000 .000
65	+Y			.30	.000	1.000 .000
85	Guide		3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000 .000
90	+Y			.30	.000	1.000 .000
100	ANC			.30	.000	.000 .000
110	+Y			.30	.000	1.000 .000
120	+Y			.30	.000	1.000 .000
120	Guide		3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000 .000
180	+Y			.30	.000	1.000 .000
210	+Y			.30	.000	1.000 .000
210	Guide		3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000 .000
230	ANC			.30	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension B: 6700mm C: 3400mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension B: 6700mm C: 3400mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18400.000
40	.000	750.000	-19150.000
45	-5052.000	750.000	-19150.000
50	-9000.000	750.000	-19150.000
60	-9000.000	750.000	-25850.000
65	-5052.000	750.000	-25850.000
70	.000	750.000	-25850.000
80	.000	.000	-26600.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63400.000
140	.000	750.000	-64150.000
150	-5052.000	750.000	-64150.000
160	-9000.000	750.000	-64150.000
170	-9000.000	750.000	-70850.000
180	-5052.000	750.000	-70850.000
190	.000	750.000	-70850.000
200	.000	.000	-71600.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 70.1 @Node 150 LOADCASE: 2 (SUS) W+P1
Code Stress: 44415.5 Allowable Stress: 63326.2
Axial Stress: 17798.7 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 115650.8 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 27277.5 @Node 130 LOADCASE: 1 (OPE) W+T1+P1
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 136912.4 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42668.7	0	0	15	32146.6	0	0	B31.3
2(SUS)		23662.7	63326.2	37.4		24481.6	63326.2	38.7	B31.3
3(EXP)		27395.4	227864	12		15043.3	227045.1	6.6	B31.3
1(OPE)	15	32397.7	0	0	20	76698.5	0	0	B31.3
2(SUS)		24483	63326.2	38.7		22057.9	63326.2	34.8	B31.3
3(EXP)		15043.3	227043.7	6.6		61149.7	229468.7	26.6	B31.3
1(OPE)	20	76888.3	0	0	28	93799.4	0	0	B31.3
2(SUS)		22061	63326.2	34.8		18135.9	63326.2	28.6	B31.3
3(EXP)		61149.7	229465.7	26.6		78727.5	233390.8	33.7	B31.3
1(OPE)	28	93799.4	0	0	29	94819	0	0	B31.3
2(SUS)		18135.9	63326.2	28.6		18366.6	63326.2	29	B31.3
3(EXP)		78727.5	233390.8	33.7		79725.7	233160	34.2	B31.3
1(OPE)	29	94819	0	0	30	95740.2	0	0	B31.3
2(SUS)		18366.6	63326.2	29		18560.6	63326.2	29.3	B31.3
3(EXP)		79725.7	233160	34.2		80369.2	232966.1	34.5	B31.3
1(OPE)	30	95740.2	0	0	38	96520.9	0	0	B31.3
2(SUS)		18560.6	63326.2	29.3		18784.9	63326.2	29.7	B31.3
3(EXP)		80369.2	232966.1	34.5		81218.6	232741.7	34.9	B31.3
1(OPE)	38	96520.9	0	0	39	94432.3	0	0	B31.3
2(SUS)		18784.9	63326.2	29.7		18908.6	63326.2	29.9	B31.3
3(EXP)		81218.6	232741.7	34.9		79043.6	232618.1	34	B31.3

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

1(OPE)	39	94432.3	0	0	40	87235	0	0	B31.3
2(SUS)		18908.6	63326.2	29.9		18571.5	63326.2	29.3	B31.3
3(EXP)		79043.6	232618.1	34		71019.8	232955.2	30.5	B31.3
1(OPE)	40	87235	0	0	45	60167.2	0	0	B31.3
2(SUS)		18571.5	63326.2	29.3		44415.5	63326.2	70.1	B31.3
3(EXP)		71019.8	232955.2	30.5		34675.5	207111.2	16.7	B31.3
1(OPE)	45	60524.9	0	0	48	121835.7	0	0	B31.3
2(SUS)		44390.4	63326.2	70.1		20102.2	63326.2	31.7	B31.3
3(EXP)		34675.5	207136.3	16.7		104691.9	231424.4	45.2	B31.3
1(OPE)	48	121835.7	0	0	49	128519	0	0	B31.3
2(SUS)		20102.2	63326.2	31.7		18490	63326.2	29.2	B31.3
3(EXP)		104691.9	231424.4	45.2		112440.8	233036.7	48.3	B31.3
1(OPE)	49	128519	0	0	50	131256	0	0	B31.3
2(SUS)		18490	63326.2	29.2		18712.9	63326.2	29.6	B31.3
3(EXP)		112440.8	233036.7	48.3		115650.8	232813.8	49.7	B31.3
1(OPE)	50	131256	0	0	59	128519	0	0	B31.3
2(SUS)		18712.9	63326.2	29.6		18490	63326.2	29.2	B31.3
3(EXP)		115650.8	232813.8	49.7		112440.8	233036.7	48.3	B31.3
1(OPE)	59	128519	0	0	60	121835.7	0	0	B31.3
2(SUS)		18490	63326.2	29.2		20102.2	63326.2	31.7	B31.3
3(EXP)		112440.8	233036.7	48.3		104691.9	231424.4	45.2	B31.3
1(OPE)	60	121835.7	0	0	65	60524.9	0	0	B31.3
2(SUS)		20102.2	63326.2	31.7		44390.4	63326.2	70.1	B31.3
3(EXP)		104691.9	231424.4	45.2		34675.5	207136.3	16.7	B31.3
1(OPE)	65	60167.2	0	0	68	87235	0	0	B31.3
2(SUS)		44415.5	63326.2	70.1		18571.5	63326.2	29.3	B31.3
3(EXP)		34675.5	207111.2	16.7		71019.8	232955.2	30.5	B31.3
1(OPE)	68	87235	0	0	69	94432.3	0	0	B31.3
2(SUS)		18571.5	63326.2	29.3		18908.6	63326.2	29.9	B31.3
3(EXP)		71019.8	232955.2	30.5		79043.6	232618.1	34	B31.3
1(OPE)	69	94432.3	0	0	70	96521	0	0	B31.3
2(SUS)		18908.6	63326.2	29.9		18784.9	63326.2	29.7	B31.3
3(EXP)		79043.6	232618.1	34		81218.6	232741.7	34.9	B31.3
1(OPE)	70	96521	0	0	78	95740.2	0	0	B31.3
2(SUS)		18784.9	63326.2	29.7		18560.6	63326.2	29.3	B31.3
3(EXP)		81218.6	232741.7	34.9		80369.2	232966.1	34.5	B31.3
1(OPE)	78	95740.2	0	0	79	94819	0	0	B31.3
2(SUS)		18560.6	63326.2	29.3		18366.6	63326.2	29	B31.3
3(EXP)		80369.2	232966.1	34.5		79725.8	233160	34.2	B31.3
1(OPE)	79	94819	0	0	80	93799.4	0	0	B31.3
2(SUS)		18366.6	63326.2	29		18135.9	63326.2	28.6	B31.3
3(EXP)		79725.8	233160	34.2		78727.6	233390.8	33.7	B31.3

Possible Approach:

Expansion Loop Dimension B: 6700mm C: 3400mm

1(OPE)	80	93799.4	0	0	85	76888.4	0	0	B31.3
2(SUS)		18135.9	63326.2	28.6		22061	63326.2	34.8	B31.3
3(EXP)		78727.6	233390.8	33.7		61149.7	229465.7	26.6	B31.3
1(OPE)	85	76698.5	0	0	90	32397.7	0	0	B31.3
2(SUS)		22057.9	63326.2	34.8		24483	63326.2	38.7	B31.3
3(EXP)		61149.7	229468.7	26.6		15043.3	227043.7	6.6	B31.3
1(OPE)	90	32146.5	0	0	100	42668.8	0	0	B31.3
2(SUS)		24481.5	63326.2	38.7		23662.7	63326.2	37.4	B31.3
3(EXP)		15043.3	227045.1	6.6		27395.5	227863.9	12	B31.3
1(OPE)	100	42668.8	0	0	110	32146.5	0	0	B31.3
2(SUS)		23662.7	63326.2	37.4		24481.5	63326.2	38.7	B31.3
3(EXP)		27395.5	227863.9	12		15043.3	227045.1	6.6	B31.3
1(OPE)	110	32397.7	0	0	120	76698.5	0	0	B31.3
2(SUS)		24483	63326.2	38.7		22057.9	63326.2	34.8	B31.3
3(EXP)		15043.3	227043.7	6.6		61149.7	229468.7	26.6	B31.3
1(OPE)	120	76888.3	0	0	128	93799.4	0	0	B31.3
2(SUS)		22061	63326.2	34.8		18135.9	63326.2	28.6	B31.3
3(EXP)		61149.7	229465.7	26.6		78727.6	233390.8	33.7	B31.3
1(OPE)	128	93799.4	0	0	129	94819	0	0	B31.3
2(SUS)		18135.9	63326.2	28.6		18366.6	63326.2	29	B31.3
3(EXP)		78727.6	233390.8	33.7		79725.8	233160	34.2	B31.3
1(OPE)	129	94819	0	0	130	95740.2	0	0	B31.3
2(SUS)		18366.6	63326.2	29		18560.6	63326.2	29.3	B31.3
3(EXP)		79725.8	233160	34.2		80369.2	232966	34.5	B31.3
1(OPE)	130	95740.2	0	0	139	94432.3	0	0	B31.3
2(SUS)		18560.6	63326.2	29.3		18908.6	63326.2	29.9	B31.3
3(EXP)		80369.2	232966	34.5		79043.6	232618.1	34	B31.3
1(OPE)	139	94432.3	0	0	140	87235.1	0	0	B31.3
2(SUS)		18908.6	63326.2	29.9		18571.5	63326.2	29.3	B31.3
3(EXP)		79043.6	232618.1	34		71019.8	232955.2	30.5	B31.3
1(OPE)	140	87235.1	0	0	150	60167.2	0	0	B31.3
2(SUS)		18571.5	63326.2	29.3		44415.5	63326.2	70.1	B31.3
3(EXP)		71019.8	232955.2	30.5		34675.5	207111.2	16.7	B31.3
1(OPE)	150	60524.9	0	0	158	121835.7	0	0	B31.3
2(SUS)		44390.4	63326.2	70.1		20102.2	63326.2	31.7	B31.3
3(EXP)		34675.5	207136.3	16.7		104691.9	231424.4	45.2	B31.3
1(OPE)	158	121835.7	0	0	159	128519	0	0	B31.3
2(SUS)		20102.2	63326.2	31.7		18490	63326.2	29.2	B31.3
3(EXP)		104691.9	231424.4	45.2		112440.8	233036.7	48.3	B31.3
1(OPE)	159	128519	0	0	160	131256	0	0	B31.3
2(SUS)		18490	63326.2	29.2		18712.9	63326.2	29.6	B31.3
3(EXP)		112440.8	233036.7	48.3		115650.8	232813.8	49.7	B31.3

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm
Page 11 of 20

1(OPE)	160	131256	0	0	168	131256	0	0	B31.3
2(SUS)		18712.9	63326.2	29.6		18712.9	63326.2	29.6	B31.3
3(EXP)		115650.8	232813.8	49.7		115650.8	232813.8	49.7	B31.3
1(OPE)	168	131256	0	0	169	128519	0	0	B31.3
2(SUS)		18712.9	63326.2	29.6		18490	63326.2	29.2	B31.3
3(EXP)		115650.8	232813.8	49.7		112440.8	233036.7	48.3	B31.3
1(OPE)	169	128519	0	0	170	121835.7	0	0	B31.3
2(SUS)		18490	63326.2	29.2		20102.2	63326.2	31.7	B31.3
3(EXP)		112440.8	233036.7	48.3		104691.9	231424.4	45.2	B31.3
1(OPE)	170	121835.7	0	0	180	60524.9	0	0	B31.3
2(SUS)		20102.2	63326.2	31.7		44390.4	63326.2	70.1	B31.3
3(EXP)		104691.9	231424.4	45.2		34675.5	207136.3	16.7	B31.3
1(OPE)	180	60167.2	0	0	188	87235.1	0	0	B31.3
2(SUS)		44415.5	63326.2	70.1		18571.5	63326.2	29.3	B31.3
3(EXP)		34675.5	207111.2	16.7		71019.8	232955.2	30.5	B31.3
1(OPE)	188	87235.1	0	0	189	94432.3	0	0	B31.3
2(SUS)		18571.5	63326.2	29.3		18908.6	63326.2	29.9	B31.3
3(EXP)		71019.8	232955.2	30.5		79043.6	232618.1	34	B31.3
1(OPE)	189	94432.3	0	0	190	96520.9	0	0	B31.3
2(SUS)		18908.6	63326.2	29.9		18784.9	63326.2	29.7	B31.3
3(EXP)		79043.6	232618.1	34		81218.6	232741.7	34.9	B31.3
1(OPE)	190	96520.9	0	0	199	94819	0	0	B31.3
2(SUS)		18784.9	63326.2	29.7		18366.6	63326.2	29	B31.3
3(EXP)		81218.6	232741.7	34.9		79725.7	233160	34.2	B31.3
1(OPE)	199	94819	0	0	200	93799.4	0	0	B31.3
2(SUS)		18366.6	63326.2	29		18135.9	63326.2	28.6	B31.3
3(EXP)		79725.7	233160	34.2		78727.5	233390.8	33.7	B31.3
1(OPE)	200	93799.4	0	0	210	76888.4	0	0	B31.3
2(SUS)		18135.9	63326.2	28.6		22060.9	63326.2	34.8	B31.3
3(EXP)		78727.5	233390.8	33.7		61149.7	229465.7	26.6	B31.3
1(OPE)	210	76698.5	0	0	220	32397.8	0	0	B31.3
2(SUS)		22057.9	63326.2	34.8		24483	63326.2	38.7	B31.3
3(EXP)		61149.7	229468.7	26.6		15043.4	227043.7	6.6	B31.3
1(OPE)	220	32146.6	0	0	230	42668.7	0	0	B31.3
2(SUS)		24481.6	63326.2	38.7		23662.7	63326.2	37.4	B31.3
3(EXP)		15043.4	227045.1	6.6		27395.4	227864	12	B31.3

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	16113	-12556	84774	-13701	-78726	4037	0	0	0
	2(SUS)	-106	-13864	-371	-16947	252	-1427	0	0	0
	3(EXP)	16219	1308	85145	3247	-78978	5465	0	0	0
	MAX	16219/L3	-13864/L	85145/L3	-16947/L	-78978/L	5465/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1911	-34886	-10290	0	0	0	10.051	0	-54.11
	2(SUS)	455	-29602	-56	0	0	0	0.003	0	0
	3(EXP)	1457	-5285	-10234	0	0	0	10.048	0	-54.11
	MAX	1911/L1	-34886/L	-10290/L1				10.051/L	-0.000/L1	-54.110/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3360	-22636	-7740	0	0	0	-3	0	-108.23
	2(SUS)	-1357	-23205	-121	0	0	0	-0.008	0	-0.001
	3(EXP)	-2003	569	-7618	0	0	0	-2.992	0	-108.229
	MAX	-3360/L1	-23205/L	-7740/L1				-3.000/L1	-0.000/L2	-108.230/L1
45		Rigid +Y								
	1(OPE)	-13074	-48341	-6275	0	0	0	-83.17	0	-39.915
	2(SUS)	1008	-51749	735	0	0	0	0.006	0	0.004
	3(EXP)	-14083	3408	-7010	0	0	0	-83.175	0	-39.919
	MAX	-14083/L	-51749/L	-7010/L3				-83.175/L	-0.000/L2	-39.919/L3
65		Rigid +Y								
	1(OPE)	-13074	-48341	6275	0	0	0	-83.17	0	39.915
	2(SUS)	1008	-51749	-735	0	0	0	0.006	0	-0.004
	3(EXP)	-14083	3408	7010	0	0	0	-83.175	0	39.919
	MAX	-14083/L	-51749/L	7010/L3				-83.175/L	-0.000/L2	39.919/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3360	-22636	7740	0	0	0	-3	0	108.23
	2(SUS)	-1357	-23205	121	0	0	0	-0.008	0	0.001
	3(EXP)	-2003	569	7619	0	0	0	-2.992	0	108.229
	MAX	-3360/L1	-23205/L	7740/L1				-3.000/L1	-0.000/L2	108.230/L1
90		Rigid +Y								
	1(OPE)	1911	-34886	10290	0	0	0	10.051	0	54.11
	2(SUS)	455	-29602	56	0	0	0	0.003	0	0
	3(EXP)	1457	-5285	10234	0	0	0	10.048	0	54.11
	MAX	1911/L1	-34886/L	10290/L1				10.051/L	-0.000/L1	54.110/L1
100		Rigid ANC								
	1(OPE)	32226	-25113	0	0	0	8074	0	0	0
	2(SUS)	-211	-27728	0	0	0	-2855	0	0	0
	3(EXP)	32438	2615	0	0	0	10929	0	0	0
	MAX	32438/L3	-27728/L	-0/L3	-0/L1	0/L3	10929/L3	0.000/L3	-0.000/L2	-0.000/L3

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

110		Rigid +Y								
	1(OPE)	1911	-34886	-10290	0	0	0	10.051	0	-54.11
	2(SUS)	455	-29602	-56	0	0	0	0.003	0	0
	3(EXP)	1457	-5285	-10234	0	0	0	10.048	0	-54.11
	MAX	1911/L1	-34886/L	-10290/L1				10.051/L	-0.000/L1	-54.110/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3360	-22636	-7740	0	0	0	-3	0	-108.23
	2(SUS)	-1357	-23205	-121	0	0	0	-0.008	0	-0.001
	3(EXP)	-2003	569	-7619	0	0	0	-2.992	0	-108.229
	MAX	-3360/L1	-23205/L	-7740/L1				-3.000/L1	-0.000/L2	-108.230/L1
150		Rigid +Y								
	1(OPE)	-13074	-48341	-6275	0	0	0	-83.17	0	-39.915
	2(SUS)	1008	-51749	735	0	0	0	0.006	0	0.004
	3(EXP)	-14083	3408	-7010	0	0	0	-83.175	0	-39.919
	MAX	-14083/L	-51749/L	-7010/L3				-83.175/L	-0.000/L2	-39.919/L3
180		Rigid +Y								
	1(OPE)	-13074	-48341	6275	0	0	0	-83.17	0	39.915
	2(SUS)	1008	-51749	-735	0	0	0	0.006	0	-0.004
	3(EXP)	-14083	3408	7010	0	0	0	-83.175	0	39.919
	MAX	-14083/L	-51749/L	7010/L3				-83.175/L	-0.000/L2	39.919/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3360	-22636	7740	0	0	0	-3	0	108.23
	2(SUS)	-1357	-23205	121	0	0	0	-0.008	0	0.001
	3(EXP)	-2003	569	7618	0	0	0	-2.992	0	108.229
	MAX	-3360/L1	-23205/L	7740/L1				-3.000/L1	-0.000/L2	108.230/L1
220		Rigid +Y								
	1(OPE)	1911	-34886	10290	0	0	0	10.051	0	54.11
	2(SUS)	455	-29602	56	0	0	0	0.003	0	0
	3(EXP)	1457	-5285	10234	0	0	0	10.048	0	54.11
	MAX	1911/L1	-34886/L	10290/L1				10.051/L	-0.000/L1	54.110/L1
230		Rigid ANC								
	1(OPE)	16113	-12556	-84774	13701	78726	4037	0	0	0
	2(SUS)	-106	-13864	371	16947	-252	-1427	0	0	0
	3(EXP)	16219	1308	-85145	-3247	78978	5465	0	0	0
	MAX	16219/L3	-13864/L	-85145/L	16947/L3	78978/L3	5465/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.048	0	-54.11	-0.0066	-0.072	0.028
20	-2.992	0	-108.229	0.0266	0.3601	0.056
28	-31.89	2.721	-131.171	0.0748	0.6966	0.0679
29	-34.498	3.293	-132.588	0.0815	0.7415	0.0712
30	-36.949	4.386	-133.663	0.0873	0.7837	0.0783
38	-40.279	6.292	-134.885	0.0902	0.8267	0.0745
39	-45.821	8.425	-133.965	0.0968	0.9099	0.0904
40	-50.539	8.786	-128.272	0.0989	0.9948	0.099
45	-83.175	0	-39.919	0.0587	1.1202	0.1174
48	-107.844	-6.998	17.97	0.0284	0.7573	0.1174
49	-112.413	-7.701	21.451	0.0244	0.6309	0.1179
50	-117.239	-7.88	20.329	0.0194	0.4978	0.1184
59	-112.413	-7.701	-21.451	-0.0244	-0.6309	0.1179
60	-107.844	-6.998	-17.97	-0.0284	-0.7573	0.1174
65	-83.175	0	39.919	-0.0587	-1.1202	0.1174
68	-50.539	8.786	128.272	-0.0989	-0.9948	0.099
69	-45.821	8.425	133.965	-0.0968	-0.9099	0.0904
70	-40.279	6.292	134.885	-0.0902	-0.8267	0.0745
78	-36.949	4.386	133.663	-0.0873	-0.7837	0.0783
79	-34.498	3.293	132.588	-0.0815	-0.7415	0.0712
80	-31.89	2.721	131.171	-0.0748	-0.6966	0.0679
85	-2.992	0	108.229	-0.0266	-0.3601	0.056
90	10.048	0	54.11	0.0066	0.072	0.028
100	0	0	0	0	0	0
110	10.048	0	-54.11	-0.0066	-0.072	0.028
120	-2.992	0	-108.229	0.0266	0.3601	0.056
128	-31.89	2.721	-131.171	0.0748	0.6966	0.0679
129	-34.498	3.293	-132.588	0.0815	0.7415	0.0712
130	-36.949	4.386	-133.663	0.0873	0.7837	0.0783
139	-45.821	8.425	-133.965	0.0968	0.9099	0.0904
140	-50.539	8.786	-128.272	0.0989	0.9948	0.099
150	-83.175	0	-39.919	0.0587	1.1202	0.1174
158	-107.844	-6.998	17.97	0.0284	0.7573	0.1174
159	-112.413	-7.701	21.451	0.0244	0.6309	0.1179
160	-117.239	-7.88	20.329	0.0194	0.4978	0.1184
168	-117.239	-7.88	-20.329	-0.0194	-0.4978	0.1184
169	-112.413	-7.701	-21.451	-0.0244	-0.6309	0.1179
170	-107.844	-6.998	-17.97	-0.0284	-0.7573	0.1174
180	-83.175	0	39.919	-0.0587	-1.1202	0.1174

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

188	-50.539	8.786	128.272	-0.0989	-0.9948	0.099
189	-45.821	8.425	133.965	-0.0968	-0.9099	0.0904
190	-40.279	6.292	134.885	-0.0902	-0.8267	0.0745
199	-34.498	3.293	132.588	-0.0815	-0.7415	0.0712
200	-31.89	2.721	131.171	-0.0748	-0.6966	0.0679
210	-2.992	0	108.229	-0.0266	-0.3601	0.056
220	10.048	0	54.11	0.0066	0.072	0.028
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0016	-0.0006	-0.0073
20	-0.008	0	-0.001	0.0063	0.0025	-0.0146
28	-0.195	0.118	-0.001	0.0017	0.0033	-0.0177
29	-0.193	0.124	0	0.0018	0.003	-0.018
30	-0.166	0.13	0.004	0.0017	0.0027	-0.0182
38	-0.106	0.136	0.011	0.0016	0.0025	-0.0185
39	-0.028	0.195	0.022	0.0008	0.0017	-0.0191
40	0.006	0.323	0.031	-0.0002	0.0009	-0.0191
45	0.006	0	0.004	-0.0106	-0.0005	0.058
48	0.006	-6.148	-0.001	-0.0185	0.0001	0.1261
49	0.005	-7.04	0	-0.0195	0.0001	0.1278
50	0.005	-7.52	0	-0.0192	0.0001	0.128
59	0.005	-7.04	0	0.0195	-0.0001	0.1278
60	0.006	-6.148	0.001	0.0185	-0.0001	0.1261
65	0.006	0	-0.004	0.0106	0.0005	0.058
68	0.006	0.323	-0.031	0.0002	-0.0009	-0.0191
69	-0.028	0.195	-0.022	-0.0008	-0.0017	-0.0191
70	-0.106	0.136	-0.011	-0.0016	-0.0025	-0.0185
78	-0.166	0.13	-0.004	-0.0017	-0.0027	-0.0182
79	-0.193	0.124	0	-0.0018	-0.003	-0.018
80	-0.195	0.118	0.001	-0.0017	-0.0033	-0.0177
85	-0.008	0	0.001	-0.0063	-0.0025	-0.0146
90	0.003	0	0	0.0016	0.0006	-0.0073
100	0	0	0	0	0	0
110	0.003	0	0	-0.0016	-0.0006	-0.0073
120	-0.008	0	-0.001	0.0063	0.0025	-0.0146
128	-0.195	0.118	-0.001	0.0017	0.0033	-0.0177
129	-0.193	0.124	0	0.0018	0.003	-0.018
130	-0.166	0.13	0.004	0.0017	0.0027	-0.0182
139	-0.028	0.195	0.022	0.0008	0.0017	-0.0191
140	0.006	0.323	0.031	-0.0002	0.0009	-0.0191
150	0.006	0	0.004	-0.0106	-0.0005	0.058
158	0.006	-6.148	-0.001	-0.0185	0.0001	0.1261
159	0.005	-7.04	0	-0.0195	0.0001	0.1278
160	0.005	-7.52	0	-0.0192	0.0001	0.128
168	0.005	-7.52	0	0.0192	-0.0001	0.128
169	0.005	-7.04	0	0.0195	-0.0001	0.1278
170	0.006	-6.148	0.001	0.0185	-0.0001	0.1261
180	0.006	0	-0.004	0.0106	0.0005	0.058

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

188	0.006	0.323	-0.031	0.0002	-0.0009	-0.0191
189	-0.028	0.195	-0.022	-0.0008	-0.0017	-0.0191
190	-0.106	0.136	-0.011	-0.0016	-0.0025	-0.0185
199	-0.193	0.124	0	-0.0018	-0.003	-0.018
200	-0.195	0.118	0.001	-0.0017	-0.0033	-0.0177
210	-0.008	0	0.001	-0.0063	-0.0025	-0.0146
220	0.003	0	0	0.0016	0.0006	-0.0073
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:42
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6700
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.051	0	-54.11	-0.0081	-0.0726	0.0207
20	-3	0	-108.23	0.0329	0.3626	0.0414
28	-32.084	2.838	-131.172	0.0765	0.6999	0.0501
29	-34.692	3.417	-132.588	0.0833	0.7446	0.0532
30	-37.115	4.516	-133.659	0.089	0.7865	0.06
38	-40.385	6.428	-134.874	0.0918	0.8292	0.056
39	-45.849	8.62	-133.943	0.0976	0.9116	0.0712
40	-50.533	9.109	-128.241	0.0987	0.9957	0.08
45	-83.17	0	-39.915	0.0481	1.1197	0.1755
48	-107.839	-13.146	17.969	0.0098	0.7575	0.2435
49	-112.407	-14.742	21.451	0.0049	0.6311	0.2457
50	-117.234	-15.4	20.329	0.0002	0.4979	0.2463
59	-112.407	-14.742	-21.451	-0.0049	-0.6311	0.2457
60	-107.839	-13.146	-17.969	-0.0098	-0.7575	0.2435
65	-83.17	0	39.915	-0.0481	-1.1197	0.1755
68	-50.533	9.109	128.241	-0.0987	-0.9957	0.08
69	-45.849	8.62	133.943	-0.0976	-0.9116	0.0712
70	-40.385	6.428	134.874	-0.0918	-0.8292	0.056
78	-37.115	4.516	133.659	-0.089	-0.7865	0.06
79	-34.692	3.417	132.588	-0.0833	-0.7446	0.0532
80	-32.084	2.838	131.172	-0.0765	-0.6999	0.0501
85	-3	0	108.23	-0.0329	-0.3626	0.0414
90	10.051	0	54.11	0.0081	0.0726	0.0207
100	0	0	0	0	0	0
110	10.051	0	-54.11	-0.0081	-0.0726	0.0207
120	-3	0	-108.23	0.0329	0.3626	0.0414
128	-32.085	2.838	-131.172	0.0765	0.6999	0.0501
129	-34.692	3.417	-132.588	0.0833	0.7446	0.0532
130	-37.115	4.516	-133.659	0.089	0.7865	0.06
139	-45.849	8.62	-133.943	0.0976	0.9116	0.0712
140	-50.533	9.109	-128.241	0.0987	0.9957	0.08
150	-83.17	0	-39.915	0.0481	1.1197	0.1755
158	-107.839	-13.146	17.969	0.0098	0.7575	0.2435
159	-112.407	-14.742	21.451	0.0049	0.6311	0.2457
160	-117.234	-15.4	20.329	0.0002	0.4979	0.2463
168	-117.234	-15.4	-20.329	-0.0002	-0.4979	0.2463
169	-112.407	-14.742	-21.451	-0.0049	-0.6311	0.2457
170	-107.839	-13.146	-17.969	-0.0098	-0.7575	0.2435
180	-83.17	0	39.915	-0.0481	-1.1197	0.1755

Possible Approach:
Expansion Loop Dimension B: 6700mm C: 3400mm

188	-50.533	9.109	128.241	-0.0987	-0.9957	0.08
189	-45.849	8.62	133.943	-0.0976	-0.9116	0.0712
190	-40.385	6.428	134.874	-0.0918	-0.8292	0.056
199	-34.692	3.417	132.588	-0.0833	-0.7446	0.0532
200	-32.084	2.838	131.172	-0.0765	-0.6999	0.0501
210	-3	0	108.23	-0.0329	-0.3626	0.0414
220	10.051	0	54.11	0.0081	0.0726	0.0207
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,300.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,900.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,300.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,300.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,900.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,300.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	Len FORCE	MU Dir Vectors
10	ANC			.30	.000	.000 .000
15	+Y			.30	.000	1.000 .000
20	Guide		3.00	.30	.000	.000 .000
20	+Y			.30	.000	1.000 .000
45	+Y			.30	.000	1.000 .000
65	+Y			.30	.000	1.000 .000
85	Guide		3.00	.30	.000	.000 .000
85	+Y			.30	.000	1.000 .000
90	+Y			.30	.000	1.000 .000
100	ANC			.30	.000	.000 .000
110	+Y			.30	.000	1.000 .000
120	+Y			.30	.000	1.000 .000
120	Guide		3.00	.30	.000	.000 .000
150	+Y			.30	.000	1.000 .000
180	+Y			.30	.000	1.000 .000
210	+Y			.30	.000	1.000 .000
210	Guide		3.00	.30	.000	.000 .000
220	+Y			.30	.000	1.000 .000
230	ANC			.30	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18300.000
40	.000	750.000	-19050.000
45	-5052.000	750.000	-19050.000
50	-9000.000	750.000	-19050.000
60	-9000.000	750.000	-25950.000
65	-5052.000	750.000	-25950.000
70	.000	750.000	-25950.000
80	.000	.000	-26700.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63300.000
140	.000	750.000	-64050.000
150	-5052.000	750.000	-64050.000
160	-9000.000	750.000	-64050.000
170	-9000.000	750.000	-70950.000
180	-5052.000	750.000	-70950.000
190	.000	750.000	-70950.000
200	.000	.000	-71700.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 71.0 @Node 150 LOADCASE: 2 (SUS) W+P1
Code Stress: 44947.0 Allowable Stress: 63326.2
Axial Stress: 17804.1 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 113991.7 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 27381.6 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 135226.8 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	42892.6	0	0	15	32337.7	0	0	B31.3
2(SUS)		23588	63326.2	37.2		24634.5	63326.2	38.9	B31.3
3(EXP)		27619.6	227938.7	12.1		15139.5	226892.2	6.7	B31.3
1(OPE)	15	32591.7	0	0	20	77288.4	0	0	B31.3
2(SUS)		24636.1	63326.2	38.9		21524.7	63326.2	34	B31.3
3(EXP)		15139.5	226890.6	6.7		61701.6	230002	26.8	B31.3
1(OPE)	20	77471.1	0	0	28	94025.5	0	0	B31.3
2(SUS)		21528.1	63326.2	34		18146.1	63326.2	28.7	B31.3
3(EXP)		61701.6	229998.5	26.8		78992.8	233380.5	33.8	B31.3
1(OPE)	28	94025.5	0	0	29	95061	0	0	B31.3
2(SUS)		18146.1	63326.2	28.7		18411.5	63326.2	29.1	B31.3
3(EXP)		78992.8	233380.5	33.8		80009.8	233115.2	34.3	B31.3
1(OPE)	29	95061	0	0	30	96000	0	0	B31.3
2(SUS)		18411.5	63326.2	29.1		18624	63326.2	29.4	B31.3
3(EXP)		80009.8	233115.2	34.3		80671	232902.6	34.6	B31.3
1(OPE)	30	96000	0	0	38	96806.7	0	0	B31.3
2(SUS)		18624	63326.2	29.4		18890.3	63326.2	29.8	B31.3
3(EXP)		80671	232902.6	34.6		81541.8	232636.4	35.1	B31.3
1(OPE)	38	96806.7	0	0	39	94762.6	0	0	B31.3
2(SUS)		18890.3	63326.2	29.8		19048.1	63326.2	30.1	B31.3
3(EXP)		81541.8	232636.4	35.1		79404.9	232478.6	34.2	B31.3

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

1(OPE)	39	94762.6	0	0	40	87621.7	0	0	B31.3
2(SUS)		19048.1	63326.2	30.1		18657.9	63326.2	29.5	B31.3
3(EXP)		79404.9	232478.6	34.2		71427.6	232868.8	30.7	B31.3
1(OPE)	40	87621.7	0	0	45	59730.8	0	0	B31.3
2(SUS)		18657.9	63326.2	29.5		44947	63326.2	71	B31.3
3(EXP)		71427.6	232868.8	30.7		33778.8	206579.7	16.4	B31.3
1(OPE)	45	60093.4	0	0	48	120287.4	0	0	B31.3
2(SUS)		44920.6	63326.2	70.9		20185	63326.2	31.9	B31.3
3(EXP)		33778.8	206606	16.3		103134.8	231341.6	44.6	B31.3
1(OPE)	48	120287.4	0	0	49	126910.6	0	0	B31.3
2(SUS)		20185	63326.2	31.9		18623	63326.2	29.4	B31.3
3(EXP)		103134.8	231341.6	44.6		110810.9	232903.7	47.6	B31.3
1(OPE)	49	126910.6	0	0	50	129620.8	0	0	B31.3
2(SUS)		18623	63326.2	29.4		18592.1	63326.2	29.4	B31.3
3(EXP)		110810.9	232903.7	47.6		113990.7	232934.5	48.9	B31.3
1(OPE)	50	129620.8	0	0	59	126910.6	0	0	B31.3
2(SUS)		18592.1	63326.2	29.4		18623	63326.2	29.4	B31.3
3(EXP)		113990.7	232934.5	48.9		110810.9	232903.7	47.6	B31.3
1(OPE)	59	126910.6	0	0	60	120287.4	0	0	B31.3
2(SUS)		18623	63326.2	29.4		20185	63326.2	31.9	B31.3
3(EXP)		110810.9	232903.7	47.6		103134.8	231341.6	44.6	B31.3
1(OPE)	60	120287.4	0	0	65	60093.4	0	0	B31.3
2(SUS)		20185	63326.2	31.9		44920.6	63326.2	70.9	B31.3
3(EXP)		103134.8	231341.6	44.6		33778.8	206606	16.3	B31.3
1(OPE)	65	59730.8	0	0	68	87621.7	0	0	B31.3
2(SUS)		44947	63326.2	71		18657.9	63326.2	29.5	B31.3
3(EXP)		33778.8	206579.7	16.4		71427.6	232868.8	30.7	B31.3
1(OPE)	68	87621.7	0	0	69	94762.6	0	0	B31.3
2(SUS)		18657.9	63326.2	29.5		19048.1	63326.2	30.1	B31.3
3(EXP)		71427.6	232868.8	30.7		79404.9	232478.6	34.2	B31.3
1(OPE)	69	94762.6	0	0	70	96806.7	0	0	B31.3
2(SUS)		19048.1	63326.2	30.1		18890.3	63326.2	29.8	B31.3
3(EXP)		79404.9	232478.6	34.2		81541.8	232636.4	35.1	B31.3
1(OPE)	70	96806.7	0	0	78	96000	0	0	B31.3
2(SUS)		18890.3	63326.2	29.8		18624	63326.2	29.4	B31.3
3(EXP)		81541.8	232636.4	35.1		80671	232902.6	34.6	B31.3
1(OPE)	78	96000	0	0	79	95061	0	0	B31.3
2(SUS)		18624	63326.2	29.4		18411.5	63326.2	29.1	B31.3
3(EXP)		80671	232902.6	34.6		80009.8	233115.2	34.3	B31.3
1(OPE)	79	95061	0	0	80	94025.5	0	0	B31.3
2(SUS)		18411.5	63326.2	29.1		18146.1	63326.2	28.7	B31.3
3(EXP)		80009.8	233115.2	34.3		78992.8	233380.5	33.8	B31.3

Possible Approach:

Expansion Loop Dimension B: 6900mm C: 3300mm

1(OPE)	80	94025.5	0	0	85	77471.2	0	0	B31.3
2(SUS)		18146.1	63326.2	28.7		21528.1	63326.2	34	B31.3
3(EXP)		78992.8	233380.5	33.8		61701.7	229998.5	26.8	B31.3
1(OPE)	85	77288.4	0	0	90	32591.6	0	0	B31.3
2(SUS)		21524.7	63326.2	34		24636.1	63326.2	38.9	B31.3
3(EXP)		61701.7	230002	26.8		15139.4	226890.6	6.7	B31.3
1(OPE)	90	32337.6	0	0	100	42892.7	0	0	B31.3
2(SUS)		24634.5	63326.2	38.9		23588	63326.2	37.2	B31.3
3(EXP)		15139.4	226892.2	6.7		27619.7	227938.6	12.1	B31.3
1(OPE)	100	42892.7	0	0	110	32337.6	0	0	B31.3
2(SUS)		23588	63326.2	37.2		24634.5	63326.2	38.9	B31.3
3(EXP)		27619.7	227938.6	12.1		15139.4	226892.2	6.7	B31.3
1(OPE)	110	32591.6	0	0	120	77288.4	0	0	B31.3
2(SUS)		24636.1	63326.2	38.9		21524.7	63326.2	34	B31.3
3(EXP)		15139.4	226890.6	6.7		61701.7	230002	26.8	B31.3
1(OPE)	120	77471.1	0	0	128	94025.6	0	0	B31.3
2(SUS)		21528.1	63326.2	34		18146.1	63326.2	28.7	B31.3
3(EXP)		61701.7	229998.5	26.8		78992.8	233380.5	33.8	B31.3
1(OPE)	128	94025.6	0	0	129	95061	0	0	B31.3
2(SUS)		18146.1	63326.2	28.7		18411.5	63326.2	29.1	B31.3
3(EXP)		78992.8	233380.5	33.8		80009.8	233115.2	34.3	B31.3
1(OPE)	129	95061	0	0	130	96000.1	0	0	B31.3
2(SUS)		18411.5	63326.2	29.1		18624	63326.2	29.4	B31.3
3(EXP)		80009.8	233115.2	34.3		80671.1	232902.6	34.6	B31.3
1(OPE)	130	96000.1	0	0	139	94762.6	0	0	B31.3
2(SUS)		18624	63326.2	29.4		19048.1	63326.2	30.1	B31.3
3(EXP)		80671.1	232902.6	34.6		79404.9	232478.6	34.2	B31.3
1(OPE)	139	94762.6	0	0	140	87621.7	0	0	B31.3
2(SUS)		19048.1	63326.2	30.1		18657.9	63326.2	29.5	B31.3
3(EXP)		79404.9	232478.6	34.2		71427.6	232868.8	30.7	B31.3
1(OPE)	140	87621.7	0	0	150	59730.8	0	0	B31.3
2(SUS)		18657.9	63326.2	29.5		44947	63326.2	71	B31.3
3(EXP)		71427.6	232868.8	30.7		33778.8	206579.7	16.4	B31.3
1(OPE)	150	60093.4	0	0	158	120287.4	0	0	B31.3
2(SUS)		44920.6	63326.2	70.9		20185	63326.2	31.9	B31.3
3(EXP)		33778.8	206606	16.3		103134.8	231341.6	44.6	B31.3
1(OPE)	158	120287.4	0	0	159	126910.6	0	0	B31.3
2(SUS)		20185	63326.2	31.9		18623	63326.2	29.4	B31.3
3(EXP)		103134.8	231341.6	44.6		110810.9	232903.7	47.6	B31.3
1(OPE)	159	126910.6	0	0	160	129620.8	0	0	B31.3
2(SUS)		18623	63326.2	29.4		18592.1	63326.2	29.4	B31.3
3(EXP)		110810.9	232903.7	47.6		113990.6	232934.5	48.9	B31.3

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

1(OPE)	160	129620.8	0	0	168	129620.8	0	0	B31.3
2(SUS)		18592.1	63326.2	29.4		18592.1	63326.2	29.4	B31.3
3(EXP)		113990.6	232934.5	48.9		113990.6	232934.5	48.9	B31.3
1(OPE)	168	129620.8	0	0	169	126910.6	0	0	B31.3
2(SUS)		18592.1	63326.2	29.4		18623	63326.2	29.4	B31.3
3(EXP)		113990.6	232934.5	48.9		110810.9	232903.7	47.6	B31.3
1(OPE)	169	126910.6	0	0	170	120287.4	0	0	B31.3
2(SUS)		18623	63326.2	29.4		20185	63326.2	31.9	B31.3
3(EXP)		110810.9	232903.7	47.6		103134.8	231341.6	44.6	B31.3
1(OPE)	170	120287.4	0	0	180	60093.3	0	0	B31.3
2(SUS)		20185	63326.2	31.9		44920.6	63326.2	70.9	B31.3
3(EXP)		103134.8	231341.6	44.6		33778.8	206606	16.3	B31.3
1(OPE)	180	59730.7	0	0	188	87621.7	0	0	B31.3
2(SUS)		44947	63326.2	71		18657.9	63326.2	29.5	B31.3
3(EXP)		33778.8	206579.7	16.4		71427.6	232868.8	30.7	B31.3
1(OPE)	188	87621.7	0	0	189	94762.6	0	0	B31.3
2(SUS)		18657.9	63326.2	29.5		19048.1	63326.2	30.1	B31.3
3(EXP)		71427.6	232868.8	30.7		79404.9	232478.6	34.2	B31.3
1(OPE)	189	94762.6	0	0	190	96806.7	0	0	B31.3
2(SUS)		19048.1	63326.2	30.1		18890.3	63326.2	29.8	B31.3
3(EXP)		79404.9	232478.6	34.2		81541.8	232636.4	35.1	B31.3
1(OPE)	190	96806.7	0	0	199	95061	0	0	B31.3
2(SUS)		18890.3	63326.2	29.8		18411.5	63326.2	29.1	B31.3
3(EXP)		81541.8	232636.4	35.1		80009.8	233115.2	34.3	B31.3
1(OPE)	199	95061	0	0	200	94025.5	0	0	B31.3
2(SUS)		18411.5	63326.2	29.1		18146.1	63326.2	28.7	B31.3
3(EXP)		80009.8	233115.2	34.3		78992.8	233380.5	33.8	B31.3
1(OPE)	200	94025.5	0	0	210	77471.2	0	0	B31.3
2(SUS)		18146.1	63326.2	28.7		21528.1	63326.2	34	B31.3
3(EXP)		78992.8	233380.5	33.8		61701.7	229998.6	26.8	B31.3
1(OPE)	210	77288.4	0	0	220	32591.7	0	0	B31.3
2(SUS)		21524.6	63326.2	34		24636.1	63326.2	38.9	B31.3
3(EXP)		61701.7	230002	26.8		15139.5	226890.6	6.7	B31.3
1(OPE)	220	32337.7	0	0	230	42892.6	0	0	B31.3
2(SUS)		24634.5	63326.2	38.9		23588	63326.2	37.2	B31.3
3(EXP)		15139.5	226892.2	6.7		27619.6	227938.7	12.1	B31.3

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	16241	-12456	84213	-13452	-79387	4030	0	0	0
	2(SUS)	-103	-13777	-423	-16733	247	-1344	0	0	0
	3(EXP)	16344	1321	84637	3281	-79633	5373	0	0	0
	MAX	16344/L	-13777/L	84637/L	-16733/L	-79633/L	5373/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1950	-35291	-10406	0	0	0	10.14	0	-54.111
	2(SUS)	446	-29951	-64	0	0	0	0.003	0	0
	3(EXP)	1504	-5340	-10342	0	0	0	10.137	0	-54.11
	MAX	1950/L1	-35291/L	-10406/L1				10.140/L	-0.000/L1	-54.111/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3328	-21687	-7448	0	0	0	-3	0	-108.231
	2(SUS)	-1402	-22278	-139	0	0	0	-0.008	0	-0.001
	3(EXP)	-1926	591	-7309	0	0	0	-2.992	0	-108.23
	MAX	-3328/L1	-22278/L	-7448/L1				-3.000/L1	-0.000/L2	-108.231/L1
45		Rigid +Y								
	1(OPE)	-13246	-48986	-6364	0	0	0	-82.095	0	-39.444
	2(SUS)	1059	-52413	882	0	0	0	0.006	0	0.005
	3(EXP)	-14305	3428	-7246	0	0	0	-82.101	0	-39.449
	MAX	-14305/L	-52413/L	-7246/L3				-82.101/L	-0.000/L2	-39.449/L3
65		Rigid +Y								
	1(OPE)	-13246	-48986	6364	0	0	0	-82.095	0	39.444
	2(SUS)	1059	-52413	-882	0	0	0	0.006	0	-0.005
	3(EXP)	-14305	3428	7246	0	0	0	-82.101	0	39.449
	MAX	-14305/L	-52413/L	7246/L3				-82.101/L	-0.000/L2	39.449/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3328	-21687	7448	0	0	0	-3	0	108.231
	2(SUS)	-1402	-22278	139	0	0	0	-0.008	0	0.001
	3(EXP)	-1926	591	7309	0	0	0	-2.992	0	108.23
	MAX	-3328/L1	-22278/L	7448/L1				-3.000/L1	-0.000/L2	108.231/L1
90		Rigid +Y								
	1(OPE)	1950	-35291	10406	0	0	0	10.14	0	54.111
	2(SUS)	446	-29951	64	0	0	0	0.003	0	0
	3(EXP)	1504	-5340	10342	0	0	0	10.137	0	54.11
	MAX	1950/L1	-35291/L	10406/L1				10.140/L	-0.000/L1	54.111/L1
100		Rigid ANC								
	1(OPE)	32482	-24912	0	0	0	8059	0	0	0
	2(SUS)	-207	-27555	0	0	0	-2687	0	0	0
	3(EXP)	32688	2643	0	0	0	10746	0	0	0
	MAX	32688/L	-27555/L	-0/L3	-0/L1	0/L1	10746/L	0.000/L3	-0.000/L2	-0.000/L3

110		Rigid +Y								
	1(OPE)	1950	-35291	-10406	0	0	0	10.14	0	-54.111
	2(SUS)	446	-29951	-64	0	0	0	0.003	0	0
	3(EXP)	1504	-5340	-10342	0	0	0	10.137	0	-54.11
	MAX	1950/L1	-35291/L	-10406/L1				10.140/L	-0.000/L1	-54.111/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3328	-21687	-7448	0	0	0	-3	0	-108.231
	2(SUS)	-1402	-22278	-139	0	0	0	-0.008	0	-0.001
	3(EXP)	-1926	591	-7309	0	0	0	-2.992	0	-108.23
	MAX	-3328/L1	-22278/L	-7448/L1				-3.000/L1	-0.000/L2	-108.231/L1
150		Rigid +Y								
	1(OPE)	-13246	-48986	-6364	0	0	0	-82.095	0	-39.444
	2(SUS)	1059	-52413	882	0	0	0	0.006	0	0.005
	3(EXP)	-14305	3428	-7246	0	0	0	-82.101	0	-39.449
	MAX	-14305/L	-52413/L	-7246/L3				-82.101/L	-0.000/L2	-39.449/L3
180		Rigid +Y								
	1(OPE)	-13246	-48986	6364	0	0	0	-82.095	0	39.444
	2(SUS)	1059	-52413	-882	0	0	0	0.006	0	-0.005
	3(EXP)	-14305	3428	7246	0	0	0	-82.101	0	39.449
	MAX	-14305/L	-52413/L	7246/L3				-82.101/L	-0.000/L2	39.449/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3328	-21687	7448	0	0	0	-3	0	108.231
	2(SUS)	-1402	-22277	139	0	0	0	-0.008	0	0.001
	3(EXP)	-1926	591	7309	0	0	0	-2.992	0	108.23
	MAX	-3328/L1	-22277/L	7448/L1				-3.000/L1	-0.000/L2	108.231/L1
220		Rigid +Y								
	1(OPE)	1950	-35291	10406	0	0	0	10.14	0	54.111
	2(SUS)	446	-29951	64	0	0	0	0.003	0	0
	3(EXP)	1504	-5340	10342	0	0	0	10.137	0	54.11
	MAX	1950/L1	-35291/L	10406/L1				10.140/L	-0.000/L1	54.111/L1
230		Rigid ANC								
	1(OPE)	16241	-12456	-84213	13452	79387	4030	0	0	0
	2(SUS)	-103	-13777	423	16733	-247	-1344	0	0	0
	3(EXP)	16344	1321	-84637	-3281	79634	5373	0	0	0
	MAX	16344/L3	-13777/L	-84637/L	16733/L3	79634/L3	5373/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.137	0	-54.11	-0.0066	-0.0728	0.0275
20	-2.992	0	-108.23	0.0268	0.3631	0.0551
28	-30.925	2.618	-130.451	0.0737	0.6909	0.0664
29	-33.512	3.187	-131.868	0.0804	0.736	0.0697
30	-35.943	4.277	-132.946	0.0862	0.7784	0.0768
38	-39.247	6.178	-134.171	0.0892	0.8215	0.073
39	-44.758	8.31	-133.27	0.0958	0.9051	0.0889
40	-49.465	8.679	-127.61	0.098	0.9904	0.0976
45	-82.101	0	-39.449	0.0585	1.1203	0.1161
48	-106.77	-6.919	18.619	0.0286	0.7638	0.1161
49	-111.36	-7.613	22.149	0.0246	0.6393	0.1166
50	-116.247	-7.786	21.051	0.0198	0.5081	0.117
59	-111.36	-7.613	-22.149	-0.0246	-0.6393	0.1166
60	-106.77	-6.919	-18.619	-0.0286	-0.7638	0.1161
65	-82.101	0	39.449	-0.0585	-1.1203	0.1161
68	-49.465	8.679	127.61	-0.098	-0.9904	0.0976
69	-44.758	8.31	133.27	-0.0958	-0.9051	0.0889
70	-39.247	6.178	134.171	-0.0892	-0.8215	0.073
78	-35.943	4.277	132.946	-0.0862	-0.7784	0.0768
79	-33.512	3.187	131.868	-0.0804	-0.736	0.0697
80	-30.925	2.618	130.451	-0.0737	-0.6909	0.0664
85	-2.992	0	108.23	-0.0268	-0.3631	0.0551
90	10.137	0	54.11	0.0066	0.0728	0.0275
100	0	0	0	0	0	0
110	10.137	0	-54.11	-0.0066	-0.0728	0.0275
120	-2.992	0	-108.23	0.0268	0.3631	0.0551
128	-30.925	2.618	-130.451	0.0737	0.6909	0.0664
129	-33.512	3.187	-131.868	0.0804	0.736	0.0697
130	-35.943	4.277	-132.946	0.0862	0.7784	0.0768
139	-44.758	8.31	-133.27	0.0958	0.9051	0.0889
140	-49.465	8.679	-127.61	0.098	0.9904	0.0976
150	-82.101	0	-39.449	0.0585	1.1203	0.1161
158	-106.77	-6.919	18.619	0.0286	0.7638	0.1161
159	-111.359	-7.613	22.149	0.0246	0.6393	0.1166
160	-116.247	-7.786	21.051	0.0198	0.5081	0.117
168	-116.247	-7.786	-21.051	-0.0198	-0.5081	0.117
169	-111.359	-7.613	-22.149	-0.0246	-0.6393	0.1166
170	-106.77	-6.919	-18.619	-0.0286	-0.7638	0.1161
180	-82.101	0	39.449	-0.0585	-1.1203	0.1161

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

188	-49.465	8.679	127.61	-0.098	-0.9904	0.0976
189	-44.758	8.31	133.27	-0.0958	-0.9051	0.0889
190	-39.247	6.178	134.171	-0.0892	-0.8215	0.073
199	-33.512	3.187	131.868	-0.0804	-0.736	0.0697
200	-30.924	2.618	130.451	-0.0737	-0.6909	0.0664
210	-2.992	0	108.23	-0.0268	-0.3631	0.0551
220	10.137	0	54.11	0.0066	0.0728	0.0275
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.002	-0.0006	-0.0069
20	-0.008	0	-0.001	0.0081	0.0024	-0.0138
28	-0.183	0.247	-0.001	0.0043	0.0031	-0.0166
29	-0.182	0.263	0.002	0.0043	0.0028	-0.0168
30	-0.156	0.276	0.011	0.0041	0.0025	-0.0171
38	-0.1	0.292	0.026	0.0039	0.0022	-0.0173
39	-0.026	0.357	0.047	0.0029	0.0014	-0.0179
40	0.007	0.482	0.058	0.0018	0.0005	-0.0178
45	0.006	0	0.005	-0.0103	-0.0007	0.0613
48	0.006	-6.402	-0.002	-0.0195	0.0002	0.1309
49	0.006	-7.329	-0.001	-0.0206	0.0002	0.1327
50	0.004	-7.831	0	-0.0205	0.0001	0.1329
59	0.006	-7.329	0.001	0.0206	-0.0002	0.1327
60	0.006	-6.402	0.002	0.0195	-0.0002	0.1309
65	0.006	0	-0.005	0.0103	0.0007	0.0613
68	0.007	0.482	-0.058	-0.0018	-0.0005	-0.0178
69	-0.026	0.357	-0.047	-0.0029	-0.0014	-0.0179
70	-0.1	0.292	-0.026	-0.0039	-0.0022	-0.0173
78	-0.156	0.276	-0.011	-0.0041	-0.0025	-0.0171
79	-0.182	0.263	-0.002	-0.0043	-0.0028	-0.0168
80	-0.183	0.247	0.001	-0.0043	-0.0031	-0.0166
85	-0.008	0	0.001	-0.0081	-0.0024	-0.0138
90	0.003	0	0	0.002	0.0006	-0.0069
100	0	0	0	0	0	0
110	0.003	0	0	-0.002	-0.0006	-0.0069
120	-0.008	0	-0.001	0.0081	0.0024	-0.0138
128	-0.183	0.247	-0.001	0.0043	0.0031	-0.0166
129	-0.182	0.263	0.002	0.0043	0.0028	-0.0168
130	-0.156	0.276	0.011	0.0041	0.0025	-0.0171
139	-0.026	0.357	0.047	0.0029	0.0014	-0.0179
140	0.007	0.482	0.058	0.0018	0.0005	-0.0178
150	0.006	0	0.005	-0.0103	-0.0007	0.0613
158	0.006	-6.402	-0.002	-0.0195	0.0002	0.1309
159	0.006	-7.329	-0.001	-0.0206	0.0002	0.1327
160	0.004	-7.831	0	-0.0205	0.0001	0.1329
168	0.004	-7.831	0	0.0205	-0.0001	0.1329
169	0.006	-7.329	0.001	0.0206	-0.0002	0.1327
170	0.006	-6.402	0.002	0.0195	-0.0002	0.1309
180	0.006	0	-0.005	0.0103	0.0007	0.0613

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

188	0.007	0.482	-0.058	-0.0018	-0.0005	-0.0178
189	-0.026	0.357	-0.047	-0.0029	-0.0014	-0.0179
190	-0.1	0.292	-0.026	-0.0039	-0.0022	-0.0173
199	-0.182	0.263	-0.002	-0.0043	-0.0028	-0.0168
200	-0.183	0.247	0.001	-0.0043	-0.0031	-0.0166
210	-0.008	0	0.001	-0.0081	-0.0024	-0.0138
220	0.003	0	0	0.002	0.0006	-0.0069
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 9:3
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 6900
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.14	0	-54.111	-0.0086	-0.0733	0.0206
20	-3	0	-108.231	0.0349	0.3655	0.0413
28	-31.107	2.866	-130.452	0.078	0.694	0.0498
29	-33.694	3.45	-131.866	0.0847	0.7388	0.0528
30	-36.099	4.553	-132.935	0.0904	0.7809	0.0597
38	-39.347	6.47	-134.145	0.0931	0.8237	0.0557
39	-44.785	8.668	-133.223	0.0988	0.9065	0.071
40	-49.458	9.161	-127.551	0.0998	0.9909	0.0798
45	-82.095	0	-39.444	0.0481	1.1197	0.1774
48	-106.764	-13.321	18.617	0.0091	0.764	0.247
49	-111.354	-14.942	22.148	0.004	0.6395	0.2492
50	-116.242	-15.616	21.051	-0.0007	0.5083	0.2499
59	-111.354	-14.942	-22.148	-0.004	-0.6395	0.2492
60	-106.764	-13.321	-18.617	-0.0091	-0.764	0.247
65	-82.095	0	39.444	-0.0481	-1.1197	0.1774
68	-49.458	9.161	127.551	-0.0998	-0.9909	0.0798
69	-44.785	8.668	133.223	-0.0988	-0.9065	0.071
70	-39.347	6.47	134.145	-0.0931	-0.8237	0.0557
78	-36.099	4.553	132.935	-0.0904	-0.7809	0.0597
79	-33.694	3.45	131.866	-0.0847	-0.7388	0.0528
80	-31.107	2.866	130.452	-0.078	-0.694	0.0498
85	-3	0	108.231	-0.0349	-0.3655	0.0413
90	10.14	0	54.111	0.0086	0.0733	0.0206
100	0	0	0	0	0	0
110	10.14	0	-54.111	-0.0086	-0.0733	0.0206
120	-3	0	-108.231	0.0349	0.3655	0.0413
128	-31.107	2.866	-130.452	0.078	0.694	0.0498
129	-33.694	3.45	-131.866	0.0847	0.7388	0.0528
130	-36.099	4.553	-132.935	0.0904	0.7809	0.0597
139	-44.785	8.668	-133.223	0.0988	0.9065	0.071
140	-49.458	9.161	-127.551	0.0998	0.9909	0.0798
150	-82.095	0	-39.444	0.0481	1.1197	0.1774
158	-106.764	-13.321	18.617	0.0091	0.764	0.247
159	-111.354	-14.942	22.148	0.004	0.6395	0.2492
160	-116.242	-15.616	21.051	-0.0007	0.5083	0.2499
168	-116.242	-15.616	-21.051	0.0007	-0.5083	0.2499
169	-111.354	-14.942	-22.148	-0.004	-0.6395	0.2492
170	-106.764	-13.321	-18.617	-0.0091	-0.764	0.247
180	-82.095	0	39.444	-0.0481	-1.1197	0.1774

Possible Approach:
Expansion Loop Dimension B: 6900mm C: 3300mm

188	-49.458	9.161	127.551	-0.0998	-0.9909	0.0798
189	-44.785	8.668	133.223	-0.0988	-0.9065	0.071
190	-39.347	6.47	134.145	-0.0931	-0.8237	0.0557
199	-33.694	3.45	131.866	-0.0847	-0.7388	0.0528
200	-31.107	2.866	130.452	-0.078	-0.694	0.0498
210	-3	0	108.231	-0.0349	-0.3655	0.0413
220	10.14	0	54.111	0.0086	0.0733	0.0206
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -3,200.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -7,100.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
---------------------------------------------------------------------------
From  80  To  85 DZ= -3,200.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
```

```
  Node  110  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .30
   Node  120  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,200.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -3,948.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -7,100.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 3,948.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .30
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,200.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .30
   Node  210  Guide   Gap= 3.000 mm.   Mu = .30
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.30	.000	.000	.000
15	+Y			.30	.000	1.000	.000
20	Guide		3.00	.30	.000	.000	.000
20	+Y			.30	.000	1.000	.000
45	+Y			.30	.000	1.000	.000
65	+Y			.30	.000	1.000	.000
85	Guide		3.00	.30	.000	.000	.000
85	+Y			.30	.000	1.000	.000
90	+Y			.30	.000	1.000	.000
100	ANC			.30	.000	.000	.000
110	+Y			.30	.000	1.000	.000
120	+Y			.30	.000	1.000	.000
120	Guide		3.00	.30	.000	.000	.000
150	+Y			.30	.000	1.000	.000
180	+Y			.30	.000	1.000	.000
210	+Y			.30	.000	1.000	.000
210	Guide		3.00	.30	.000	.000	.000
220	+Y			.30	.000	1.000	.000
230	ANC			.30	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

Possible Approach:

Expansion Loop Dimension B: 7100mm C: 3100mm

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

Possible Approach:

Expansion Loop Dimension B: 7100mm C: 3100mm

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18200.000
40	.000	750.000	-18950.000
45	-5052.000	750.000	-18950.000
50	-9000.000	750.000	-18950.000
60	-9000.000	750.000	-26050.000
65	-5052.000	750.000	-26050.000
70	.000	750.000	-26050.000
80	.000	.000	-26800.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63200.000
140	.000	750.000	-63950.000
150	-5052.000	750.000	-63950.000
160	-9000.000	750.000	-63950.000
170	-9000.000	750.000	-71050.000
180	-5052.000	750.000	-71050.000
190	.000	750.000	-71050.000
200	.000	.000	-71800.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 71.8 @Node 150 LOADCASE: 2 (SUS) W+P1
Code Stress: 45479.4 Allowable Stress: 63326.2
Axial Stress: 17809.7 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 112394.9 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 27498.4 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 133592.9 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	43126.5	0	0	15	32529.3	0	0	B31.3
2(SUS)		23516.8	63326.2	37.1		24780.6	63326.2	39.1	B31.3
3(EXP)		27854.3	228009.8	12.2		15241.8	226746.1	6.7	B31.3
1(OPE)	15	32786	0	0	20	77901.5	0	0	B31.3
2(SUS)		24782.4	63326.2	39.1		21018.7	63326.2	33.2	B31.3
3(EXP)		15241.8	226744.3	6.7		62269.5	230507.9	27	B31.3
1(OPE)	20	78077.3	0	0	28	94260.6	0	0	B31.3
2(SUS)		21022.6	63326.2	33.2		18185.5	63326.2	28.7	B31.3
3(EXP)		62269.5	230504.1	27		79265.9	233341.2	34	B31.3
1(OPE)	28	94260.6	0	0	29	95312.1	0	0	B31.3
2(SUS)		18185.5	63326.2	28.7		18479.1	63326.2	29.2	B31.3
3(EXP)		79265.9	233341.2	34		80302.4	233047.5	34.5	B31.3
1(OPE)	29	95312.1	0	0	30	96268.8	0	0	B31.3
2(SUS)		18479.1	63326.2	29.2		18708.9	63326.2	29.5	B31.3
3(EXP)		80302.4	233047.5	34.5		80981.8	232817.8	34.8	B31.3
1(OPE)	30	96268.8	0	0	38	97101	0	0	B31.3
2(SUS)		18708.9	63326.2	29.5		19011	63326.2	30	B31.3
3(EXP)		80981.8	232817.8	34.8		81874.5	232515.7	35.2	B31.3
1(OPE)	38	97101	0	0	39	95100.1	0	0	B31.3
2(SUS)		19011	63326.2	30		19195.6	63326.2	30.3	B31.3
3(EXP)		81874.5	232515.7	35.2		79775.7	232331.1	34.3	B31.3

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

1(OPE)	39	95100.1	0	0	40	88013.3	0	0	B31.3
2(SUS)		19195.6	63326.2	30.3		18744.6	63326.2	29.6	B31.3
3(EXP)		79775.7	232331.1	34.3		71843.2	232782.1	30.9	B31.3
1(OPE)	40	88013.3	0	0	45	59337.1	0	0	B31.3
2(SUS)		18744.6	63326.2	29.6		45479.4	63326.2	71.8	B31.3
3(EXP)		71843.2	232782.1	30.9		32901.9	206047.2	16	B31.3
1(OPE)	45	59704.6	0	0	48	118786.3	0	0	B31.3
2(SUS)		45451.6	63326.2	71.8		20269.3	63326.2	32	B31.3
3(EXP)		32901.9	206075	16		101624.7	231257.3	43.9	B31.3
1(OPE)	48	118786.3	0	0	49	125351.4	0	0	B31.3
2(SUS)		20269.3	63326.2	32		18754.6	63326.2	29.6	B31.3
3(EXP)		101624.7	231257.3	43.9		109230.9	232772.1	46.9	B31.3
1(OPE)	49	125351.4	0	0	50	128035.4	0	0	B31.3
2(SUS)		18754.6	63326.2	29.6		18474.5	63326.2	29.2	B31.3
3(EXP)		109230.9	232772.1	46.9		112381.8	233052.1	48.2	B31.3
1(OPE)	50	128035.4	0	0	59	125351.4	0	0	B31.3
2(SUS)		18474.5	63326.2	29.2		18754.6	63326.2	29.6	B31.3
3(EXP)		112381.8	233052.1	48.2		109230.9	232772.1	46.9	B31.3
1(OPE)	59	125351.4	0	0	60	118786.3	0	0	B31.3
2(SUS)		18754.6	63326.2	29.6		20269.3	63326.2	32	B31.3
3(EXP)		109230.9	232772.1	46.9		101624.7	231257.3	43.9	B31.3
1(OPE)	60	118786.3	0	0	65	59704.6	0	0	B31.3
2(SUS)		20269.3	63326.2	32		45451.6	63326.2	71.8	B31.3
3(EXP)		101624.7	231257.3	43.9		32901.9	206075	16	B31.3
1(OPE)	65	59337.1	0	0	68	88013.3	0	0	B31.3
2(SUS)		45479.4	63326.2	71.8		18744.6	63326.2	29.6	B31.3
3(EXP)		32901.9	206047.2	16		71843.2	232782.1	30.9	B31.3
1(OPE)	68	88013.3	0	0	69	95100.2	0	0	B31.3
2(SUS)		18744.6	63326.2	29.6		19195.6	63326.2	30.3	B31.3
3(EXP)		71843.2	232782.1	30.9		79775.7	232331.1	34.3	B31.3
1(OPE)	69	95100.2	0	0	70	97101	0	0	B31.3
2(SUS)		19195.6	63326.2	30.3		19011	63326.2	30	B31.3
3(EXP)		79775.7	232331.1	34.3		81874.5	232515.7	35.2	B31.3
1(OPE)	70	97101	0	0	78	96268.8	0	0	B31.3
2(SUS)		19011	63326.2	30		18708.9	63326.2	29.5	B31.3
3(EXP)		81874.5	232515.7	35.2		80981.8	232817.8	34.8	B31.3
1(OPE)	78	96268.8	0	0	79	95312.1	0	0	B31.3
2(SUS)		18708.9	63326.2	29.5		18479.1	63326.2	29.2	B31.3
3(EXP)		80981.8	232817.8	34.8		80302.4	233047.5	34.5	B31.3
1(OPE)	79	95312.1	0	0	80	94260.6	0	0	B31.3
2(SUS)		18479.1	63326.2	29.2		18185.5	63326.2	28.7	B31.3
3(EXP)		80302.4	233047.5	34.5		79265.9	233341.2	34	B31.3

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm
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1(OPE)	80	94260.6	0	0	85	78077.3	0	0	B31.3
2(SUS)		18185.5	63326.2	28.7		21022.6	63326.2	33.2	B31.3
3(EXP)		79265.9	233341.2	34		62269.6	230504.1	27	B31.3
1(OPE)	85	77901.5	0	0	90	32786	0	0	B31.3
2(SUS)		21018.7	63326.2	33.2		24782.3	63326.2	39.1	B31.3
3(EXP)		62269.6	230507.9	27		15241.7	226744.3	6.7	B31.3
1(OPE)	90	32529.3	0	0	100	43126.6	0	0	B31.3
2(SUS)		24780.6	63326.2	39.1		23516.9	63326.2	37.1	B31.3
3(EXP)		15241.7	226746.1	6.7		27854.4	228009.8	12.2	B31.3
1(OPE)	100	43126.6	0	0	110	32529.2	0	0	B31.3
2(SUS)		23516.9	63326.2	37.1		24780.6	63326.2	39.1	B31.3
3(EXP)		27854.4	228009.8	12.2		15241.7	226746.1	6.7	B31.3
1(OPE)	110	32786	0	0	120	77901.5	0	0	B31.3
2(SUS)		24782.3	63326.2	39.1		21018.7	63326.2	33.2	B31.3
3(EXP)		15241.7	226744.3	6.7		62269.6	230507.9	27	B31.3
1(OPE)	120	78077.3	0	0	128	94260.6	0	0	B31.3
2(SUS)		21022.6	63326.2	33.2		18185.5	63326.2	28.7	B31.3
3(EXP)		62269.6	230504.1	27		79266	233341.2	34	B31.3
1(OPE)	128	94260.6	0	0	129	95312.1	0	0	B31.3
2(SUS)		18185.5	63326.2	28.7		18479.1	63326.2	29.2	B31.3
3(EXP)		79266	233341.2	34		80302.4	233047.5	34.5	B31.3
1(OPE)	129	95312.1	0	0	130	96268.8	0	0	B31.3
2(SUS)		18479.1	63326.2	29.2		18708.9	63326.2	29.5	B31.3
3(EXP)		80302.4	233047.5	34.5		80981.8	232817.8	34.8	B31.3
1(OPE)	130	96268.8	0	0	139	95100.2	0	0	B31.3
2(SUS)		18708.9	63326.2	29.5		19195.6	63326.2	30.3	B31.3
3(EXP)		80981.8	232817.8	34.8		79775.7	232331.1	34.3	B31.3
1(OPE)	139	95100.2	0	0	140	88013.3	0	0	B31.3
2(SUS)		19195.6	63326.2	30.3		18744.6	63326.2	29.6	B31.3
3(EXP)		79775.7	232331.1	34.3		71843.2	232782.1	30.9	B31.3
1(OPE)	140	88013.3	0	0	150	59337.1	0	0	B31.3
2(SUS)		18744.6	63326.2	29.6		45479.4	63326.2	71.8	B31.3
3(EXP)		71843.2	232782.1	30.9		32901.9	206047.2	16	B31.3
1(OPE)	150	59704.6	0	0	158	118786.3	0	0	B31.3
2(SUS)		45451.6	63326.2	71.8		20269.3	63326.2	32	B31.3
3(EXP)		32901.9	206075	16		101624.7	231257.3	43.9	B31.3
1(OPE)	158	118786.3	0	0	159	125351.3	0	0	B31.3
2(SUS)		20269.3	63326.2	32		18754.6	63326.2	29.6	B31.3
3(EXP)		101624.7	231257.3	43.9		109230.9	232772.1	46.9	B31.3
1(OPE)	159	125351.3	0	0	160	128035.4	0	0	B31.3
2(SUS)		18754.6	63326.2	29.6		18474.5	63326.2	29.2	B31.3
3(EXP)		109230.9	232772.1	46.9		112381.8	233052.1	48.2	B31.3

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

1(OPE)	160	128035.4	0	0	168	128035.4	0	0	B31.3
2(SUS)		18474.5	63326.2	29.2		18474.5	63326.2	29.2	B31.3
3(EXP)		112381.8	233052.1	48.2		112381.8	233052.1	48.2	B31.3
1(OPE)	168	128035.4	0	0	169	125351.3	0	0	B31.3
2(SUS)		18474.5	63326.2	29.2		18754.6	63326.2	29.6	B31.3
3(EXP)		112381.8	233052.1	48.2		109230.9	232772.1	46.9	B31.3
1(OPE)	169	125351.3	0	0	170	118786.3	0	0	B31.3
2(SUS)		18754.6	63326.2	29.6		20269.3	63326.2	32	B31.3
3(EXP)		109230.9	232772.1	46.9		101624.7	231257.3	43.9	B31.3
1(OPE)	170	118786.3	0	0	180	59704.6	0	0	B31.3
2(SUS)		20269.3	63326.2	32		45451.6	63326.2	71.8	B31.3
3(EXP)		101624.7	231257.3	43.9		32901.9	206075	16	B31.3
1(OPE)	180	59337.1	0	0	188	88013.3	0	0	B31.3
2(SUS)		45479.4	63326.2	71.8		18744.6	63326.2	29.6	B31.3
3(EXP)		32901.9	206047.2	16		71843.2	232782.1	30.9	B31.3
1(OPE)	188	88013.3	0	0	189	95100.2	0	0	B31.3
2(SUS)		18744.6	63326.2	29.6		19195.6	63326.2	30.3	B31.3
3(EXP)		71843.2	232782.1	30.9		79775.7	232331.1	34.3	B31.3
1(OPE)	189	95100.2	0	0	190	97101	0	0	B31.3
2(SUS)		19195.6	63326.2	30.3		19011	63326.2	30	B31.3
3(EXP)		79775.7	232331.1	34.3		81874.6	232515.7	35.2	B31.3
1(OPE)	190	97101	0	0	199	95312.1	0	0	B31.3
2(SUS)		19011	63326.2	30		18479.1	63326.2	29.2	B31.3
3(EXP)		81874.6	232515.7	35.2		80302.4	233047.5	34.5	B31.3
1(OPE)	199	95312.1	0	0	200	94260.6	0	0	B31.3
2(SUS)		18479.1	63326.2	29.2		18185.5	63326.2	28.7	B31.3
3(EXP)		80302.4	233047.5	34.5		79265.9	233341.2	34	B31.3
1(OPE)	200	94260.6	0	0	210	78077.3	0	0	B31.3
2(SUS)		18185.5	63326.2	28.7		21022.6	63326.2	33.2	B31.3
3(EXP)		79265.9	233341.2	34		62269.6	230504.1	27	B31.3
1(OPE)	210	77901.6	0	0	220	32786	0	0	B31.3
2(SUS)		21018.7	63326.2	33.2		24782.4	63326.2	39.1	B31.3
3(EXP)		62269.6	230507.9	27		15241.8	226744.3	6.7	B31.3
1(OPE)	220	32529.3	0	0	230	43126.5	0	0	B31.3
2(SUS)		24780.6	63326.2	39.1		23516.8	63326.2	37.1	B31.3
3(EXP)		15241.8	226746.1	6.7		27854.3	228009.8	12.2	B31.3

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	16374	-12360	83671	-13213	-80076	4008	0	0	0
	2(SUS)	-102	-13695	-475	-16528	243	-1274	0	0	0
	3(EXP)	16476	1335	84146	3315	-80319	5282	0	0	0
	MAX	16476/L3	-13695/L	84146/L	-16528/L	-80319/L	5282/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1989	-35681	-10518	0	0	0	10.233	0	-54.111
	2(SUS)	440	-30285	-72	0	0	0	0.003	0	0
	3(EXP)	1549	-5396	-10446	0	0	0	10.231	0	-54.111
	MAX	1989/L1	-35681/L	-10518/L1				10.233/L	-0.000/L1	-54.111/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3299	-20745	-7159	0	0	0	-3	0	-108.232
	2(SUS)	-1455	-21358	-155	0	0	0	-0.008	0	-0.001
	3(EXP)	-1844	613	-7004	0	0	0	-2.992	0	-108.231
	MAX	-3299/L1	-21358/L	-7159/L1				-3.000/L1	-0.000/L2	-108.232/L1
45		Rigid +Y								
	1(OPE)	-13419	-49634	-6453	0	0	0	-81.028	0	-38.968
	2(SUS)	1117	-53082	1023	0	0	0	0.006	0	0.006
	3(EXP)	-14536	3448	-7477	0	0	0	-81.034	0	-38.974
	MAX	-14536/L	-53082/L	-7477/L3				-81.034/L	-0.000/L2	-38.974/L3
65		Rigid +Y								
	1(OPE)	-13419	-49634	6453	0	0	0	-81.028	0	38.968
	2(SUS)	1117	-53082	-1023	0	0	0	0.006	0	-0.006
	3(EXP)	-14536	3448	7477	0	0	0	-81.034	0	38.974
	MAX	-14536/L	-53082/L	7477/L3				-81.034/L	-0.000/L2	38.974/L3
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-3299	-20745	7159	0	0	0	-3	0	108.232
	2(SUS)	-1455	-21358	155	0	0	0	-0.008	0	0.001
	3(EXP)	-1844	613	7004	0	0	0	-2.992	0	108.231
	MAX	-3299/L1	-21358/L	7159/L1				-3.000/L1	-0.000/L2	108.232/L1
90		Rigid +Y								
	1(OPE)	1989	-35681	10518	0	0	0	10.233	0	54.111
	2(SUS)	440	-30285	72	0	0	0	0.003	0	0
	3(EXP)	1549	-5396	10446	0	0	0	10.231	0	54.111
	MAX	1989/L1	-35681/L	10518/L1				10.233/L	-0.000/L1	54.111/L1
100		Rigid ANC								
	1(OPE)	32748	-24719	0	0	0	8016	0	0	0
	2(SUS)	-204	-27390	0	0	0	-2547	0	0	0
	3(EXP)	32952	2671	0	0	0	10563	0	0	0
	MAX	32952/L3	-27390/L	-0/L3	-0/L1	0/L1	10563/L3	0.000/L3	-0.000/L2	-0.000/L3

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

110		Rigid +Y								
	1(OPE)	1989	-35681	-10518	0	0	0	10.233	0	-54.111
	2(SUS)	440	-30285	-72	0	0	0	0.003	0	0
	3(EXP)	1549	-5396	-10446	0	0	0	10.231	0	-54.111
	MAX	1989/L1	-35681/L	-10518/L1				10.233/L	-0.000/L1	-54.111/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3299	-20745	-7159	0	0	0	-3	0	-108.232
	2(SUS)	-1455	-21358	-155	0	0	0	-0.008	0	-0.001
	3(EXP)	-1844	613	-7004	0	0	0	-2.992	0	-108.231
	MAX	-3299/L1	-21358/L	-7159/L1				-3.000/L1	-0.000/L2	-108.232/L1
150		Rigid +Y								
	1(OPE)	-13419	-49634	-6453	0	0	0	-81.028	0	-38.968
	2(SUS)	1117	-53082	1023	0	0	0	0.006	0	0.006
	3(EXP)	-14536	3448	-7477	0	0	0	-81.034	0	-38.974
	MAX	-14536/L	-53082/L	-7477/L3				-81.034/L	-0.000/L2	-38.974/L3
180		Rigid +Y								
	1(OPE)	-13419	-49634	6453	0	0	0	-81.028	0	38.968
	2(SUS)	1117	-53082	-1023	0	0	0	0.006	0	-0.006
	3(EXP)	-14536	3448	7477	0	0	0	-81.034	0	38.974
	MAX	-14536/L	-53082/L	7477/L3				-81.034/L	-0.000/L2	38.974/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-3299	-20745	7159	0	0	0	-3	0	108.232
	2(SUS)	-1455	-21358	155	0	0	0	-0.008	0	0.001
	3(EXP)	-1844	613	7004	0	0	0	-2.992	0	108.231
	MAX	-3299/L1	-21358/L	7159/L1				-3.000/L1	-0.000/L2	108.232/L1
220		Rigid +Y								
	1(OPE)	1989	-35681	10518	0	0	0	10.233	0	54.111
	2(SUS)	440	-30285	72	0	0	0	0.003	0	0
	3(EXP)	1549	-5396	10446	0	0	0	10.231	0	54.111
	MAX	1989/L1	-35681/L	10518/L1				10.233/L	-0.000/L1	54.111/L1
230		Rigid ANC								
	1(OPE)	16374	-12360	-83671	13213	80076	4008	0	0	0
	2(SUS)	-102	-13695	475	16528	-243	-1274	0	0	0
	3(EXP)	16476	1335	-84146	-3315	80319	5282	0	0	0
	MAX	16476/L3	-13695/L	-84146/L	16528/L3	80319/L3	5282/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.231	0	-54.111	-0.0067	-0.0735	0.0271
20	-2.992	0	-108.231	0.0271	0.3661	0.0541
28	-29.966	2.517	-129.73	0.0726	0.6852	0.0649
29	-32.532	3.082	-131.148	0.0794	0.7305	0.0682
30	-34.944	4.169	-132.228	0.0852	0.773	0.0753
38	-38.222	6.066	-133.458	0.0881	0.8163	0.0715
39	-43.704	8.197	-132.575	0.0948	0.9003	0.0874
40	-48.398	8.573	-126.947	0.0971	0.9861	0.0962
45	-81.034	0	-38.974	0.0582	1.1205	0.1148
48	-105.703	-6.841	19.27	0.0288	0.7702	0.1148
49	-110.313	-7.526	22.847	0.0249	0.6475	0.1153
50	-115.261	-7.693	21.773	0.0201	0.5181	0.1157
59	-110.313	-7.526	-22.847	-0.0249	-0.6475	0.1153
60	-105.703	-6.841	-19.27	-0.0288	-0.7702	0.1148
65	-81.034	0	38.974	-0.0582	-1.1205	0.1148
68	-48.398	8.573	126.947	-0.0971	-0.9861	0.0962
69	-43.704	8.197	132.575	-0.0948	-0.9003	0.0874
70	-38.222	6.066	133.458	-0.0881	-0.8163	0.0715
78	-34.944	4.169	132.228	-0.0852	-0.773	0.0753
79	-32.532	3.082	131.148	-0.0794	-0.7305	0.0682
80	-29.966	2.517	129.73	-0.0726	-0.6852	0.0649
85	-2.992	0	108.231	-0.0271	-0.3661	0.0541
90	10.231	0	54.111	0.0067	0.0735	0.0271
100	0	0	0	0	0	0
110	10.231	0	-54.111	-0.0067	-0.0735	0.0271
120	-2.992	0	-108.231	0.0271	0.3661	0.0541
128	-29.966	2.517	-129.73	0.0726	0.6852	0.0649
129	-32.532	3.082	-131.148	0.0794	0.7305	0.0682
130	-34.944	4.169	-132.228	0.0852	0.773	0.0753
139	-43.703	8.197	-132.575	0.0948	0.9003	0.0874
140	-48.398	8.573	-126.947	0.0971	0.9861	0.0962
150	-81.034	0	-38.974	0.0582	1.1205	0.1148
158	-105.703	-6.841	19.27	0.0288	0.7702	0.1148
159	-110.313	-7.526	22.847	0.0249	0.6475	0.1153
160	-115.261	-7.693	21.773	0.0201	0.5181	0.1157
168	-115.261	-7.693	-21.773	-0.0201	-0.5181	0.1157
169	-110.313	-7.526	-22.847	-0.0249	-0.6475	0.1153
170	-105.703	-6.841	-19.27	-0.0288	-0.7702	0.1148
180	-81.034	0	38.974	-0.0582	-1.1205	0.1148

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

188	-48.398	8.573	126.947	-0.0971	-0.9861	0.0962
189	-43.703	8.197	132.575	-0.0948	-0.9003	0.0874
190	-38.222	6.066	133.458	-0.0881	-0.8163	0.0715
199	-32.532	3.082	131.148	-0.0794	-0.7305	0.0682
200	-29.966	2.517	129.73	-0.0726	-0.6852	0.0649
210	-2.992	0	108.231	-0.0271	-0.3661	0.0541
220	10.231	0	54.111	0.0067	0.0735	0.0271
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.003	0	0	-0.0024	-0.0006	-0.0065
20	-0.008	0	-0.001	0.0097	0.0024	-0.0131
28	-0.173	0.361	-0.001	0.0067	0.003	-0.0156
29	-0.172	0.385	0.004	0.0066	0.0027	-0.0158
30	-0.147	0.405	0.017	0.0064	0.0023	-0.0161
38	-0.095	0.429	0.041	0.0061	0.002	-0.0164
39	-0.024	0.502	0.071	0.005	0.0011	-0.0169
40	0.007	0.624	0.084	0.0036	0.0002	-0.0167
45	0.006	0	0.006	-0.0101	-0.0009	0.0644
48	0.006	-6.643	-0.002	-0.0205	0.0002	0.1355
49	0.006	-7.604	-0.001	-0.0218	0.0002	0.1373
50	0.004	-8.126	0	-0.0219	0.0002	0.1376
59	0.006	-7.604	0.001	0.0218	-0.0002	0.1373
60	0.006	-6.643	0.002	0.0205	-0.0002	0.1355
65	0.006	0	-0.006	0.0101	0.0009	0.0644
68	0.007	0.624	-0.084	-0.0036	-0.0002	-0.0167
69	-0.024	0.502	-0.071	-0.005	-0.0011	-0.0169
70	-0.095	0.429	-0.041	-0.0061	-0.002	-0.0164
78	-0.147	0.405	-0.017	-0.0064	-0.0023	-0.0161
79	-0.172	0.385	-0.004	-0.0066	-0.0027	-0.0158
80	-0.173	0.361	0.001	-0.0067	-0.003	-0.0156
85	-0.008	0	0.001	-0.0097	-0.0024	-0.0131
90	0.003	0	0	0.0024	0.0006	-0.0065
100	0	0	0	0	0	0
110	0.003	0	0	-0.0024	-0.0006	-0.0065
120	-0.008	0	-0.001	0.0097	0.0024	-0.0131
128	-0.173	0.361	-0.001	0.0067	0.003	-0.0156
129	-0.172	0.385	0.004	0.0066	0.0027	-0.0158
130	-0.147	0.405	0.017	0.0064	0.0023	-0.0161
139	-0.024	0.502	0.071	0.005	0.0011	-0.0169
140	0.007	0.624	0.084	0.0036	0.0002	-0.0167
150	0.006	0	0.006	-0.0101	-0.0009	0.0644
158	0.006	-6.643	-0.002	-0.0205	0.0002	0.1355
159	0.006	-7.604	-0.001	-0.0218	0.0002	0.1373
160	0.004	-8.126	0	-0.0219	0.0002	0.1376
168	0.004	-8.126	0	0.0219	-0.0002	0.1376
169	0.006	-7.604	0.001	0.0218	-0.0002	0.1373
170	0.006	-6.643	0.002	0.0205	-0.0002	0.1355
180	0.006	0	-0.006	0.0101	0.0009	0.0644

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

188	0.007	0.624	-0.084	-0.0036	-0.0002	-0.0167
189	-0.024	0.502	-0.071	-0.005	-0.0011	-0.0169
190	-0.095	0.429	-0.041	-0.0061	-0.002	-0.0164
199	-0.172	0.385	-0.004	-0.0066	-0.0027	-0.0158
200	-0.173	0.361	0.001	-0.0067	-0.003	-0.0156
210	-0.008	0	0.001	-0.0097	-0.0024	-0.0131
220	0.003	0	0	0.0024	0.0006	-0.0065
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 10:10
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 7100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.233	0	-54.111	-0.0091	-0.0741	0.0205
20	-3	0	-108.232	0.0368	0.3685	0.0411
28	-30.139	2.878	-129.731	0.0794	0.6882	0.0492
29	-32.704	3.467	-131.145	0.086	0.7332	0.0523
30	-35.091	4.574	-132.211	0.0916	0.7753	0.0592
38	-38.317	6.495	-133.417	0.0942	0.8183	0.0552
39	-43.728	8.699	-132.504	0.0998	0.9014	0.0705
40	-48.391	9.197	-126.863	0.1007	0.9863	0.0795
45	-81.028	0	-38.968	0.0481	1.1196	0.1792
48	-105.697	-13.484	19.268	0.0082	0.7704	0.2503
49	-110.307	-15.13	22.846	0.0031	0.6477	0.2526
50	-115.256	-15.82	21.773	-0.0018	0.5183	0.2533
59	-110.307	-15.13	-22.846	-0.0031	-0.6477	0.2526
60	-105.697	-13.484	-19.268	-0.0083	-0.7704	0.2503
65	-81.028	0	38.968	-0.0481	-1.1196	0.1792
68	-48.391	9.197	126.863	-0.1007	-0.9863	0.0795
69	-43.728	8.699	132.504	-0.0998	-0.9014	0.0705
70	-38.317	6.495	133.417	-0.0942	-0.8183	0.0552
78	-35.091	4.574	132.211	-0.0916	-0.7753	0.0592
79	-32.704	3.467	131.145	-0.086	-0.7332	0.0523
80	-30.139	2.878	129.731	-0.0794	-0.6882	0.0492
85	-3	0	108.232	-0.0368	-0.3685	0.0411
90	10.233	0	54.111	0.0091	0.0741	0.0205
100	0	0	0	0	0	0
110	10.233	0	-54.111	-0.0091	-0.0741	0.0205
120	-3	0	-108.232	0.0368	0.3685	0.0411
128	-30.139	2.878	-129.731	0.0794	0.6882	0.0492
129	-32.704	3.467	-131.145	0.086	0.7332	0.0523
130	-35.091	4.574	-132.211	0.0916	0.7753	0.0592
139	-43.728	8.699	-132.504	0.0998	0.9014	0.0705
140	-48.391	9.197	-126.863	0.1007	0.9863	0.0795
150	-81.028	0	-38.968	0.0481	1.1196	0.1792
158	-105.697	-13.484	19.268	0.0083	0.7704	0.2503
159	-110.307	-15.13	22.846	0.0031	0.6477	0.2526
160	-115.256	-15.82	21.773	-0.0018	0.5183	0.2533
168	-115.256	-15.82	-21.773	0.0018	-0.5183	0.2533
169	-110.307	-15.13	-22.846	-0.0031	-0.6477	0.2526
170	-105.697	-13.484	-19.268	-0.0082	-0.7704	0.2503
180	-81.028	0	38.968	-0.0481	-1.1196	0.1792

Possible Approach:
Expansion Loop Dimension B: 7100mm C: 3100mm

188	-48.391	9.197	126.863	-0.1007	-0.9863	0.0795
189	-43.728	8.699	132.504	-0.0998	-0.9014	0.0705
190	-38.317	6.495	133.417	-0.0942	-0.8183	0.0552
199	-32.704	3.467	131.145	-0.086	-0.7332	0.0523
200	-30.139	2.878	129.731	-0.0794	-0.6882	0.0492
210	-3	0	108.232	-0.0368	-0.3685	0.0411
220	10.233	0	54.111	0.0091	0.0741	0.0205
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28

From 30 To 40 DY= 1,066.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -1,066.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 79
---------------------------------------------------------------------------
From  80  To  85 DZ= -4,250.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
  Node  110  +Y   Mu = .30
---------------------------------------------------------------------------
```

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 129
Angle/Node @2= .00 128

From 130 To 140 DY= 1,066.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -1,066.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 199

From 200 To 210 DZ= -4,250.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS
Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 79
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
159 Angle/Node @2= .00 158
160 170 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
169 Angle/Node @2= .00 168

```
 180        190          Radius= 533.400 mm. (LONG)
                       Bend Angle= 90.000   Angle/Node @1= 45.00
                     189   Angle/Node @2= .00 188
 190        200          Radius= 533.400 mm. (LONG)
                       Bend Angle= 90.000   Angle/Node @1= 45.00
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	FRICTION	Len / YIELD	MU / Dir	Vectors
10	ANC			.30	.000	.000			.000
15	+Y			.30	.000	1.000			.000
20	Guide			3.00	.30	.000	.000		.000
20	+Y			.30	.000	1.000			.000
45	+Y			.30	.000	1.000			.000
65	+Y			.30	.000	1.000			.000
85	Guide			3.00	.30	.000	.000		.000
85	+Y			.30	.000	1.000			.000
90	+Y			.30	.000	1.000			.000
100	ANC			.30	.000	.000			.000
110	+Y			.30	.000	1.000			.000
120	+Y			.30	.000	1.000			.000
120	Guide			3.00	.30	.000	.000		.000
150	+Y			.30	.000	1.000			.000
180	+Y			.30	.000	1.000			.000
210	+Y			.30	.000	1.000			.000
210	Guide			3.00	.30	.000	.000		.000
220	+Y			.30	.000	1.000			.000
230	ANC			.30	.000	.000			.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
TRANSL. STIF	lbs./in.	x	1.751	= N./cm.
ROTATIONAL STIF	in.lb./deg.	x	0.113	= N.m./deg
UNIFORM LOAD	lb./in.	x	1.751	= N./cm.
G LOAD	g's	x	1.000	= g's

WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO
B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT

ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000
Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1066mm

COORDINATE REPORT

NODE	X (mm.)	Y (mm.)	Z (mm.)
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-19250.000
40	.000	1066.000	-19250.000
45	-5052.000	1066.000	-19250.000
50	-9000.000	1066.000	-19250.000
60	-9000.000	1066.000	-25750.000
65	-5052.000	1066.000	-25750.000
70	.000	1066.000	-25750.000
80	.000	.000	-25750.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-64250.000
140	.000	1066.000	-64250.000
150	-5052.000	1066.000	-64250.000
160	-9000.000	1066.000	-64250.000
170	-9000.000	1066.000	-70750.000
180	-5052.000	1066.000	-70750.000
190	.000	1066.000	-70750.000
200	.000	.000	-70750.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43888.3 Allowable Stress: 63326.2
Axial Stress: 17829.4 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 115808.3 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 38934.8 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 136896.1 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	40689.2	0	0	15	31296.2	0	0	B31.3
2(SUS)		24046.9	63326.2	38		23708.5	63326.2	37.4	B31.3
3(EXP)		25470.9	227479.8	11.2		14444	227818.2	6.3	B31.3
1(OPE)	15	31546.3	0	0	20	72220.9	0	0	B31.3
2(SUS)		23708.7	63326.2	37.4		24877.9	63326.2	39.3	B31.3
3(EXP)		14444	227817.9	6.3		56496.2	226648.8	24.9	B31.3
1(OPE)	20	72434.7	0	0	28	91960.2	0	0	B31.3
2(SUS)		24878.4	63326.2	39.3		18103	63326.2	28.6	B31.3
3(EXP)		56496.2	226648.3	24.9		76846.1	233423.7	32.9	B31.3
1(OPE)	28	91960.2	0	0	29	93587	0	0	B31.3
2(SUS)		18103	63326.2	28.6		18731.2	63326.2	29.6	B31.3
3(EXP)		76846.1	233423.7	32.9		78271.3	232795.5	33.6	B31.3
1(OPE)	29	93587	0	0	30	94593.6	0	0	B31.3
2(SUS)		18731.2	63326.2	29.6		18871.9	63326.2	29.8	B31.3
3(EXP)		78271.3	232795.5	33.6		78225.8	232654.7	33.6	B31.3
1(OPE)	30	94593.6	0	0	39	90968.2	0	0	B31.3
2(SUS)		18871.9	63326.2	29.8		18927.8	63326.2	29.9	B31.3
3(EXP)		78225.8	232654.7	33.6		74775.5	232598.8	32.1	B31.3
1(OPE)	39	90968.2	0	0	40	82828.1	0	0	B31.3
2(SUS)		18927.8	63326.2	29.9		18350.3	63326.2	29	B31.3
3(EXP)		74775.5	232598.8	32.1		66645.2	233176.4	28.6	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1066mm

1(OPE)	40	82828.1	0	0	45	61681	0	0	B31.3
2(SUS)		18350.3	63326.2	29		43888.3	63326.2	69.3	B31.3
3(EXP)		66645.2	233176.4	28.6		36304.7	207638.3	17.5	B31.3
1(OPE)	45	62020.1	0	0	48	122161.5	0	0	B31.3
2(SUS)		43855.5	63326.2	69.3		20000.4	63326.2	31.6	B31.3
3(EXP)		36304.7	207671.1	17.5		105027	231526.3	45.4	B31.3
1(OPE)	48	122161.5	0	0	49	128664.7	0	0	B31.3
2(SUS)		20000.4	63326.2	31.6		17959.3	63326.2	28.4	B31.3
3(EXP)		105027	231526.3	45.4		112650.1	233567.3	48.2	B31.3
1(OPE)	49	128664.7	0	0	50	131312.2	0	0	B31.3
2(SUS)		17959.3	63326.2	28.4		19442	63326.2	30.7	B31.3
3(EXP)		112650.1	233567.3	48.2		115808.3	232084.7	49.9	B31.3
1(OPE)	50	131312.2	0	0	59	128664.7	0	0	B31.3
2(SUS)		19442	63326.2	30.7		17959.3	63326.2	28.4	B31.3
3(EXP)		115808.3	232084.7	49.9		112650.1	233567.3	48.2	B31.3
1(OPE)	59	128664.7	0	0	60	122161.5	0	0	B31.3
2(SUS)		17959.3	63326.2	28.4		20000.4	63326.2	31.6	B31.3
3(EXP)		112650.1	233567.3	48.2		105027	231526.3	45.4	B31.3
1(OPE)	60	122161.5	0	0	65	62020.1	0	0	B31.3
2(SUS)		20000.4	63326.2	31.6		43855.5	63326.2	69.3	B31.3
3(EXP)		105027	231526.3	45.4		36304.7	207671.1	17.5	B31.3
1(OPE)	65	61681	0	0	68	82828.1	0	0	B31.3
2(SUS)		43888.3	63326.2	69.3		18350.3	63326.2	29	B31.3
3(EXP)		36304.7	207638.3	17.5		66645.2	233176.4	28.6	B31.3
1(OPE)	68	82828.1	0	0	69	90968.2	0	0	B31.3
2(SUS)		18350.3	63326.2	29		18927.8	63326.2	29.9	B31.3
3(EXP)		66645.2	233176.4	28.6		74775.5	232598.8	32.1	B31.3
1(OPE)	69	90968.2	0	0	70	94593.6	0	0	B31.3
2(SUS)		18927.8	63326.2	29.9		18871.9	63326.2	29.8	B31.3
3(EXP)		74775.5	232598.8	32.1		78225.8	232654.7	33.6	B31.3
1(OPE)	70	94593.6	0	0	79	93587	0	0	B31.3
2(SUS)		18871.9	63326.2	29.8		18731.2	63326.2	29.6	B31.3
3(EXP)		78225.8	232654.7	33.6		78271.3	232795.5	33.6	B31.3
1(OPE)	79	93587	0	0	80	91960.2	0	0	B31.3
2(SUS)		18731.2	63326.2	29.6		18103	63326.2	28.6	B31.3
3(EXP)		78271.3	232795.5	33.6		76846.1	233423.7	32.9	B31.3
1(OPE)	80	91960.2	0	0	85	72434.7	0	0	B31.3
2(SUS)		18103	63326.2	28.6		24878.4	63326.2	39.3	B31.3
3(EXP)		76846.1	233423.7	32.9		56496.2	226648.3	24.9	B31.3
1(OPE)	85	72220.9	0	0	90	31546.3	0	0	B31.3
2(SUS)		24877.9	63326.2	39.3		23708.7	63326.2	37.4	B31.3
3(EXP)		56496.2	226648.7	24.9		14444	227818	6.3	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1066mm

1(OPE)	90	31296.2	0	0	100	40689.3	0	0	B31.3
2(SUS)		23708.5	63326.2	37.4		24046.9	63326.2	38	B31.3
3(EXP)		14444	227818.2	6.3		25471	227479.7	11.2	B31.3
1(OPE)	100	40689.3	0	0	110	31296.2	0	0	B31.3
2(SUS)		24046.9	63326.2	38		23708.5	63326.2	37.4	B31.3
3(EXP)		25471	227479.7	11.2		14444	227818.2	6.3	B31.3
1(OPE)	110	31546.3	0	0	120	72221	0	0	B31.3
2(SUS)		23708.7	63326.2	37.4		24877.9	63326.2	39.3	B31.3
3(EXP)		14444	227818	6.3		56496.2	226648.8	24.9	B31.3
1(OPE)	120	72434.7	0	0	128	91960.2	0	0	B31.3
2(SUS)		24878.4	63326.2	39.3		18103	63326.2	28.6	B31.3
3(EXP)		56496.2	226648.3	24.9		76846.1	233423.7	32.9	B31.3
1(OPE)	128	91960.2	0	0	129	93587	0	0	B31.3
2(SUS)		18103	63326.2	28.6		18731.2	63326.2	29.6	B31.3
3(EXP)		76846.1	233423.7	32.9		78271.3	232795.5	33.6	B31.3
1(OPE)	129	93587	0	0	130	94593.6	0	0	B31.3
2(SUS)		18731.2	63326.2	29.6		18871.9	63326.2	29.8	B31.3
3(EXP)		78271.3	232795.5	33.6		78225.8	232654.7	33.6	B31.3
1(OPE)	130	94593.6	0	0	139	90968.3	0	0	B31.3
2(SUS)		18871.9	63326.2	29.8		18927.8	63326.2	29.9	B31.3
3(EXP)		78225.8	232654.7	33.6		74775.5	232598.8	32.1	B31.3
1(OPE)	139	90968.3	0	0	140	82828.1	0	0	B31.3
2(SUS)		18927.8	63326.2	29.9		18350.3	63326.2	29	B31.3
3(EXP)		74775.5	232598.8	32.1		66645.2	233176.4	28.6	B31.3
1(OPE)	140	82828.1	0	0	150	61681	0	0	B31.3
2(SUS)		18350.3	63326.2	29		43888.3	63326.2	69.3	B31.3
3(EXP)		66645.2	233176.4	28.6		36304.7	207638.3	17.5	B31.3
1(OPE)	150	62020.1	0	0	158	122161.5	0	0	B31.3
2(SUS)		43855.5	63326.2	69.3		20000.4	63326.2	31.6	B31.3
3(EXP)		36304.7	207671.1	17.5		105027	231526.3	45.4	B31.3
1(OPE)	158	122161.5	0	0	159	128664.7	0	0	B31.3
2(SUS)		20000.4	63326.2	31.6		17959.3	63326.2	28.4	B31.3
3(EXP)		105027	231526.3	45.4		112650.1	233567.3	48.2	B31.3
1(OPE)	159	128664.7	0	0	160	131312.2	0	0	B31.3
2(SUS)		17959.3	63326.2	28.4		19442	63326.2	30.7	B31.3
3(EXP)		112650.1	233567.3	48.2		115808.3	232084.7	49.9	B31.3
1(OPE)	160	131312.2	0	0	168	131312.2	0	0	B31.3
2(SUS)		19442	63326.2	30.7		19442	63326.2	30.7	B31.3
3(EXP)		115808.3	232084.7	49.9		115808.3	232084.7	49.9	B31.3
1(OPE)	168	131312.2	0	0	169	128664.7	0	0	B31.3
2(SUS)		19442	63326.2	30.7		17959.3	63326.2	28.4	B31.3
3(EXP)		115808.3	232084.7	49.9		112650.1	233567.3	48.2	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1066mm

1(OPE)	169	128664.7	0	0	170	122161.5	0	0	B31.3
2(SUS)		17959.3	63326.2	28.4		20000.4	63326.2	31.6	B31.3
3(EXP)		112650.1	233567.3	48.2		105027	231526.3	45.4	B31.3
1(OPE)	170	122161.5	0	0	180	62020.1	0	0	B31.3
2(SUS)		20000.4	63326.2	31.6		43855.5	63326.2	69.3	B31.3
3(EXP)		105027	231526.3	45.4		36304.7	207671.1	17.5	B31.3
1(OPE)	180	61681	0	0	188	82828.1	0	0	B31.3
2(SUS)		43888.3	63326.2	69.3		18350.3	63326.2	29	B31.3
3(EXP)		36304.7	207638.3	17.5		66645.2	233176.4	28.6	B31.3
1(OPE)	188	82828.1	0	0	189	90968.2	0	0	B31.3
2(SUS)		18350.3	63326.2	29		18927.8	63326.2	29.9	B31.3
3(EXP)		66645.2	233176.4	28.6		74775.5	232598.8	32.1	B31.3
1(OPE)	189	90968.2	0	0	190	94593.6	0	0	B31.3
2(SUS)		18927.8	63326.2	29.9		18871.9	63326.2	29.8	B31.3
3(EXP)		74775.5	232598.8	32.1		78225.8	232654.7	33.6	B31.3
1(OPE)	190	94593.6	0	0	199	93586.9	0	0	B31.3
2(SUS)		18871.9	63326.2	29.8		18731.2	63326.2	29.6	B31.3
3(EXP)		78225.8	232654.7	33.6		78271.3	232795.5	33.6	B31.3
1(OPE)	199	93586.9	0	0	200	91960.2	0	0	B31.3
2(SUS)		18731.2	63326.2	29.6		18103	63326.2	28.6	B31.3
3(EXP)		78271.3	232795.5	33.6		76846.1	233423.7	32.9	B31.3
1(OPE)	200	91960.2	0	0	210	72434.7	0	0	B31.3
2(SUS)		18103	63326.2	28.6		24878.4	63326.2	39.3	B31.3
3(EXP)		76846.1	233423.7	32.9		56496.2	226648.3	24.9	B31.3
1(OPE)	210	72221	0	0	220	31546.3	0	0	B31.3
2(SUS)		24877.9	63326.2	39.3		23708.7	63326.2	37.4	B31.3
3(EXP)		56496.2	226648.8	24.9		14444	227817.9	6.3	B31.3
1(OPE)	220	31296.2	0	0	230	40689.2	0	0	B31.3
2(SUS)		23708.5	63326.2	37.4		24046.9	63326.2	38	B31.3
3(EXP)		14444	227818.2	6.3		25471	227479.8	11.2	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14926	-12646	83917	-13923	-72701	5485	0	0	0
	2(SUS)	-195	-14306	-58	-18044	466	-2033	0	0	0
	3(EXP)	15121	1660	83976	4121	-73167	7518	0	0	0
	MAX	15121/L3	-14306/L	83976/L	-18044/L	-73167/L	7518/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1746	-34524	-10209	0	0	0	9.252	0	-54.111
	2(SUS)	835	-27816	-9	0	0	0	0.005	0	0
	3(EXP)	911	-6708	-10200	0	0	0	9.247	0	-54.111
	MAX	1746/L1	-34524/L	-10209/L1				9.252/L1	-0.000/L1	-54.111/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2777	-26707	-8775	0	0	0	-3	0	-108.231
	2(SUS)	-1958	-27053	-19	0	0	0	-0.011	0	0
	3(EXP)	-819	346	-8756	0	0	0	-2.989	0	-108.231
	MAX	-2777/L1	-27053/L	-8775/L1				-3.000/L1	-0.000/L2	-108.231/L1
45		Rigid +Y								
	1(OPE)	-12592	-46622	-6088	0	0	0	-81.771	0	-39.537
	2(SUS)	1318	-51324	-304	0	0	0	0.008	0	-0.002
	3(EXP)	-13910	4702	-5785	0	0	0	-81.778	0	-39.536
	MAX	-13910/L	-51324/L	-6088/L1				-81.778/L	-0.000/L2	-39.537/L1
65		Rigid +Y								
	1(OPE)	-12592	-46622	6088	0	0	0	-81.771	0	39.537
	2(SUS)	1318	-51324	304	0	0	0	0.008	0	0.002
	3(EXP)	-13910	4702	5785	0	0	0	-81.778	0	39.536
	MAX	-13910/L	-51324/L	6088/L1				-81.778/L	-0.000/L2	39.537/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2777	-26707	8776	0	0	0	-3	0	108.231
	2(SUS)	-1958	-27053	19	0	0	0	-0.011	0	0
	3(EXP)	-819	346	8756	0	0	0	-2.989	0	108.231
	MAX	-2777/L1	-27053/L	8776/L1				-3.000/L1	-0.000/L2	108.231/L1
90		Rigid +Y								
	1(OPE)	1746	-34524	10209	0	0	0	9.252	0	54.111
	2(SUS)	835	-27816	9	0	0	0	0.005	0	0
	3(EXP)	911	-6708	10200	0	0	0	9.247	0	54.111
	MAX	1746/L1	-34524/L	10209/L1				9.252/L1	-0.000/L1	54.111/L1
100		Rigid ANC								
	1(OPE)	29852	-25292	0	0	0	10970	0	0	0
	2(SUS)	-390	-28611	0	0	0	-4067	0	0	0
	3(EXP)	30242	3319	0	0	0	15037	0	0	0
	MAX	30242/L3	-28611/L	-0/L1	0/L1	-0/L1	15037/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1746	-34524	-10209	0	0	0	9.252	0	-54.111
	2(SUS)	835	-27816	-9	0	0	0	0.005	0	0
	3(EXP)	911	-6708	-10200	0	0	0	9.247	0	-54.111
	MAX	1746/L1	-34524/L	-10209/L1				9.252/L1	-0.000/L1	-54.111/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2777	-26707	-8775	0	0	0	-3	0	-108.231
	2(SUS)	-1958	-27053	-19	0	0	0	-0.011	0	0
	3(EXP)	-819	346	-8756	0	0	0	-2.989	0	-108.231
	MAX	-2777/L1	-27053/L	-8775/L1				-3.000/L1	-0.000/L2	-108.231/L1
150		Rigid +Y								
	1(OPE)	-12592	-46622	-6088	0	0	0	-81.771	0	-39.537
	2(SUS)	1318	-51324	-304	0	0	0	0.008	0	-0.002
	3(EXP)	-13910	4702	-5785	0	0	0	-81.778	0	-39.536
	MAX	-13910/L	-51324/L	-6088/L1				-81.778/L	-0.000/L2	-39.537/L1
180		Rigid +Y								
	1(OPE)	-12592	-46622	6088	0	0	0	-81.771	0	39.537
	2(SUS)	1318	-51324	304	0	0	0	0.008	0	0.002
	3(EXP)	-13910	4702	5785	0	0	0	-81.778	0	39.536
	MAX	-13910/L	-51324/L	6088/L1				-81.778/L	-0.000/L2	39.537/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2777	-26707	8775	0	0	0	-3	0	108.231
	2(SUS)	-1958	-27053	19	0	0	0	-0.011	0	0
	3(EXP)	-819	346	8756	0	0	0	-2.989	0	108.231
	MAX	-2777/L1	-27053/L	8775/L1				-3.000/L1	-0.000/L2	108.231/L1
220		Rigid +Y								
	1(OPE)	1746	-34524	10209	0	0	0	9.252	0	54.111
	2(SUS)	835	-27816	9	0	0	0	0.005	0	0
	3(EXP)	911	-6708	10200	0	0	0	9.247	0	54.111
	MAX	1746/L1	-34524/L	10209/L1				9.252/L1	-0.000/L1	54.111/L1
230		Rigid ANC								
	1(OPE)	14926	-12646	-83917	13923	72701	5485	0	0	0
	2(SUS)	-195	-14306	58	18044	-466	-2033	0	0	0
	3(EXP)	15121	1660	-83976	-4121	73167	7518	0	0	0
	MAX	15121/L1	-14306/L	-83976/L	18044/L1	73167/L1	7518/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.247	0	-54.111	-0.0083	-0.0653	0.0385
20	-2.989	0	-108.231	0.0337	0.3329	0.0771
28	-35.981	4.43	-135.054	0.1089	0.7039	0.0961
29	-41.157	6.336	-137.443	0.1268	0.7881	0.1069
30	-44.125	9.423	-137.68	0.1379	0.8575	0.12
39	-46.062	11.809	-134.272	0.1469	0.9255	0.1274
40	-49.141	12.069	-127.492	0.1495	1.0024	0.136
45	-81.778	0	-39.536	0.0883	1.1068	0.1613
48	-106.447	-9.615	17.411	0.0421	0.7401	0.1613
49	-110.968	-10.575	20.777	0.036	0.6135	0.1621
50	-115.679	-10.806	19.608	0.0285	0.4803	0.1628
59	-110.968	-10.575	-20.777	-0.036	-0.6135	0.1621
60	-106.447	-9.615	-17.411	-0.0421	-0.7401	0.1613
65	-81.778	0	39.536	-0.0883	-1.1068	0.1613
68	-49.141	12.069	127.492	-0.1495	-1.0024	0.136
69	-46.062	11.809	134.272	-0.1469	-0.9255	0.1274
70	-44.125	9.423	137.68	-0.1379	-0.8575	0.12
79	-41.157	6.336	137.443	-0.1268	-0.7881	0.1069
80	-35.981	4.43	135.054	-0.1089	-0.7039	0.0961
85	-2.989	0	108.231	-0.0337	-0.3329	0.0771
90	9.247	0	54.111	0.0083	0.0653	0.0385
100	0	0	0	0	0	0
110	9.247	0	-54.111	-0.0083	-0.0653	0.0385
120	-2.989	0	-108.231	0.0337	0.3329	0.0771
128	-35.981	4.43	-135.054	0.1089	0.7039	0.0961
129	-41.157	6.336	-137.443	0.1268	0.7881	0.1069
130	-44.125	9.423	-137.68	0.1379	0.8575	0.12
139	-46.062	11.809	-134.272	0.1469	0.9255	0.1274
140	-49.141	12.069	-127.492	0.1495	1.0024	0.136
150	-81.778	0	-39.536	0.0883	1.1068	0.1613
158	-106.447	-9.615	17.411	0.0421	0.7401	0.1613
159	-110.968	-10.575	20.777	0.036	0.6135	0.1621
160	-115.679	-10.806	19.608	0.0285	0.4803	0.1628
168	-115.679	-10.806	-19.608	-0.0285	-0.4803	0.1628
169	-110.968	-10.575	-20.777	-0.036	-0.6135	0.1621
170	-106.447	-9.615	-17.411	-0.0421	-0.7401	0.1613
180	-81.778	0	39.536	-0.0883	-1.1068	0.1613
188	-49.141	12.069	127.492	-0.1495	-1.0024	0.136
189	-46.062	11.809	134.272	-0.1469	-0.9255	0.1274

190	-44.125	9.423	137.68	-0.1379	-0.8575	0.12
199	-41.157	6.336	137.443	-0.1268	-0.7881	0.1069
200	-35.981	4.43	135.054	-0.1089	-0.7039	0.0961
210	-2.989	0	108.231	-0.0337	-0.3329	0.0771
220	9.247	0	54.111	0.0083	0.0653	0.0385
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.005	0	0	0.0007	-0.0011	-0.0104
20	-0.011	0	0	-0.0027	0.0045	-0.0208
28	-0.445	-0.756	0	-0.0136	0.0072	-0.026
29	-0.419	-0.845	-0.037	-0.0137	0.0066	-0.0267
30	-0.257	-0.883	-0.128	-0.0141	0.006	-0.0277
39	-0.071	-0.805	-0.208	-0.0146	0.0054	-0.0288
40	0.008	-0.611	-0.215	-0.015	0.0046	-0.0293
45	0.008	0	-0.002	-0.0186	0.0009	0.0445
48	0.008	-5.283	0.003	-0.0213	-0.0003	0.111
49	0.008	-6.081	0.001	-0.0215	-0.0003	0.1126
50	0.01	-6.53	0	-0.0205	-0.0003	0.1127
59	0.008	-6.081	-0.001	0.0215	0.0003	0.1126
60	0.008	-5.283	-0.003	0.0213	0.0003	0.111
65	0.008	0	0.002	0.0186	-0.0009	0.0445
68	0.008	-0.611	0.215	0.015	-0.0046	-0.0293
69	-0.071	-0.805	0.208	0.0146	-0.0054	-0.0288
70	-0.257	-0.883	0.128	0.0141	-0.006	-0.0277
79	-0.419	-0.845	0.037	0.0137	-0.0066	-0.0267
80	-0.445	-0.756	0	0.0136	-0.0072	-0.026
85	-0.011	0	0	0.0027	-0.0045	-0.0208
90	0.005	0	0	-0.0007	0.0011	-0.0104
100	0	0	0	0	0	0
110	0.005	0	0	0.0007	-0.0011	-0.0104
120	-0.011	0	0	-0.0027	0.0045	-0.0208
128	-0.445	-0.756	0	-0.0136	0.0072	-0.026
129	-0.419	-0.845	-0.037	-0.0137	0.0066	-0.0267
130	-0.257	-0.883	-0.128	-0.0141	0.006	-0.0277
139	-0.071	-0.805	-0.208	-0.0146	0.0054	-0.0288
140	0.008	-0.611	-0.215	-0.015	0.0046	-0.0293
150	0.008	0	-0.002	-0.0186	0.0009	0.0445
158	0.008	-5.283	0.003	-0.0213	-0.0003	0.111
159	0.008	-6.081	0.001	-0.0215	-0.0003	0.1126
160	0.01	-6.53	0	-0.0205	-0.0003	0.1127
168	0.01	-6.53	0	0.0205	0.0003	0.1127
169	0.008	-6.081	-0.001	0.0215	0.0003	0.1126
170	0.008	-5.283	-0.003	0.0213	0.0003	0.111
180	0.008	0	0.002	0.0186	-0.0009	0.0445
188	0.008	-0.611	0.215	0.015	-0.0046	-0.0293
189	-0.071	-0.805	0.208	0.0146	-0.0054	-0.0288

190	-0.257	-0.883	0.128	0.0141	-0.006	-0.0277
199	-0.419	-0.845	0.037	0.0137	-0.0066	-0.0267
200	-0.445	-0.756	0	0.0136	-0.0072	-0.026
210	-0.011	0	0	0.0027	-0.0045	-0.0208
220	0.005	0	0	-0.0007	0.0011	-0.0104
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: FEB 9, 2015 Time: 11:32
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.252	0	-54.111	-0.0077	-0.0663	0.0281
20	-3	0	-108.231	0.031	0.3374	0.0562
28	-36.426	3.674	-135.054	0.0953	0.7111	0.0701
29	-41.576	5.491	-137.481	0.1131	0.7947	0.0802
30	-44.382	8.541	-137.809	0.1238	0.8635	0.0922
39	-46.134	11.004	-134.48	0.1322	0.9309	0.0986
40	-49.133	11.458	-127.707	0.1345	1.007	0.1067
45	-81.771	0	-39.537	0.0698	1.1078	0.2058
48	-106.44	-14.898	17.414	0.0208	0.7397	0.2723
49	-110.96	-16.656	20.778	0.0145	0.6132	0.2746
50	-115.668	-17.336	19.608	0.008	0.4801	0.2755
59	-110.96	-16.656	-20.778	-0.0145	-0.6132	0.2746
60	-106.44	-14.898	-17.414	-0.0208	-0.7397	0.2723
65	-81.771	0	39.537	-0.0698	-1.1078	0.2058
68	-49.133	11.458	127.707	-0.1345	-1.007	0.1067
69	-46.134	11.004	134.48	-0.1322	-0.9309	0.0986
70	-44.382	8.541	137.809	-0.1238	-0.8635	0.0922
79	-41.576	5.491	137.481	-0.1131	-0.7947	0.0802
80	-36.426	3.674	135.054	-0.0953	-0.7111	0.0701
85	-3	0	108.231	-0.031	-0.3374	0.0562
90	9.252	0	54.111	0.0077	0.0663	0.0281
100	0	0	0	0	0	0
110	9.252	0	-54.111	-0.0077	-0.0663	0.0281
120	-3	0	-108.231	0.031	0.3374	0.0562
128	-36.426	3.674	-135.054	0.0953	0.7111	0.0701
129	-41.576	5.491	-137.481	0.1131	0.7947	0.0802
130	-44.382	8.541	-137.809	0.1238	0.8634	0.0922
139	-46.134	11.004	-134.48	0.1322	0.9309	0.0986
140	-49.133	11.458	-127.707	0.1345	1.007	0.1067
150	-81.771	0	-39.537	0.0698	1.1078	0.2058
158	-106.44	-14.898	17.414	0.0208	0.7397	0.2723
159	-110.96	-16.656	20.778	0.0145	0.6132	0.2746
160	-115.668	-17.336	19.608	0.008	0.4801	0.2755
168	-115.668	-17.336	-19.608	-0.008	-0.4801	0.2755
169	-110.96	-16.656	-20.778	-0.0145	-0.6132	0.2746
170	-106.44	-14.898	-17.414	-0.0208	-0.7397	0.2723
180	-81.771	0	39.537	-0.0698	-1.1078	0.2058
188	-49.133	11.458	127.707	-0.1345	-1.007	0.1067
189	-46.134	11.004	134.48	-0.1322	-0.9309	0.0986

190	-44.382	8.541	137.809	-0.1238	-0.8634	0.0922
199	-41.576	5.491	137.481	-0.1131	-0.7947	0.0802
200	-36.426	3.674	135.054	-0.0953	-0.7111	0.0701
210	-3	0	108.231	-0.031	-0.3374	0.0562
220	9.252	0	54.111	0.0077	0.0663	0.0281
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28

From 30 To 40 DY= 1,166.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -1,166.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 79
-------------------------------------------------------------------------------
From  80  To  85 DZ= -4,250.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
-------------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
-------------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
  Node  110  +Y   Mu = .30
-------------------------------------------------------------------------------
```

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 129
Angle/Node @2= .00 128

From 130 To 140 DY= 1,166.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -1,166.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 199

From 200 To 210 DZ= -4,250.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS
Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 79
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
159 Angle/Node @2= .00 158
160 170 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
169 Angle/Node @2= .00 168

```
 180        190          Radius= 533.400 mm. (LONG)
                       Bend Angle= 90.000   Angle/Node @1= 45.00
                     189   Angle/Node @2= .00 188
 190        200          Radius= 533.400 mm. (LONG)
                       Bend Angle= 90.000   Angle/Node @1= 45.00
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	FRICTION	Len / YIELD	MU / Dir	Vectors
10	ANC			.30	.000	.000			.000
15	+Y			.30	.000	1.000			.000
20	Guide			3.00	.30	.000	.000		.000
20	+Y			.30	.000	1.000			.000
45	+Y			.30	.000	1.000			.000
65	+Y			.30	.000	1.000			.000
85	Guide			3.00	.30	.000	.000		.000
85	+Y			.30	.000	1.000			.000
90	+Y			.30	.000	1.000			.000
100	ANC			.30	.000	.000			.000
110	+Y			.30	.000	1.000			.000
120	+Y			.30	.000	1.000			.000
120	Guide			3.00	.30	.000	.000		.000
150	+Y			.30	.000	1.000			.000
180	+Y			.30	.000	1.000			.000
210	+Y			.30	.000	1.000			.000
210	Guide			3.00	.30	.000	.000		.000
220	+Y			.30	.000	1.000			.000
230	ANC			.30	.000	.000			.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
TRANSL. STIF	lbs./in.	x	1.751	= N./cm.
ROTATIONAL STIF	in.lb./deg.	x	0.113	= N.m./deg
UNIFORM LOAD	lb./in.	x	1.751	= N./cm.
G LOAD	g's	x	1.000	= g's

WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO
B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1166mm

ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000
Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1166mm

COORDINATE REPORT

NODE	X (mm.)	Y (mm.)	Z (mm.)
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-19250.000
40	.000	1166.000	-19250.000
45	-5052.000	1166.000	-19250.000
50	-9000.000	1166.000	-19250.000
60	-9000.000	1166.000	-25750.000
65	-5052.000	1166.000	-25750.000
70	.000	1166.000	-25750.000
80	.000	.000	-25750.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-64250.000
140	.000	1166.000	-64250.000
150	-5052.000	1166.000	-64250.000
160	-9000.000	1166.000	-64250.000
170	-9000.000	1166.000	-70750.000
180	-5052.000	1166.000	-70750.000
190	.000	1166.000	-70750.000
200	.000	.000	-70750.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43893.8 Allowable Stress: 63326.2
Axial Stress: 17832.6 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 115370.0 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 38346.5 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 136409.4 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	40332.1	0	0	15	31251.1	0	0	B31.3
2(SUS)		24096.1	63326.2	38.1		23611.2	63326.2	37.3	B31.3
3(EXP)		25148	227430.5	11.1		14401.3	227915.4	6.3	B31.3
1(OPE)	15	31503.4	0	0	20	71487.5	0	0	B31.3
2(SUS)		23611.3	63326.2	37.3		25255.5	63326.2	39.9	B31.3
3(EXP)		14401.3	227915.4	6.3		55735.8	226271.2	24.6	B31.3
1(OPE)	20	71705	0	0	28	91184	0	0	B31.3
2(SUS)		25255.5	63326.2	39.9		18105	63326.2	28.6	B31.3
3(EXP)		55735.8	226271.1	24.6		76034.2	233421.7	32.6	B31.3
1(OPE)	28	91184	0	0	29	92711.9	0	0	B31.3
2(SUS)		18105	63326.2	28.6		18733.1	63326.2	29.6	B31.3
3(EXP)		76034.2	233421.7	32.6		77394	232793.6	33.2	B31.3
1(OPE)	29	92711.9	0	0	30	93520.8	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		18874.2	63326.2	29.8	B31.3
3(EXP)		77394	232793.6	33.2		77188.8	232652.5	33.2	B31.3
1(OPE)	30	93520.8	0	0	39	89897.2	0	0	B31.3
2(SUS)		18874.2	63326.2	29.8		18985.5	63326.2	30	B31.3
3(EXP)		77188.8	232652.5	33.2		73741.1	232541.1	31.7	B31.3
1(OPE)	39	89897.2	0	0	40	81886.7	0	0	B31.3
2(SUS)		18985.5	63326.2	30		18377.5	63326.2	29	B31.3
3(EXP)		73741.1	232541.1	31.7		65739	233149.1	28.2	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1166mm

1(OPE)	40	81886.7	0	0	45	61864.6	0	0	B31.3
2(SUS)		18377.5	63326.2	29		43893.8	63326.2	69.3	B31.3
3(EXP)		65739	233149.1	28.2		36390.3	207632.9	17.5	B31.3
1(OPE)	45	62197	0	0	48	121788.6	0	0	B31.3
2(SUS)		43858	63326.2	69.3		19999	63326.2	31.6	B31.3
3(EXP)		36390.3	207668.7	17.5		104653.3	231527.7	45.2	B31.3
1(OPE)	48	121788.6	0	0	49	128235.5	0	0	B31.3
2(SUS)		19999	63326.2	31.6		17911.3	63326.2	28.3	B31.3
3(EXP)		104653.3	231527.7	45.2		112230.6	233615.3	48	B31.3
1(OPE)	49	128235.5	0	0	50	130855.1	0	0	B31.3
2(SUS)		17911.3	63326.2	28.3		19524.7	63326.2	30.8	B31.3
3(EXP)		112230.6	233615.3	48		115370	232001.9	49.7	B31.3
1(OPE)	50	130855.1	0	0	59	128235.5	0	0	B31.3
2(SUS)		19524.7	63326.2	30.8		17911.3	63326.2	28.3	B31.3
3(EXP)		115370	232001.9	49.7		112230.6	233615.3	48	B31.3
1(OPE)	59	128235.5	0	0	60	121788.6	0	0	B31.3
2(SUS)		17911.3	63326.2	28.3		19999	63326.2	31.6	B31.3
3(EXP)		112230.6	233615.3	48		104653.3	231527.7	45.2	B31.3
1(OPE)	60	121788.6	0	0	65	62197	0	0	B31.3
2(SUS)		19999	63326.2	31.6		43858	63326.2	69.3	B31.3
3(EXP)		104653.3	231527.7	45.2		36390.3	207668.7	17.5	B31.3
1(OPE)	65	61864.6	0	0	68	81886.7	0	0	B31.3
2(SUS)		43893.8	63326.2	69.3		18377.5	63326.2	29	B31.3
3(EXP)		36390.3	207632.9	17.5		65739	233149.1	28.2	B31.3
1(OPE)	68	81886.7	0	0	69	89897.2	0	0	B31.3
2(SUS)		18377.5	63326.2	29		18985.5	63326.2	30	B31.3
3(EXP)		65739	233149.1	28.2		73741.1	232541.1	31.7	B31.3
1(OPE)	69	89897.2	0	0	70	93408	0	0	B31.3
2(SUS)		18985.5	63326.2	30		18931.1	63326.2	29.9	B31.3
3(EXP)		73741.1	232541.1	31.7		77068.7	232595.5	33.1	B31.3
1(OPE)	70	93408	0	0	79	92711.9	0	0	B31.3
2(SUS)		18931.1	63326.2	29.9		18733.1	63326.2	29.6	B31.3
3(EXP)		77068.7	232595.5	33.1		77394	232793.6	33.2	B31.3
1(OPE)	79	92711.9	0	0	80	91184	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		18105	63326.2	28.6	B31.3
3(EXP)		77394	232793.6	33.2		76034.2	233421.7	32.6	B31.3
1(OPE)	80	91184	0	0	85	71705	0	0	B31.3
2(SUS)		18105	63326.2	28.6		25255.5	63326.2	39.9	B31.3
3(EXP)		76034.2	233421.7	32.6		55735.8	226271.1	24.6	B31.3
1(OPE)	85	71487.5	0	0	90	31503.3	0	0	B31.3
2(SUS)		25255.5	63326.2	39.9		23611.2	63326.2	37.3	B31.3
3(EXP)		55735.8	226271.2	24.6		14401.3	227915.4	6.3	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1166mm

1(OPE)	90	31251.1	0	0	100	40332.2	0	0	B31.3
2(SUS)		23611.2	63326.2	37.3		24096.2	63326.2	38.1	B31.3
3(EXP)		14401.3	227915.4	6.3		25148.1	227430.5	11.1	B31.3
1(OPE)	100	40332.2	0	0	110	31251.1	0	0	B31.3
2(SUS)		24096.2	63326.2	38.1		23611.2	63326.2	37.3	B31.3
3(EXP)		25148.1	227430.5	11.1		14401.3	227915.4	6.3	B31.3
1(OPE)	110	31503.4	0	0	120	71487.5	0	0	B31.3
2(SUS)		23611.3	63326.2	37.3		25255.5	63326.2	39.9	B31.3
3(EXP)		14401.3	227915.4	6.3		55735.9	226271.2	24.6	B31.3
1(OPE)	120	71705	0	0	128	91184	0	0	B31.3
2(SUS)		25255.5	63326.2	39.9		18105	63326.2	28.6	B31.3
3(EXP)		55735.9	226271.1	24.6		76034.3	233421.7	32.6	B31.3
1(OPE)	128	91184	0	0	129	92711.9	0	0	B31.3
2(SUS)		18105	63326.2	28.6		18733.1	63326.2	29.6	B31.3
3(EXP)		76034.3	233421.7	32.6		77394	232793.6	33.2	B31.3
1(OPE)	129	92711.9	0	0	130	93520.8	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		18874.2	63326.2	29.8	B31.3
3(EXP)		77394	232793.6	33.2		77188.8	232652.5	33.2	B31.3
1(OPE)	130	93520.8	0	0	139	89897.2	0	0	B31.3
2(SUS)		18874.2	63326.2	29.8		18985.5	63326.2	30	B31.3
3(EXP)		77188.8	232652.5	33.2		73741.1	232541.1	31.7	B31.3
1(OPE)	139	89897.2	0	0	140	81886.7	0	0	B31.3
2(SUS)		18985.5	63326.2	30		18377.5	63326.2	29	B31.3
3(EXP)		73741.1	232541.1	31.7		65739	233149.1	28.2	B31.3
1(OPE)	140	81886.7	0	0	150	61864.6	0	0	B31.3
2(SUS)		18377.5	63326.2	29		43893.8	63326.2	69.3	B31.3
3(EXP)		65739	233149.1	28.2		36390.3	207632.9	17.5	B31.3
1(OPE)	150	62197	0	0	158	121788.6	0	0	B31.3
2(SUS)		43858	63326.2	69.3		19999	63326.2	31.6	B31.3
3(EXP)		36390.3	207668.7	17.5		104653.2	231527.7	45.2	B31.3
1(OPE)	158	121788.6	0	0	159	128235.5	0	0	B31.3
2(SUS)		19999	63326.2	31.6		17911.3	63326.2	28.3	B31.3
3(EXP)		104653.2	231527.7	45.2		112230.6	233615.3	48	B31.3
1(OPE)	159	128235.5	0	0	160	130855.1	0	0	B31.3
2(SUS)		17911.3	63326.2	28.3		19524.7	63326.2	30.8	B31.3
3(EXP)		112230.6	233615.3	48		115370	232001.9	49.7	B31.3
1(OPE)	160	130855.1	0	0	168	130855.1	0	0	B31.3
2(SUS)		19524.7	63326.2	30.8		19524.7	63326.2	30.8	B31.3
3(EXP)		115370	232001.9	49.7		115370	232001.9	49.7	B31.3
1(OPE)	168	130855.1	0	0	169	128235.5	0	0	B31.3
2(SUS)		19524.7	63326.2	30.8		17911.3	63326.2	28.3	B31.3
3(EXP)		115370	232001.9	49.7		112230.6	233615.3	48	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1166mm

1(OPE)	169	128235.5	0	0	170	121788.6	0	0	B31.3
2(SUS)		17911.3	63326.2	28.3		19999	63326.2	31.6	B31.3
3(EXP)		112230.6	233615.3	48		104653.3	231527.7	45.2	B31.3
1(OPE)	170	121788.6	0	0	180	62197	0	0	B31.3
2(SUS)		19999	63326.2	31.6		43858	63326.2	69.3	B31.3
3(EXP)		104653.3	231527.7	45.2		36390.3	207668.7	17.5	B31.3
1(OPE)	180	61864.6	0	0	188	81886.7	0	0	B31.3
2(SUS)		43893.8	63326.2	69.3		18377.5	63326.2	29	B31.3
3(EXP)		36390.3	207632.9	17.5		65739	233149.1	28.2	B31.3
1(OPE)	188	81886.7	0	0	189	89897.2	0	0	B31.3
2(SUS)		18377.5	63326.2	29		18985.5	63326.2	30	B31.3
3(EXP)		65739	233149.1	28.2		73741.1	232541.1	31.7	B31.3
1(OPE)	189	89897.2	0	0	190	93408	0	0	B31.3
2(SUS)		18985.5	63326.2	30		18931.1	63326.2	29.9	B31.3
3(EXP)		73741.1	232541.1	31.7		77068.7	232595.5	33.1	B31.3
1(OPE)	190	93408	0	0	199	92711.9	0	0	B31.3
2(SUS)		18931.1	63326.2	29.9		18733.1	63326.2	29.6	B31.3
3(EXP)		77068.7	232595.5	33.1		77394	232793.6	33.2	B31.3
1(OPE)	199	92711.9	0	0	200	91184	0	0	B31.3
2(SUS)		18733.1	63326.2	29.6		18105	63326.2	28.6	B31.3
3(EXP)		77394	232793.6	33.2		76034.2	233421.7	32.6	B31.3
1(OPE)	200	91184	0	0	210	71705	0	0	B31.3
2(SUS)		18105	63326.2	28.6		25255.5	63326.2	39.9	B31.3
3(EXP)		76034.2	233421.7	32.6		55735.8	226271.1	24.6	B31.3
1(OPE)	210	71487.5	0	0	220	31503.4	0	0	B31.3
2(SUS)		25255.5	63326.2	39.9		23611.3	63326.2	37.3	B31.3
3(EXP)		55735.8	226271.2	24.6		14401.3	227915.4	6.3	B31.3
1(OPE)	220	31251.1	0	0	230	40332.1	0	0	B31.3
2(SUS)		23611.2	63326.2	37.3		24096.1	63326.2	38.1	B31.3
3(EXP)		14401.3	227915.4	6.3		25148	227430.5	11.1	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14708	-12569	83556	-13732	-71604	6143	0	0	0
	2(SUS)	-219	-14362	-7	-18185	524	-2099	0	0	0
	3(EXP)	14927	1793	83563	4453	-72128	8243	0	0	0
	MAX	14927/L3	-14362/L	83563/L3	-18185/L	-72128/L	8243/L3	0.000/L3	-0.000/L2	0.000/L3
15		Rigid +Y								
	1(OPE)	1735	-34836	-10306	0	0	0	9.108	0	-54.111
	2(SUS)	938	-27588	-1	0	0	0	0.005	0	0
	3(EXP)	796	-7248	-10305	0	0	0	9.102	0	-54.111
	MAX	1735/L1	-34836/L	-10306/L1				9.108/L1	-0.000/L1	-54.111/L1
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2822	-27187	-8932	0	0	0	-3	0	-108.232
	2(SUS)	-2156	-27533	-2	0	0	0	-0.012	0	0
	3(EXP)	-666	346	-8930	0	0	0	-2.988	0	-108.232
	MAX	-2822/L1	-27533/L	-8932/L1				-3.000/L1	-0.000/L2	-108.232/L1
45		Rigid +Y								
	1(OPE)	-12509	-46282	-6026	0	0	0	-81.56	0	-39.29
	2(SUS)	1437	-51391	-499	0	0	0	0.008	0	-0.003
	3(EXP)	-13946	5108	-5527	0	0	0	-81.568	0	-39.287
	MAX	-13946/L	-51391/L	-6026/L1				-81.568/L	-0.000/L2	-39.290/L1
65		Rigid +Y								
	1(OPE)	-12509	-46282	6026	0	0	0	-81.56	0	39.29
	2(SUS)	1437	-51391	499	0	0	0	0.008	0	0.003
	3(EXP)	-13946	5108	5527	0	0	0	-81.568	0	39.287
	MAX	-13946/L	-51391/L	6026/L1				-81.568/L	-0.000/L2	39.290/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2822	-27187	8932	0	0	0	-3	0	108.232
	2(SUS)	-2156	-27533	2	0	0	0	-0.012	0	0
	3(EXP)	-667	346	8930	0	0	0	-2.988	0	108.232
	MAX	-2822/L1	-27533/L	8932/L1				-3.000/L1	-0.000/L2	108.232/L1
90		Rigid +Y								
	1(OPE)	1735	-34835	10306	0	0	0	9.108	0	54.111
	2(SUS)	938	-27588	1	0	0	0	0.005	0	0
	3(EXP)	796	-7248	10305	0	0	0	9.102	0	54.111
	MAX	1735/L1	-34835/L	10306/L1				9.108/L1	-0.000/L1	54.111/L1
100		Rigid ANC								
	1(OPE)	29416	-25138	0	0	0	12287	0	0	0
	2(SUS)	-438	-28725	0	0	0	-4199	0	0	0
	3(EXP)	29854	3587	0	0	0	16485	0	0	0
	MAX	29854/L3	-28725/L	-0/L1	0/L1	-0/L1	16485/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1735	-34836	-10306	0	0	0	9.108	0	-54.111
	2(SUS)	938	-27588	-1	0	0	0	0.005	0	0
	3(EXP)	796	-7248	-10305	0	0	0	9.102	0	-54.111
	MAX	1735/L1	-34836/L	-10306/L1				9.108/L1	-0.000/L1	-54.111/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2822	-27187	-8932	0	0	0	-3	0	-108.232
	2(SUS)	-2156	-27533	-2	0	0	0	-0.012	0	0
	3(EXP)	-667	346	-8930	0	0	0	-2.988	0	-108.232
	MAX	-2822/L1	-27533/L	-8932/L1				-3.000/L1	-0.000/L2	-108.232/L1
150		Rigid +Y								
	1(OPE)	-12509	-46283	-6026	0	0	0	-81.56	0	-39.29
	2(SUS)	1437	-51391	-499	0	0	0	0.008	0	-0.003
	3(EXP)	-13946	5108	-5527	0	0	0	-81.568	0	-39.287
	MAX	-13946/L	-51391/L	-6026/L1				-81.568/L	-0.000/L2	-39.290/L1
180		Rigid +Y								
	1(OPE)	-12509	-46282	6026	0	0	0	-81.56	0	39.29
	2(SUS)	1437	-51391	499	0	0	0	0.008	0	0.003
	3(EXP)	-13946	5108	5527	0	0	0	-81.568	0	39.287
	MAX	-13946/L	-51391/L	6026/L1				-81.568/L	-0.000/L2	39.290/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2822	-27187	8932	0	0	0	-3	0	108.232
	2(SUS)	-2156	-27533	2	0	0	0	-0.012	0	0
	3(EXP)	-667	346	8930	0	0	0	-2.988	0	108.232
	MAX	-2822/L1	-27533/L	8932/L1				-3.000/L1	-0.000/L2	108.232/L1
220		Rigid +Y								
	1(OPE)	1735	-34836	10306	0	0	0	9.108	0	54.111
	2(SUS)	938	-27588	1	0	0	0	0.005	0	0
	3(EXP)	796	-7248	10305	0	0	0	9.102	0	54.111
	MAX	1735/L1	-34836/L	10306/L1				9.108/L1	-0.000/L1	54.111/L1
230		Rigid ANC								
	1(OPE)	14708	-12569	-83556	13732	71604	6143	0	0	0
	2(SUS)	-219	-14362	7	18185	-524	-2099	0	0	0
	3(EXP)	14927	1793	-83563	-4453	72128	8243	0	0	0
	MAX	14927/L3	-14362/L	-83563/L	18185/L3	72128/L3	8243/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.102	0	-54.111	-0.009	-0.0641	0.0422
20	-2.988	0	-108.232	0.0364	0.3278	0.0845
28	-35.468	4.789	-135.055	0.1178	0.693	0.1054
29	-40.594	6.758	-137.418	0.1373	0.7759	0.1162
30	-43.589	9.875	-137.579	0.1501	0.8443	0.1294
39	-45.821	12.948	-133.821	0.1591	0.9262	0.1386
40	-48.932	13.131	-127.008	0.1612	1.0018	0.1479
45	-81.568	0	-39.287	0.0952	1.1027	0.1755
48	-106.237	-10.461	17.435	0.0454	0.7371	0.1755
49	-110.751	-11.506	20.784	0.0388	0.611	0.1763
50	-115.447	-11.759	19.608	0.0307	0.4784	0.1771
59	-110.751	-11.506	-20.784	-0.0388	-0.611	0.1763
60	-106.237	-10.461	-17.435	-0.0454	-0.7371	0.1755
65	-81.568	0	39.287	-0.0952	-1.1027	0.1755
68	-48.932	13.131	127.008	-0.1612	-1.0018	0.1479
69	-45.821	12.948	133.821	-0.1591	-0.9262	0.1386
70	-43.813	10.592	137.315	-0.1509	-0.8593	0.1303
79	-40.594	6.758	137.418	-0.1373	-0.7759	0.1162
80	-35.468	4.789	135.055	-0.1178	-0.693	0.1054
85	-2.988	0	108.232	-0.0364	-0.3278	0.0845
90	9.102	0	54.111	0.009	0.0641	0.0422
100	0	0	0	0	0	0
110	9.102	0	-54.111	-0.009	-0.0641	0.0422
120	-2.988	0	-108.232	0.0364	0.3278	0.0845
128	-35.468	4.789	-135.055	0.1178	0.693	0.1054
129	-40.593	6.758	-137.418	0.1373	0.7759	0.1162
130	-43.589	9.875	-137.579	0.1501	0.8443	0.1294
139	-45.821	12.948	-133.821	0.1591	0.9262	0.1386
140	-48.932	13.131	-127.008	0.1612	1.0018	0.1479
150	-81.568	0	-39.287	0.0952	1.1027	0.1755
158	-106.237	-10.461	17.435	0.0454	0.7371	0.1755
159	-110.751	-11.506	20.784	0.0388	0.611	0.1763
160	-115.447	-11.759	19.608	0.0307	0.4784	0.1771
168	-115.447	-11.759	-19.608	-0.0307	-0.4784	0.1771
169	-110.751	-11.506	-20.784	-0.0388	-0.611	0.1763
170	-106.237	-10.461	-17.435	-0.0454	-0.7371	0.1755
180	-81.568	0	39.287	-0.0952	-1.1027	0.1755
188	-48.932	13.131	127.008	-0.1612	-1.0018	0.1479
189	-45.821	12.948	133.821	-0.1591	-0.9262	0.1386

190	-43.813	10.592	137.315	-0.1509	-0.8593	0.1303
199	-40.594	6.758	137.418	-0.1373	-0.7759	0.1162
200	-35.468	4.789	135.055	-0.1178	-0.693	0.1054
210	-2.988	0	108.232	-0.0364	-0.3278	0.0845
220	9.102	0	54.111	0.009	0.0641	0.0422
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.005	0	0	0.0009	-0.0012	-0.0108
20	-0.012	0	0	-0.0038	0.0051	-0.0215
28	-0.503	-0.871	0	-0.0156	0.0082	-0.0268
29	-0.481	-0.973	-0.042	-0.0156	0.0076	-0.0276
30	-0.317	-1.016	-0.146	-0.0159	0.007	-0.0286
39	-0.074	-0.935	-0.262	-0.0164	0.0063	-0.03
40	0.009	-0.733	-0.269	-0.0167	0.0055	-0.0306
45	0.008	0	-0.003	-0.0196	0.0012	0.0428
48	0.008	-5.184	0.004	-0.0217	-0.0004	0.1093
49	0.009	-5.973	0.001	-0.0219	-0.0004	0.1109
50	0.012	-6.419	0	-0.0208	-0.0003	0.111
59	0.009	-5.973	-0.001	0.0219	0.0004	0.1109
60	0.008	-5.184	-0.004	0.0217	0.0004	0.1093
65	0.008	0	0.003	0.0196	-0.0012	0.0428
68	0.009	-0.733	0.269	0.0167	-0.0055	-0.0306
69	-0.074	-0.935	0.262	0.0164	-0.0063	-0.03
70	-0.267	-1.016	0.174	0.016	-0.0069	-0.0288
79	-0.481	-0.973	0.042	0.0156	-0.0076	-0.0276
80	-0.503	-0.871	0	0.0156	-0.0082	-0.0268
85	-0.012	0	0	0.0038	-0.0051	-0.0215
90	0.005	0	0	-0.0009	0.0012	-0.0108
100	0	0	0	0	0	0
110	0.005	0	0	0.0009	-0.0012	-0.0108
120	-0.012	0	0	-0.0038	0.0051	-0.0215
128	-0.503	-0.871	0	-0.0156	0.0082	-0.0268
129	-0.481	-0.973	-0.042	-0.0156	0.0076	-0.0276
130	-0.317	-1.016	-0.146	-0.0159	0.007	-0.0286
139	-0.074	-0.935	-0.262	-0.0164	0.0063	-0.03
140	0.009	-0.733	-0.269	-0.0167	0.0055	-0.0306
150	0.008	0	-0.003	-0.0196	0.0012	0.0428
158	0.008	-5.184	0.004	-0.0217	-0.0004	0.1093
159	0.009	-5.973	0.001	-0.0219	-0.0004	0.1109
160	0.012	-6.419	0	-0.0208	-0.0003	0.111
168	0.012	-6.419	0	0.0208	0.0003	0.111
169	0.009	-5.973	-0.001	0.0219	0.0004	0.1109
170	0.008	-5.184	-0.004	0.0217	0.0004	0.1093
180	0.008	0	0.003	0.0196	-0.0012	0.0428
188	0.009	-0.733	0.269	0.0167	-0.0055	-0.0306
189	-0.074	-0.935	0.262	0.0164	-0.0063	-0.03

190	-0.267	-1.016	0.174	0.016	-0.0069	-0.0288
199	-0.481	-0.973	0.042	0.0156	-0.0076	-0.0276
200	-0.503	-0.871	0	0.0156	-0.0082	-0.0268
210	-0.012	0	0	0.0038	-0.0051	-0.0215
220	0.005	0	0	-0.0009	0.0012	-0.0108
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:18
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+100
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	9.108	0	-54.111	-0.0081	-0.0652	0.0315
20	-3	0	-108.232	0.0326	0.3329	0.063
28	-35.971	3.918	-135.055	0.1022	0.7012	0.0786
29	-41.075	5.785	-137.46	0.1217	0.7835	0.0887
30	-43.906	8.86	-137.725	0.1342	0.8512	0.1008
39	-45.895	12.013	-134.083	0.1427	0.9325	0.1086
40	-48.923	12.398	-127.277	0.1444	1.0073	0.1174
45	-81.56	0	-39.29	0.0756	1.1039	0.2184
48	-106.229	-15.645	17.44	0.0237	0.7366	0.2849
49	-110.742	-17.478	20.785	0.0169	0.6106	0.2872
50	-115.435	-18.179	19.608	0.0099	0.478	0.2881
59	-110.742	-17.478	-20.785	-0.0169	-0.6106	0.2872
60	-106.229	-15.645	-17.44	-0.0237	-0.7366	0.2849
65	-81.56	0	39.29	-0.0756	-1.1039	0.2184
68	-48.923	12.398	127.277	-0.1444	-1.0073	0.1174
69	-45.895	12.013	134.083	-0.1427	-0.9325	0.1086
70	-44.08	9.576	137.489	-0.135	-0.8662	0.1016
79	-41.075	5.785	137.46	-0.1217	-0.7835	0.0887
80	-35.971	3.918	135.055	-0.1022	-0.7012	0.0786
85	-3	0	108.232	-0.0326	-0.3329	0.063
90	9.108	0	54.111	0.0081	0.0652	0.0315
100	0	0	0	0	0	0
110	9.108	0	-54.111	-0.0081	-0.0652	0.0315
120	-3	0	-108.232	0.0326	0.3329	0.063
128	-35.971	3.918	-135.055	0.1022	0.7012	0.0786
129	-41.075	5.785	-137.46	0.1217	0.7835	0.0887
130	-43.906	8.86	-137.725	0.1342	0.8512	0.1008
139	-45.895	12.013	-134.083	0.1427	0.9325	0.1086
140	-48.923	12.398	-127.277	0.1444	1.0073	0.1174
150	-81.56	0	-39.29	0.0756	1.1039	0.2184
158	-106.229	-15.645	17.44	0.0237	0.7366	0.2849
159	-110.742	-17.478	20.785	0.0169	0.6106	0.2872
160	-115.435	-18.179	19.608	0.0099	0.478	0.2881
168	-115.435	-18.179	-19.608	-0.0099	-0.478	0.2881
169	-110.742	-17.478	-20.785	-0.0169	-0.6106	0.2872
170	-106.229	-15.645	-17.44	-0.0237	-0.7366	0.2849
180	-81.56	0	39.29	-0.0756	-1.1039	0.2184
188	-48.923	12.398	127.277	-0.1444	-1.0073	0.1174
189	-45.895	12.013	134.083	-0.1427	-0.9325	0.1086

190	-44.08	9.576	137.489	-0.135	-0.8662	0.1016
199	-41.075	5.785	137.46	-0.1217	-0.7835	0.0887
200	-35.971	3.918	135.055	-0.1022	-0.7012	0.0786
210	-3	0	108.232	-0.0326	-0.3329	0.063
220	9.108	0	54.111	0.0081	0.0652	0.0315
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28

From 30 To 40 DY= 1,266.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -1,266.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 79
-------------------------------------------------------------------------------
From  80  To  85 DZ= -4,250.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
-------------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
-------------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
  Node  110  +Y   Mu = .30
-------------------------------------------------------------------------------
```

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 129
Angle/Node @2= .00 128

From 130 To 140 DY= 1,266.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -1,266.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 199

From 200 To 210 DZ= -4,250.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS
Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 79
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
159 Angle/Node @2= .00 158
160 170 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
169 Angle/Node @2= .00 168

```
 180         190          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
                      189   Angle/Node @2= .00 188
 190         200          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	FORCE	Len / YIELD	MU / Dir	Vectors
10	ANC			.30	.000	.000		.000	
15	+Y			.30	.000	1.000		.000	
20	Guide			3.00	.30	.000	.000	.000	
20	+Y			.30	.000	1.000		.000	
45	+Y			.30	.000	1.000		.000	
65	+Y			.30	.000	1.000		.000	
85	Guide			3.00	.30	.000	.000	.000	
85	+Y			.30	.000	1.000		.000	
90	+Y			.30	.000	1.000		.000	
100	ANC			.30	.000	.000		.000	
110	+Y			.30	.000	1.000		.000	
120	+Y			.30	.000	1.000		.000	
120	Guide			3.00	.30	.000	.000	.000	
150	+Y			.30	.000	1.000		.000	
180	+Y			.30	.000	1.000		.000	
210	+Y			.30	.000	1.000		.000	
210	Guide			3.00	.30	.000	.000	.000	
220	+Y			.30	.000	1.000		.000	
230	ANC			.30	.000	.000		.000	

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
TRANSL. STIF	lbs./in.	x	1.751	= N./cm.
ROTATIONAL STIF	in.lb./deg.	x	0.113	= N.m./deg
UNIFORM LOAD	lb./in.	x	1.751	= N./cm.
G LOAD	g's	x	1.000	= g's

WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO
B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT

ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000
Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1266mm

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-19250.000
40	.000	1266.000	-19250.000
45	-5052.000	1266.000	-19250.000
50	-9000.000	1266.000	-19250.000
60	-9000.000	1266.000	-25750.000
65	-5052.000	1266.000	-25750.000
70	.000	1266.000	-25750.000
80	.000	.000	-25750.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-64250.000
140	.000	1266.000	-64250.000
150	-5052.000	1266.000	-64250.000
160	-9000.000	1266.000	-64250.000
170	-9000.000	1266.000	-70750.000
180	-5052.000	1266.000	-70750.000
190	.000	1266.000	-70750.000
200	.000	.000	-70750.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43900.6 Allowable Stress: 63326.2
Axial Stress: 17835.9 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 114914.3 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 37758.9 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 135903.0 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	39978.3	0	0	15	31210	0	0	B31.3
2(SUS)		24144.3	63326.2	38.1		23516.1	63326.2	37.1	B31.3
3(EXP)		24829	227382.3	10.9		14367.1	228010.5	6.3	B31.3
1(OPE)	15	31464.4	0	0	20	70757.4	0	0	B31.3
2(SUS)		23515.9	63326.2	37.1		25628.4	63326.2	40.5	B31.3
3(EXP)		14367.1	228010.7	6.3		54983.8	225898.3	24.3	B31.3
1(OPE)	20	70978.7	0	0	28	90443	0	0	B31.3
2(SUS)		25628	63326.2	40.5		18110.7	63326.2	28.6	B31.3
3(EXP)		54983.8	225898.7	24.3		75248.8	233416	32.2	B31.3
1(OPE)	28	90443	0	0	29	91877.4	0	0	B31.3
2(SUS)		18110.7	63326.2	28.6		18737	63326.2	29.6	B31.3
3(EXP)		75248.8	233416	32.2		76546.8	232789.6	32.9	B31.3
1(OPE)	29	91877.4	0	0	30	92492.2	0	0	B31.3
2(SUS)		18737	63326.2	29.6		18883.1	63326.2	29.8	B31.3
3(EXP)		76546.8	232789.6	32.9		76186	232643.5	32.7	B31.3
1(OPE)	30	92492.2	0	0	39	88842.4	0	0	B31.3
2(SUS)		18883.1	63326.2	29.8		19057.2	63326.2	30.1	B31.3
3(EXP)		76186	232643.5	32.7		72721.7	232469.5	31.3	B31.3
1(OPE)	39	88842.4	0	0	40	80962.3	0	0	B31.3
2(SUS)		19057.2	63326.2	30.1		18419.3	63326.2	29.1	B31.3
3(EXP)		72721.7	232469.5	31.3		64850	233107.3	27.8	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1266mm

1(OPE)	40	80962.3	0	0	45	62039.5	0	0	B31.3
2(SUS)		18419.3	63326.2	29.1		43900.6	63326.2	69.3	B31.3
3(EXP)		64850	233107.3	27.8		36454.3	207626.1	17.6	B31.3
1(OPE)	45	62365.3	0	0	48	121397.3	0	0	B31.3
2(SUS)		43861.8	63326.2	69.3		19997.9	63326.2	31.6	B31.3
3(EXP)		36454.3	207664.8	17.6		104261.2	231528.7	45	B31.3
1(OPE)	48	121397.3	0	0	49	127787.5	0	0	B31.3
2(SUS)		19997.9	63326.2	31.6		17870.3	63326.2	28.2	B31.3
3(EXP)		104261.2	231528.7	45		111793.5	233656.4	47.8	B31.3
1(OPE)	49	127787.5	0	0	50	130378.9	0	0	B31.3
2(SUS)		17870.3	63326.2	28.2		19603.7	63326.2	31	B31.3
3(EXP)		111793.5	233656.4	47.8		114914.3	231923	49.5	B31.3
1(OPE)	50	130378.9	0	0	59	127787.5	0	0	B31.3
2(SUS)		19603.7	63326.2	31		17870.3	63326.2	28.2	B31.3
3(EXP)		114914.3	231923	49.5		111793.5	233656.4	47.8	B31.3
1(OPE)	59	127787.5	0	0	60	121397.3	0	0	B31.3
2(SUS)		17870.3	63326.2	28.2		19997.9	63326.2	31.6	B31.3
3(EXP)		111793.5	233656.4	47.8		104261.2	231528.7	45	B31.3
1(OPE)	60	121397.3	0	0	65	62365.3	0	0	B31.3
2(SUS)		19997.9	63326.2	31.6		43861.8	63326.2	69.3	B31.3
3(EXP)		104261.2	231528.7	45		36454.3	207664.8	17.6	B31.3
1(OPE)	65	62039.5	0	0	68	80962.3	0	0	B31.3
2(SUS)		43900.6	63326.2	69.3		18419.3	63326.2	29.1	B31.3
3(EXP)		36454.3	207626.1	17.6		64850	233107.3	27.8	B31.3
1(OPE)	68	80962.3	0	0	69	88842.4	0	0	B31.3
2(SUS)		18419.3	63326.2	29.1		19057.2	63326.2	30.1	B31.3
3(EXP)		64850	233107.3	27.8		72721.7	232469.5	31.3	B31.3
1(OPE)	69	88842.4	0	0	70	92238.5	0	0	B31.3
2(SUS)		19057.2	63326.2	30.1		19009.4	63326.2	30	B31.3
3(EXP)		72721.7	232469.5	31.3		75925.8	232517.3	32.7	B31.3
1(OPE)	70	92238.5	0	0	79	91877.4	0	0	B31.3
2(SUS)		19009.4	63326.2	30		18737	63326.2	29.6	B31.3
3(EXP)		75925.8	232517.3	32.7		76546.8	232789.6	32.9	B31.3
1(OPE)	79	91877.4	0	0	80	90443	0	0	B31.3
2(SUS)		18737	63326.2	29.6		18110.7	63326.2	28.6	B31.3
3(EXP)		76546.8	232789.6	32.9		75248.8	233416	32.2	B31.3
1(OPE)	80	90443	0	0	85	70978.7	0	0	B31.3
2(SUS)		18110.7	63326.2	28.6		25628	63326.2	40.5	B31.3
3(EXP)		75248.8	233416	32.2		54983.8	225898.7	24.3	B31.3
1(OPE)	85	70757.4	0	0	90	31464.3	0	0	B31.3
2(SUS)		25628.4	63326.2	40.5		23515.9	63326.2	37.1	B31.3
3(EXP)		54983.8	225898.3	24.3		14367	228010.7	6.3	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1266mm

1(OPE)	90	31209.9	0	0	100	39978.4	0	0	B31.3
2(SUS)		23516.1	63326.2	37.1		24144.4	63326.2	38.1	B31.3
3(EXP)		14367	228010.5	6.3		24829.1	227382.3	10.9	B31.3
1(OPE)	100	39978.4	0	0	110	31209.9	0	0	B31.3
2(SUS)		24144.4	63326.2	38.1		23516.1	63326.2	37.1	B31.3
3(EXP)		24829.1	227382.3	10.9		14367.1	228010.5	6.3	B31.3
1(OPE)	110	31464.4	0	0	120	70757.4	0	0	B31.3
2(SUS)		23515.9	63326.2	37.1		25628.4	63326.2	40.5	B31.3
3(EXP)		14367.1	228010.7	6.3		54983.9	225898.3	24.3	B31.3
1(OPE)	120	70978.7	0	0	128	90443	0	0	B31.3
2(SUS)		25628	63326.2	40.5		18110.7	63326.2	28.6	B31.3
3(EXP)		54983.9	225898.7	24.3		75248.8	233416	32.2	B31.3
1(OPE)	128	90443	0	0	129	91877.4	0	0	B31.3
2(SUS)		18110.7	63326.2	28.6		18737	63326.2	29.6	B31.3
3(EXP)		75248.8	233416	32.2		76546.8	232789.6	32.9	B31.3
1(OPE)	129	91877.4	0	0	130	92492.2	0	0	B31.3
2(SUS)		18737	63326.2	29.6		18883.1	63326.2	29.8	B31.3
3(EXP)		76546.8	232789.6	32.9		76186	232643.5	32.7	B31.3
1(OPE)	130	92492.2	0	0	139	88842.4	0	0	B31.3
2(SUS)		18883.1	63326.2	29.8		19057.2	63326.2	30.1	B31.3
3(EXP)		76186	232643.5	32.7		72721.7	232469.5	31.3	B31.3
1(OPE)	139	88842.4	0	0	140	80962.3	0	0	B31.3
2(SUS)		19057.2	63326.2	30.1		18419.3	63326.2	29.1	B31.3
3(EXP)		72721.7	232469.5	31.3		64850	233107.3	27.8	B31.3
1(OPE)	140	80962.3	0	0	150	62039.5	0	0	B31.3
2(SUS)		18419.3	63326.2	29.1		43900.6	63326.2	69.3	B31.3
3(EXP)		64850	233107.3	27.8		36454.3	207626.1	17.6	B31.3
1(OPE)	150	62365.3	0	0	158	121397.3	0	0	B31.3
2(SUS)		43861.8	63326.2	69.3		19997.9	63326.2	31.6	B31.3
3(EXP)		36454.3	207664.8	17.6		104261.2	231528.7	45	B31.3
1(OPE)	158	121397.3	0	0	159	127787.5	0	0	B31.3
2(SUS)		19997.9	63326.2	31.6		17870.3	63326.2	28.2	B31.3
3(EXP)		104261.2	231528.7	45		111793.5	233656.4	47.8	B31.3
1(OPE)	159	127787.5	0	0	160	130378.9	0	0	B31.3
2(SUS)		17870.3	63326.2	28.2		19603.7	63326.2	31	B31.3
3(EXP)		111793.5	233656.4	47.8		114914.3	231923	49.5	B31.3
1(OPE)	160	130378.9	0	0	168	130378.9	0	0	B31.3
2(SUS)		19603.7	63326.2	31		19603.7	63326.2	31	B31.3
3(EXP)		114914.3	231923	49.5		114914.3	231923	49.5	B31.3
1(OPE)	168	130378.9	0	0	169	127787.5	0	0	B31.3
2(SUS)		19603.7	63326.2	31		17870.3	63326.2	28.2	B31.3
3(EXP)		114914.3	231923	49.5		111793.5	233656.4	47.8	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1266mm

1(OPE)	169	127787.5	0	0	170	121397.3	0	0	B31.3
2(SUS)		17870.3	63326.2	28.2		19997.9	63326.2	31.6	B31.3
3(EXP)		111793.5	233656.4	47.8		104261.2	231528.7	45	B31.3
1(OPE)	170	121397.3	0	0	180	62365.3	0	0	B31.3
2(SUS)		19997.9	63326.2	31.6		43861.8	63326.2	69.3	B31.3
3(EXP)		104261.2	231528.7	45		36454.3	207664.8	17.6	B31.3
1(OPE)	180	62039.5	0	0	188	80962.3	0	0	B31.3
2(SUS)		43900.6	63326.2	69.3		18419.3	63326.2	29.1	B31.3
3(EXP)		36454.3	207626.1	17.6		64850	233107.3	27.8	B31.3
1(OPE)	188	80962.3	0	0	189	88842.4	0	0	B31.3
2(SUS)		18419.3	63326.2	29.1		19057.2	63326.2	30.1	B31.3
3(EXP)		64850	233107.3	27.8		72721.7	232469.5	31.3	B31.3
1(OPE)	189	88842.4	0	0	190	92238.4	0	0	B31.3
2(SUS)		19057.2	63326.2	30.1		19009.4	63326.2	30	B31.3
3(EXP)		72721.7	232469.5	31.3		75925.8	232517.3	32.7	B31.3
1(OPE)	190	92238.5	0	0	199	91877.4	0	0	B31.3
2(SUS)		19009.4	63326.2	30		18737	63326.2	29.6	B31.3
3(EXP)		75925.8	232517.3	32.7		76546.8	232789.6	32.9	B31.3
1(OPE)	199	91877.4	0	0	200	90443	0	0	B31.3
2(SUS)		18737	63326.2	29.6		18110.7	63326.2	28.6	B31.3
3(EXP)		76546.8	232789.6	32.9		75248.8	233416	32.2	B31.3
1(OPE)	200	90443	0	0	210	70978.7	0	0	B31.3
2(SUS)		18110.7	63326.2	28.6		25628	63326.2	40.5	B31.3
3(EXP)		75248.8	233416	32.2		54983.8	225898.7	24.3	B31.3
1(OPE)	210	70757.4	0	0	220	31464.4	0	0	B31.3
2(SUS)		25628.4	63326.2	40.5		23515.9	63326.2	37.1	B31.3
3(EXP)		54983.8	225898.3	24.3		14367.1	228010.7	6.3	B31.3
1(OPE)	220	31210	0	0	230	39978.3	0	0	B31.3
2(SUS)		23516.1	63326.2	37.1		24144.3	63326.2	38.1	B31.3
3(EXP)		14367.1	228010.5	6.3		24829.1	227382.3	10.9	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14490	-12494	83185	-13547	-70507	6794	0	0	0
	2(SUS)	-244	-14418	52	-18322	583	-2159	0	0	0
	3(EXP)	14734	1923	83133	4776	-71091	8954	0	0	0
	MAX	14734/L3	-14418/L	83185/L	-18322/L	-71091/L	8954/L3	0.000/L3	-0.000/L2	0.000/L1
15		Rigid +Y								
	1(OPE)	1723	-35137	-10399	0	0	0	8.964	0	-54.112
	2(SUS)	1044	-27364	8	0	0	0	0.006	0	0
	3(EXP)	678	-7773	-10407	0	0	0	8.958	0	-54.112
	MAX	1723/L1	-35137/L	-10407/L3				8.964/L1	-0.000/L1	-54.112/L3
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2861	-27669	-9087	0	0	0	-3	0	-108.233
	2(SUS)	-2355	-28010	17	0	0	0	-0.013	0	0
	3(EXP)	-506	341	-9104	0	0	0	-2.987	0	-108.233
	MAX	-2861/L1	-28010/L	-9104/L3				-3.000/L1	-0.000/L2	-108.233/L3
45		Rigid +Y								
	1(OPE)	-12430	-45952	-5961	0	0	0	-81.381	0	-39.031
	2(SUS)	1555	-51460	-716	0	0	0	0.009	0	-0.004
	3(EXP)	-13985	5509	-5246	0	0	0	-81.39	0	-39.027
	MAX	-13985/L	-51460/L	-5961/L1				-81.390/L	-0.000/L2	-39.031/L1
65		Rigid +Y								
	1(OPE)	-12430	-45951	5961	0	0	0	-81.381	0	39.031
	2(SUS)	1555	-51460	716	0	0	0	0.009	0	0.004
	3(EXP)	-13985	5509	5246	0	0	0	-81.39	0	39.027
	MAX	-13985/L	-51460/L	5961/L1				-81.390/L	-0.000/L2	39.031/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2861	-27669	9087	0	0	0	-3	0	108.233
	2(SUS)	-2355	-28010	-17	0	0	0	-0.013	0	0
	3(EXP)	-506	341	9104	0	0	0	-2.987	0	108.233
	MAX	-2861/L1	-28010/L	9104/L3				-3.000/L1	-0.000/L2	108.233/L3
90		Rigid +Y								
	1(OPE)	1723	-35137	10399	0	0	0	8.964	0	54.112
	2(SUS)	1044	-27364	-8	0	0	0	0.006	0	0
	3(EXP)	678	-7773	10407	0	0	0	8.958	0	54.112
	MAX	1723/L1	-35137/L	10407/L3				8.964/L1	-0.000/L1	54.112/L3
100		Rigid ANC								
	1(OPE)	28979	-24989	0	0	0	13589	0	0	0
	2(SUS)	-488	-28836	0	0	0	-4319	0	0	0
	3(EXP)	29468	3847	0	0	0	17907	0	0	0
	MAX	29468/L3	-28836/L	-0/L1	0/L1	-0/L1	17907/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1723	-35137	-10399	0	0	0	8.964	0	-54.112
	2(SUS)	1044	-27364	8	0	0	0	0.006	0	0
	3(EXP)	678	-7773	-10407	0	0	0	8.958	0	-54.112
	MAX	1723/L1	-35137/L	-10407/L3				8.964/L1	-0.000/L1	-54.112/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2861	-27669	-9087	0	0	0	-3	0	-108.233
	2(SUS)	-2355	-28010	17	0	0	0	-0.013	0	0
	3(EXP)	-506	341	-9104	0	0	0	-2.987	0	-108.233
	MAX	-2861/L1	-28010/L	-9104/L3				-3.000/L1	-0.000/L2	-108.233/L3
150		Rigid +Y								
	1(OPE)	-12430	-45952	-5961	0	0	0	-81.381	0	-39.031
	2(SUS)	1555	-51460	-716	0	0	0	0.009	0	-0.004
	3(EXP)	-13985	5509	-5246	0	0	0	-81.39	0	-39.027
	MAX	-13985/L	-51460/L	-5961/L1				-81.390/L	-0.000/L2	-39.031/L1
180		Rigid +Y								
	1(OPE)	-12430	-45951	5961	0	0	0	-81.381	0	39.031
	2(SUS)	1555	-51460	716	0	0	0	0.009	0	0.004
	3(EXP)	-13985	5509	5246	0	0	0	-81.39	0	39.027
	MAX	-13985/L	-51460/L	5961/L1				-81.390/L	-0.000/L2	39.031/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2861	-27669	9087	0	0	0	-3	0	108.233
	2(SUS)	-2355	-28010	-17	0	0	0	-0.013	0	0
	3(EXP)	-506	341	9104	0	0	0	-2.987	0	108.233
	MAX	-2861/L1	-28010/L	9104/L3				-3.000/L1	-0.000/L2	108.233/L3
220		Rigid +Y								
	1(OPE)	1723	-35137	10399	0	0	0	8.964	0	54.112
	2(SUS)	1044	-27364	-8	0	0	0	0.006	0	0
	3(EXP)	678	-7773	10407	0	0	0	8.958	0	54.112
	MAX	1723/L1	-35137/L	10407/L3				8.964/L1	-0.000/L1	54.112/L3
230		Rigid ANC								
	1(OPE)	14490	-12494	-83185	13547	70507	6794	0	0	0
	2(SUS)	-244	-14418	-52	18322	-583	-2159	0	0	0
	3(EXP)	14734	1923	-83133	-4776	71091	8954	0	0	0
	MAX	14734/L3	-14418/L	-83185/L	18322/L3	71091/L3	8954/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.958	0	-54.112	-0.0097	-0.0628	0.0459
20	-2.987	0	-108.233	0.0391	0.3228	0.0918
28	-34.953	5.138	-135.056	0.1264	0.682	0.1145
29	-40.027	7.17	-137.392	0.1475	0.7636	0.1254
30	-43.049	10.316	-137.481	0.162	0.831	0.1388
39	-45.612	14.081	-133.328	0.1712	0.9265	0.1498
40	-48.753	14.188	-126.486	0.1727	1.0009	0.1599
45	-81.39	0	-39.027	0.102	1.0983	0.1896
48	-106.059	-11.301	17.461	0.0486	0.7339	0.1896
49	-110.565	-12.431	20.791	0.0416	0.6084	0.1905
50	-115.246	-12.707	19.608	0.0329	0.4763	0.1913
59	-110.565	-12.431	-20.791	-0.0416	-0.6084	0.1905
60	-106.059	-11.301	-17.461	-0.0486	-0.7339	0.1896
65	-81.39	0	39.027	-0.102	-1.0983	0.1896
68	-48.753	14.188	126.486	-0.1727	-1.0009	0.1599
69	-45.612	14.081	133.328	-0.1712	-0.9265	0.1498
70	-43.532	11.755	136.907	-0.1639	-0.8607	0.1407
79	-40.027	7.17	137.392	-0.1475	-0.7636	0.1254
80	-34.953	5.138	135.056	-0.1264	-0.682	0.1145
85	-2.987	0	108.233	-0.0391	-0.3228	0.0918
90	8.958	0	54.112	0.0097	0.0628	0.0459
100	0	0	0	0	0	0
110	8.958	0	-54.112	-0.0097	-0.0628	0.0459
120	-2.987	0	-108.233	0.0391	0.3228	0.0918
128	-34.953	5.138	-135.056	0.1264	0.682	0.1145
129	-40.027	7.17	-137.392	0.1475	0.7636	0.1254
130	-43.049	10.316	-137.481	0.162	0.831	0.1388
139	-45.612	14.081	-133.328	0.1712	0.9265	0.1498
140	-48.753	14.188	-126.486	0.1727	1.0009	0.1599
150	-81.39	0	-39.027	0.102	1.0983	0.1896
158	-106.059	-11.301	17.461	0.0486	0.7339	0.1896
159	-110.565	-12.431	20.791	0.0416	0.6084	0.1905
160	-115.246	-12.707	19.608	0.0329	0.4763	0.1913
168	-115.246	-12.707	-19.608	-0.0329	-0.4763	0.1913
169	-110.565	-12.431	-20.791	-0.0416	-0.6084	0.1905
170	-106.059	-11.301	-17.461	-0.0486	-0.7339	0.1896
180	-81.39	0	39.027	-0.102	-1.0983	0.1896
188	-48.753	14.188	126.486	-0.1727	-1.0009	0.1599
189	-45.612	14.081	133.328	-0.1712	-0.9265	0.1498

190	-43.532	11.755	136.907	-0.1639	-0.8607	0.1407
199	-40.027	7.17	137.392	-0.1475	-0.7636	0.1254
200	-34.953	5.138	135.056	-0.1264	-0.682	0.1145
210	-2.987	0	108.233	-0.0391	-0.3228	0.0918
220	8.958	0	54.112	0.0097	0.0628	0.0459
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.006	0	0	0.0012	-0.0013	-0.0111
20	-0.013	0	0	-0.0049	0.0056	-0.0221
28	-0.563	-0.983	0	-0.0176	0.0093	-0.0276
29	-0.546	-1.098	-0.047	-0.0175	0.0087	-0.0284
30	-0.379	-1.146	-0.163	-0.0177	0.0081	-0.0294
39	-0.076	-1.062	-0.322	-0.0181	0.0072	-0.0311
40	0.01	-0.852	-0.326	-0.0183	0.0065	-0.0319
45	0.009	0	-0.004	-0.0205	0.0015	0.0412
48	0.009	-5.087	0.005	-0.0222	-0.0005	0.1077
49	0.01	-5.866	0.002	-0.0223	-0.0005	0.1092
50	0.013	-6.31	0	-0.0211	-0.0004	0.1093
59	0.01	-5.866	-0.002	0.0223	0.0005	0.1092
60	0.009	-5.087	-0.005	0.0222	0.0005	0.1077
65	0.009	0	0.004	0.0205	-0.0015	0.0412
68	0.01	-0.852	0.326	0.0183	-0.0065	-0.0319
69	-0.076	-1.062	0.322	0.0181	-0.0072	-0.0311
70	-0.277	-1.146	0.224	0.0177	-0.0078	-0.0298
79	-0.546	-1.098	0.047	0.0175	-0.0087	-0.0284
80	-0.563	-0.983	0	0.0176	-0.0093	-0.0276
85	-0.013	0	0	0.0049	-0.0056	-0.0221
90	0.006	0	0	-0.0012	0.0013	-0.0111
100	0	0	0	0	0	0
110	0.006	0	0	0.0012	-0.0013	-0.0111
120	-0.013	0	0	-0.0049	0.0056	-0.0221
128	-0.563	-0.983	0	-0.0176	0.0093	-0.0276
129	-0.546	-1.098	-0.047	-0.0175	0.0087	-0.0284
130	-0.379	-1.146	-0.163	-0.0177	0.0081	-0.0294
139	-0.076	-1.062	-0.322	-0.0181	0.0072	-0.0311
140	0.01	-0.852	-0.326	-0.0183	0.0065	-0.0319
150	0.009	0	-0.004	-0.0205	0.0015	0.0412
158	0.009	-5.087	0.005	-0.0222	-0.0005	0.1077
159	0.01	-5.866	0.002	-0.0223	-0.0005	0.1092
160	0.013	-6.31	0	-0.0211	-0.0004	0.1093
168	0.013	-6.31	0	0.0211	0.0004	0.1093
169	0.01	-5.866	-0.002	0.0223	0.0005	0.1092
170	0.009	-5.087	-0.005	0.0222	0.0005	0.1077
180	0.009	0	0.004	0.0205	-0.0015	0.0412
188	0.01	-0.852	0.326	0.0183	-0.0065	-0.0319
189	-0.076	-1.062	0.322	0.0181	-0.0072	-0.0311

190	-0.277	-1.146	0.224	0.0177	-0.0078	-0.0298
199	-0.546	-1.098	0.047	0.0175	-0.0087	-0.0284
200	-0.563	-0.983	0	0.0176	-0.0093	-0.0276
210	-0.013	0	0	0.0049	-0.0056	-0.0221
220	0.006	0	0	-0.0012	0.0013	-0.0111
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:24
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+200
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.964	0	-54.112	-0.0084	-0.0641	0.0348
20	-3	0	-108.233	0.0341	0.3284	0.0696
28	-35.516	4.155	-135.056	0.1089	0.6913	0.0869
29	-40.573	6.071	-137.44	0.13	0.7723	0.097
30	-43.428	9.17	-137.644	0.1444	0.8391	0.1093
39	-45.688	13.019	-133.65	0.1532	0.9338	0.1187
40	-48.744	13.336	-126.812	0.1543	1.0074	0.128
45	-81.381	0	-39.031	0.0815	1.0999	0.2308
48	-106.05	-16.388	17.466	0.0264	0.7334	0.2973
49	-110.555	-18.297	20.792	0.0193	0.6079	0.2997
50	-115.233	-19.018	19.608	0.0118	0.4759	0.3007
59	-110.555	-18.297	-20.792	-0.0193	-0.6079	0.2997
60	-106.05	-16.388	-17.466	-0.0264	-0.7334	0.2973
65	-81.381	0	39.031	-0.0815	-1.0999	0.2308
68	-48.744	13.336	126.812	-0.1543	-1.0074	0.128
69	-45.688	13.019	133.65	-0.1532	-0.9338	0.1187
70	-43.809	10.609	137.131	-0.1461	-0.8685	0.1109
79	-40.573	6.071	137.44	-0.13	-0.7723	0.097
80	-35.516	4.155	135.056	-0.1089	-0.6913	0.0869
85	-3	0	108.233	-0.0341	-0.3284	0.0696
90	8.964	0	54.112	0.0084	0.0641	0.0348
100	0	0	0	0	0	0
110	8.964	0	-54.112	-0.0084	-0.0641	0.0348
120	-3	0	-108.233	0.0341	0.3284	0.0696
128	-35.516	4.155	-135.056	0.1089	0.6913	0.0869
129	-40.573	6.071	-137.44	0.13	0.7723	0.097
130	-43.428	9.17	-137.644	0.1444	0.8391	0.1093
139	-45.688	13.019	-133.65	0.1532	0.9338	0.1187
140	-48.744	13.336	-126.812	0.1543	1.0074	0.128
150	-81.381	0	-39.031	0.0815	1.0999	0.2308
158	-106.05	-16.388	17.466	0.0264	0.7334	0.2973
159	-110.555	-18.297	20.792	0.0193	0.6079	0.2997
160	-115.233	-19.018	19.608	0.0118	0.4759	0.3007
168	-115.233	-19.018	-19.608	-0.0118	-0.4759	0.3007
169	-110.555	-18.297	-20.792	-0.0193	-0.6079	0.2997
170	-106.05	-16.388	-17.466	-0.0264	-0.7334	0.2973
180	-81.381	0	39.031	-0.0815	-1.0999	0.2308
188	-48.744	13.336	126.812	-0.1543	-1.0074	0.128
189	-45.688	13.019	133.65	-0.1532	-0.9338	0.1187

190	-43.809	10.609	137.131	-0.1461	-0.8685	0.1109
199	-40.573	6.071	137.44	-0.13	-0.7723	0.097
200	-35.516	4.155	135.056	-0.1089	-0.6913	0.0869
210	-3	0	108.233	-0.0341	-0.3284	0.0696
220	8.964	0	54.112	0.0084	0.0641	0.0348
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28

From 30 To 40 DY= 1,366.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
---------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
---------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
---------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
---------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
---------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
---------------------------------------------------------------------------
From  70  To  80 DY= -1,366.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 79
---------------------------------------------------------------------------
From  80  To  85 DZ= -4,250.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
---------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
---------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
---------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
  Node  110  +Y   Mu = .30
---------------------------------------------------------------------------
```

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 129
Angle/Node @2= .00 128

From 130 To 140 DY= 1,366.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -1,366.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 199

From 200 To 210 DZ= -4,250.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS
Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 79
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
159 Angle/Node @2= .00 158
160 170 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
169 Angle/Node @2= .00 168

```
 180         190          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
                      189   Angle/Node @2= .00 188
 190         200          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       199

RESTRAINTS                        Len       MU
                                GAP     YIELD         Dir
  NODE  TYPE    CNODE     STIF1     STIF2     FORCE       Vectors
-------+-------+------+----------+----------+----------+--------------------
    10  ANC                          .30    .000   .000   .000
    15  +Y                           .30    .000  1.000   .000
    20  Guide                   3.00      .30    .000   .000   .000
    20  +Y                           .30    .000  1.000   .000
    45  +Y                           .30    .000  1.000   .000
    65  +Y                           .30    .000  1.000   .000
    85  Guide                   3.00      .30    .000   .000   .000
    85  +Y                           .30    .000  1.000   .000
    90  +Y                           .30    .000  1.000   .000
   100  ANC                          .30    .000   .000   .000
   110  +Y                           .30    .000  1.000   .000
   120  +Y                           .30    .000  1.000   .000
   120  Guide                   3.00      .30    .000   .000   .000
   150  +Y                           .30    .000  1.000   .000
   180  +Y                           .30    .000  1.000   .000
   210  +Y                           .30    .000  1.000   .000
   210  Guide                   3.00      .30    .000   .000   .000
   220  +Y                           .30    .000  1.000   .000
   230  ANC                          .30    .000   .000   .000

INPUT UNITS USED...

UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =   mm.
     FORCE           pounds      x     4.448  =   N.
     MASS(dynamics)  pounds      x     0.454  =   Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =   N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =   N.m.
     STRESS          lbs./sq.in. x     6.895  =    KPa
     TEMP. SCALE     degrees F.  x     0.556  =   C
     PRESSURE        psig        x     6.895  =    KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =    KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =   kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =   kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =   kg./cu.cm.
     TRANSL. STIF    lbs./in.    x     1.751  =   N./cm.
     ROTATIONAL STIF in.lb./deg. x     0.113  =   N.m./deg
     UNIFORM LOAD    lb./in.     x     1.751  =   N./cm.
     G LOAD          g's         x     1.000  =   g's
```

WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO
B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT

ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000
Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1366mm

COORDINATE REPORT

NODE	X (mm.)	Y (mm.)	Z (mm.)
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-19250.000
40	.000	1366.000	-19250.000
45	-5052.000	1366.000	-19250.000
50	-9000.000	1366.000	-19250.000
60	-9000.000	1366.000	-25750.000
65	-5052.000	1366.000	-25750.000
70	.000	1366.000	-25750.000
80	.000	.000	-25750.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-64250.000
140	.000	1366.000	-64250.000
150	-5052.000	1366.000	-64250.000
160	-9000.000	1366.000	-64250.000
170	-9000.000	1366.000	-70750.000
180	-5052.000	1366.000	-70750.000
190	.000	1366.000	-70750.000
200	.000	.000	-70750.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.3 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43908.8 Allowable Stress: 63326.2
Axial Stress: 17839.3 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 114445.0 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 37176.8 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 135381.3 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	39630.6	0	0	15	31172.8	0	0	B31.3
2(SUS)		24191	63326.2	38.2		23424	63326.2	37	B31.3
3(EXP)		24516.5	227335.6	10.8		14340.8	228102.6	6.3	B31.3
1(OPE)	15	31429.3	0	0	20	70036.3	0	0	B31.3
2(SUS)		23423.6	63326.2	37		25993.3	63326.2	41	B31.3
3(EXP)		14340.8	228103.1	6.3		54246.4	225533.3	24.1	B31.3
1(OPE)	20	70261.4	0	0	28	89742.2	0	0	B31.3
2(SUS)		25992.4	63326.2	41		18123.4	63326.2	28.6	B31.3
3(EXP)		54246.4	225534.3	24.1		74495.4	233403.3	31.9	B31.3
1(OPE)	28	89742.2	0	0	29	91089.1	0	0	B31.3
2(SUS)		18123.4	63326.2	28.6		18744.4	63326.2	29.6	B31.3
3(EXP)		74495.4	233403.3	31.9		75735.6	232782.2	32.5	B31.3
1(OPE)	29	91089.1	0	0	30	91515.5	0	0	B31.3
2(SUS)		18744.4	63326.2	29.6		18898.9	63326.2	29.8	B31.3
3(EXP)		75735.6	232782.2	32.5		75224.8	232627.8	32.3	B31.3
1(OPE)	30	91515.5	0	0	39	87812	0	0	B31.3
2(SUS)		18898.9	63326.2	29.8		19141.6	63326.2	30.2	B31.3
3(EXP)		75224.8	232627.8	32.3		71725.9	232385.1	30.9	B31.3
1(OPE)	39	87812	0	0	40	80062.2	0	0	B31.3
2(SUS)		19141.6	63326.2	30.2		18475.2	63326.2	29.2	B31.3
3(EXP)		71725.9	232385.1	30.9		63985.4	233051.4	27.5	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1366mm

1(OPE)	40	80062.2	0	0	45	62204.2	0	0	B31.3
2(SUS)		18475.2	63326.2	29.2		43908.8	63326.2	69.3	B31.3
3(EXP)		63985.4	233051.4	27.5		36497.6	207617.8	17.6	B31.3
1(OPE)	45	62523.6	0	0	48	120991.2	0	0	B31.3
2(SUS)		43867.2	63326.2	69.3		19997.2	63326.2	31.6	B31.3
3(EXP)		36497.6	207659.5	17.6		103854.3	231529.4	44.9	B31.3
1(OPE)	48	120991.2	0	0	49	127324.4	0	0	B31.3
2(SUS)		19997.2	63326.2	31.6		17840.8	63326.2	28.2	B31.3
3(EXP)		103854.3	231529.4	44.9		111342.4	233685.9	47.6	B31.3
1(OPE)	49	127324.4	0	0	50	129887.6	0	0	B31.3
2(SUS)		17840.8	63326.2	28.2		19678.1	63326.2	31.1	B31.3
3(EXP)		111342.4	233685.9	47.6		114445	231848.5	49.4	B31.3
1(OPE)	50	129887.6	0	0	59	127324.4	0	0	B31.3
2(SUS)		19678.1	63326.2	31.1		17840.8	63326.2	28.2	B31.3
3(EXP)		114445	231848.5	49.4		111342.4	233685.9	47.6	B31.3
1(OPE)	59	127324.4	0	0	60	120991.2	0	0	B31.3
2(SUS)		17840.8	63326.2	28.2		19997.2	63326.2	31.6	B31.3
3(EXP)		111342.4	233685.9	47.6		103854.3	231529.4	44.9	B31.3
1(OPE)	60	120991.2	0	0	65	62523.6	0	0	B31.3
2(SUS)		19997.2	63326.2	31.6		43867.2	63326.2	69.3	B31.3
3(EXP)		103854.3	231529.4	44.9		36497.6	207659.5	17.6	B31.3
1(OPE)	65	62204.2	0	0	68	80062.2	0	0	B31.3
2(SUS)		43908.8	63326.2	69.3		18475.2	63326.2	29.2	B31.3
3(EXP)		36497.6	207617.8	17.6		63985.4	233051.4	27.5	B31.3
1(OPE)	68	80062.2	0	0	69	87812	0	0	B31.3
2(SUS)		18475.2	63326.2	29.2		19141.6	63326.2	30.2	B31.3
3(EXP)		63985.4	233051.4	27.5		71725.9	232385.1	30.9	B31.3
1(OPE)	69	87812	0	0	70	91094	0	0	B31.3
2(SUS)		19141.6	63326.2	30.2		19103.4	63326.2	30.2	B31.3
3(EXP)		71725.9	232385.1	30.9		74806.7	232423.3	32.2	B31.3
1(OPE)	70	91094	0	0	79	91089.1	0	0	B31.3
2(SUS)		19103.4	63326.2	30.2		18744.4	63326.2	29.6	B31.3
3(EXP)		74806.7	232423.3	32.2		75735.6	232782.2	32.5	B31.3
1(OPE)	79	91089.1	0	0	80	89742.2	0	0	B31.3
2(SUS)		18744.4	63326.2	29.6		18123.4	63326.2	28.6	B31.3
3(EXP)		75735.6	232782.2	32.5		74495.4	233403.3	31.9	B31.3
1(OPE)	80	89742.2	0	0	85	70261.4	0	0	B31.3
2(SUS)		18123.4	63326.2	28.6		25992.4	63326.2	41	B31.3
3(EXP)		74495.4	233403.3	31.9		54246.4	225534.3	24.1	B31.3
1(OPE)	85	70036.3	0	0	90	31429.3	0	0	B31.3
2(SUS)		25993.3	63326.2	41		23423.6	63326.2	37	B31.3
3(EXP)		54246.4	225533.3	24.1		14340.7	228103.1	6.3	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1366mm

1(OPE)	90	31172.8	0	0	100	39630.7	0	0	B31.3
2(SUS)		23424	63326.2	37		24191.1	63326.2	38.2	B31.3
3(EXP)		14340.7	228102.7	6.3		24516.6	227335.6	10.8	B31.3
1(OPE)	100	39630.7	0	0	110	31172.8	0	0	B31.3
2(SUS)		24191.1	63326.2	38.2		23424	63326.2	37	B31.3
3(EXP)		24516.6	227335.6	10.8		14340.7	228102.7	6.3	B31.3
1(OPE)	110	31429.3	0	0	120	70036.4	0	0	B31.3
2(SUS)		23423.6	63326.2	37		25993.3	63326.2	41	B31.3
3(EXP)		14340.7	228103.1	6.3		54246.4	225533.3	24.1	B31.3
1(OPE)	120	70261.4	0	0	128	89742.2	0	0	B31.3
2(SUS)		25992.4	63326.2	41		18123.4	63326.2	28.6	B31.3
3(EXP)		54246.4	225534.3	24.1		74495.4	233403.3	31.9	B31.3
1(OPE)	128	89742.2	0	0	129	91089.1	0	0	B31.3
2(SUS)		18123.4	63326.2	28.6		18744.4	63326.2	29.6	B31.3
3(EXP)		74495.4	233403.3	31.9		75735.6	232782.2	32.5	B31.3
1(OPE)	129	91089.1	0	0	130	91515.5	0	0	B31.3
2(SUS)		18744.4	63326.2	29.6		18898.9	63326.2	29.8	B31.3
3(EXP)		75735.6	232782.2	32.5		75224.8	232627.8	32.3	B31.3
1(OPE)	130	91515.5	0	0	139	87812	0	0	B31.3
2(SUS)		18898.9	63326.2	29.8		19141.6	63326.2	30.2	B31.3
3(EXP)		75224.8	232627.8	32.3		71725.9	232385.1	30.9	B31.3
1(OPE)	139	87812	0	0	140	80062.2	0	0	B31.3
2(SUS)		19141.6	63326.2	30.2		18475.2	63326.2	29.2	B31.3
3(EXP)		71725.9	232385.1	30.9		63985.4	233051.4	27.5	B31.3
1(OPE)	140	80062.2	0	0	150	62204.2	0	0	B31.3
2(SUS)		18475.2	63326.2	29.2		43908.8	63326.2	69.3	B31.3
3(EXP)		63985.4	233051.4	27.5		36497.6	207617.8	17.6	B31.3
1(OPE)	150	62523.6	0	0	158	120991.2	0	0	B31.3
2(SUS)		43867.2	63326.2	69.3		19997.2	63326.2	31.6	B31.3
3(EXP)		36497.6	207659.5	17.6		103854.3	231529.4	44.9	B31.3
1(OPE)	158	120991.2	0	0	159	127324.4	0	0	B31.3
2(SUS)		19997.2	63326.2	31.6		17840.8	63326.2	28.2	B31.3
3(EXP)		103854.3	231529.4	44.9		111342.4	233685.9	47.6	B31.3
1(OPE)	159	127324.4	0	0	160	129887.6	0	0	B31.3
2(SUS)		17840.8	63326.2	28.2		19678.1	63326.2	31.1	B31.3
3(EXP)		111342.4	233685.9	47.6		114445	231848.5	49.4	B31.3
1(OPE)	160	129887.6	0	0	168	129887.6	0	0	B31.3
2(SUS)		19678.1	63326.2	31.1		19678.1	63326.2	31.1	B31.3
3(EXP)		114445	231848.5	49.4		114445	231848.5	49.4	B31.3
1(OPE)	168	129887.6	0	0	169	127324.4	0	0	B31.3
2(SUS)		19678.1	63326.2	31.1		17840.8	63326.2	28.2	B31.3
3(EXP)		114445	231848.5	49.4		111342.4	233685.9	47.6	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1366mm

1(OPE)	169	127324.4	0	0	170	120991.2	0	0	B31.3
2(SUS)		17840.8	63326.2	28.2		19997.2	63326.2	31.6	B31.3
3(EXP)		111342.4	233685.9	47.6		103854.3	231529.4	44.9	B31.3
1(OPE)	170	120991.2	0	0	180	62523.6	0	0	B31.3
2(SUS)		19997.2	63326.2	31.6		43867.2	63326.2	69.3	B31.3
3(EXP)		103854.3	231529.4	44.9		36497.6	207659.5	17.6	B31.3
1(OPE)	180	62204.2	0	0	188	80062.2	0	0	B31.3
2(SUS)		43908.8	63326.2	69.3		18475.2	63326.2	29.2	B31.3
3(EXP)		36497.6	207617.8	17.6		63985.4	233051.4	27.5	B31.3
1(OPE)	188	80062.2	0	0	189	87812	0	0	B31.3
2(SUS)		18475.2	63326.2	29.2		19141.6	63326.2	30.2	B31.3
3(EXP)		63985.4	233051.4	27.5		71725.8	232385.1	30.9	B31.3
1(OPE)	189	87812	0	0	190	91094	0	0	B31.3
2(SUS)		19141.6	63326.2	30.2		19103.4	63326.2	30.2	B31.3
3(EXP)		71725.8	232385.1	30.9		74806.7	232423.3	32.2	B31.3
1(OPE)	190	91094	0	0	199	91089.1	0	0	B31.3
2(SUS)		19103.4	63326.2	30.2		18744.4	63326.2	29.6	B31.3
3(EXP)		74806.7	232423.3	32.2		75735.6	232782.2	32.5	B31.3
1(OPE)	199	91089.1	0	0	200	89742.2	0	0	B31.3
2(SUS)		18744.4	63326.2	29.6		18123.4	63326.2	28.6	B31.3
3(EXP)		75735.6	232782.2	32.5		74495.4	233403.3	31.9	B31.3
1(OPE)	200	89742.2	0	0	210	70261.4	0	0	B31.3
2(SUS)		18123.4	63326.2	28.6		25992.4	63326.2	41	B31.3
3(EXP)		74495.4	233403.3	31.9		54246.4	225534.3	24.1	B31.3
1(OPE)	210	70036.3	0	0	220	31429.3	0	0	B31.3
2(SUS)		25993.3	63326.2	41		23423.6	63326.2	37	B31.3
3(EXP)		54246.4	225533.3	24.1		14340.8	228103.1	6.3	B31.3
1(OPE)	220	31172.8	0	0	230	39630.6	0	0	B31.3
2(SUS)		23424	63326.2	37		24191	63326.2	38.2	B31.3
3(EXP)		14340.8	228102.6	6.3		24516.5	227335.6	10.8	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14274	-12423	82808	-13370	-69420	7433	0	0	0
	2(SUS)	-269	-14472	116	-18456	643	-2213	0	0	0
	3(EXP)	14543	2049	82691	5087	-70064	9645	0	0	0
	MAX	14543/L3	-14472/L	82808/L	-18456/L	-70064/L	9645/L3	0.000/L3	-0.000/L2	0.000/L1
15		Rigid +Y								
	1(OPE)	1710	-35425	-10489	0	0	0	8.821	0	-54.112
	2(SUS)	1152	-27146	18	0	0	0	0.007	0	0
	3(EXP)	558	-8279	-10507	0	0	0	8.814	0	-54.112
	MAX	1710/L1	-35425/L	-10507/L3				8.821/L1	-0.000/L1	-54.112/L3
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2893	-28150	-9240	0	0	0	-3	0	-108.233
	2(SUS)	-2553	-28479	38	0	0	0	-0.015	0	0
	3(EXP)	-339	329	-9278	0	0	0	-2.985	0	-108.234
	MAX	-2893/L1	-28479/L	-9278/L3				-3.000/L1	-0.000/L2	-108.234/L3
45		Rigid +Y								
	1(OPE)	-12355	-45632	-5895	0	0	0	-81.235	0	-38.761
	2(SUS)	1671	-51533	-950	0	0	0	0.01	0	-0.005
	3(EXP)	-14026	5902	-4946	0	0	0	-81.245	0	-38.756
	MAX	-14026/L	-51533/L	-5895/L1				-81.245/L	-0.000/L2	-38.761/L1
65		Rigid +Y								
	1(OPE)	-12355	-45632	5895	0	0	0	-81.235	0	38.761
	2(SUS)	1671	-51533	950	0	0	0	0.01	0	0.005
	3(EXP)	-14026	5902	4946	0	0	0	-81.245	0	38.756
	MAX	-14026/L	-51533/L	5895/L1				-81.245/L	-0.000/L2	38.761/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2893	-28150	9240	0	0	0	-3	0	108.233
	2(SUS)	-2553	-28479	-38	0	0	0	-0.015	0	0
	3(EXP)	-340	329	9278	0	0	0	-2.985	0	108.234
	MAX	-2893/L1	-28479/L	9278/L3				-3.000/L1	-0.000/L2	108.234/L3
90		Rigid +Y								
	1(OPE)	1710	-35425	10489	0	0	0	8.821	0	54.112
	2(SUS)	1152	-27146	-18	0	0	0	0.007	0	0
	3(EXP)	558	-8279	10507	0	0	0	8.814	0	54.112
	MAX	1710/L1	-35425/L	10507/L3				8.821/L1	-0.000/L1	54.112/L3
100		Rigid ANC								
	1(OPE)	28547	-24846	0	0	0	14866	0	0	0
	2(SUS)	-539	-28943	0	0	0	-4425	0	0	0
	3(EXP)	29086	4097	0	0	0	19291	0	0	0
	MAX	29086/L3	-28943/L	-0/L1	0/L1	0/L3	19291/L3	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1710	-35425	-10489	0	0	0	8.821	0	-54.112
	2(SUS)	1152	-27146	18	0	0	0	0.007	0	0
	3(EXP)	558	-8279	-10507	0	0	0	8.814	0	-54.112
	MAX	1710/L1	-35425/L	-10507/L3				8.821/L1	-0.000/L1	-54.112/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2893	-28150	-9240	0	0	0	-3	0	-108.233
	2(SUS)	-2553	-28479	38	0	0	0	-0.015	0	0
	3(EXP)	-339	329	-9278	0	0	0	-2.985	0	-108.234
	MAX	-2893/L1	-28479/L	-9278/L3				-3.000/L1	-0.000/L2	-108.234/L3
150		Rigid +Y								
	1(OPE)	-12355	-45632	-5895	0	0	0	-81.235	0	-38.761
	2(SUS)	1671	-51533	-950	0	0	0	0.01	0	-0.005
	3(EXP)	-14026	5902	-4946	0	0	0	-81.245	0	-38.756
	MAX	-14026/L	-51533/L	-5895/L1				-81.245/L	-0.000/L2	-38.761/L1
180		Rigid +Y								
	1(OPE)	-12355	-45632	5895	0	0	0	-81.235	0	38.761
	2(SUS)	1671	-51533	950	0	0	0	0.01	0	0.005
	3(EXP)	-14026	5902	4946	0	0	0	-81.245	0	38.756
	MAX	-14026/L	-51533/L	5895/L1				-81.245/L	-0.000/L2	38.761/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2893	-28150	9240	0	0	0	-3	0	108.233
	2(SUS)	-2553	-28479	-38	0	0	0	-0.015	0	0
	3(EXP)	-339	329	9278	0	0	0	-2.985	0	108.234
	MAX	-2893/L1	-28479/L	9278/L3				-3.000/L1	-0.000/L2	108.234/L3
220		Rigid +Y								
	1(OPE)	1710	-35425	10489	0	0	0	8.821	0	54.112
	2(SUS)	1152	-27146	-18	0	0	0	0.007	0	0
	3(EXP)	558	-8279	10507	0	0	0	8.814	0	54.112
	MAX	1710/L1	-35425/L	10507/L3				8.821/L1	-0.000/L1	54.112/L3
230		Rigid ANC								
	1(OPE)	14274	-12423	-82808	13370	69420	7433	0	0	0
	2(SUS)	-269	-14472	-116	18456	-643	-2213	0	0	0
	3(EXP)	14543	2049	-82691	-5087	70064	9645	0	0	0
	MAX	14543/L1	-14472/L	-82808/L	18456/L1	70064/L1	9645/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.814	0	-54.112	-0.0103	-0.0616	0.0494
20	-2.985	0	-108.234	0.0416	0.3178	0.0989
28	-34.44	5.476	-135.057	0.1348	0.671	0.1233
29	-39.462	7.566	-137.368	0.1574	0.7515	0.1343
30	-42.509	10.741	-137.386	0.1736	0.8178	0.1478
39	-45.435	15.199	-132.8	0.1831	0.9265	0.1608
40	-48.608	15.231	-125.93	0.184	0.9996	0.1717
45	-81.245	0	-38.756	0.1087	1.0937	0.2035
48	-105.914	-12.131	17.488	0.0518	0.7307	0.2035
49	-110.412	-13.344	20.798	0.0443	0.6057	0.2044
50	-115.077	-13.643	19.608	0.035	0.4742	0.2053
59	-110.412	-13.344	-20.798	-0.0443	-0.6057	0.2044
60	-105.914	-12.131	-17.488	-0.0518	-0.7307	0.2035
65	-81.245	0	38.756	-0.1087	-1.0937	0.2035
68	-48.608	15.231	125.93	-0.184	-0.9996	0.1717
69	-45.435	15.199	132.8	-0.1831	-0.9265	0.1608
70	-43.286	12.902	136.46	-0.1765	-0.8617	0.1509
79	-39.463	7.566	137.368	-0.1574	-0.7515	0.1343
80	-34.44	5.476	135.057	-0.1348	-0.671	0.1233
85	-2.985	0	108.234	-0.0416	-0.3178	0.0988
90	8.814	0	54.112	0.0103	0.0616	0.0494
100	0	0	0	0	0	0
110	8.814	0	-54.112	-0.0103	-0.0616	0.0494
120	-2.985	0	-108.234	0.0416	0.3178	0.0989
128	-34.44	5.476	-135.057	0.1348	0.671	0.1233
129	-39.462	7.566	-137.368	0.1574	0.7515	0.1343
130	-42.509	10.741	-137.386	0.1736	0.8178	0.1478
139	-45.435	15.199	-132.8	0.1831	0.9265	0.1608
140	-48.608	15.231	-125.93	0.184	0.9996	0.1717
150	-81.245	0	-38.756	0.1087	1.0937	0.2035
158	-105.914	-12.131	17.488	0.0518	0.7307	0.2035
159	-110.412	-13.344	20.798	0.0443	0.6057	0.2044
160	-115.077	-13.643	19.608	0.035	0.4742	0.2053
168	-115.077	-13.643	-19.608	-0.035	-0.4742	0.2053
169	-110.412	-13.344	-20.798	-0.0443	-0.6057	0.2044
170	-105.914	-12.131	-17.488	-0.0518	-0.7307	0.2035
180	-81.245	0	38.756	-0.1087	-1.0937	0.2035
188	-48.608	15.231	125.93	-0.184	-0.9996	0.1717
189	-45.435	15.199	132.8	-0.1831	-0.9265	0.1608

190	-43.286	12.902	136.46	-0.1765	-0.8617	0.1509
199	-39.462	7.566	137.368	-0.1574	-0.7515	0.1343
200	-34.44	5.476	135.057	-0.1348	-0.671	0.1233
210	-2.985	0	108.234	-0.0416	-0.3178	0.0988
220	8.814	0	54.112	0.0103	0.0616	0.0494
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.007	0	0	0.0015	-0.0015	-0.0113
20	-0.015	0	0	-0.006	0.0062	-0.0227
28	-0.624	-1.092	0	-0.0194	0.0104	-0.0283
29	-0.612	-1.219	-0.052	-0.0193	0.0098	-0.0291
30	-0.444	-1.271	-0.179	-0.0193	0.0092	-0.0302
39	-0.079	-1.184	-0.385	-0.0196	0.0082	-0.0322
40	0.01	-0.968	-0.387	-0.0199	0.0075	-0.0331
45	0.01	0	-0.005	-0.0214	0.0019	0.0396
48	0.01	-4.992	0.006	-0.0226	-0.0006	0.1061
49	0.011	-5.761	0.002	-0.0227	-0.0006	0.1076
50	0.015	-6.204	0	-0.0214	-0.0005	0.1077
59	0.011	-5.761	-0.002	0.0227	0.0006	0.1076
60	0.01	-4.992	-0.006	0.0226	0.0006	0.1061
65	0.01	0	0.005	0.0214	-0.0019	0.0396
68	0.01	-0.968	0.387	0.0199	-0.0075	-0.0331
69	-0.079	-1.184	0.385	0.0196	-0.0082	-0.0322
70	-0.285	-1.271	0.28	0.0194	-0.0088	-0.0307
79	-0.612	-1.219	0.052	0.0193	-0.0098	-0.0291
80	-0.624	-1.092	0	0.0194	-0.0104	-0.0283
85	-0.015	0	0	0.006	-0.0062	-0.0227
90	0.007	0	0	-0.0015	0.0015	-0.0113
100	0	0	0	0	0	0
110	0.007	0	0	0.0015	-0.0015	-0.0113
120	-0.015	0	0	-0.006	0.0062	-0.0227
128	-0.624	-1.092	0	-0.0194	0.0104	-0.0283
129	-0.612	-1.219	-0.052	-0.0193	0.0098	-0.0291
130	-0.444	-1.271	-0.179	-0.0193	0.0092	-0.0302
139	-0.079	-1.184	-0.385	-0.0196	0.0082	-0.0322
140	0.01	-0.968	-0.387	-0.0199	0.0075	-0.0331
150	0.01	0	-0.005	-0.0214	0.0019	0.0396
158	0.01	-4.992	0.006	-0.0226	-0.0006	0.1061
159	0.011	-5.761	0.002	-0.0227	-0.0006	0.1076
160	0.015	-6.204	0	-0.0214	-0.0005	0.1077
168	0.015	-6.204	0	0.0214	0.0005	0.1077
169	0.011	-5.761	-0.002	0.0227	0.0006	0.1076
170	0.01	-4.992	-0.006	0.0226	0.0006	0.1061
180	0.01	0	0.005	0.0214	-0.0019	0.0396
188	0.01	-0.968	0.387	0.0199	-0.0075	-0.0331
189	-0.079	-1.184	0.385	0.0196	-0.0082	-0.0322

190	-0.285	-1.271	0.28	0.0194	-0.0088	-0.0307
199	-0.612	-1.219	0.052	0.0193	-0.0098	-0.0291
200	-0.624	-1.092	0	0.0194	-0.0104	-0.0283
210	-0.015	0	0	0.006	-0.0062	-0.0227
220	0.007	0	0	-0.0015	0.0015	-0.0113
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:28
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+300
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.821	0	-54.112	-0.0088	-0.063	0.0381
20	-3	0	-108.233	0.0356	0.324	0.0762
28	-35.064	4.383	-135.057	0.1154	0.6814	0.095
29	-40.075	6.347	-137.42	0.1382	0.7613	0.1053
30	-42.953	9.47	-137.565	0.1542	0.827	0.1176
39	-45.514	14.014	-133.185	0.1635	0.9347	0.1286
40	-48.598	14.263	-126.317	0.1641	1.0071	0.1386
45	-81.235	0	-38.761	0.0873	1.0956	0.2432
48	-105.904	-17.122	17.494	0.0292	0.7301	0.3097
49	-110.401	-19.106	20.799	0.0216	0.6051	0.3121
50	-115.062	-19.846	19.608	0.0137	0.4737	0.3131
59	-110.401	-19.106	-20.799	-0.0216	-0.6051	0.3121
60	-105.904	-17.122	-17.494	-0.0292	-0.7301	0.3097
65	-81.235	0	38.761	-0.0873	-1.0956	0.2432
68	-48.598	14.263	126.317	-0.1641	-1.0071	0.1386
69	-45.514	14.014	133.185	-0.1635	-0.9347	0.1286
70	-43.572	11.631	136.74	-0.1571	-0.8706	0.1202
79	-40.075	6.347	137.42	-0.1382	-0.7613	0.1053
80	-35.064	4.383	135.057	-0.1154	-0.6814	0.095
85	-3	0	108.233	-0.0356	-0.324	0.0762
90	8.821	0	54.112	0.0088	0.063	0.0381
100	0	0	0	0	0	0
110	8.821	0	-54.112	-0.0088	-0.063	0.0381
120	-3	0	-108.233	0.0356	0.324	0.0762
128	-35.064	4.383	-135.057	0.1154	0.6814	0.095
129	-40.075	6.347	-137.42	0.1382	0.7613	0.1053
130	-42.953	9.47	-137.565	0.1542	0.827	0.1176
139	-45.514	14.014	-133.185	0.1635	0.9347	0.1286
140	-48.598	14.263	-126.317	0.1641	1.0071	0.1386
150	-81.235	0	-38.761	0.0873	1.0956	0.2432
158	-105.904	-17.122	17.494	0.0292	0.7301	0.3097
159	-110.401	-19.106	20.799	0.0216	0.6051	0.3121
160	-115.062	-19.846	19.608	0.0137	0.4737	0.3131
168	-115.062	-19.846	-19.608	-0.0137	-0.4737	0.3131
169	-110.401	-19.106	-20.799	-0.0216	-0.6051	0.3121
170	-105.904	-17.122	-17.494	-0.0292	-0.7301	0.3097
180	-81.235	0	38.761	-0.0873	-1.0956	0.2432
188	-48.598	14.263	126.317	-0.1641	-1.0071	0.1386
189	-45.514	14.014	133.185	-0.1635	-0.9347	0.1286

190	-43.572	11.631	136.74	-0.1571	-0.8706	0.1202
199	-40.075	6.347	137.42	-0.1382	-0.7613	0.1053
200	-35.064	4.383	135.057	-0.1154	-0.6814	0.095
210	-3	0	108.233	-0.0356	-0.324	0.0762
220	8.821	0	54.112	0.0088	0.063	0.0381
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .30
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .30
Node 20 +Y Mu = .30

From 20 To 30 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28

From 30 To 40 DY= 1,466.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
-------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .30
-------------------------------------------------------------------------------
From  45  To  50  DX= -3,948.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
-------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
-------------------------------------------------------------------------------
From  60  To  65  DX= 3,948.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .30
-------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
-------------------------------------------------------------------------------
From  70  To  80 DY= -1,466.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 79
-------------------------------------------------------------------------------
From  80  To  85 DZ= -4,250.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .30
  Node  85  +Y   Mu = .30
-------------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .30
-------------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
-------------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
  Node  110  +Y   Mu = .30
-------------------------------------------------------------------------------
```

From 110 To 120 DZ= -7,500.000 mm.
RESTRAINTS
Node 120 +Y Mu = .30
Node 120 Guide Gap= 3.000 mm. Mu = .30

From 120 To 130 DZ= -4,250.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 129
Angle/Node @2= .00 128

From 130 To 140 DY= 1,466.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 139

From 140 To 150 DX= -5,052.000 mm.
RESTRAINTS
Node 150 +Y Mu = .30

From 150 To 160 DX= -3,948.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 159
Angle/Node @2= .00 158

From 160 To 170 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 169
Angle/Node @2= .00 168

From 170 To 180 DX= 3,948.000 mm.
RESTRAINTS
Node 180 +Y Mu = .30

From 180 To 190 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 189
Angle/Node @2= .00 188

From 190 To 200 DY= -1,466.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 199

From 200 To 210 DZ= -4,250.000 mm.
RESTRAINTS
Node 210 +Y Mu = .30
Node 210 Guide Gap= 3.000 mm. Mu = .30

From 210 To 220 DZ= -7,500.000 mm.
RESTRAINTS
Node 220 +Y Mu = .30

From 220 To 230 DZ= -7,500.000 mm.
RESTRAINTS
Node 230 ANC

MATERIAL Changes:
10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.
JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes
10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS
20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 29
Angle/Node @2= .00 28
30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48
50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59
65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68
70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 79
120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
129 Angle/Node @2= .00 128
130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139
150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
159 Angle/Node @2= .00 158
160 170 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
169 Angle/Node @2= .00 168

```
 180         190          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
                      189   Angle/Node @2= .00 188
 190         200          Radius= 533.400 mm. (LONG)
                        Bend Angle= 90.000   Angle/Node @1= 45.00
       199

RESTRAINTS                        Len       MU
                                GAP     YIELD         Dir
  NODE  TYPE    CNODE     STIF1     STIF2     FORCE       Vectors
-------+-------+------+----------+----------+----------+--------------------
    10  ANC                          .30    .000   .000   .000
    15  +Y                           .30    .000  1.000   .000
    20  Guide                  3.00      .30    .000   .000   .000
    20  +Y                           .30    .000  1.000   .000
    45  +Y                           .30    .000  1.000   .000
    65  +Y                           .30    .000  1.000   .000
    85  Guide                  3.00      .30    .000   .000   .000
    85  +Y                           .30    .000  1.000   .000
    90  +Y                           .30    .000  1.000   .000
   100  ANC                          .30    .000   .000   .000
   110  +Y                           .30    .000  1.000   .000
   120  +Y                           .30    .000  1.000   .000
   120  Guide                  3.00      .30    .000   .000   .000
   150  +Y                           .30    .000  1.000   .000
   180  +Y                           .30    .000  1.000   .000
   210  +Y                           .30    .000  1.000   .000
   210  Guide                  3.00      .30    .000   .000   .000
   220  +Y                           .30    .000  1.000   .000
   230  ANC                          .30    .000   .000   .000

INPUT UNITS USED...

UNITS=    SI (m NOM/SCH INPUT= ON
     LENGTH          inches      x    25.400  =   mm.
     FORCE           pounds      x     4.448  =   N.
     MASS(dynamics)  pounds      x     0.454  =   Kg.
     MOMENTS(INPUT)  inch-pounds x     0.113  =   N.m.
     MOMENTS(OUTPUT) inch-pounds x     0.113  =   N.m.
     STRESS          lbs./sq.in. x     6.895  =    KPa
     TEMP. SCALE     degrees F.  x     0.556  =   C
     PRESSURE        psig        x     6.895  =    KPa
     ELASTIC MODULUS lbs./sq.in. x     6.895  =    KPa
     PIPE DENSITY    lbs./cu.in. x     0.028  =   kg./cu.cm.
     INSULATION DENS. lbs./cu.in. x    0.028  =   kg./cu.cm.
     FLUID DENSITY   lbs./cu.in. x     0.028  =   kg./cu.cm.
     TRANSL. STIF    lbs./in.    x     1.751  =   N./cm.
     ROTATIONAL STIF in.lb./deg. x     0.113  =   N.m./deg
     UNIFORM LOAD    lb./in.     x     1.751  =   N./cm.
     G LOAD          g's         x     1.000  =   g's
```

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1466mm

WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO
B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT

ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000
Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1466mm

COORDINATE REPORT

NODE	X (mm.)	Y (mm.)	Z (mm.)
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-19250.000
40	.000	1466.000	-19250.000
45	-5052.000	1466.000	-19250.000
50	-9000.000	1466.000	-19250.000
60	-9000.000	1466.000	-25750.000
65	-5052.000	1466.000	-25750.000
70	.000	1466.000	-25750.000
80	.000	.000	-25750.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-64250.000
140	.000	1466.000	-64250.000
150	-5052.000	1466.000	-64250.000
160	-9000.000	1466.000	-64250.000
170	-9000.000	1466.000	-70750.000
180	-5052.000	1466.000	-70750.000
190	.000	1466.000	-70750.000
200	.000	.000	-70750.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 69.4 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 43918.7 Allowable Stress: 63326.2
Axial Stress: 17842.6 @Node 39 LOADCASE: 2 (SUS) W+P1
Bending Stress: 113962.3 @Node 50 LOADCASE: 3 (EXP) L3=L1-L2
Torsion Stress: 36600.5 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 134844.6 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	39289.2	0	0	15	31139.3	0	0	B31.3
2(SUS)		24236.2	63326.2	38.3		23334.9	63326.2	36.8	B31.3
3(EXP)		24210.2	227290.4	10.7		14321.4	228191.7	6.3	B31.3
1(OPE)	15	31397.7	0	0	20	69324.1	0	0	B31.3
2(SUS)		23334.2	63326.2	36.8		26350.1	63326.2	41.6	B31.3
3(EXP)		14321.4	228192.4	6.3		53523.6	225176.6	23.8	B31.3
1(OPE)	20	69552.8	0	0	28	89080	0	0	B31.3
2(SUS)		26348.5	63326.2	41.6		18146.2	63326.2	28.7	B31.3
3(EXP)		53523.6	225178.1	23.8		73772.7	233380.5	31.6	B31.3
1(OPE)	28	89080	0	0	29	90345.4	0	0	B31.3
2(SUS)		18146.2	63326.2	28.7		18756.8	63326.2	29.6	B31.3
3(EXP)		73772.7	233380.5	31.6		74959.3	232769.8	32.2	B31.3
1(OPE)	29	90345.4	0	0	30	90589.2	0	0	B31.3
2(SUS)		18756.8	63326.2	29.6		18921.6	63326.2	29.9	B31.3
3(EXP)		74959.3	232769.8	32.2		74304.4	232605	31.9	B31.3
1(OPE)	30	90589.2	0	0	39	86805.5	0	0	B31.3
2(SUS)		18921.6	63326.2	29.9		19237.8	63326.2	30.4	B31.3
3(EXP)		74304.4	232605	31.9		70753.6	232288.9	30.5	B31.3
1(OPE)	39	86805.5	0	0	40	79185.7	0	0	B31.3
2(SUS)		19237.8	63326.2	30.4		18544.3	63326.2	29.3	B31.3
3(EXP)		70753.6	232288.9	30.5		63145.2	232982.3	27.1	B31.3

Possible Approach:
Expansion Loop +90 Elbow Dimension D:1466mm

1(OPE)	40	79185.7	0	0	45	62359.1	0	0	B31.3
2(SUS)		18544.3	63326.2	29.3		43918.7	63326.2	69.4	B31.3
3(EXP)		63145.2	232982.3	27.1		36521.9	207608	17.6	B31.3
1(OPE)	45	62672.3	0	0	48	120570.6	0	0	B31.3
2(SUS)		43874.2	63326.2	69.3		19996.8	63326.2	31.6	B31.3
3(EXP)		36521.9	207652.5	17.6		103432.9	231529.8	44.7	B31.3
1(OPE)	48	120570.6	0	0	49	126846.7	0	0	B31.3
2(SUS)		19996.8	63326.2	31.6		17829.7	63326.2	28.2	B31.3
3(EXP)		103432.9	231529.8	44.7		110877.6	233697	47.4	B31.3
1(OPE)	49	126846.7	0	0	50	129381.6	0	0	B31.3
2(SUS)		17829.7	63326.2	28.2		19748	63326.2	31.2	B31.3
3(EXP)		110877.6	233697	47.4		113962.3	231778.7	49.2	B31.3
1(OPE)	50	129381.6	0	0	59	126846.7	0	0	B31.3
2(SUS)		19748	63326.2	31.2		17829.7	63326.2	28.2	B31.3
3(EXP)		113962.3	231778.7	49.2		110877.6	233697	47.4	B31.3
1(OPE)	59	126846.7	0	0	60	120570.6	0	0	B31.3
2(SUS)		17829.7	63326.2	28.2		19996.8	63326.2	31.6	B31.3
3(EXP)		110877.6	233697	47.4		103432.9	231529.8	44.7	B31.3
1(OPE)	60	120570.6	0	0	65	62672.3	0	0	B31.3
2(SUS)		19996.8	63326.2	31.6		43874.2	63326.2	69.3	B31.3
3(EXP)		103432.9	231529.8	44.7		36521.9	207652.5	17.6	B31.3
1(OPE)	65	62359.1	0	0	68	79185.7	0	0	B31.3
2(SUS)		43918.7	63326.2	69.4		18544.3	63326.2	29.3	B31.3
3(EXP)		36521.9	207608	17.6		63145.2	232982.3	27.1	B31.3
1(OPE)	68	79185.7	0	0	69	86805.5	0	0	B31.3
2(SUS)		18544.3	63326.2	29.3		19237.8	63326.2	30.4	B31.3
3(EXP)		63145.2	232982.3	27.1		70753.6	232288.9	30.5	B31.3
1(OPE)	69	86805.5	0	0	70	89974.3	0	0	B31.3
2(SUS)		19237.8	63326.2	30.4		19210.5	63326.2	30.3	B31.3
3(EXP)		70753.6	232288.9	30.5		73711.5	232316.1	31.7	B31.3
1(OPE)	70	89974.3	0	0	79	90345.4	0	0	B31.3
2(SUS)		19210.5	63326.2	30.3		18756.8	63326.2	29.6	B31.3
3(EXP)		73711.5	232316.1	31.7		74959.3	232769.8	32.2	B31.3
1(OPE)	79	90345.4	0	0	80	89080	0	0	B31.3
2(SUS)		18756.8	63326.2	29.6		18146.2	63326.2	28.7	B31.3
3(EXP)		74959.3	232769.8	32.2		73772.7	233380.5	31.6	B31.3
1(OPE)	80	89080	0	0	85	69552.8	0	0	B31.3
2(SUS)		18146.2	63326.2	28.7		26348.5	63326.2	41.6	B31.3
3(EXP)		73772.7	233380.5	31.6		53523.6	225178.1	23.8	B31.3
1(OPE)	85	69324.1	0	0	90	31397.7	0	0	B31.3
2(SUS)		26350.1	63326.2	41.6		23334.2	63326.2	36.8	B31.3
3(EXP)		53523.6	225176.6	23.8		14321.3	228192.4	6.3	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1466mm

1(OPE)	90	31139.3	0	0	100	39289.3	0	0	B31.3
2(SUS)		23334.9	63326.2	36.8		24236.3	63326.2	38.3	B31.3
3(EXP)		14321.3	228191.7	6.3		24210.3	227290.3	10.7	B31.3
1(OPE)	100	39289.3	0	0	110	31139.3	0	0	B31.3
2(SUS)		24236.3	63326.2	38.3		23334.9	63326.2	36.8	B31.3
3(EXP)		24210.3	227290.4	10.7		14321.4	228191.7	6.3	B31.3
1(OPE)	110	31397.7	0	0	120	69324.1	0	0	B31.3
2(SUS)		23334.2	63326.2	36.8		26350.1	63326.2	41.6	B31.3
3(EXP)		14321.4	228192.4	6.3		53523.6	225176.6	23.8	B31.3
1(OPE)	120	69552.9	0	0	128	89080	0	0	B31.3
2(SUS)		26348.5	63326.2	41.6		18146.2	63326.2	28.7	B31.3
3(EXP)		53523.6	225178.1	23.8		73772.7	233380.5	31.6	B31.3
1(OPE)	128	89080	0	0	129	90345.4	0	0	B31.3
2(SUS)		18146.2	63326.2	28.7		18756.8	63326.2	29.6	B31.3
3(EXP)		73772.7	233380.5	31.6		74959.4	232769.8	32.2	B31.3
1(OPE)	129	90345.4	0	0	130	90589.2	0	0	B31.3
2(SUS)		18756.8	63326.2	29.6		18921.6	63326.2	29.9	B31.3
3(EXP)		74959.4	232769.8	32.2		74304.4	232605	31.9	B31.3
1(OPE)	130	90589.2	0	0	139	86805.5	0	0	B31.3
2(SUS)		18921.6	63326.2	29.9		19237.8	63326.2	30.4	B31.3
3(EXP)		74304.4	232605	31.9		70753.6	232288.9	30.5	B31.3
1(OPE)	139	86805.5	0	0	140	79185.7	0	0	B31.3
2(SUS)		19237.8	63326.2	30.4		18544.3	63326.2	29.3	B31.3
3(EXP)		70753.6	232288.9	30.5		63145.2	232982.3	27.1	B31.3
1(OPE)	140	79185.7	0	0	150	62359.1	0	0	B31.3
2(SUS)		18544.3	63326.2	29.3		43918.7	63326.2	69.4	B31.3
3(EXP)		63145.2	232982.3	27.1		36521.9	207608	17.6	B31.3
1(OPE)	150	62672.3	0	0	158	120570.6	0	0	B31.3
2(SUS)		43874.2	63326.2	69.3		19996.8	63326.2	31.6	B31.3
3(EXP)		36521.9	207652.5	17.6		103432.9	231529.8	44.7	B31.3
1(OPE)	158	120570.6	0	0	159	126846.7	0	0	B31.3
2(SUS)		19996.8	63326.2	31.6		17829.7	63326.2	28.2	B31.3
3(EXP)		103432.9	231529.8	44.7		110877.6	233697	47.4	B31.3
1(OPE)	159	126846.7	0	0	160	129381.6	0	0	B31.3
2(SUS)		17829.7	63326.2	28.2		19748	63326.2	31.2	B31.3
3(EXP)		110877.6	233697	47.4		113962.3	231778.7	49.2	B31.3
1(OPE)	160	129381.6	0	0	168	129381.6	0	0	B31.3
2(SUS)		19748	63326.2	31.2		19748	63326.2	31.2	B31.3
3(EXP)		113962.3	231778.7	49.2		113962.3	231778.7	49.2	B31.3
1(OPE)	168	129381.6	0	0	169	126846.7	0	0	B31.3
2(SUS)		19748	63326.2	31.2		17829.7	63326.2	28.2	B31.3
3(EXP)		113962.3	231778.7	49.2		110877.6	233697	47.4	B31.3

Possible Approach:

Expansion Loop +90 Elbow Dimension D:1466mm

1(OPE)	169	126846.7	0	0	170	120570.6	0	0	B31.3
2(SUS)		17829.7	63326.2	28.2		19996.8	63326.2	31.6	B31.3
3(EXP)		110877.6	233697	47.4		103432.9	231529.8	44.7	B31.3
1(OPE)	170	120570.6	0	0	180	62672.3	0	0	B31.3
2(SUS)		19996.8	63326.2	31.6		43874.2	63326.2	69.3	B31.3
3(EXP)		103432.9	231529.8	44.7		36521.9	207652.5	17.6	B31.3
1(OPE)	180	62359.1	0	0	188	79185.7	0	0	B31.3
2(SUS)		43918.7	63326.2	69.4		18544.3	63326.2	29.3	B31.3
3(EXP)		36521.9	207608	17.6		63145.2	232982.3	27.1	B31.3
1(OPE)	188	79185.7	0	0	189	86805.5	0	0	B31.3
2(SUS)		18544.3	63326.2	29.3		19237.8	63326.2	30.4	B31.3
3(EXP)		63145.2	232982.3	27.1		70753.6	232288.9	30.5	B31.3
1(OPE)	189	86805.5	0	0	190	89974.3	0	0	B31.3
2(SUS)		19237.8	63326.2	30.4		19210.5	63326.2	30.3	B31.3
3(EXP)		70753.6	232288.9	30.5		73711.5	232316.1	31.7	B31.3
1(OPE)	190	89974.3	0	0	199	90345.4	0	0	B31.3
2(SUS)		19210.5	63326.2	30.3		18756.8	63326.2	29.6	B31.3
3(EXP)		73711.5	232316.1	31.7		74959.3	232769.8	32.2	B31.3
1(OPE)	199	90345.4	0	0	200	89080	0	0	B31.3
2(SUS)		18756.8	63326.2	29.6		18146.2	63326.2	28.7	B31.3
3(EXP)		74959.3	232769.8	32.2		73772.7	233380.5	31.6	B31.3
1(OPE)	200	89080	0	0	210	69552.8	0	0	B31.3
2(SUS)		18146.2	63326.2	28.7		26348.5	63326.2	41.6	B31.3
3(EXP)		73772.7	233380.5	31.6		53523.6	225178.1	23.8	B31.3
1(OPE)	210	69324.1	0	0	220	31397.7	0	0	B31.3
2(SUS)		26350	63326.2	41.6		23334.2	63326.2	36.8	B31.3
3(EXP)		53523.6	225176.6	23.8		14321.4	228192.4	6.3	B31.3
1(OPE)	220	31139.3	0	0	230	39289.2	0	0	B31.3
2(SUS)		23335	63326.2	36.8		24236.2	63326.2	38.3	B31.3
3(EXP)		14321.4	228191.7	6.3		24210.2	227290.4	10.7	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10		Rigid ANC								
	1(OPE)	14060	-12355	82425	-13201	-68343	8059	0	0	0
	2(SUS)	-295	-14524	186	-18587	704	-2259	0	0	0
	3(EXP)	14354	2169	82239	5386	-69047	10318	0	0	0
	MAX	14354/L	-14524/L	82425/L	-18587/L	-69047/L	10318/L	0.000/L3	-0.000/L2	0.000/L1
15		Rigid +Y								
	1(OPE)	1696	-35700	-10575	0	0	0	8.679	0	-54.112
	2(SUS)	1260	-26934	28	0	0	0	0.007	0	0
	3(EXP)	436	-8766	-10603	0	0	0	8.672	0	-54.113
	MAX	1696/L1	-35700/L	-10603/L3				8.679/L1	-0.000/L1	-54.113/L3
20		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2919	-28631	-9390	0	0	0	-3	0	-108.234
	2(SUS)	-2751	-28941	61	0	0	0	-0.016	0	0
	3(EXP)	-168	311	-9451	0	0	0	-2.984	0	-108.234
	MAX	-2919/L1	-28941/L	-9451/L3				-3.000/L1	-0.000/L2	-108.234/L3
45		Rigid +Y								
	1(OPE)	-12285	-45322	-5828	0	0	0	-81.122	0	-38.482
	2(SUS)	1785	-51609	-1198	0	0	0	0.01	0	-0.007
	3(EXP)	-14070	6286	-4629	0	0	0	-81.132	0	-38.475
	MAX	-14070/L	-51609/L	-5828/L1				-81.132/L	-0.000/L2	-38.482/L1
65		Rigid +Y								
	1(OPE)	-12285	-45322	5828	0	0	0	-81.122	0	38.482
	2(SUS)	1785	-51609	1198	0	0	0	0.01	0	0.007
	3(EXP)	-14070	6286	4629	0	0	0	-81.132	0	38.475
	MAX	-14070/L	-51609/L	5828/L1				-81.132/L	-0.000/L2	38.482/L1
85		Rigid GUI w/gap; Rigid +Y								
	1(OPE)	-2919	-28631	9390	0	0	0	-3	0	108.234
	2(SUS)	-2751	-28941	-61	0	0	0	-0.016	0	0
	3(EXP)	-168	311	9451	0	0	0	-2.984	0	108.234
	MAX	-2919/L1	-28941/L	9451/L3				-3.000/L1	-0.000/L2	108.234/L3
90		Rigid +Y								
	1(OPE)	1696	-35700	10575	0	0	0	8.679	0	54.112
	2(SUS)	1260	-26934	-28	0	0	0	0.007	0	0
	3(EXP)	436	-8766	10603	0	0	0	8.672	0	54.113
	MAX	1696/L1	-35700/L	10603/L3				8.679/L1	-0.000/L1	54.113/L3
100		Rigid ANC								
	1(OPE)	28119	-24710	0	0	0	16118	0	0	0
	2(SUS)	-590	-29048	0	0	0	-4518	0	0	0
	3(EXP)	28709	4338	0	0	0	20636	0	0	0
	MAX	28709/L	-29048/L	-0/L1	0/L1	0/L3	20636/L	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	1696	-35700	-10575	0	0	0	8.679	0	-54.112
	2(SUS)	1260	-26934	28	0	0	0	0.007	0	0
	3(EXP)	436	-8766	-10603	0	0	0	8.672	0	-54.113
	MAX	1696/L1	-35700/L	-10603/L3				8.679/L1	-0.000/L1	-54.113/L3
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2919	-28631	-9390	0	0	0	-3	0	-108.234
	2(SUS)	-2751	-28941	61	0	0	0	-0.016	0	0
	3(EXP)	-168	311	-9451	0	0	0	-2.984	0	-108.234
	MAX	-2919/L1	-28941/L	-9451/L3				-3.000/L1	-0.000/L2	-108.234/L3
150		Rigid +Y								
	1(OPE)	-12285	-45322	-5828	0	0	0	-81.122	0	-38.482
	2(SUS)	1785	-51609	-1198	0	0	0	0.01	0	-0.007
	3(EXP)	-14070	6286	-4629	0	0	0	-81.132	0	-38.475
	MAX	-14070/L	-51609/L	-5828/L1				-81.132/L	-0.000/L2	-38.482/L1
180		Rigid +Y								
	1(OPE)	-12285	-45322	5828	0	0	0	-81.122	0	38.482
	2(SUS)	1785	-51609	1198	0	0	0	0.01	0	0.007
	3(EXP)	-14070	6286	4629	0	0	0	-81.132	0	38.475
	MAX	-14070/L	-51609/L	5828/L1				-81.132/L	-0.000/L2	38.482/L1
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-2919	-28631	9390	0	0	0	-3	0	108.234
	2(SUS)	-2751	-28941	-61	0	0	0	-0.016	0	0
	3(EXP)	-168	311	9451	0	0	0	-2.984	0	108.234
	MAX	-2919/L1	-28941/L	9451/L3				-3.000/L1	-0.000/L2	108.234/L3
220		Rigid +Y								
	1(OPE)	1696	-35700	10575	0	0	0	8.679	0	54.112
	2(SUS)	1260	-26934	-28	0	0	0	0.007	0	0
	3(EXP)	436	-8766	10603	0	0	0	8.672	0	54.113
	MAX	1696/L1	-35700/L	10603/L3				8.679/L1	-0.000/L1	54.113/L3
230		Rigid ANC								
	1(OPE)	14060	-12355	-82425	13201	68343	8059	0	0	0
	2(SUS)	-295	-14524	-186	18587	-704	-2259	0	0	0
	3(EXP)	14354	2169	-82239	-5386	69047	10318	0	0	0
	MAX	14354/L3	-14524/L	-82425/L	18587/L3	69047/L3	10318/L3	0.000/L3	-0.000/L2	-0.000/L1

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.672	0	-54.113	-0.0109	-0.0604	0.0529
20	-2.984	0	-108.234	0.0441	0.3128	0.1057
28	-33.931	5.8	-135.058	0.1429	0.6601	0.1319
29	-38.901	7.949	-137.345	0.167	0.7393	0.143
30	-41.971	11.151	-137.295	0.1847	0.8047	0.1566
39	-45.292	16.302	-132.237	0.1947	0.9261	0.1717
40	-48.495	16.259	-125.343	0.195	0.9979	0.1833
45	-81.132	0	-38.475	0.1152	1.0889	0.2173
48	-105.801	-12.948	17.515	0.0549	0.7274	0.2173
49	-110.291	-14.245	20.805	0.047	0.6029	0.2182
50	-114.94	-14.565	19.608	0.0371	0.472	0.2192
59	-110.291	-14.245	-20.805	-0.047	-0.6029	0.2182
60	-105.801	-12.948	-17.515	-0.0549	-0.7274	0.2173
65	-81.132	0	38.475	-0.1152	-1.0889	0.2173
68	-48.495	16.259	125.343	-0.195	-0.9979	0.1833
69	-45.292	16.302	132.237	-0.1947	-0.9261	0.1717
70	-43.073	14.035	135.976	-0.1889	-0.8624	0.1611
79	-38.901	7.949	137.345	-0.167	-0.7393	0.143
80	-33.931	5.8	135.058	-0.1429	-0.6601	0.1319
85	-2.984	0	108.234	-0.0441	-0.3128	0.1057
90	8.672	0	54.113	0.0109	0.0604	0.0529
100	0	0	0	0	0	0
110	8.672	0	-54.113	-0.0109	-0.0604	0.0529
120	-2.984	0	-108.234	0.0441	0.3128	0.1057
128	-33.931	5.8	-135.058	0.1429	0.6601	0.1319
129	-38.901	7.949	-137.345	0.167	0.7393	0.143
130	-41.971	11.151	-137.295	0.1847	0.8047	0.1566
139	-45.292	16.302	-132.237	0.1947	0.9261	0.1717
140	-48.495	16.259	-125.343	0.195	0.9979	0.1833
150	-81.132	0	-38.475	0.1152	1.0889	0.2173
158	-105.801	-12.948	17.515	0.0549	0.7274	0.2173
159	-110.291	-14.245	20.805	0.047	0.6029	0.2182
160	-114.94	-14.565	19.608	0.0371	0.472	0.2192
168	-114.94	-14.565	-19.608	-0.0371	-0.472	0.2192
169	-110.291	-14.245	-20.805	-0.047	-0.6029	0.2182
170	-105.801	-12.948	-17.515	-0.0549	-0.7274	0.2173
180	-81.132	0	38.475	-0.1152	-1.0889	0.2173
188	-48.495	16.259	125.343	-0.195	-0.9979	0.1833
189	-45.292	16.302	132.237	-0.1947	-0.9261	0.1717

190	-43.073	14.035	135.976	-0.1889	-0.8624	0.1611
199	-38.901	7.949	137.345	-0.167	-0.7393	0.143
200	-33.931	5.8	135.058	-0.1429	-0.6601	0.1319
210	-2.984	0	108.234	-0.0441	-0.3128	0.1057
220	8.672	0	54.113	0.0109	0.0604	0.0529
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.007	0	0	0.0018	-0.0016	-0.0116
20	-0.016	0	0	-0.0071	0.0068	-0.0232
28	-0.685	-1.197	0	-0.0212	0.0115	-0.0289
29	-0.68	-1.336	-0.057	-0.0209	0.011	-0.0297
30	-0.51	-1.393	-0.194	-0.0209	0.0103	-0.0308
39	-0.081	-1.303	-0.452	-0.0211	0.0093	-0.0332
40	0.011	-1.079	-0.451	-0.0212	0.0085	-0.0342
45	0.01	0	-0.007	-0.0222	0.0022	0.0381
48	0.01	-4.899	0.007	-0.023	-0.0008	0.1046
49	0.012	-5.66	0.002	-0.023	-0.0007	0.1061
50	0.017	-6.1	0	-0.0216	-0.0006	0.1062
59	0.012	-5.66	-0.002	0.023	0.0007	0.1061
60	0.01	-4.899	-0.007	0.023	0.0008	0.1046
65	0.01	0	0.007	0.0222	-0.0022	0.0381
68	0.011	-1.079	0.451	0.0212	-0.0085	-0.0342
69	-0.081	-1.303	0.452	0.0211	-0.0093	-0.0332
70	-0.294	-1.393	0.34	0.0209	-0.0098	-0.0316
79	-0.68	-1.336	0.057	0.0209	-0.011	-0.0297
80	-0.685	-1.197	0	0.0212	-0.0115	-0.0289
85	-0.016	0	0	0.0071	-0.0068	-0.0232
90	0.007	0	0	-0.0018	0.0016	-0.0116
100	0	0	0	0	0	0
110	0.007	0	0	0.0018	-0.0016	-0.0116
120	-0.016	0	0	-0.0071	0.0068	-0.0232
128	-0.685	-1.197	0	-0.0212	0.0115	-0.0289
129	-0.68	-1.336	-0.057	-0.0209	0.011	-0.0297
130	-0.51	-1.393	-0.194	-0.0209	0.0103	-0.0308
139	-0.081	-1.303	-0.452	-0.0211	0.0093	-0.0332
140	0.011	-1.079	-0.451	-0.0212	0.0085	-0.0342
150	0.01	0	-0.007	-0.0222	0.0022	0.0381
158	0.01	-4.899	0.007	-0.023	-0.0008	0.1046
159	0.012	-5.66	0.002	-0.023	-0.0007	0.1061
160	0.017	-6.1	0	-0.0216	-0.0006	0.1062
168	0.017	-6.1	0	0.0216	0.0006	0.1062
169	0.012	-5.66	-0.002	0.023	0.0007	0.1061
170	0.01	-4.899	-0.007	0.023	0.0008	0.1046
180	0.01	0	0.007	0.0222	-0.0022	0.0381
188	0.011	-1.079	0.451	0.0212	-0.0085	-0.0342
189	-0.081	-1.303	0.452	0.0211	-0.0093	-0.0332

190	-0.294	-1.393	0.34	0.0209	-0.0098	-0.0316
199	-0.68	-1.336	0.057	0.0209	-0.011	-0.0297
200	-0.685	-1.197	0	0.0212	-0.0115	-0.0289
210	-0.016	0	0	0.0071	-0.0068	-0.0232
220	0.007	0	0	-0.0018	0.0016	-0.0116
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 8, 2015 Time: 15:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST X2 90ELBOW+400
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	8.679	0	-54.112	-0.0091	-0.0619	0.0413
20	-3	0	-108.234	0.0369	0.3196	0.0826
28	-34.616	4.603	-135.058	0.1216	0.6717	0.1031
29	-39.581	6.613	-137.401	0.146	0.7503	0.1134
30	-42.481	9.758	-137.489	0.1638	0.815	0.1258
39	-45.373	14.999	-132.689	0.1736	0.9354	0.1386
40	-48.484	15.18	-125.794	0.1738	1.0065	0.1491
45	-81.122	0	-38.482	0.093	1.0911	0.2553
48	-105.791	-17.848	17.523	0.0319	0.7266	0.3218
49	-110.279	-19.905	20.807	0.024	0.6022	0.3243
50	-114.923	-20.665	19.608	0.0155	0.4715	0.3253
59	-110.279	-19.905	-20.807	-0.024	-0.6022	0.3243
60	-105.791	-17.848	-17.523	-0.0319	-0.7266	0.3218
65	-81.122	0	38.482	-0.093	-1.0911	0.2553
68	-48.484	15.18	125.794	-0.1738	-1.0065	0.1491
69	-45.373	14.999	132.689	-0.1736	-0.9354	0.1386
70	-43.367	12.642	136.315	-0.168	-0.8723	0.1295
79	-39.581	6.613	137.401	-0.146	-0.7503	0.1134
80	-34.616	4.603	135.058	-0.1216	-0.6717	0.1031
85	-3	0	108.234	-0.0369	-0.3196	0.0826
90	8.679	0	54.112	0.0091	0.062	0.0413
100	0	0	0	0	0	0
110	8.679	0	-54.112	-0.0091	-0.062	0.0413
120	-3	0	-108.234	0.0369	0.3196	0.0826
128	-34.616	4.603	-135.058	0.1216	0.6717	0.1031
129	-39.581	6.613	-137.401	0.146	0.7503	0.1134
130	-42.481	9.758	-137.489	0.1638	0.815	0.1258
139	-45.373	14.999	-132.689	0.1736	0.9354	0.1386
140	-48.484	15.18	-125.794	0.1738	1.0065	0.1491
150	-81.122	0	-38.482	0.093	1.0911	0.2553
158	-105.791	-17.848	17.523	0.0319	0.7266	0.3218
159	-110.279	-19.905	20.807	0.024	0.6022	0.3243
160	-114.923	-20.665	19.608	0.0155	0.4715	0.3253
168	-114.923	-20.665	-19.608	-0.0155	-0.4715	0.3253
169	-110.279	-19.905	-20.807	-0.024	-0.6022	0.3243
170	-105.791	-17.848	-17.523	-0.0319	-0.7266	0.3218
180	-81.122	0	38.482	-0.093	-1.0911	0.2553
188	-48.484	15.18	125.794	-0.1738	-1.0065	0.1491
189	-45.373	14.999	132.689	-0.1736	-0.9354	0.1386

190	-43.367	12.642	136.315	-0.168	-0.8723	0.1295
199	-39.581	6.613	137.401	-0.146	-0.7503	0.1134
200	-34.616	4.603	135.058	-0.1216	-0.6717	0.1031
210	-3	0	108.234	-0.0369	-0.3196	0.0826
220	8.679	0	54.112	0.0091	0.062	0.0413
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .15
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .15
Node 20 +Y Mu = .15

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

```
GENERAL
  Insul Thk= 200.000 mm.   Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 39
  Angle/Node @2= .00 38
------------------------------------------------------------------------------
From  40  To  45  DX= -5,052.000 mm.
RESTRAINTS
  Node  45  +Y   Mu = .15
------------------------------------------------------------------------------
From  45  To  50  DX= -4,548.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 49
  Angle/Node @2= .00 48
------------------------------------------------------------------------------
From  50  To  60 DZ= -6,500.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 59
------------------------------------------------------------------------------
From  60  To  65  DX= 4,548.000 mm.
  Dia= 355.600 mm.   Wall= 41.550 mm.
  Insul Thk= 200.000 mm.
RESTRAINTS
  Node  65  +Y   Mu = .15
------------------------------------------------------------------------------
From  65  To  70  DX= 5,052.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 69
  Angle/Node @2= .00 68
------------------------------------------------------------------------------
From  70  To  80 DY= -750.000 mm.  DZ= -750.000 mm.
BEND at "TO" end
  Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 79
  Angle/Node @2= .00 78
------------------------------------------------------------------------------
From  80  To  85 DZ= -3,500.000 mm.
RESTRAINTS
  Node  85  Guide   Gap= 3.000 mm.   Mu = .15
  Node  85  +Y   Mu = .15
------------------------------------------------------------------------------
From  85  To  90 DZ= -7,500.000 mm.
RESTRAINTS
  Node  90  +Y   Mu = .15
------------------------------------------------------------------------------
From  90  To  100 DZ= -7,500.000 mm.
RESTRAINTS
  Node  100  ANC
------------------------------------------------------------------------------
From  100  To  110 DZ= -7,500.000 mm.
RESTRAINTS
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```
  Node  110  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .15
   Node  120  Guide   Gap= 3.000 mm.   Mu = .15
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,548.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,548.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .15
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .15
   Node  210  Guide   Gap= 3.000 mm.   Mu = .15
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
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Node 220 +Y Mu = .15

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

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                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP	STIF1	STIF2	YIELD FORCE	Len MU Dir Vectors
10	ANC			.15	.000	.000	.000
15	+Y			.15	.000	1.000	.000
20	Guide		3.00	.15	.000	.000	.000
20	+Y			.15	.000	1.000	.000
45	+Y			.15	.000	1.000	.000
65	+Y			.15	.000	1.000	.000
85	Guide		3.00	.15	.000	.000	.000
85	+Y			.15	.000	1.000	.000
90	+Y			.15	.000	1.000	.000
100	ANC			.15	.000	.000	.000
110	+Y			.15	.000	1.000	.000
120	+Y			.15	.000	1.000	.000
120	Guide		3.00	.15	.000	.000	.000
150	+Y			.15	.000	1.000	.000
180	+Y			.15	.000	1.000	.000
210	+Y			.15	.000	1.000	.000
210	Guide		3.00	.15	.000	.000	.000
220	+Y			.15	.000	1.000	.000
230	ANC			.15	.000	.000	.000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9600.000	750.000	-19250.000
60	-9600.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9600.000	750.000	-64250.000
170	-9600.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 78.5 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 49712.7 Allowable Stress: 63326.2
Axial Stress: 17849.4 @Node 70 LOADCASE: 2 (SUS) W+P1
Bending Stress: 107012.2 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 24187.8 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 127945.4 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

Load Case	From Node	Code Stres	Allowable	Ratio %	To Node	Code Stres	Allowable	Ratio %	Piping Code
1(OPE)	10	43319	0	0	15	33336.5	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		27598.1	228300.1	12.1		15382.3	226146.4	6.8	B31.3
1(OPE)	15	33467.6	0	0	20	75917.6	0	0	B31.3
2(SUS)		25383.2	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		15382.3	226143.5	6.8		59879.4	232552.1	25.7	B31.3
1(OPE)	20	76017.9	0	0	28	85524.4	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		59879.4	232546	25.7		70465.1	233009.8	30.2	B31.3
1(OPE)	28	85524.4	0	0	29	86078.1	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		70465.1	233009.8	30.2		71017.6	232892.3	30.5	B31.3
1(OPE)	29	86078.1	0	0	30	86608.4	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		71017.6	232892.3	30.5		71317.3	232753.1	30.6	B31.3
1(OPE)	30	86608.4	0	0	38	86939.5	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19128.6	63326.2	30.2	B31.3
3(EXP)		71317.3	232753.1	30.6		71719.5	232398	30.9	B31.3
1(OPE)	38	86939.5	0	0	39	84877.6	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		19530	63326.2	30.8	B31.3
3(EXP)		71719.5	232398	30.9		69463.9	231996.7	29.9	B31.3

1(OPE)	39	84877.6	0	0	40	78719.9	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		69463.9	231996.7	29.9		62484.9	232229.9	26.9	B31.3
1(OPE)	40	78719.9	0	0	45	58054.8	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		62484.9	232229.9	26.9		27117.5	201814	13.4	B31.3
1(OPE)	45	58249.4	0	0	48	114718.6	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		27117.5	201841.8	13.4		97534.1	231448	42.1	B31.3
1(OPE)	48	114718.6	0	0	49	120476.7	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97534.1	231448	42.1		104163.5	232593.7	44.8	B31.3
1(OPE)	49	120476.7	0	0	50	122828.4	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104163.5	232593.7	44.8		106909.7	233504.9	45.8	B31.3
1(OPE)	50	122828.4	0	0	59	120476.7	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		106909.7	233504.9	45.8		104163.5	232593.7	44.8	B31.3
1(OPE)	59	120476.7	0	0	60	114718.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104163.5	232593.7	44.8		97534.1	231448	42.1	B31.3
1(OPE)	60	114718.6	0	0	65	58249.4	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97534.1	231448	42.1		27117.5	201841.8	13.4	B31.3
1(OPE)	65	58054.8	0	0	68	78719.9	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		27117.5	201814	13.4		62484.9	232229.9	26.9	B31.3
1(OPE)	68	78719.9	0	0	69	84877.6	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		62484.9	232229.9	26.9		69463.9	231996.7	29.9	B31.3
1(OPE)	69	84877.6	0	0	70	86939.5	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		69463.9	231996.7	29.9		71719.5	232398	30.9	B31.3
1(OPE)	70	86939.5	0	0	78	86608.5	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18773.6	63326.2	29.6	B31.3
3(EXP)		71719.5	232398	30.9		71317.3	232753.1	30.6	B31.3
1(OPE)	78	86608.4	0	0	79	86078.1	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		18634.3	63326.2	29.4	B31.3
3(EXP)		71317.3	232753.1	30.6		71017.6	232892.3	30.5	B31.3
1(OPE)	79	86078.1	0	0	80	85524.4	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		71017.6	232892.3	30.5		70465.2	233009.8	30.2	B31.3

Optimized Model:
Dimension A: 4548mm, Friction Factor 0.15

1(OPE)	80	85524.4	0	0	85	76018	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		70465.2	233009.8	30.2		59879.4	232546	25.7	B31.3
1(OPE)	85	75917.6	0	0	90	33467.6	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.1	63326.2	40.1	B31.3
3(EXP)		59879.4	232552.1	25.7		15382.3	226143.5	6.8	B31.3
1(OPE)	90	33336.5	0	0	100	43319.2	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		15382.3	226146.4	6.8		27598.2	228300	12.1	B31.3
1(OPE)	100	43319.2	0	0	110	33336.5	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		27598.2	228300	12.1		15382.3	226146.4	6.8	B31.3
1(OPE)	110	33467.6	0	0	120	75917.7	0	0	B31.3
2(SUS)		25383.1	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		15382.3	226143.5	6.8		59879.4	232552.1	25.7	B31.3
1(OPE)	120	76018	0	0	128	85524.4	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		59879.4	232546	25.7		70465.2	233009.8	30.2	B31.3
1(OPE)	128	85524.4	0	0	129	86078.1	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		70465.2	233009.8	30.2		71017.6	232892.3	30.5	B31.3
1(OPE)	129	86078.1	0	0	130	86608.5	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		71017.6	232892.3	30.5		71317.4	232753.1	30.6	B31.3
1(OPE)	130	86608.5	0	0	139	84877.7	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19530	63326.2	30.8	B31.3
3(EXP)		71317.4	232753.1	30.6		69464	231996.7	29.9	B31.3
1(OPE)	139	84877.7	0	0	140	78719.9	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		69464	231996.7	29.9		62484.9	232229.9	26.9	B31.3
1(OPE)	140	78719.9	0	0	150	58054.8	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		62484.9	232229.9	26.9		27117.5	201814	13.4	B31.3
1(OPE)	150	58249.4	0	0	158	114718.6	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		27117.5	201841.8	13.4		97534.1	231448	42.1	B31.3
1(OPE)	158	114718.6	0	0	159	120476.7	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97534.1	231448	42.1		104163.5	232593.7	44.8	B31.3
1(OPE)	159	120476.7	0	0	160	122828.4	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104163.5	232593.7	44.8		106909.7	233504.9	45.8	B31.3

Optimized Model:
Dimension A: 4548mm, Friction Factor 0.15

1(OPE)	160	122828.4	0	0	168	122828.4	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18021.7	63326.2	28.5	B31.3
3(EXP)		106909.7	233504.9	45.8		106909.7	233504.9	45.8	B31.3
1(OPE)	168	122828.4	0	0	169	120476.7	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		106909.7	233504.9	45.8		104163.5	232593.7	44.8	B31.3
1(OPE)	169	120476.7	0	0	170	114718.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104163.5	232593.7	44.8		97534.1	231448	42.1	B31.3
1(OPE)	170	114718.6	0	0	180	58249.4	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97534.1	231448	42.1		27117.5	201841.8	13.4	B31.3
1(OPE)	180	58054.8	0	0	188	78719.9	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		27117.5	201814	13.4		62484.9	232229.9	26.9	B31.3
1(OPE)	188	78719.9	0	0	189	84877.6	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		62484.9	232229.9	26.9		69463.9	231996.7	29.9	B31.3
1(OPE)	189	84877.6	0	0	190	86939.5	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		69463.9	231996.7	29.9		71719.5	232398	30.9	B31.3
1(OPE)	190	86939.5	0	0	199	86078.1	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18634.3	63326.2	29.4	B31.3
3(EXP)		71719.5	232398	30.9		71017.6	232892.3	30.5	B31.3
1(OPE)	199	86078.1	0	0	200	85524.4	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		71017.6	232892.3	30.5		70465.1	233009.8	30.2	B31.3
1(OPE)	200	85524.4	0	0	210	76018	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		70465.1	233009.8	30.2		59879.4	232546	25.7	B31.3
1(OPE)	210	75917.6	0	0	220	33467.6	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.2	63326.2	40.1	B31.3
3(EXP)		59879.4	232552.1	25.7		15382.3	226143.5	6.8	B31.3
1(OPE)	220	33336.5	0	0	230	43319.1	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		15382.3	226146.3	6.8		27598.1	228300.1	12.1	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	16354	-12174	65401	-12751	-79362	4842	0	0	0
	2(SUS)	-82	-13357	-750	-15688	196	-916	0	0	0
	3(EXP)	16436	1183	66150	2937	-79558	5758	0	0	0
	MAX	16436/L	-13357/L	66150/L	-15688/L	-79558/L	5758/L3	0.000/L3	-0.000/L2	0.000/L3
15	Rigid +Y									
	1(OPE)	999	-36432	-5373	0	0	0	10.06	0	-54.127
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	642	-4781	-5259	0	0	0	10.058	0	-54.127
	MAX	999/L1	-36432/L	-5373/L1				10.060/L	-0.000/L1	-54.127/L1
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-9378	-18049	-4102	0	0	0	-3	0	-108.259
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	-7988	1109	-3856	0	0	0	-2.992	0	-108.258
	MAX	-9378/L1	-19158/L	-4102/L1				-3.000/L1	-0.000/L2	-108.259/L1
45	Rigid +Y									
	1(OPE)	-7089	-54032	-3928	0	0	0	-83.207	0	-46.101
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-8206	2489	-5659	0	0	0	-83.214	0	-46.111
	MAX	-8206/L3	-56522/L	-5659/L3				-83.214/L	-0.000/L2	-46.111/L3
65	Rigid +Y									
	1(OPE)	-7089	-54032	3928	0	0	0	-83.207	0	46.101
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-8206	2489	5659	0	0	0	-83.214	0	46.111
	MAX	-8206/L3	-56522/L	5659/L3				-83.214/L	-0.000/L2	46.111/L3
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-9378	-18049	4102	0	0	0	-3	0	108.259
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	-7988	1109	3856	0	0	0	-2.992	0	108.258
	MAX	-9378/L1	-19158/L	4102/L1				-3.000/L1	-0.000/L2	108.259/L1
90	Rigid +Y									
	1(OPE)	999	-36432	5373	0	0	0	10.06	0	54.127
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	642	-4781	5259	0	0	0	10.058	0	54.127
	MAX	999/L1	-36432/L	5373/L1				10.060/L	-0.000/L1	54.127/L1
100	Rigid ANC									
	1(OPE)	32708	-24348	0	0	0	9683	0	0	0
	2(SUS)	-164	-26714	0	0	0	-1832	0	0	0
	3(EXP)	32873	2366	0	0	0	11515	0	0	0
	MAX	32873/L	-26714/L	-0/L1	0/L2	-0/L3	11515/L	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	999	-36432	-5373	0	0	0	10.06	0	-54.127
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	642	-4781	-5259	0	0	0	10.058	0	-54.127
	MAX	999/L1	-36432/L	-5373/L1				10.060/L	-0.000/L1	-54.127/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-9379	-18049	-4102	0	0	0	-3	0	-108.259
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	-7988	1109	-3856	0	0	0	-2.992	0	-108.258
	MAX	-9379/L1	-19158/L	-4102/L1				-3.000/L1	-0.000/L2	-108.259/L1
150		Rigid +Y								
	1(OPE)	-7089	-54032	-3928	0	0	0	-83.207	0	-46.101
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-8206	2489	-5659	0	0	0	-83.214	0	-46.111
	MAX	-8206/L3	-56522/L	-5659/L3				-83.214/L	-0.000/L2	-46.111/L3
180		Rigid +Y								
	1(OPE)	-7089	-54032	3928	0	0	0	-83.207	0	46.101
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-8206	2489	5659	0	0	0	-83.214	0	46.111
	MAX	-8206/L3	-56522/L	5659/L3				-83.214/L	-0.000/L2	46.111/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-9378	-18049	4102	0	0	0	-3	0	108.259
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	-7988	1109	3856	0	0	0	-2.992	0	108.258
	MAX	-9378/L1	-19158/L	4102/L1				-3.000/L1	-0.000/L2	108.259/L1
220		Rigid +Y								
	1(OPE)	999	-36432	5373	0	0	0	10.06	0	54.127
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	642	-4781	5259	0	0	0	10.058	0	54.127
	MAX	999/L1	-36432/L	5373/L1				10.060/L	-0.000/L1	54.127/L1
230		Rigid ANC								
	1(OPE)	16354	-12174	-65401	12751	79362	4842	0	0	0
	2(SUS)	-82	-13357	750	15688	-196	-916	0	0	0
	3(EXP)	16436	1183	-66150	-2937	79558	5758	0	0	0
	MAX	16436/L3	-13357/L	-66150/L	15688/L3	79558/L3	5758/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.058	0	-54.127	-0.0059	-0.0711	0.0295
20	-2.992	0	-108.258	0.024	0.3563	0.059
28	-32.384	2.55	-131.926	0.0676	0.6801	0.0719
29	-34.929	3.095	-133.348	0.0734	0.7203	0.075
30	-37.316	4.162	-134.441	0.0783	0.7578	0.0813
38	-40.552	6.032	-135.699	0.0808	0.7958	0.078
39	-45.94	8.113	-134.928	0.0866	0.8691	0.0914
40	-50.574	8.453	-129.562	0.0886	0.9438	0.0981
45	-83.214	0	-46.111	0.0542	1.0661	0.1116
48	-112.217	-7.818	17.871	0.0237	0.6845	0.1116
49	-116.603	-8.495	20.898	0.0202	0.5671	0.112
50	-121.042	-8.682	19.61	0.016	0.4439	0.1124
59	-116.602	-8.495	-20.898	-0.0202	-0.5671	0.112
60	-112.217	-7.818	-17.871	-0.0237	-0.6845	0.1116
65	-83.214	0	46.111	-0.0542	-1.0661	0.1116
68	-50.574	8.453	129.562	-0.0886	-0.9438	0.0981
69	-45.94	8.113	134.928	-0.0866	-0.8691	0.0914
70	-40.552	6.032	135.699	-0.0808	-0.7958	0.078
78	-37.316	4.162	134.441	-0.0783	-0.7578	0.0813
79	-34.929	3.095	133.348	-0.0734	-0.7203	0.075
80	-32.384	2.55	131.926	-0.0676	-0.6801	0.0719
85	-2.992	0	108.258	-0.024	-0.3563	0.059
90	10.058	0	54.127	0.0059	0.0711	0.0295
100	0	0	0	0	0	0
110	10.058	0	-54.127	-0.0059	-0.0711	0.0295
120	-2.992	0	-108.258	0.024	0.3563	0.059
128	-32.384	2.55	-131.926	0.0676	0.6801	0.0719
129	-34.929	3.095	-133.348	0.0734	0.7203	0.075
130	-37.316	4.162	-134.441	0.0783	0.7578	0.0813
139	-45.94	8.113	-134.928	0.0866	0.8691	0.0914
140	-50.574	8.453	-129.562	0.0886	0.9438	0.0981
150	-83.214	0	-46.111	0.0542	1.0661	0.1116
158	-112.217	-7.818	17.871	0.0237	0.6845	0.1116
159	-116.602	-8.495	20.898	0.0202	0.5671	0.112
160	-121.041	-8.682	19.61	0.016	0.4439	0.1124
168	-121.042	-8.682	-19.61	-0.016	-0.4439	0.1124
169	-116.602	-8.495	-20.898	-0.0202	-0.5671	0.112
170	-112.217	-7.818	-17.871	-0.0237	-0.6845	0.1116
180	-83.214	0	46.111	-0.0542	-1.0661	0.1116

188	-50.574	8.453	129.562	-0.0886	-0.9438	0.0981
189	-45.94	8.113	134.928	-0.0866	-0.8691	0.0914
190	-40.552	6.032	135.699	-0.0808	-0.7958	0.078
199	-34.929	3.095	133.348	-0.0734	-0.7203	0.075
200	-32.384	2.55	131.926	-0.0676	-0.6801	0.0719
210	-2.992	0	108.258	-0.024	-0.3563	0.059
220	10.058	0	54.127	0.0059	0.0711	0.0295
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
20	-0.008	0	-0.001	0.0166	0.002	-0.0094
28	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
29	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
30	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
38	-0.078	1.242	0.132	0.0203	0.0003	-0.012
39	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
40	0.007	1.487	0.25	0.0175	-0.002	-0.0117
45	0.006	0	0.01	0.0015	-0.002	0.0856
48	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
49	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
50	0.001	-12.155	0	-0.0147	0.0005	0.1803
59	0.005	-11.565	0.002	0.0142	-0.0006	0.18
60	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
65	0.006	0	-0.01	-0.0015	0.002	0.0856
68	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
69	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
70	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
78	-0.12	1.164	-0.055	-0.0206	-0.0008	-0.0118
79	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
80	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
85	-0.008	0	0.001	-0.0166	-0.002	-0.0094
90	0.002	0	0.001	0.0041	0.0004	-0.0047
100	0	0	0	0	0	0
110	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
120	-0.008	0	-0.001	0.0166	0.002	-0.0094
128	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
129	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
130	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
139	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
140	0.007	1.487	0.25	0.0175	-0.002	-0.0117
150	0.006	0	0.01	0.0015	-0.002	0.0856
158	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
159	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
160	0.001	-12.155	0	-0.0147	0.0005	0.1803
168	0.001	-12.155	0	0.0147	-0.0005	0.1803
169	0.005	-11.565	0.002	0.0142	-0.0006	0.18
170	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
180	0.006	0	-0.01	-0.0015	0.002	0.0856

188	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
189	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
190	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
199	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
200	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
210	-0.008	0	0.001	-0.0166	-0.002	-0.0094
220	0.002	0	0.001	0.0041	0.0004	-0.0047
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:33
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.15
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.06	0	-54.127	-0.0101	-0.0715	0.0248
20	-3	0	-108.259	0.0406	0.3583	0.0496
28	-32.528	3.576	-131.927	0.0882	0.6817	0.0605
29	-35.07	4.196	-133.335	0.094	0.7215	0.0634
30	-37.436	5.325	-134.387	0.0989	0.7585	0.0695
38	-40.63	7.274	-135.566	0.1011	0.7962	0.066
39	-45.96	9.482	-134.704	0.1056	0.8683	0.079
40	-50.567	9.94	-129.312	0.1061	0.9418	0.0864
45	-83.207	0	-46.101	0.0557	1.0641	0.1972
48	-112.211	-18.162	17.865	0.011	0.6851	0.2899
49	-116.598	-20.06	20.896	0.006	0.5677	0.292
50	-121.04	-20.837	19.61	0.0013	0.4444	0.2927
59	-116.598	-20.06	-20.896	-0.006	-0.5677	0.292
60	-112.211	-18.162	-17.865	-0.011	-0.6851	0.2899
65	-83.207	0	46.101	-0.0557	-1.0641	0.1972
68	-50.567	9.94	129.312	-0.1061	-0.9418	0.0864
69	-45.96	9.482	134.704	-0.1056	-0.8683	0.079
70	-40.63	7.274	135.566	-0.1011	-0.7962	0.066
78	-37.436	5.325	134.387	-0.0989	-0.7585	0.0695
79	-35.07	4.196	133.335	-0.094	-0.7215	0.0634
80	-32.528	3.576	131.927	-0.0882	-0.6817	0.0605
85	-3	0	108.259	-0.0406	-0.3583	0.0496
90	10.06	0	54.127	0.0101	0.0715	0.0248
100	0	0	0	0	0	0
110	10.06	0	-54.127	-0.0101	-0.0715	0.0248
120	-3	0	-108.259	0.0406	0.3583	0.0496
128	-32.528	3.576	-131.927	0.0882	0.6817	0.0605
129	-35.07	4.196	-133.335	0.094	0.7215	0.0634
130	-37.436	5.325	-134.387	0.0989	0.7585	0.0695
139	-45.96	9.482	-134.704	0.1056	0.8683	0.079
140	-50.567	9.94	-129.312	0.1061	0.9418	0.0864
150	-83.207	0	-46.101	0.0557	1.0641	0.1972
158	-112.211	-18.162	17.865	0.011	0.6851	0.2899
159	-116.598	-20.06	20.896	0.006	0.5677	0.292
160	-121.04	-20.837	19.61	0.0013	0.4444	0.2927
168	-121.04	-20.837	-19.61	-0.0013	-0.4444	0.2927
169	-116.598	-20.06	-20.896	-0.006	-0.5677	0.292
170	-112.211	-18.162	-17.865	-0.011	-0.6851	0.2899
180	-83.207	0	46.101	-0.0557	-1.0641	0.1972

188	-50.567	9.94	129.312	-0.1061	-0.9418	0.0864
189	-45.96	9.482	134.704	-0.1056	-0.8683	0.079
190	-40.63	7.274	135.566	-0.1011	-0.7962	0.066
199	-35.07	4.196	133.335	-0.094	-0.7215	0.0634
200	-32.528	3.576	131.927	-0.0882	-0.6817	0.0605
210	-3	0	108.259	-0.0406	-0.3583	0.0496
220	10.06	0	54.127	0.0101	0.0715	0.0248
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .10
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .10
Node 20 +Y Mu = .10

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .10

From 45 To 50 DX= -4,548.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 4,548.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .10

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .10
Node 85 +Y Mu = .10

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .10

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .10
   Node  120  Guide   Gap= 3.000 mm.   Mu = .10
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,548.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,548.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .10
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .10
   Node  210  Guide   Gap= 3.000 mm.   Mu = .10
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .10

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	Len FORCE	MU Dir Vectors
10	ANC			.10	.000	.000 .000
15	+Y			.10	.000	1.000 .000
20	Guide		3.00	.10	.000	.000 .000
20	+Y			.10	.000	1.000 .000
45	+Y			.10	.000	1.000 .000
65	+Y			.10	.000	1.000 .000
85	Guide		3.00	.10	.000	.000 .000
85	+Y			.10	.000	1.000 .000
90	+Y			.10	.000	1.000 .000
100	ANC			.10	.000	.000 .000
110	+Y			.10	.000	1.000 .000
120	+Y			.10	.000	1.000 .000
120	Guide		3.00	.10	.000	.000 .000
150	+Y			.10	.000	1.000 .000
180	+Y			.10	.000	1.000 .000
210	+Y			.10	.000	1.000 .000
210	Guide		3.00	.10	.000	.000 .000
220	+Y			.10	.000	1.000 .000
230	ANC			.10	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9600.000	750.000	-19250.000
60	-9600.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9600.000	750.000	-64250.000
170	-9600.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 78.5 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 49712.7 Allowable Stress: 63326.2
Axial Stress: 17849.4 @Node 70 LOADCASE: 2 (SUS) W+P1
Bending Stress: 106939.3 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 23623.6 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 127873.7 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	44522.2	0	0	15	34025.2	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		28716	228300.1	12.6		16046.1	226146.4	7.1	B31.3
1(OPE)	15	34112.7	0	0	20	77625.4	0	0	B31.3
2(SUS)		25383.2	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		16046.1	226143.5	7.1		61528.1	232552.1	26.5	B31.3
1(OPE)	20	77700.8	0	0	28	84223.6	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		61528.1	232546	26.5		69131.3	233009.8	29.7	B31.3
1(OPE)	28	84223.6	0	0	29	84594.8	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		69131.3	233009.8	29.7		69500.3	232892.3	29.8	B31.3
1(OPE)	29	84594.8	0	0	30	84968	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		69500.3	232892.3	29.8		69646.9	232753.1	29.9	B31.3
1(OPE)	30	84968	0	0	38	85105.1	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19128.6	63326.2	30.2	B31.3
3(EXP)		69646.9	232753.1	29.9		69853.8	232398	30.1	B31.3
1(OPE)	38	85105.1	0	0	39	82906.4	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		19530	63326.2	30.8	B31.3
3(EXP)		69853.8	232398	30.1		67424.2	231996.7	29.1	B31.3

1(OPE)	39	82906.4	0	0	40	76816.8	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		67424.2	231996.7	29.1		60522.1	232229.9	26.1	B31.3
1(OPE)	40	76816.8	0	0	45	57975.1	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		60522.1	232229.9	26.1		26893	201814	13.3	B31.3
1(OPE)	45	58106	0	0	48	114627.6	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		26893	201841.8	13.3		97443.3	231448	42.1	B31.3
1(OPE)	48	114627.6	0	0	49	120396.7	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97443.3	231448	42.1		104085.4	232593.7	44.7	B31.3
1(OPE)	49	120396.7	0	0	50	122753.1	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104085.4	232593.7	44.7		106836.8	233504.9	45.8	B31.3
1(OPE)	50	122753.1	0	0	59	120396.7	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		106836.8	233504.9	45.8		104085.3	232593.7	44.7	B31.3
1(OPE)	59	120396.7	0	0	60	114627.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104085.3	232593.7	44.7		97443.2	231448	42.1	B31.3
1(OPE)	60	114627.6	0	0	65	58106	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97443.2	231448	42.1		26893	201841.8	13.3	B31.3
1(OPE)	65	57975.1	0	0	68	76816.8	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		26893	201814	13.3		60522.1	232229.9	26.1	B31.3
1(OPE)	68	76816.8	0	0	69	82906.4	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		60522.1	232229.9	26.1		67424.2	231996.7	29.1	B31.3
1(OPE)	69	82906.4	0	0	70	85105.2	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		67424.2	231996.7	29.1		69853.8	232398	30.1	B31.3
1(OPE)	70	85105.2	0	0	78	84968	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18773.6	63326.2	29.6	B31.3
3(EXP)		69853.8	232398	30.1		69647	232753.1	29.9	B31.3
1(OPE)	78	84968	0	0	79	84594.8	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		18634.3	63326.2	29.4	B31.3
3(EXP)		69647	232753.1	29.9		69500.3	232892.3	29.8	B31.3
1(OPE)	79	84594.8	0	0	80	84223.6	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		69500.3	232892.3	29.8		69131.4	233009.8	29.7	B31.3

1(OPE)	80	84223.6	0	0	85	77700.8	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		69131.4	233009.8	29.7		61528.1	232546	26.5	B31.3
1(OPE)	85	77625.4	0	0	90	34112.7	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.1	63326.2	40.1	B31.3
3(EXP)		61528.1	232552.1	26.5		16046.1	226143.5	7.1	B31.3
1(OPE)	90	34025.1	0	0	100	44522.4	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		16046.1	226146.4	7.1		28716.1	228300	12.6	B31.3
1(OPE)	100	44522.4	0	0	110	34025.1	0	0	B31.3
2(SUS)		23226.6	63326.2	36.7		25380.3	63326.2	40.1	B31.3
3(EXP)		28716.1	228300	12.6		16046.1	226146.4	7.1	B31.3
1(OPE)	110	34112.7	0	0	120	77625.5	0	0	B31.3
2(SUS)		25383.1	63326.2	40.1		18974.5	63326.2	30	B31.3
3(EXP)		16046.1	226143.5	7.1		61528.1	232552.1	26.5	B31.3
1(OPE)	120	77700.9	0	0	128	84223.6	0	0	B31.3
2(SUS)		18980.6	63326.2	30		18516.8	63326.2	29.2	B31.3
3(EXP)		61528.1	232546	26.5		69131.4	233009.8	29.7	B31.3
1(OPE)	128	84223.6	0	0	129	84594.8	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18634.3	63326.2	29.4	B31.3
3(EXP)		69131.4	233009.8	29.7		69500.3	232892.3	29.8	B31.3
1(OPE)	129	84594.8	0	0	130	84968	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18773.6	63326.2	29.6	B31.3
3(EXP)		69500.3	232892.3	29.8		69647	232753.1	29.9	B31.3
1(OPE)	130	84968	0	0	139	82906.4	0	0	B31.3
2(SUS)		18773.6	63326.2	29.6		19530	63326.2	30.8	B31.3
3(EXP)		69647	232753.1	29.9		67424.2	231996.7	29.1	B31.3
1(OPE)	139	82906.4	0	0	140	76816.9	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19296.8	63326.2	30.5	B31.3
3(EXP)		67424.2	231996.7	29.1		60522.1	232229.9	26.1	B31.3
1(OPE)	140	76816.9	0	0	150	57975.1	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		49712.7	63326.2	78.5	B31.3
3(EXP)		60522.1	232229.9	26.1		26893	201814	13.3	B31.3
1(OPE)	150	58106	0	0	158	114627.6	0	0	B31.3
2(SUS)		49684.9	63326.2	78.5		20078.7	63326.2	31.7	B31.3
3(EXP)		26893	201841.8	13.3		97443.2	231448	42.1	B31.3
1(OPE)	158	114627.6	0	0	159	120396.7	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		18933	63326.2	29.9	B31.3
3(EXP)		97443.2	231448	42.1		104085.3	232593.7	44.7	B31.3
1(OPE)	159	120396.7	0	0	160	122753.1	0	0	B31.3
2(SUS)		18933	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104085.3	232593.7	44.7		106836.7	233504.9	45.8	B31.3

1(OPE)	160	122753.1	0	0	168	122753.1	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18021.7	63326.2	28.5	B31.3
3(EXP)		106836.7	233504.9	45.8		106836.8	233504.9	45.8	B31.3
1(OPE)	168	122753.1	0	0	169	120396.7	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18933	63326.2	29.9	B31.3
3(EXP)		106836.8	233504.9	45.8		104085.3	232593.7	44.7	B31.3
1(OPE)	169	120396.7	0	0	170	114627.6	0	0	B31.3
2(SUS)		18933	63326.2	29.9		20078.7	63326.2	31.7	B31.3
3(EXP)		104085.3	232593.7	44.7		97443.2	231448	42.1	B31.3
1(OPE)	170	114627.6	0	0	180	58106	0	0	B31.3
2(SUS)		20078.7	63326.2	31.7		49684.9	63326.2	78.5	B31.3
3(EXP)		97443.2	231448	42.1		26893	201841.8	13.3	B31.3
1(OPE)	180	57975.1	0	0	188	76816.8	0	0	B31.3
2(SUS)		49712.7	63326.2	78.5		19296.8	63326.2	30.5	B31.3
3(EXP)		26893	201814	13.3		60522.1	232229.9	26.1	B31.3
1(OPE)	188	76816.8	0	0	189	82906.4	0	0	B31.3
2(SUS)		19296.8	63326.2	30.5		19530	63326.2	30.8	B31.3
3(EXP)		60522.1	232229.9	26.1		67424.2	231996.7	29.1	B31.3
1(OPE)	189	82906.4	0	0	190	85105.1	0	0	B31.3
2(SUS)		19530	63326.2	30.8		19128.6	63326.2	30.2	B31.3
3(EXP)		67424.2	231996.7	29.1		69853.8	232398	30.1	B31.3
1(OPE)	190	85105.1	0	0	199	84594.8	0	0	B31.3
2(SUS)		19128.6	63326.2	30.2		18634.3	63326.2	29.4	B31.3
3(EXP)		69853.8	232398	30.1		69500.3	232892.3	29.8	B31.3
1(OPE)	199	84594.8	0	0	200	84223.6	0	0	B31.3
2(SUS)		18634.3	63326.2	29.4		18516.8	63326.2	29.2	B31.3
3(EXP)		69500.3	232892.3	29.8		69131.3	233009.8	29.7	B31.3
1(OPE)	200	84223.6	0	0	210	77700.8	0	0	B31.3
2(SUS)		18516.8	63326.2	29.2		18980.6	63326.2	30	B31.3
3(EXP)		69131.3	233009.8	29.7		61528.1	232546	26.5	B31.3
1(OPE)	210	77625.4	0	0	220	34112.7	0	0	B31.3
2(SUS)		18974.5	63326.2	30		25383.2	63326.2	40.1	B31.3
3(EXP)		61528.1	232552.1	26.5		16046.1	226143.5	7.1	B31.3
1(OPE)	220	34025.2	0	0	230	44522.2	0	0	B31.3
2(SUS)		25380.3	63326.2	40.1		23226.6	63326.2	36.7	B31.3
3(EXP)		16046.1	226146.3	7.1		28716	228300.1	12.6	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	17038	-12148	61208	-12688	-82587	5071	0	0	0
	2(SUS)	-82	-13357	-750	-15688	196	-916	0	0	0
	3(EXP)	17120	1209	61958	3001	-82783	5987	0	0	0
	MAX	17120/L	-13357/L	61958/L	-15688/L	-82783/L	5987/L3	0.000/L3	-0.000/L2	0.000/L3
15	Rigid +Y									
	1(OPE)	693	-36535	-3587	0	0	0	10.457	0	-54.131
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	337	-4884	-3473	0	0	0	10.455	0	-54.13
	MAX	693/L1	-36535/L	-3587/L1				10.457/L	-0.000/L1	-54.131/L1
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-12365	-17630	-2994	0	0	0	-3	0	-108.265
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	-10974	1528	-2749	0	0	0	-2.992	0	-108.263
	MAX	-12365/L	-19158/L	-2994/L1				-3.000/L1	-0.000/L2	-108.265/L1
45	Rigid +Y									
	1(OPE)	-4770	-54374	-2611	0	0	0	-84.101	0	-46.034
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-5886	2147	-4341	0	0	0	-84.107	0	-46.044
	MAX	-5886/L3	-56522/L	-4341/L3				-84.107/L	-0.000/L2	-46.044/L3
65	Rigid +Y									
	1(OPE)	-4770	-54374	2611	0	0	0	-84.101	0	46.034
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-5886	2147	4341	0	0	0	-84.107	0	46.044
	MAX	-5886/L3	-56522/L	4341/L3				-84.107/L	-0.000/L2	46.044/L3
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-12365	-17630	2994	0	0	0	-3	0	108.265
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	-10974	1528	2749	0	0	0	-2.992	0	108.263
	MAX	-12365/L	-19158/L	2994/L1				-3.000/L1	-0.000/L2	108.265/L1
90	Rigid +Y									
	1(OPE)	693	-36535	3587	0	0	0	10.457	0	54.131
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	337	-4884	3473	0	0	0	10.455	0	54.13
	MAX	693/L1	-36535/L	3587/L1				10.457/L	-0.000/L1	54.131/L1
100	Rigid ANC									
	1(OPE)	34077	-24297	0	0	0	10142	0	0	0
	2(SUS)	-164	-26714	0	0	0	-1832	0	0	0
	3(EXP)	34241	2417	0	0	0	11974	0	0	0
	MAX	34241/L	-26714/L	-0/L1	0/L2	-0/L3	11974/L	0.000/L3	-0.000/L2	-0.000/L1

110		Rigid +Y								
	1(OPE)	693	-36535	-3587	0	0	0	10.457	0	-54.131
	2(SUS)	356	-31651	-114	0	0	0	0.002	0	-0.001
	3(EXP)	337	-4884	-3473	0	0	0	10.455	0	-54.13
	MAX	693/L1	-36535/L	-3587/L1				10.457/L	-0.000/L1	-54.131/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-12365	-17630	-2994	0	0	0	-3	0	-108.265
	2(SUS)	-1391	-19158	-245	0	0	0	-0.008	0	-0.001
	3(EXP)	-10974	1528	-2749	0	0	0	-2.992	0	-108.263
	MAX	-12365/L	-19158/L	-2994/L1				-3.000/L1	-0.000/L2	-108.265/L1
150		Rigid +Y								
	1(OPE)	-4770	-54374	-2611	0	0	0	-84.101	0	-46.034
	2(SUS)	1116	-56522	1731	0	0	0	0.006	0	0.01
	3(EXP)	-5886	2147	-4341	0	0	0	-84.107	0	-46.044
	MAX	-5886/L3	-56522/L	-4341/L3				-84.107/L	-0.000/L2	-46.044/L3
180		Rigid +Y								
	1(OPE)	-4770	-54374	2611	0	0	0	-84.101	0	46.034
	2(SUS)	1116	-56522	-1731	0	0	0	0.006	0	-0.01
	3(EXP)	-5886	2147	4341	0	0	0	-84.107	0	46.044
	MAX	-5886/L3	-56522/L	4341/L3				-84.107/L	-0.000/L2	46.044/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-12365	-17630	2994	0	0	0	-3	0	108.265
	2(SUS)	-1391	-19158	245	0	0	0	-0.008	0	0.001
	3(EXP)	-10974	1528	2749	0	0	0	-2.992	0	108.263
	MAX	-12365/L	-19158/L	2994/L1				-3.000/L1	-0.000/L2	108.265/L1
220		Rigid +Y								
	1(OPE)	693	-36535	3587	0	0	0	10.457	0	54.131
	2(SUS)	356	-31651	114	0	0	0	0.002	0	0.001
	3(EXP)	337	-4884	3473	0	0	0	10.455	0	54.13
	MAX	693/L1	-36535/L	3587/L1				10.457/L	-0.000/L1	54.131/L1
230		Rigid ANC								
	1(OPE)	17038	-12148	-61208	12688	82587	5071	0	0	0
	2(SUS)	-82	-13357	750	15688	-196	-916	0	0	0
	3(EXP)	17120	1209	-61958	-3001	82783	5987	0	0	0
	MAX	17120/L3	-13357/L	-61958/L	15688/L3	82783/L3	5987/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.455	0	-54.13	-0.0061	-0.0737	0.0307
20	-2.992	0	-108.263	0.0245	0.3669	0.0614
28	-33.088	2.584	-131.932	0.0679	0.6914	0.0748
29	-35.674	3.13	-133.354	0.0736	0.7308	0.0778
30	-38.098	4.197	-134.447	0.0784	0.7675	0.0841
38	-41.38	6.067	-135.705	0.0808	0.8047	0.0808
39	-46.817	8.142	-134.914	0.0864	0.8759	0.0935
40	-51.466	8.47	-129.512	0.0883	0.9482	0.0996
45	-84.107	0	-46.044	0.054	1.0646	0.1112
48	-113.111	-7.791	17.875	0.0236	0.684	0.1112
49	-117.495	-8.466	20.899	0.0202	0.5667	0.1116
50	-121.931	-8.652	19.61	0.0159	0.4436	0.112
59	-117.495	-8.466	-20.899	-0.0202	-0.5667	0.1116
60	-113.111	-7.791	-17.875	-0.0236	-0.684	0.1112
65	-84.107	0	46.044	-0.054	-1.0646	0.1112
68	-51.466	8.47	129.512	-0.0883	-0.9482	0.0996
69	-46.817	8.142	134.914	-0.0864	-0.8759	0.0935
70	-41.38	6.067	135.705	-0.0808	-0.8047	0.0808
78	-38.098	4.197	134.447	-0.0784	-0.7675	0.0841
79	-35.674	3.13	133.354	-0.0736	-0.7308	0.0778
80	-33.088	2.584	131.932	-0.0679	-0.6914	0.0748
85	-2.992	0	108.263	-0.0245	-0.3669	0.0614
90	10.455	0	54.13	0.0061	0.0737	0.0307
100	0	0	0	0	0	0
110	10.455	0	-54.13	-0.0061	-0.0737	0.0307
120	-2.992	0	-108.263	0.0245	0.3669	0.0614
128	-33.088	2.584	-131.932	0.0679	0.6914	0.0748
129	-35.674	3.13	-133.354	0.0736	0.7308	0.0778
130	-38.098	4.197	-134.447	0.0784	0.7675	0.0841
139	-46.817	8.142	-134.914	0.0864	0.8759	0.0935
140	-51.466	8.47	-129.512	0.0883	0.9482	0.0996
150	-84.107	0	-46.044	0.054	1.0646	0.1112
158	-113.111	-7.791	17.875	0.0236	0.684	0.1112
159	-117.494	-8.466	20.899	0.0202	0.5667	0.1116
160	-121.931	-8.652	19.61	0.0159	0.4436	0.112
168	-121.931	-8.652	-19.61	-0.0159	-0.4436	0.112
169	-117.494	-8.466	-20.899	-0.0202	-0.5667	0.1116
170	-113.111	-7.791	-17.875	-0.0236	-0.684	0.1112
180	-84.107	0	46.044	-0.054	-1.0646	0.1112

Optimized Model:
Dimension A: 4548mm, Friction Factor 0.10

188	-51.466	8.47	129.512	-0.0883	-0.9482	0.0996
189	-46.817	8.142	134.914	-0.0864	-0.8758	0.0935
190	-41.38	6.067	135.705	-0.0808	-0.8047	0.0808
199	-35.674	3.13	133.354	-0.0736	-0.7308	0.0778
200	-33.088	2.584	131.932	-0.0679	-0.6914	0.0748
210	-2.992	0	108.263	-0.0245	-0.3669	0.0614
220	10.455	0	54.13	0.0061	0.0737	0.0307
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
20	-0.008	0	-0.001	0.0166	0.002	-0.0094
28	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
29	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
30	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
38	-0.078	1.242	0.132	0.0203	0.0003	-0.012
39	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
40	0.007	1.487	0.25	0.0175	-0.002	-0.0117
45	0.006	0	0.01	0.0015	-0.002	0.0856
48	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
49	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
50	0.001	-12.155	0	-0.0147	0.0005	0.1803
59	0.005	-11.565	0.002	0.0142	-0.0006	0.18
60	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
65	0.006	0	-0.01	-0.0015	0.002	0.0856
68	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
69	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
70	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
78	-0.12	1.164	-0.055	-0.0206	-0.0008	-0.0118
79	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
80	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
85	-0.008	0	0.001	-0.0166	-0.002	-0.0094
90	0.002	0	0.001	0.0041	0.0004	-0.0047
100	0	0	0	0	0	0
110	0.002	0	-0.001	-0.0041	-0.0004	-0.0047
120	-0.008	0	-0.001	0.0166	0.002	-0.0094
128	-0.144	1.027	-0.002	0.0206	0.0016	-0.0114
129	-0.141	1.101	0.013	0.0207	0.0012	-0.0116
130	-0.12	1.164	0.055	0.0206	0.0008	-0.0118
139	-0.02	1.369	0.224	0.019	-0.0008	-0.0124
140	0.007	1.487	0.25	0.0175	-0.002	-0.0117
150	0.006	0	0.01	0.0015	-0.002	0.0856
158	0.006	-10.344	-0.006	-0.0127	0.0006	0.1783
159	0.005	-11.565	-0.002	-0.0142	0.0006	0.18
160	0.001	-12.155	0	-0.0147	0.0005	0.1803
168	0.001	-12.155	0	0.0147	-0.0005	0.1803
169	0.005	-11.565	0.002	0.0142	-0.0006	0.18
170	0.006	-10.344	0.006	0.0127	-0.0006	0.1783
180	0.006	0	-0.01	-0.0015	0.002	0.0856

188	0.007	1.487	-0.25	-0.0175	0.002	-0.0117
189	-0.02	1.369	-0.224	-0.019	0.0008	-0.0124
190	-0.078	1.242	-0.132	-0.0203	-0.0003	-0.012
199	-0.141	1.101	-0.013	-0.0207	-0.0012	-0.0116
200	-0.144	1.027	0.002	-0.0206	-0.0016	-0.0114
210	-0.008	0	0.001	-0.0166	-0.002	-0.0094
220	0.002	0	0.001	0.0041	0.0004	-0.0047
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 16, 2015 Time: 14:40
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.10
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.457	0	-54.131	-0.0102	-0.0741	0.026
20	-3	0	-108.265	0.0411	0.3689	0.052
28	-33.232	3.611	-131.934	0.0885	0.6931	0.0633
29	-35.815	4.231	-133.341	0.0942	0.732	0.0662
30	-38.219	5.361	-134.393	0.099	0.7683	0.0722
38	-41.458	7.309	-135.572	0.1011	0.805	0.0688
39	-46.836	9.51	-134.69	0.1054	0.875	0.0811
40	-51.459	9.957	-129.262	0.1057	0.9462	0.0879
45	-84.101	0	-46.034	0.0555	1.0626	0.1968
48	-113.104	-18.135	17.869	0.0109	0.6846	0.2895
49	-117.49	-20.03	20.897	0.006	0.5673	0.2916
50	-121.93	-20.807	19.61	0.0013	0.4441	0.2923
59	-117.49	-20.03	-20.897	-0.006	-0.5673	0.2916
60	-113.104	-18.135	-17.869	-0.0109	-0.6846	0.2895
65	-84.101	0	46.034	-0.0555	-1.0626	0.1968
68	-51.459	9.957	129.262	-0.1057	-0.9462	0.0879
69	-46.836	9.51	134.69	-0.1054	-0.875	0.0811
70	-41.458	7.309	135.572	-0.1011	-0.805	0.0688
78	-38.219	5.361	134.393	-0.099	-0.7683	0.0722
79	-35.815	4.231	133.341	-0.0942	-0.732	0.0662
80	-33.232	3.611	131.934	-0.0885	-0.6931	0.0633
85	-3	0	108.265	-0.0411	-0.3689	0.052
90	10.457	0	54.131	0.0102	0.0741	0.026
100	0	0	0	0	0	0
110	10.457	0	-54.131	-0.0102	-0.0741	0.026
120	-3	0	-108.265	0.0411	0.3689	0.052
128	-33.232	3.611	-131.934	0.0885	0.6931	0.0633
129	-35.815	4.231	-133.341	0.0942	0.732	0.0662
130	-38.219	5.361	-134.393	0.099	0.7683	0.0722
139	-46.836	9.51	-134.69	0.1054	0.875	0.0811
140	-51.459	9.957	-129.262	0.1057	0.9462	0.0879
150	-84.101	0	-46.034	0.0555	1.0626	0.1968
158	-113.104	-18.135	17.869	0.0109	0.6846	0.2895
159	-117.49	-20.03	20.897	0.006	0.5673	0.2916
160	-121.93	-20.807	19.61	0.0013	0.4441	0.2923
168	-121.93	-20.807	-19.61	-0.0013	-0.4441	0.2923
169	-117.49	-20.03	-20.897	-0.006	-0.5673	0.2916
170	-113.104	-18.135	-17.869	-0.0109	-0.6846	0.2895
180	-84.101	0	46.034	-0.0555	-1.0626	0.1968

188	-51.459	9.957	129.262	-0.1057	-0.9462	0.0879
189	-46.836	9.51	134.69	-0.1054	-0.875	0.0811
190	-41.458	7.309	135.572	-0.1011	-0.805	0.0688
199	-35.815	4.231	133.341	-0.0942	-0.732	0.0662
200	-33.231	3.611	131.934	-0.0885	-0.6931	0.0633
210	-3	0	108.265	-0.0411	-0.3689	0.052
220	10.457	0	54.131	0.0102	0.0741	0.026
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt

Input Echo

Job Description:

PROJECT:

CLIENT :

ANALYST:

NOTES :

PIPE DATA

From 10 To 15 DZ= -7,500.000 mm.
B31.3 (2010) Cycle Max Switch = --- App.P Sy/St Switch = ON
Sc= 137,895 KPa Sh1= 63,326 KPa Sh2= 137,895 KPa Sh3= 137,895 KPa
Sh4= 137,895 KPa Sh5= 137,895 KPa Sh6= 137,895 KPa Sh7= 137,895 KPa
Sh8= 137,895 KPa Sh9= 137,895 KPa Sy= 206,843 KPa
Dia= 355.600 mm. Wall= 41.550 mm. Cor= 1.0000 mm.
GENERAL
T1= 525 C P1=12,000.2734 KPa Mat= (185)A335 P22 E= 210,694,720 KPa
EH1= 171,202,208 KPa EH2= 210,694,720 KPa EH3= 210,694,720 KPa
EH4= 210,694,720 KPa EH5= 210,694,720 KPa EH6= 210,694,720 KPa
EH7= 210,694,720 KPa EH8= 210,694,720 KPa EH9= 210,694,720 KPa
v = .292 Pipe Den= .0078334 kg./cu.cm. Fluid Den= .0000000 kg./cu.cm.
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
RESTRAINTS
Node 10 ANC
Node 15 +Y Mu = .05
ALLOWABLE STRESSES

From 15 To 20 DZ= -7,500.000 mm.
RESTRAINTS
Node 20 Guide Gap= 3.000 mm. Mu = .05
Node 20 +Y Mu = .05

From 20 To 30 DZ= -3,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

From 30 To 40 DY= 750.000 mm. DZ= -750.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.

GENERAL
Insul Thk= 200.000 mm. Insul Den= .0001842 kg./cu.cm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

From 40 To 45 DX= -5,052.000 mm.
RESTRAINTS
Node 45 +Y Mu = .05

From 45 To 50 DX= -4,548.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

From 50 To 60 DZ= -6,500.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 59

From 60 To 65 DX= 4,548.000 mm.
Dia= 355.600 mm. Wall= 41.550 mm.
Insul Thk= 200.000 mm.
RESTRAINTS
Node 65 +Y Mu = .05

From 65 To 70 DX= 5,052.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

From 70 To 80 DY= -750.000 mm. DZ= -750.000 mm.
BEND at "TO" end
Radius= 533.400 mm. (LONG) Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

From 80 To 85 DZ= -3,500.000 mm.
RESTRAINTS
Node 85 Guide Gap= 3.000 mm. Mu = .05
Node 85 +Y Mu = .05

From 85 To 90 DZ= -7,500.000 mm.
RESTRAINTS
Node 90 +Y Mu = .05

From 90 To 100 DZ= -7,500.000 mm.
RESTRAINTS
Node 100 ANC

From 100 To 110 DZ= -7,500.000 mm.
RESTRAINTS

```
  Node  110  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  110  To  120 DZ= -7,500.000 mm.
 RESTRAINTS
   Node  120  +Y   Mu = .05
   Node  120  Guide   Gap= 3.000 mm.   Mu = .05
 ------------------------------------------------------------------------------
 From  120  To  130 DZ= -3,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 129
   Angle/Node @2= .00 128
 ------------------------------------------------------------------------------
 From  130  To  140 DY= 750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 139
 ------------------------------------------------------------------------------
 From  140  To  150  DX= -5,052.000 mm.
 RESTRAINTS
   Node  150  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  150  To  160  DX= -4,548.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 159
   Angle/Node @2= .00 158
 ------------------------------------------------------------------------------
 From  160  To  170 DZ= -6,500.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 169
   Angle/Node @2= .00 168
 ------------------------------------------------------------------------------
 From  170  To  180  DX= 4,548.000 mm.
 RESTRAINTS
   Node  180  +Y   Mu = .05
 ------------------------------------------------------------------------------
 From  180  To  190  DX= 5,052.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 90.000   Angle/Node @1= 45.00 189
   Angle/Node @2= .00 188
 ------------------------------------------------------------------------------
 From  190  To  200 DY= -750.000 mm.  DZ= -750.000 mm.
 BEND at "TO" end
   Radius= 533.400 mm. (LONG)   Bend Angle= 45.000   Angle/Node @1= 22.50 199
 ------------------------------------------------------------------------------
 From  200  To  210 DZ= -3,500.000 mm.
 RESTRAINTS
   Node  210  +Y   Mu = .05
   Node  210  Guide   Gap= 3.000 mm.   Mu = .05
 ------------------------------------------------------------------------------
 From  210  To  220 DZ= -7,500.000 mm.
 RESTRAINTS
```

Node 220 +Y Mu = .05

From 220 To 230 DZ= -7,500.000 mm.

RESTRAINTS

Node 230 ANC

MATERIAL Changes:

10 15 Mat= (185)A335 P22 E= 210,694,720 KPa
v = .292 Density= .0078 kg./cu.cm.

JOBNAME: E:\GDRIVE\M.ENG(MECH)\METJ 25110 PROJECT\ULTRA HIGH PRESSURE STEAM_CII

ALLOWABLE STRESS Changes

10 15 B31.3 (2010) Cycle Max Switch = ---
App.P Sy/St Switch = ON Sc= 137,895 KPa
Sh1= 63,326 KPa Sh2= 137,895 KPa
Sh3= 137,895 KPa Sh4= 137,895 KPa
Sh5= 137,895 KPa Sh6= 137,895 KPa
Sh7= 137,895 KPa Sh8= 137,895 KPa
Sh9= 137,895 KPa Sy= 206,843 KPa

BEND ELEMENTS

20 30 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 29
Angle/Node @2= .00 28

30 40 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 39
Angle/Node @2= .00 38

45 50 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 49
Angle/Node @2= .00 48

50 60 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 59

65 70 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00 69
Angle/Node @2= .00 68

70 80 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50 79
Angle/Node @2= .00 78

120 130 Radius= 533.400 mm. (LONG)
Bend Angle= 45.000 Angle/Node @1= 22.50
129 Angle/Node @2= .00 128

130 140 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00
139

150 160 Radius= 533.400 mm. (LONG)
Bend Angle= 90.000 Angle/Node @1= 45.00

```
                    159   Angle/Node @2= .00 158
 160          170          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    169   Angle/Node @2= .00 168
 180          190          Radius= 533.400 mm. (LONG)
                     Bend Angle= 90.000   Angle/Node @1= 45.00
                    189   Angle/Node @2= .00 188
 190          200          Radius= 533.400 mm. (LONG)
                     Bend Angle= 45.000   Angle/Node @1= 22.50
       199
```

RESTRAINTS

NODE	TYPE	CNODE	GAP STIF1	YIELD STIF2	Len FORCE	MU Dir Vectors
10	ANC			.05	.000	.000 .000
15	+Y			.05	.000	1.000 .000
20	Guide		3.00	.05	.000	.000 .000
20	+Y			.05	.000	1.000 .000
45	+Y			.05	.000	1.000 .000
65	+Y			.05	.000	1.000 .000
85	Guide		3.00	.05	.000	.000 .000
85	+Y			.05	.000	1.000 .000
90	+Y			.05	.000	1.000 .000
100	ANC			.05	.000	.000 .000
110	+Y			.05	.000	1.000 .000
120	+Y			.05	.000	1.000 .000
120	Guide		3.00	.05	.000	.000 .000
150	+Y			.05	.000	1.000 .000
180	+Y			.05	.000	1.000 .000
210	+Y			.05	.000	1.000 .000
210	Guide		3.00	.05	.000	.000 .000
220	+Y			.05	.000	1.000 .000
230	ANC			.05	.000	.000 .000

INPUT UNITS USED...

UNITS= SI (m NOM/SCH INPUT= ON

LENGTH	inches	x	25.400	= mm.
FORCE	pounds	x	4.448	= N.
MASS(dynamics)	pounds	x	0.454	= Kg.
MOMENTS(INPUT)	inch-pounds	x	0.113	= N.m.
MOMENTS(OUTPUT)	inch-pounds	x	0.113	= N.m.
STRESS	lbs./sq.in.	x	6.895	= KPa
TEMP. SCALE	degrees F.	x	0.556	= C
PRESSURE	psig	x	6.895	= KPa
ELASTIC MODULUS	lbs./sq.in.	x	6.895	= KPa
PIPE DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.
INSULATION DENS.	lbs./cu.in.	x	0.028	= kg./cu.cm.
FLUID DENSITY	lbs./cu.in.	x	0.028	= kg./cu.cm.

TRANSL. STIF lbs./in. x 1.751 = N./cm.
ROTATIONAL STIF in.lb./deg. x 0.113 = N.m./deg
UNIFORM LOAD lb./in. x 1.751 = N./cm.
G LOAD g's x 1.000 = g's
WIND LOAD lbs./sq.in. x 6.895 = KPa
ELEVATION inches x 0.025 = m.
COMPOUND LENGTH inches x 25.400 = mm.
DIAMETER inches x 25.400 = mm.
WALL THICKNESS inches x 25.400 = mm.

SETUP FILE PARAMETERS

CONNECT GEOMETRY THRU CNODES = YES
MIN ALLOWED BEND ANGLE = 5.00000
MAX ALLOWED BEND ANGLE = 95.0000
BEND LENGTH ATTACHMENT PERCENT = 1.00000
MIN ANGLE TO ADJACENT BEND PT = 5.00000
LOOP CLOSURE TOLERANCE = 25.4000 mm.
THERMAL BOWING HORZ TOLERANCE = 0.100000E-03
AUTO NODE NUMBER INCREMENT= 10.0000
Z AXIS UP= NO
USE PRESSURE STIFFENING = DEFAULT
ALPHA TOLERANCE = 0.500000E-01
RESLD-FORCE = NO
HGR DEF RESWGT STIF = 0.175127E+13 N./cm.
DECOMP SNG TOL = 0.100000E+11
BEND AXIAL SHAPE = YES
FRICT STIF = 0.175127E+07 N./cm.
FRICT NORM FORCE VAR = 0.150000
FRICT ANGLE VAR = 15.0000
FRICT SLIDE MULT = 1.00000
ROD TOLERANCE = 1.00000
ROD INC = 2.00000
INCORE NUMERICAL CHECK = NO
OUTCORE NUMERICAL CHECK = NO
DEFAULT TRANS RESTRAINT STIFF= 0.175127E+13 N./cm.
DEFAULT ROT RESTRAINT STIFF= 0.112985E+12 N.m./deg
IGNORE SPRING HANGER STIFFNESS = NO
MISSING MASS ZPA = EXTRACTED
MIN WALL MILL TOLERANCE = 12.5000
WRC-107 VERSION = MAR 79 1B1/2B1
WRC-107 INTERPOLATION = LAST VALUE
DEFAULT AMBIENT TEMPERATURE= 28.0000 C
BOURDON PRESSURE= NONE
COEFFICIENT OF FRICTION (MU) = 0.000000
INCLUDE SPRG STIF IN HGR OPE = NO
INCLUDE INSULATION IN HYDROTEST = NO
REDUCED INTERSECTION = B31.1(POST1980)
USE WRC329 NO
NO REDUCED SIF FOR RFT AND WLT NO

B31.1 REDUCED Z FIX = YES
CLASS 1 BRANCH FLEX NO
ALL STRESS CASES CORRODED = NO
ADD TORSION IN SL STRESS = DEFAULT
ADD F/A IN STRESS = DEFAULT
OCCASIONAL LOAD FACTOR = 0.000000
DEFAULT CODE = B31.3
B31.3 SUS CASE SIF FACTOR = 1.00000
ALLOW USERS BEND SIF = NO
USE SCHNEIDER NO
YIELD CRITERION STRESS = MAX 3D SHEAR
USE PD/4T NO
BASE HOOP STRESS ON ? = ID
EN13480 USE IN OUTPLANE SIFS= NO
LIBERAL EXPANSION ALLOWABLE= YES
B31.3 SEC 319.2.3C SAXIAL= NO
B31.3 WELDING/CONTOUR TEE ISB16.9 FALSE
PRESSURE VARIATION IN EXP CASE= DEFAULT
IMPLEMENT B313 APP-P NO
IMPLEMENT B313 CODE CASE 178 YES
IGNORE B31.1/B31.3 Wc FACTOR= YES
USE FRP SIF = YES
USE FRP FLEX = YES
BS 7159 Pressure Stiffening= Design Strain
FRP Emod (axial) = 0.220632E+08 KPa
FRP Ratio Gmod/Emod (axial) = 0.250000
FRP Ea/Eh*Vh/a = 0.152730
FRP Laminate Type = THREE
FRP Alpha = 21.6000 C
FRP Density = 0.166079E-02 kg./cu.cm.
EXCLUDE f2 FROM UKOOA BENDING = NO

EXECUTION CONTROL PARAMETERS

Rigid/ExpJt Print Flag 1.000
Bourdon Option ..... .000
Loop Closure Flag ..... .000
Thermal Bowing Delta Temp .. .000 C
Liberal Allowable Flag 1.000
Uniform Load Option ..... .000

Ambient Temperature ..... 27.996 C
Plastic (FRP) Alpha 21.600
Plastic (FRP) GMOD/EMODa ... .250
Plastic (FRP) Laminate Type. 3.000
Eqn Optimizer ..... .000
Node Selection ..... .000
Eqn Ordering ..... .000

Collins ..... .000
Degree Determination ..... .000
User Eqn Control ..... .000

COORDINATE REPORT

/----------(mm.)----------/

NODE	X	Y	Z
10	.000	.000	.000
15	.000	.000	-7500.000
20	.000	.000	-15000.000
30	.000	.000	-18500.000
40	.000	750.000	-19250.000
45	-5052.000	750.000	-19250.000
50	-9600.000	750.000	-19250.000
60	-9600.000	750.000	-25750.000
65	-5052.000	750.000	-25750.000
70	.000	750.000	-25750.000
80	.000	.000	-26500.000
85	.000	.000	-30000.000
90	.000	.000	-37500.000
100	.000	.000	-45000.000
110	.000	.000	-52500.000
120	.000	.000	-60000.000
130	.000	.000	-63500.000
140	.000	750.000	-64250.000
150	-5052.000	750.000	-64250.000
160	-9600.000	750.000	-64250.000
170	-9600.000	750.000	-70750.000
180	-5052.000	750.000	-70750.000
190	.000	750.000	-70750.000
200	.000	.000	-71500.000
210	.000	.000	-75000.000
220	.000	.000	-82500.000
230	.000	.000	-90000.000

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
CODE COMPLIANCE EXTENDED REPORT: Code Stresses on Elements
Various Load Cases

Load Case From Node Code Stres Allowable Ratio % To Node Code Stres Allowable Ratio % Piping Code

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (SUS) W+P1
CASE 3 (EXP) L3=L1-L2

Piping Code: B31.3 = B31.3 -2010, March 31, 2011

*** CODE COMPLIANCE EVALUATION PASSED ***

Highest Stresses: (KPa)
Ratio (%): 78.5 @Node 45 LOADCASE: 2 (SUS) W+P1
Code Stress: 49704.0 Allowable Stress: 63326.2
Axial Stress: 17846.5 @Node 38 LOADCASE: 2 (SUS) W+P1
Bending Stress: 106854.6 @Node 50 LOADCASE: 1 (OPE) W+T1+P1
Torsion Stress: 23010.4 @Node 130 LOADCASE: 3 (EXP) L3=L1-L2
Hoop Stress: 40617.4 @Node 15 LOADCASE: 2 (SUS) W+P1
Max Stress Intensity: 127789.6 @Node 50 LOADCASE: 1 (OPE) W+T1+P1

1(OPE)	10	45780	0	0	15	34757.4	0	0	B31.3
2(SUS)		23228.5	63326.2	36.7		25371.4	63326.2	40.1	B31.3
3(EXP)		29813	228298.2	13.1		16610.2	226155.2	7.3	B31.3
1(OPE)	15	34801.3	0	0	20	79377.1	0	0	B31.3
2(SUS)		25374.1	63326.2	40.1		18899.2	63326.2	29.8	B31.3
3(EXP)		16610.2	226152.5	7.3		63468.8	232627.5	27.3	B31.3
1(OPE)	20	79415.7	0	0	28	82899	0	0	B31.3
2(SUS)		18903.4	63326.2	29.9		18455.3	63326.2	29.1	B31.3
3(EXP)		63468.8	232623.3	27.3		67694.9	233071.4	29	B31.3
1(OPE)	28	82899	0	0	29	83084	0	0	B31.3
2(SUS)		18455.3	63326.2	29.1		18541.5	63326.2	29.3	B31.3
3(EXP)		67694.9	233071.4	29		67855.9	232985.2	29.1	B31.3
1(OPE)	29	83084	0	0	30	83297	0	0	B31.3
2(SUS)		18541.5	63326.2	29.3		18681	63326.2	29.5	B31.3
3(EXP)		67855.9	232985.2	29.1		67828.9	232845.7	29.1	B31.3
1(OPE)	30	83297	0	0	38	83237	0	0	B31.3
2(SUS)		18681	63326.2	29.5		19025.1	63326.2	30	B31.3
3(EXP)		67828.9	232845.7	29.1		67815	232501.6	29.2	B31.3
1(OPE)	38	83237	0	0	39	80900	0	0	B31.3
2(SUS)		19025.1	63326.2	30		19409.1	63326.2	30.6	B31.3
3(EXP)		67815	232501.6	29.2		65188	232117.6	28.1	B31.3

1(OPE)	39	80900	0	0	40	74878.9	0	0	B31.3
2(SUS)		19409.1	63326.2	30.6		19255.7	63326.2	30.4	B31.3
3(EXP)		65188	232117.6	28.1		58368.4	232270.9	25.1	B31.3
1(OPE)	40	74878.9	0	0	45	57909.8	0	0	B31.3
2(SUS)		19255.7	63326.2	30.4		49704	63326.2	78.5	B31.3
3(EXP)		58368.4	232270.9	25.1		26644.3	201822.6	13.2	B31.3
1(OPE)	45	57975.9	0	0	48	114528.7	0	0	B31.3
2(SUS)		49683.6	63326.2	78.5		20078.6	63326.2	31.7	B31.3
3(EXP)		26644.3	201843	13.2		97343.9	231448.1	42.1	B31.3
1(OPE)	48	114528.7	0	0	49	120306.5	0	0	B31.3
2(SUS)		20078.6	63326.2	31.7		18932.6	63326.2	29.9	B31.3
3(EXP)		97343.9	231448.1	42.1		104000.1	232594.1	44.7	B31.3
1(OPE)	49	120306.5	0	0	50	122666.6	0	0	B31.3
2(SUS)		18932.6	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104000.1	232594.1	44.7		106757.4	233504.9	45.7	B31.3
1(OPE)	50	122666.6	0	0	59	120306.5	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18932.6	63326.2	29.9	B31.3
3(EXP)		106757.4	233504.9	45.7		104000.1	232594.1	44.7	B31.3
1(OPE)	59	120306.5	0	0	60	114528.7	0	0	B31.3
2(SUS)		18932.6	63326.2	29.9		20078.6	63326.2	31.7	B31.3
3(EXP)		104000.1	232594.1	44.7		97343.8	231448.1	42.1	B31.3
1(OPE)	60	114528.7	0	0	65	57975.9	0	0	B31.3
2(SUS)		20078.6	63326.2	31.7		49683.6	63326.2	78.5	B31.3
3(EXP)		97343.8	231448.1	42.1		26644.3	201843	13.2	B31.3
1(OPE)	65	57909.8	0	0	68	74878.9	0	0	B31.3
2(SUS)		49704	63326.2	78.5		19255.7	63326.2	30.4	B31.3
3(EXP)		26644.3	201822.6	13.2		58368.5	232270.9	25.1	B31.3
1(OPE)	68	74878.9	0	0	69	80900	0	0	B31.3
2(SUS)		19255.7	63326.2	30.4		19409.1	63326.2	30.6	B31.3
3(EXP)		58368.5	232270.9	25.1		65188	232117.6	28.1	B31.3
1(OPE)	69	80900	0	0	70	83237	0	0	B31.3
2(SUS)		19409.1	63326.2	30.6		19025.1	63326.2	30	B31.3
3(EXP)		65188	232117.6	28.1		67815	232501.6	29.2	B31.3
1(OPE)	70	83237	0	0	78	83297	0	0	B31.3
2(SUS)		19025.1	63326.2	30		18681	63326.2	29.5	B31.3
3(EXP)		67815	232501.6	29.2		67829	232845.7	29.1	B31.3
1(OPE)	78	83297	0	0	79	83084.1	0	0	B31.3
2(SUS)		18681	63326.2	29.5		18541.5	63326.2	29.3	B31.3
3(EXP)		67829	232845.7	29.1		67855.9	232985.2	29.1	B31.3
1(OPE)	79	83084.1	0	0	80	82899	0	0	B31.3
2(SUS)		18541.5	63326.2	29.3		18455.3	63326.2	29.1	B31.3
3(EXP)		67855.9	232985.2	29.1		67694.9	233071.4	29	B31.3

1(OPE)	80	82899	0	0	85	79415.7	0	0	B31.3
2(SUS)		18455.3	63326.2	29.1		18903.4	63326.2	29.9	B31.3
3(EXP)		67694.9	233071.4	29		63468.8	232623.3	27.3	B31.3
1(OPE)	85	79377.1	0	0	90	34801.2	0	0	B31.3
2(SUS)		18899.2	63326.2	29.8		25374.1	63326.2	40.1	B31.3
3(EXP)		63468.8	232627.5	27.3		16610.2	226152.5	7.3	B31.3
1(OPE)	90	34757.4	0	0	100	45780.1	0	0	B31.3
2(SUS)		25371.4	63326.2	40.1		23228.5	63326.2	36.7	B31.3
3(EXP)		16610.2	226155.2	7.3		29813.1	228298.1	13.1	B31.3
1(OPE)	100	45780.1	0	0	110	34757.4	0	0	B31.3
2(SUS)		23228.5	63326.2	36.7		25371.4	63326.2	40.1	B31.3
3(EXP)		29813.2	228298.1	13.1		16610.2	226155.2	7.3	B31.3
1(OPE)	110	34801.2	0	0	120	79377.2	0	0	B31.3
2(SUS)		25374.1	63326.2	40.1		18899.2	63326.2	29.8	B31.3
3(EXP)		16610.2	226152.5	7.3		63468.9	232627.5	27.3	B31.3
1(OPE)	120	79415.8	0	0	128	82899	0	0	B31.3
2(SUS)		18903.3	63326.2	29.9		18455.3	63326.2	29.1	B31.3
3(EXP)		63468.9	232623.3	27.3		67695	233071.4	29	B31.3
1(OPE)	128	82899	0	0	129	83084.1	0	0	B31.3
2(SUS)		18455.3	63326.2	29.1		18541.5	63326.2	29.3	B31.3
3(EXP)		67695	233071.4	29		67855.9	232985.2	29.1	B31.3
1(OPE)	129	83084.1	0	0	130	83297.1	0	0	B31.3
2(SUS)		18541.5	63326.2	29.3		18681	63326.2	29.5	B31.3
3(EXP)		67855.9	232985.2	29.1		67829	232845.7	29.1	B31.3
1(OPE)	130	83297.1	0	0	139	80900.1	0	0	B31.3
2(SUS)		18681	63326.2	29.5		19409.1	63326.2	30.6	B31.3
3(EXP)		67829	232845.7	29.1		65188.1	232117.6	28.1	B31.3
1(OPE)	139	80900.1	0	0	140	74878.9	0	0	B31.3
2(SUS)		19409.1	63326.2	30.6		19255.7	63326.2	30.4	B31.3
3(EXP)		65188.1	232117.6	28.1		58368.5	232270.9	25.1	B31.3
1(OPE)	140	74878.9	0	0	150	57909.8	0	0	B31.3
2(SUS)		19255.7	63326.2	30.4		49704	63326.2	78.5	B31.3
3(EXP)		58368.5	232270.9	25.1		26644.3	201822.6	13.2	B31.3
1(OPE)	150	57975.9	0	0	158	114528.6	0	0	B31.3
2(SUS)		49683.6	63326.2	78.5		20078.6	63326.2	31.7	B31.3
3(EXP)		26644.3	201843	13.2		97343.8	231448.1	42.1	B31.3
1(OPE)	158	114528.6	0	0	159	120306.5	0	0	B31.3
2(SUS)		20078.6	63326.2	31.7		18932.6	63326.2	29.9	B31.3
3(EXP)		97343.8	231448.1	42.1		104000.1	232594.1	44.7	B31.3
1(OPE)	159	120306.5	0	0	160	122666.6	0	0	B31.3
2(SUS)		18932.6	63326.2	29.9		18021.7	63326.2	28.5	B31.3
3(EXP)		104000.1	232594.1	44.7		106757.4	233504.9	45.7	B31.3

Optimized Model:
Dimension A: 4548mm, Friction Factor 0.05

1(OPE)	160	122666.6	0	0	168	122666.6	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18021.7	63326.2	28.5	B31.3
3(EXP)		106757.4	233504.9	45.7		106757.4	233504.9	45.7	B31.3
1(OPE)	168	122666.6	0	0	169	120306.5	0	0	B31.3
2(SUS)		18021.7	63326.2	28.5		18932.6	63326.2	29.9	B31.3
3(EXP)		106757.4	233504.9	45.7		104000.1	232594.1	44.7	B31.3
1(OPE)	169	120306.5	0	0	170	114528.7	0	0	B31.3
2(SUS)		18932.6	63326.2	29.9		20078.6	63326.2	31.7	B31.3
3(EXP)		104000.1	232594.1	44.7		97343.8	231448.1	42.1	B31.3
1(OPE)	170	114528.7	0	0	180	57975.9	0	0	B31.3
2(SUS)		20078.6	63326.2	31.7		49683.6	63326.2	78.5	B31.3
3(EXP)		97343.8	231448.1	42.1		26644.3	201843	13.2	B31.3
1(OPE)	180	57909.8	0	0	188	74878.9	0	0	B31.3
2(SUS)		49704	63326.2	78.5		19255.7	63326.2	30.4	B31.3
3(EXP)		26644.3	201822.6	13.2		58368.4	232270.9	25.1	B31.3
1(OPE)	188	74878.9	0	0	189	80900	0	0	B31.3
2(SUS)		19255.7	63326.2	30.4		19409.1	63326.2	30.6	B31.3
3(EXP)		58368.4	232270.9	25.1		65188	232117.6	28.1	B31.3
1(OPE)	189	80900	0	0	190	83237	0	0	B31.3
2(SUS)		19409.1	63326.2	30.6		19025.1	63326.2	30	B31.3
3(EXP)		65188	232117.6	28.1		67815	232501.6	29.2	B31.3
1(OPE)	190	83237	0	0	199	83084	0	0	B31.3
2(SUS)		19025.1	63326.2	30		18541.5	63326.2	29.3	B31.3
3(EXP)		67815	232501.6	29.2		67855.9	232985.2	29.1	B31.3
1(OPE)	199	83084	0	0	200	82899	0	0	B31.3
2(SUS)		18541.5	63326.2	29.3		18455.3	63326.2	29.1	B31.3
3(EXP)		67855.9	232985.2	29.1		67694.9	233071.4	29	B31.3
1(OPE)	200	82899	0	0	210	79415.7	0	0	B31.3
2(SUS)		18455.3	63326.2	29.1		18903.3	63326.2	29.9	B31.3
3(EXP)		67694.9	233071.4	29		63468.8	232623.3	27.3	B31.3
1(OPE)	210	79377.1	0	0	220	34801.3	0	0	B31.3
2(SUS)		18899.2	63326.2	29.8		25374.1	63326.2	40.1	B31.3
3(EXP)		63468.8	232627.5	27.3		16610.2	226152.5	7.3	B31.3
1(OPE)	220	34757.5	0	0	230	45780	0	0	B31.3
2(SUS)		25371.4	63326.2	40.1		23228.5	63326.2	36.7	B31.3
3(EXP)		16610.2	226155.2	7.3		29813	228298.2	13.1	B31.3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
RESTRAINT SUMMARY EXTENDED REPORT: Loads On Restraints
Various Load Cases

Node	Load Case	FX N.	FY N.	FZ N.	MX N.m.	MY N.m.	MZ N.m.	DX mm.	DY mm.	DZ mm.
LOAD CASE DEFINITION KEY										
CASE 1 (OPE) W+T1+P1										
CASE 2 (SUS) W+P1										
CASE 3 (EXP) L3=L1-L2										
10	Rigid ANC									
	1(OPE)	17750	-12122	56512	-12622	-85932	5305	0	0	0
	2(SUS)	-6	-13361	-709	-15698	12	-943	0	0	0
	3(EXP)	17756	1239	57220	3076	-85944	6248	0	0	0
	MAX	17756/L	-13361/L	57220/L	-15698/L	-85944/L	6248/L3	0.000/L3	-0.000/L2	0.000/L3
15	Rigid +Y									
	1(OPE)	361	-36642	-1796	0	0	0	10.866	0	-54.135
	2(SUS)	129	-31636	-108	0	0	0	0.001	0	-0.001
	3(EXP)	231	-5006	-1688	0	0	0	10.866	0	-54.134
	MAX	361/L1	-36642/L	-1796/L1				10.866/L	-0.000/L1	-54.135/L1
20	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-15402	-17201	-1629	0	0	0	-3	0	-108.271
	2(SUS)	-960	-19208	-20	0	0	0	-0.064	0	-0.001
	3(EXP)	-14442	2007	-1609	0	0	0	-2.936	0	-108.27
	MAX	-15402/L	-19208/L	-1629/L1				-3.000/L1	-0.000/L2	-108.271/L1
45	Rigid +Y									
	1(OPE)	-2407	-54722	-1301	0	0	0	-85.017	0	-45.962
	2(SUS)	820	-56483	1573	0	0	0	0.005	0	0.009
	3(EXP)	-3227	1761	-2874	0	0	0	-85.022	0	-45.971
	MAX	-3227/L3	-56483/L	-2874/L3				-85.022/L	-0.000/L2	-45.971/L3
65	Rigid +Y									
	1(OPE)	-2407	-54722	1301	0	0	0	-85.017	0	45.962
	2(SUS)	820	-56483	-1573	0	0	0	0.005	0	-0.009
	3(EXP)	-3227	1761	2874	0	0	0	-85.022	0	45.971
	MAX	-3227/L3	-56483/L	2874/L3				-85.022/L	-0.000/L2	45.971/L3
85	Rigid GUI w/gap; Rigid +Y									
	1(OPE)	-15402	-17201	1629	0	0	0	-3	0	108.271
	2(SUS)	-960	-19208	20	0	0	0	-0.064	0	0.001
	3(EXP)	-14442	2007	1609	0	0	0	-2.936	0	108.27
	MAX	-15402/L	-19208/L	1629/L1				-3.000/L1	-0.000/L2	108.271/L1
90	Rigid +Y									
	1(OPE)	361	-36642	1796	0	0	0	10.866	0	54.135
	2(SUS)	129	-31636	108	0	0	0	0.001	0	0.001
	3(EXP)	231	-5006	1688	0	0	0	10.866	0	54.134
	MAX	361/L1	-36642/L	1796/L1				10.866/L	-0.000/L1	54.135/L1
100	Rigid ANC									
	1(OPE)	35500	-24244	0	0	0	10611	0	0	0
	2(SUS)	-12	-26721	0	0	0	-1886	0	0	0
	3(EXP)	35512	2477	0	0	0	12497	0	0	0
	MAX	35512/L	-26721/L	-0/L3	0/L2	-0/L1	12497/L	0.000/L3	-0.000/L2	-0.000/L3

110		Rigid +Y								
	1(OPE)	361	-36642	-1796	0	0	0	10.866	0	-54.135
	2(SUS)	129	-31636	-108	0	0	0	0.001	0	-0.001
	3(EXP)	231	-5006	-1688	0	0	0	10.866	0	-54.134
	MAX	361/L1	-36642/L	-1796/L1				10.866/L	-0.000/L1	-54.135/L1
120		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-15402	-17201	-1629	0	0	0	-3	0	-108.271
	2(SUS)	-960	-19208	-20	0	0	0	-0.064	0	-0.001
	3(EXP)	-14442	2007	-1609	0	0	0	-2.936	0	-108.27
	MAX	-15402/L	-19208/L	-1629/L1				-3.000/L1	-0.000/L2	-108.271/L1
150		Rigid +Y								
	1(OPE)	-2407	-54722	-1301	0	0	0	-85.017	0	-45.962
	2(SUS)	820	-56483	1573	0	0	0	0.005	0	0.009
	3(EXP)	-3227	1761	-2874	0	0	0	-85.021	0	-45.971
	MAX	-3227/L3	-56483/L	-2874/L3				-85.021/L	-0.000/L2	-45.971/L3
180		Rigid +Y								
	1(OPE)	-2407	-54722	1301	0	0	0	-85.017	0	45.962
	2(SUS)	820	-56483	-1573	0	0	0	0.005	0	-0.009
	3(EXP)	-3227	1761	2874	0	0	0	-85.022	0	45.971
	MAX	-3227/L3	-56483/L	2874/L3				-85.022/L	-0.000/L2	45.971/L3
210		Rigid +Y; Rigid GUI w/gap								
	1(OPE)	-15402	-17201	1629	0	0	0	-3	0	108.271
	2(SUS)	-960	-19208	20	0	0	0	-0.064	0	0.001
	3(EXP)	-14442	2007	1609	0	0	0	-2.936	0	108.27
	MAX	-15402/L	-19208/L	1629/L1				-3.000/L1	-0.000/L2	108.271/L1
220		Rigid +Y								
	1(OPE)	361	-36642	1796	0	0	0	10.866	0	54.135
	2(SUS)	129	-31636	108	0	0	0	0.001	0	0.001
	3(EXP)	231	-5006	1688	0	0	0	10.866	0	54.134
	MAX	361/L1	-36642/L	1796/L1				10.866/L	-0.000/L1	54.135/L1
230		Rigid ANC								
	1(OPE)	17750	-12122	-56512	12622	85932	5305	0	0	0
	2(SUS)	-6	-13361	709	15698	-12	-943	0	0	0
	3(EXP)	17756	1239	-57220	-3076	85944	6248	0	0	0
	MAX	17756/L1	-13361/L	-57220/L	15698/L1	85944/L1	6248/L3	0.000/L3	-0.000/L2	-0.000/L3

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 3 (EXP) L3=L1-L2

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.866	0	-54.134	-0.0062	-0.0768	0.032
20	-2.936	0	-108.27	0.0252	0.378	0.064
28	-33.793	2.625	-131.939	0.0684	0.7039	0.078
29	-36.425	3.173	-133.361	0.0739	0.7424	0.0811
30	-38.889	4.241	-134.454	0.0785	0.7782	0.0872
38	-42.222	6.111	-135.711	0.0809	0.8143	0.0839
39	-47.713	8.178	-134.898	0.0863	0.8832	0.0959
40	-52.379	8.492	-129.457	0.088	0.9531	0.1013
45	-85.022	0	-45.971	0.0539	1.063	0.1108
48	-114.025	-7.763	17.879	0.0235	0.6835	0.1108
49	-118.408	-8.435	20.9	0.0201	0.5663	0.1112
50	-122.842	-8.621	19.61	0.0159	0.4433	0.1116
59	-118.408	-8.435	-20.9	-0.0201	-0.5663	0.1112
60	-114.025	-7.763	-17.879	-0.0235	-0.6835	0.1108
65	-85.022	0	45.971	-0.0539	-1.063	0.1108
68	-52.379	8.492	129.457	-0.088	-0.9531	0.1013
69	-47.713	8.178	134.898	-0.0863	-0.8833	0.0959
70	-42.222	6.111	135.711	-0.0809	-0.8143	0.0839
78	-38.889	4.241	134.454	-0.0785	-0.7782	0.0872
79	-36.425	3.173	133.361	-0.0739	-0.7424	0.0811
80	-33.793	2.625	131.939	-0.0684	-0.7039	0.078
85	-2.936	0	108.27	-0.0252	-0.378	0.064
90	10.866	0	54.134	0.0062	0.0768	0.032
100	0	0	0	0	0	0
110	10.866	0	-54.134	-0.0062	-0.0768	0.032
120	-2.936	0	-108.27	0.0252	0.378	0.064
128	-33.793	2.625	-131.939	0.0684	0.7039	0.078
129	-36.425	3.173	-133.361	0.0739	0.7424	0.0811
130	-38.889	4.241	-134.454	0.0785	0.7782	0.0872
139	-47.713	8.178	-134.898	0.0863	0.8832	0.0959
140	-52.379	8.492	-129.457	0.088	0.9531	0.1013
150	-85.021	0	-45.971	0.0539	1.063	0.1108
158	-114.025	-7.763	17.879	0.0235	0.6835	0.1108
159	-118.408	-8.435	20.9	0.0201	0.5663	0.1112
160	-122.842	-8.621	19.61	0.0159	0.4433	0.1116
168	-122.842	-8.621	-19.61	-0.0159	-0.4433	0.1116
169	-118.408	-8.435	-20.9	-0.0201	-0.5663	0.1112
170	-114.025	-7.763	-17.879	-0.0235	-0.6835	0.1108
180	-85.022	0	45.971	-0.0539	-1.063	0.1108

188	-52.379	8.492	129.457	-0.088	-0.9531	0.1013
189	-47.713	8.178	134.898	-0.0863	-0.8832	0.0959
190	-42.222	6.111	135.711	-0.0809	-0.8143	0.0839
199	-36.425	3.173	133.361	-0.0739	-0.7424	0.0811
200	-33.793	2.625	131.939	-0.0684	-0.7039	0.078
210	-2.936	0	108.27	-0.0252	-0.378	0.064
220	10.866	0	54.134	0.0062	0.0768	0.032
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 2 (SUS) W+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	0.001	0	-0.001	-0.0041	0	-0.0048
20	-0.064	0	-0.001	0.0165	0.0017	-0.0097
28	-0.16	1.021	-0.002	0.0205	0.0009	-0.0118
29	-0.154	1.095	0.013	0.0206	0.0005	-0.0119
30	-0.131	1.158	0.055	0.0205	0.0001	-0.0122
38	-0.085	1.236	0.132	0.0203	-0.0003	-0.0123
39	-0.023	1.363	0.222	0.019	-0.0013	-0.0127
40	0.005	1.483	0.246	0.0174	-0.0023	-0.0119
45	0.005	0	0.009	0.0015	-0.0019	0.0856
48	0.005	-10.345	-0.006	-0.0127	0.0006	0.1784
49	0.003	-11.566	-0.002	-0.0142	0.0006	0.1801
50	0	-12.156	0	-0.0147	0.0004	0.1803
59	0.003	-11.566	0.002	0.0142	-0.0006	0.1801
60	0.005	-10.345	0.006	0.0127	-0.0006	0.1784
65	0.005	0	-0.009	-0.0015	0.0019	0.0856
68	0.005	1.483	-0.246	-0.0174	0.0023	-0.0119
69	-0.023	1.363	-0.222	-0.019	0.0013	-0.0127
70	-0.085	1.236	-0.132	-0.0203	0.0003	-0.0123
78	-0.131	1.158	-0.055	-0.0205	-0.0001	-0.0122
79	-0.154	1.095	-0.013	-0.0206	-0.0005	-0.0119
80	-0.16	1.021	0.002	-0.0205	-0.0009	-0.0118
85	-0.064	0	0.001	-0.0165	-0.0017	-0.0097
90	0.001	0	0.001	0.0041	0	-0.0048
100	0	0	0	0	0	0
110	0.001	0	-0.001	-0.0041	0	-0.0048
120	-0.064	0	-0.001	0.0165	0.0017	-0.0097
128	-0.16	1.021	-0.002	0.0205	0.0009	-0.0118
129	-0.154	1.095	0.013	0.0206	0.0005	-0.0119
130	-0.131	1.158	0.055	0.0205	0.0001	-0.0122
139	-0.023	1.363	0.222	0.019	-0.0013	-0.0127
140	0.005	1.483	0.246	0.0174	-0.0023	-0.0119
150	0.005	0	0.009	0.0015	-0.0019	0.0856
158	0.005	-10.345	-0.006	-0.0127	0.0006	0.1784
159	0.003	-11.566	-0.002	-0.0142	0.0006	0.1801
160	0	-12.156	0	-0.0147	0.0004	0.1803
168	0	-12.156	0	0.0147	-0.0004	0.1803
169	0.003	-11.566	0.002	0.0142	-0.0006	0.1801
170	0.005	-10.345	0.006	0.0127	-0.0006	0.1784
180	0.005	0	-0.009	-0.0015	0.0019	0.0856

188	0.005	1.483	-0.246	-0.0174	0.0023	-0.0119
189	-0.023	1.363	-0.222	-0.019	0.0013	-0.0127
190	-0.085	1.236	-0.132	-0.0203	0.0003	-0.0123
199	-0.154	1.095	-0.013	-0.0206	-0.0005	-0.0119
200	-0.16	1.021	0.002	-0.0205	-0.0009	-0.0118
210	-0.064	0	0.001	-0.0165	-0.0017	-0.0097
220	0.001	0	0.001	0.0041	0	-0.0048
230	0	0	0	0	0	0

CAESAR II 2013 R1 Ver.6.10.01.0051, (Build 130703) Date: JAN 19, 2015 Time: 14:31
Job Name: A335 P22_2 EXPANSION LOOP_LOOP ADJUST 4548_MU 0.05
Licensed To: SPLM: Edit company name in <system>\company.txt
DISPLACEMENTS REPORT: Nodal Movements
CASE 1 (OPE) W+T1+P1

Node	DX mm.	DY mm.	DZ mm.	RX deg.	RY deg.	RZ deg.
10	0	0	0	0	0	0
15	10.866	0	-54.135	-0.0103	-0.0768	0.0272
20	-3	0	-108.271	0.0417	0.3797	0.0544
28	-33.953	3.647	-131.941	0.0889	0.7048	0.0663
29	-36.579	4.268	-133.348	0.0945	0.7429	0.0691
30	-39.021	5.398	-134.399	0.0991	0.7783	0.075
38	-42.307	7.347	-135.579	0.1011	0.814	0.0716
39	-47.736	9.541	-134.676	0.1052	0.882	0.0833
40	-52.374	9.975	-129.211	0.1054	0.9509	0.0893
45	-85.017	0	-45.962	0.0553	1.0611	0.1964
48	-114.021	-18.108	17.873	0.0108	0.6841	0.2891
49	-118.405	-20.001	20.898	0.0059	0.5668	0.2913
50	-122.843	-20.777	19.61	0.0012	0.4437	0.2919
59	-118.405	-20.001	-20.898	-0.0059	-0.5668	0.2913
60	-114.02	-18.108	-17.873	-0.0108	-0.6841	0.2891
65	-85.017	0	45.962	-0.0553	-1.0611	0.1964
68	-52.374	9.975	129.211	-0.1054	-0.9509	0.0893
69	-47.736	9.541	134.676	-0.1052	-0.882	0.0833
70	-42.307	7.347	135.579	-0.1011	-0.814	0.0716
78	-39.021	5.398	134.399	-0.0991	-0.7783	0.075
79	-36.579	4.268	133.348	-0.0945	-0.7429	0.0691
80	-33.953	3.647	131.941	-0.0889	-0.7048	0.0663
85	-3	0	108.271	-0.0417	-0.3797	0.0544
90	10.866	0	54.135	0.0103	0.0768	0.0272
100	0	0	0	0	0	0
110	10.866	0	-54.135	-0.0103	-0.0768	0.0272
120	-3	0	-108.271	0.0417	0.3797	0.0544
128	-33.953	3.647	-131.941	0.0889	0.7048	0.0663
129	-36.579	4.268	-133.348	0.0945	0.7429	0.0691
130	-39.021	5.398	-134.399	0.0991	0.7783	0.075
139	-47.735	9.541	-134.676	0.1052	0.882	0.0833
140	-52.373	9.975	-129.211	0.1054	0.9509	0.0893
150	-85.017	0	-45.962	0.0553	1.0611	0.1964
158	-114.02	-18.108	17.873	0.0108	0.6841	0.2891
159	-118.405	-20.001	20.898	0.0059	0.5668	0.2913
160	-122.842	-20.777	19.61	0.0012	0.4437	0.2919
168	-122.843	-20.777	-19.61	-0.0012	-0.4437	0.2919
169	-118.405	-20.001	-20.898	-0.0059	-0.5668	0.2913
170	-114.02	-18.108	-17.873	-0.0108	-0.6841	0.2891
180	-85.017	0	45.962	-0.0553	-1.0611	0.1964

188	-52.373	9.975	129.211	-0.1054	-0.9509	0.0893
189	-47.735	9.541	134.676	-0.1052	-0.882	0.0833
190	-42.307	7.347	135.579	-0.1011	-0.814	0.0716
199	-36.579	4.268	133.348	-0.0945	-0.7429	0.0691
200	-33.953	3.647	131.941	-0.0889	-0.7048	0.0663
210	-3	0	108.271	-0.0417	-0.3797	0.0544
220	10.866	0	54.135	0.0103	0.0768	0.0272
230	0	0	0	0	0	0

PROJECT: DATE :
CLIENT : BY:
PROJECT NO: Rev:

PIPE WALL THICKNESS CALCULATIONS FOR PIPING CLASS - 25A1

DESIGN CODE - ASME B 31.3 2012
Nominal wall thickness, t =P*D / 2(S*E*W+P*Y)
Minimum wall thickness required, tm=(t+c)

Piping Class		25A1	
Material Grade		A335 P22	
Pressure Rating		2500	
Design Pressure	P (BarG)	120	(Note 1)
Design Temperature	^{0} C	525	(Note 1)
Allowable Stress	S (Ksig)	9.18	(Table A-1 of ASME B 31.3)
Quality fantor	E	1.0	(for seamless pipes/EFW pipes 100% NDT) as per Table A-1A&A-1B of ASME B 31.3)
Weld joint reduction factor	W	0.839	(as per Table 302.3.5 of ASME B 31.3)
Coefficient	Y	0.607	(as per Table 304.1.1 of ASME B 31.3)
Corrosion Allowance	c (mm)	1.00	

PIPE SIZE		DIAMETER	PRESSURE		ALLOWABLE STRESS	MATERIAL		DESGIN FACTOR			CA	NOMINAL WALL THK	REQD. MIN THICKNESS	THICKNESS INCLUDE MILL TOLERANCES	SELECTED WALL THICKNESS (mm)			REMARKS
NPS (IN)	DN (MM)	OD (IN)	(BarG)	(Ksig)	(Ksig)	GRADE	FINSIH	E	W	Y	mm	t, (mm)	tm = (t + C) (mm)	T, (mm)	SCH. NO.	NOMINAL THK.	SELECTION	
0.5	15	0.84	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	2.12	3.12	3.567	S-80	3.73	OK	
0.75	20	1.05	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	2.65	3.65	4.173	S-160	5.56	OK	
1	25	1.315	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	3.32	4.32	4.937	S-160	6.35	OK	
1.5	40	1.9	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	4.80	5.80	6.625	S-160	7.14	OK	
2	50	2.375	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	6.00	7.00	7.996	S-160	8.74	OK	
3	80	3.5	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	8.84	9.84	11.242	XXS	15.24	OK	
4	100	4.5	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	11.36	12.36	14.127	XXS	17.12	OK	
6	150	6.625	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	16.73	17.73	20.259	XXS	21.95	OK	
8	200	8.625	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	21.78	22.78	26.030	-	26.05	OK	
10	250	10.75	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	27.14	28.14	32.161	-	32.2	OK	
12	300	12.75	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	32.19	33.19	37.932	-	37.95	OK	
14	350	14	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	35.35	36.35	41.539	-	41.55	OK	
16	400	16	120	1.74	9.18	A335 Gr.P22	S	1.0	0.839	0.607	1.00	40.40	41.40	47.310	-	47.35	OK	

Notes

1) Design pressure & temperature base on full rating as per ASME B16.5 Table 2-1.1

PROJECT: DATE :
CLIENT : BY:
PROJECT NO: Rev:

PIPE WALL THICKNESS CALCULATIONS FOR PIPING CLASS - 15T

DESIGN CODE - ASME B 31.3 2012
Nominal wall thickness, t =P*D / 2(S*E*W+P*Y)
Minimum wall thickness required, tm=(t+c)

Piping Class		15T	
Material Grade		A335 P11	
Pressure Rating		1500	
Design Pressure	P (BarG)	120	(Note 1)
Design Temperature	^{0} C	525	(Note 1)
Allowable Stress	S (Ksig)	7.68	(Table A-1 of ASME B 31.3)
Quality fantor	E	1.0	(for seamless pipes/EFW pipes 100% NDT) as per Table A-1A&A-1B of ASME B 31.3)
Weld joint reduction factor	W	0.839	(as per Table 302.3.5 of ASME B 31.3)
Coefficient	Y	0.607	(as per Table 304.1.1 of ASME B 31.3)
Corrosion Allowance	c (mm)	1.00	

PIPE SIZE		DIAMETER	PRESSURE		ALLOWABLE STRESS	MATERIAL		DESGIN FACTOR			CA	NOMINAL WALL THK	REQD. MIN THICKNESS	THICKNESS INCLUDE MILL TOLERANCES	SELECTED WALL THICKNESS (mm)			REMARKS
NPS (IN)	DN (MM)	OD (IN)	(BarG)	(Ksig)	(Ksig)	GRADE	FINSIH	E	W	Y	mm	t, (mm)	tm = (t + C) (mm)	T, (mm)	SCH. NO.	NOMINAL THK.	SELECTION	
0.5	15	0.84	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	2.48	3.48	3.973	S-160	4.78	OK	
0.75	20	1.05	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	3.10	4.10	4.681	S-160	5.56	OK	
1	25	1.315	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	3.88	4.88	5.574	S-160	6.35	OK	
1.5	40	1.9	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	5.60	6.60	7.545	XXS	10.15	OK	
2	50	2.375	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	7.00	8.00	9.146	S-160	11.07	OK	
3	80	3.5	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	10.32	11.32	12.936	XXS	15.24	OK	
4	100	4.5	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	13.27	14.27	16.306	XXS	17.12	OK	
6	150	6.625	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	19.53	20.53	23.466	-	23.5	OK	
8	200	8.625	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	25.43	26.43	30.205	-	30.25	OK	
10	250	10.75	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	31.70	32.70	37.366	-	37.4	OK	
12	300	12.75	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	37.59	38.59	44.105	-	44.15	OK	
14	350	14	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	41.28	42.28	48.317	-	48.35	OK	
16	400	16	120	1.74	7.68	A335 Gr.P11	S	1.0	0.839	0.607	1.00	47.17	48.17	55.056	-	55.1	OK	

Notes

1) Design pressure & temperature base on full rating as per ASME B16.5 Table 2-1.1

BEAM OUTPUT: c:\esteem~2\test2q\BM2.oo1

ALTERNATIVE CASE

FILE NAME : BM2; **Code : BS8110:1997**

D.L.	L.L.	fcu	fy	fyv	cover	span	cantilever
1.40	1.60	30	460	410	35	1	Nil

Span No	Span-m	Width-mm	Depth-mm	F-width	F-depth
BM1	4.00	230	600	450	0

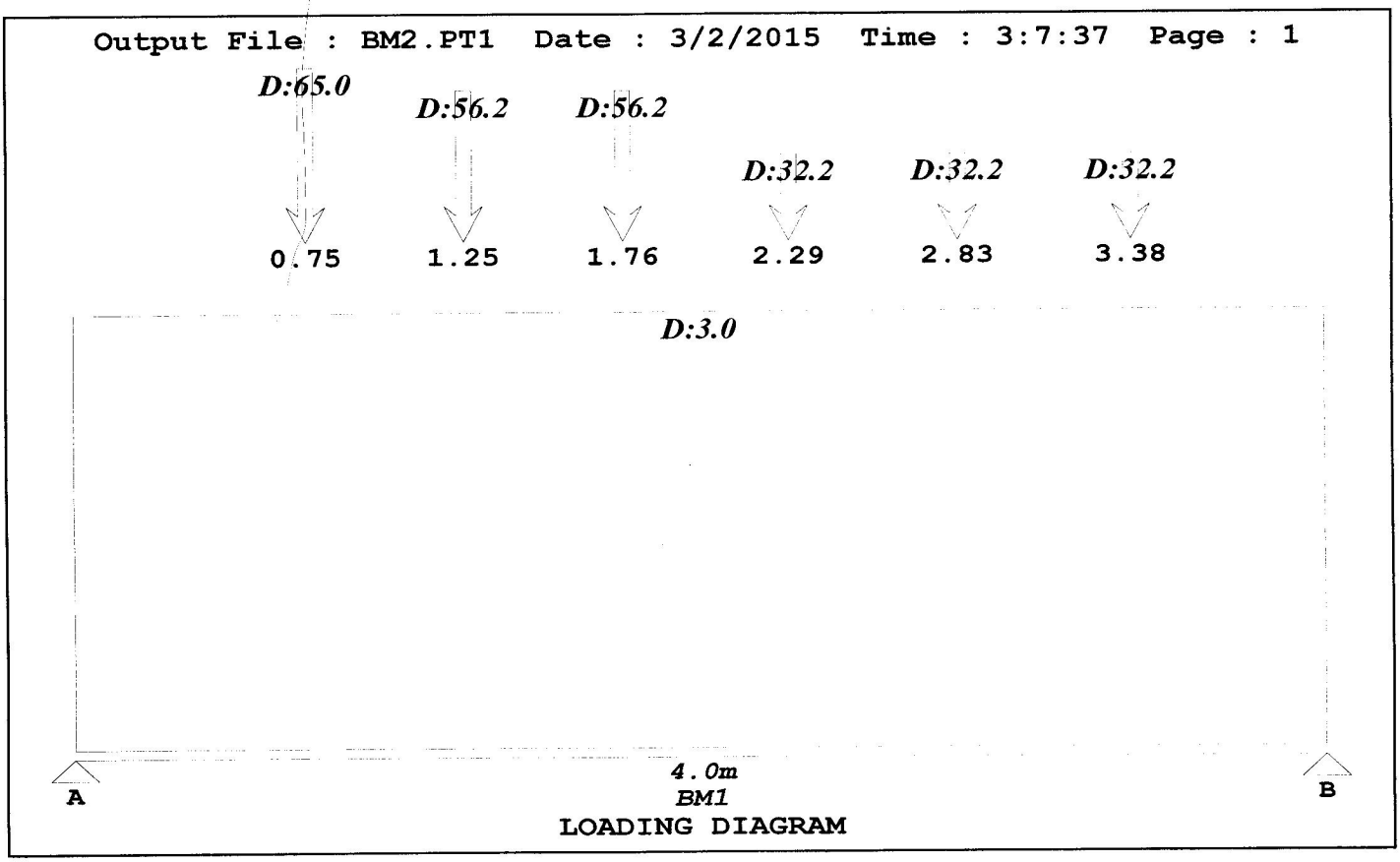
Span No	Load Type	D.L. kN;kN/m	L.L. kN;kN/m	X1 m	D.L. kN;kN/m	L.L. kN;kN/m	X2 m
1	udl	3.00	0.00				
1	point load	65.00	0.00	0.75			
1	point load	56.25	0.00	1.25			
1	point load	56.25	0.00	1.76			
1	point load	32.25	0.00	2.29			
1	point load	32.25	0.00	2.83			
1	point load	32.25	0.00	3.38			

Support No	Support Reaction-kN D.L.	L.L.
A	157.2	0.0
B	129.1	0.0

Span No	FACTORED MOMENT-kNm Left	Span	Right	FACTORED SHEAR-kN Left	Right
BM1	0.0	247.4	0.0	220.1	180.7

Span No.	AREA OF REBAR-mm2 Left	Span	Right	REBAR ARRANGEMENT -Top/Bottom Left	Span	Right	Side Bar
BM1	207	207	207	2Y12= 2x1	2Y12= 2x1	2Y12= 2x1	Top
	606	1213	606	2Y25= 2x1	3Y25= 3x1	2Y25= 2x1	Bot

Span No	Stress-N/mm2 L	R	Vc-N/mm2 L	R	Link L	S	R	Defl'n ratio
BM1	1.72	1.41	0.62	0.62	1Y10-225	1Y10-300	1Y10-300	2.93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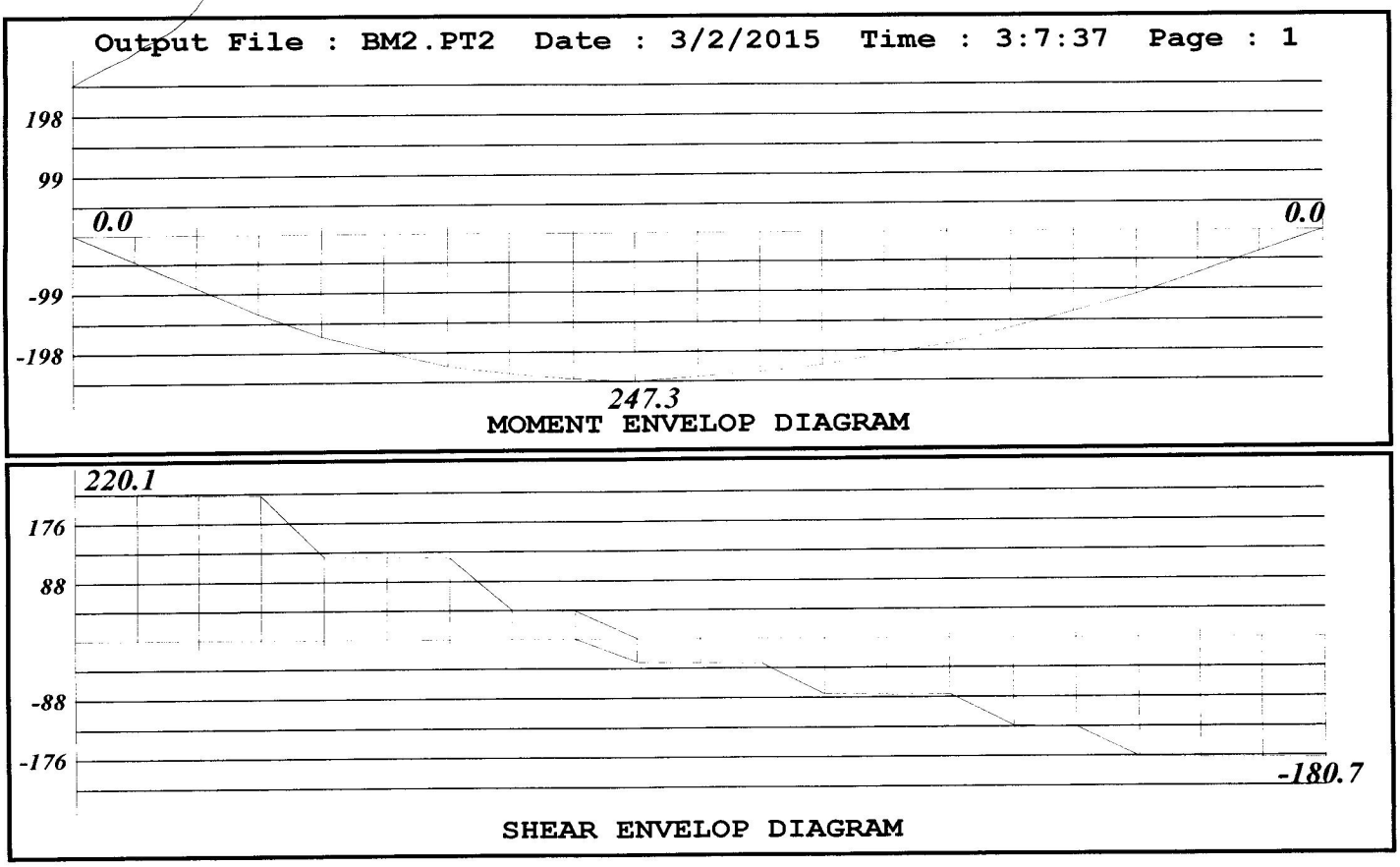
D:65.0
D:56.2
D:56.2
D:32.2
D:32.2
D:32.2
0.75
1.25
1.76
2.29
2.83
3.38
D:3.0
A
B
4.0m
BM1
LOADING DIAGRAM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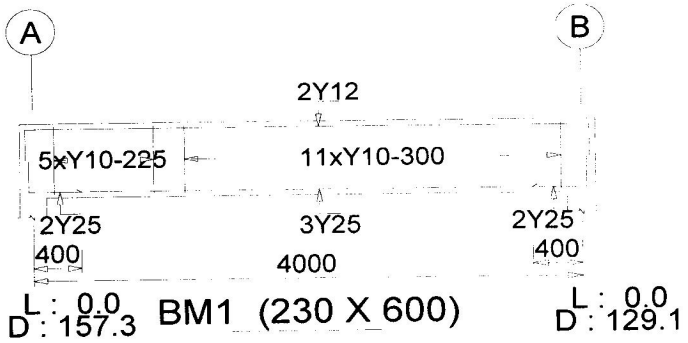
198
99
0.0
-99
-198
0.0
247.3
MOMENT ENVELOP DIAGRAM
220.1
176
88
-88
-176
-180.7
SHEAR ENVELOP DIAGRAM


A
B
2Y12
5xY10-225
11xY10-300
2Y25
400
3Y25
4000
2Y25
400
L : 0.0
D : 157.3
BM1 (230 X 600)
L : 0.0
D : 129.1

BEAM OUTPUT: c:\esteem~2\test2q\BM1.oo1

BASE CASE

FILE NAME : BM1; **Code : BS8110:1997**

D.L.	L.L.	fcu	fy	fyv	cover	span	cantilever
1.40	1.60	30	460	410	35	1	Nil

Span No	Span-m	Width-mm	Depth-mm	F-width	F-depth
BM1	4.00	230	600	450	0

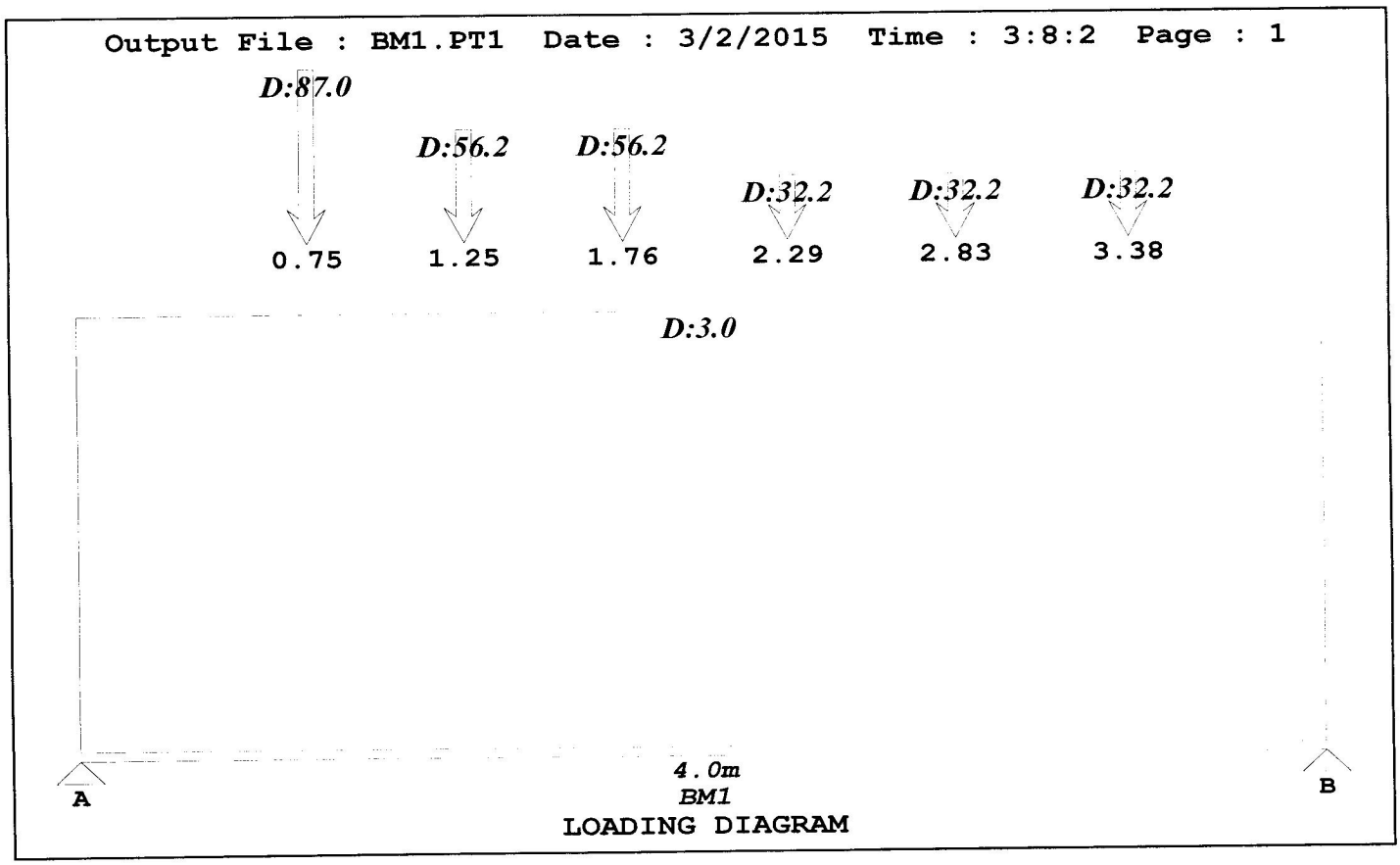
Span No	Load Type	D.L. kN;kN/m	L.L. kN;kN/m	X1 m	D.L. kN;kN/m	L.L. kN;kN/m	X2 m
1	udl	3.00	0.00				
1	point load	87.00	0.00	0.75			
1	point load	56.25	0.00	1.25			
1	point load	56.25	0.00	1.76			
1	point load	32.25	0.00	2.29			
1	point load	32.25	0.00	2.83			
1	point load	32.25	0.00	3.38			

Support No	Support Reaction-kN D.L.	L.L.
A	175.1	0.0
B	133.2	0.0

Span No	FACTORED MOMENT-kNm Left	Span	Right	FACTORED SHEAR-kN Left	Right
BM1	0.0	260.1	0.0	245.2	186.5

Span No.	AREA OF REBAR-mm2 Left	Span	Right	REBAR ARRANGEMENT -Top/Bottom Left	Span	Right	Side Bar
BM1	207	207	207	2Y12= 2x1	2Y12= 2x1	2Y12= 2x1	Top
	645	1290	645	2Y25= 2x1	3Y25= 3x1	2Y25= 2x1	Bot

Span No	Stress-N/mm2 L	R	Vc-N/mm2 L	R	Link L	S	R	Defl'n ratio
BM1	1.91	1.45	0.62	0.62	1Y10-200	1Y10-300	1Y10-300	2.80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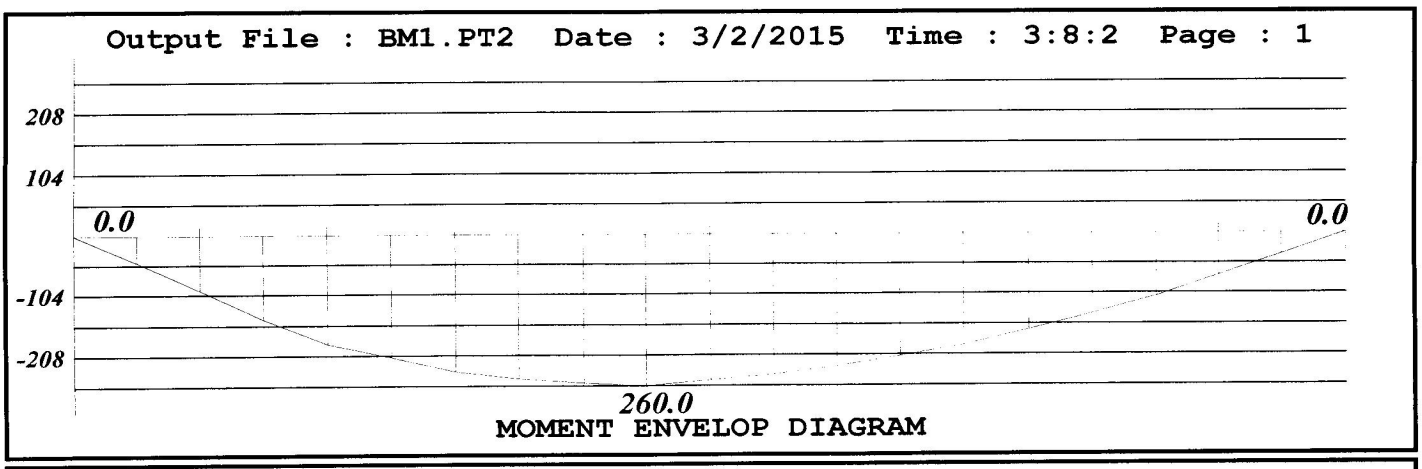
D:87.0
D:56.2
D:56.2
D:32.2
D:32.2
D:32.2
0.75
1.25
1.76
2.29
2.83
3.38
D:3.0
A
B
4.0m
BM1
LOADING DIAGRAM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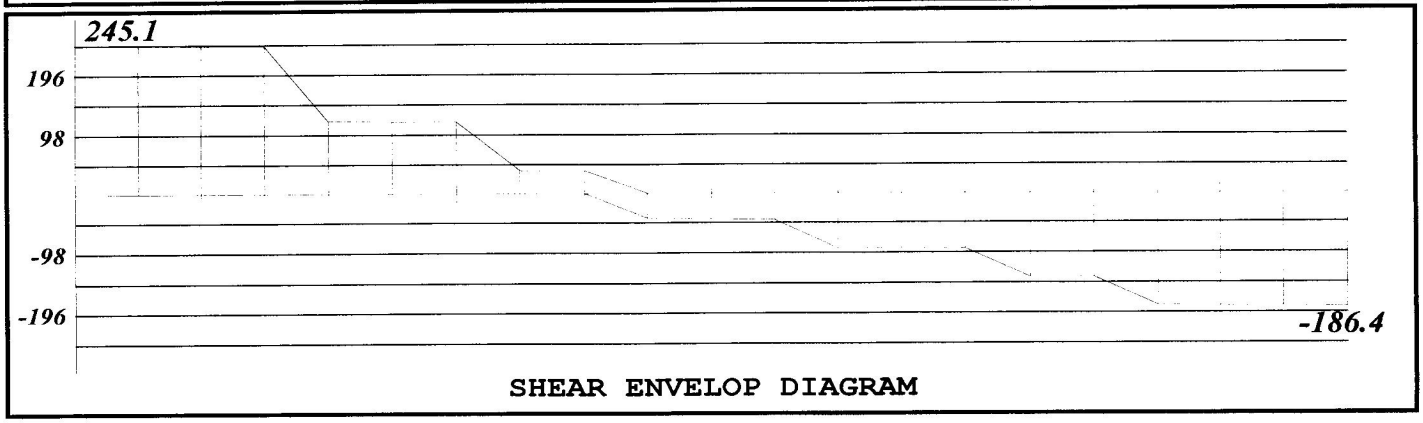
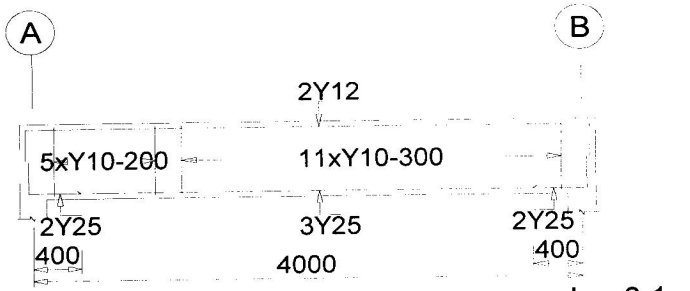
208
104
-104
-208
0.0
0.0
260.0
MOMENT ENVELOP DIAGRAM


245.1
196
98
-98
-196
-186.4
SHEAR ENVELOP DIAGRAM



L : 0.1
D : 175.1 BM1 (230 X 600) L : 0.1
D : 133.2

APPENDIX B: Computer Programme Listing

Below is the list of computer software that used in this project.

1. Microsoft Words 2013
2. Microsoft Excel 2013
3. Intergraph CAESAR II 2013 R1
4. AutoCAD LT 2014 – English
5. Nuance PDF Converter Professional 8