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Certificate No. 3425.01

Section 1: Executive Summary

Report Date: March 6, 2019

Test Dates: October 10, 2018 – February 11,2019

Client: TMK–Premium Services
Morozova Str. 30, Taganrog, RUSSIA 347928

Project Number: RDP–105–18–1008

Pipe Specifications: 7.0 In. OD–32 lb.–P110

Connection Identification:

Connection Specifications and Ratings					
Connection OD:	7.875 in				
Make – Up Loss:	6.083 in				
Drift:	5.969 in				
Connection ID:	6.008 in				
Thread Compound Used:	BESTOLIFE 72733				
Torque (min. /opt. /max.):	18,400 / 20,500 / 22,600 ft–lbs				
	Connection data sheet ratings	**Min. Test Rating (% of PBYS)**			
		SP1	**SP2R2**	**SP3**	**SP4**
API Burst Pressure:	12,450 psi	95%	95%	95%	95%
API Collapse Pressure:	10,790 psi	100%	100%	100%	100%
Tensile Load:	1,026,000 lbs	95%	95%	95%	95%
Compression Load:	1,026,000 lbs	95%	95%	95%	95%
Bending (Dogleg):	70.9º / 100 ft	20º/100 ft			

Table 1-1: Connection Specifications

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Specimen Preparation & Test Locations

Mechanical Property Testing:	TMK–IPSCO R&D Center, 10120 Houston Oaks Dr., Houston, TX 77064
Specimen Machining and Surface Treatments:	Custom Threading (CTI), 5835 Cheswood, Houston, TX 77087
Make and Breaks:	Stress Engineering Services Waller Testing Facility, 42403 Old Houston Highway, Waller, TX 77484
Sealability (Series A, B, C, Limit Load):	TMK–IPSCO R&D Center, 10120 Houston Oaks Dr., Houston, TX 77064 Stress Engineering Services Waller Testing Facility, 42403 Old Houston Highway, Waller, TX 77484

Table 1-2: Specimen Preparation and Test Locations

Test Procedure

Test Proposal: TP PS-01-03-2018 Revision 3

Test Type: CAL IV

Number of Specimens: 7 (Specimen 1, 2, 2R1,2R2 , 3, 4, 5)

Number of 7” 29# L80 13cr MB Specimens: 2 (3R1,5R1)

Test Temperatures: 96ºF (35.5ºC) for Ambient Temperature Testing
356 ºF (180 ºC) for Elevated Temperature Testing
Bake Out temperature 375°F

Planned deviations from API RP 5C5:

Ported Couplings. see Figure 1-1.

Additional Make and Break Cycle. see Table 1-8.

The test proposal stated that the actual minimum wall thickness (but not more than 95% of the specified wall thickness) was to be used to determine loads. Testing was conducted with the actual minimum wall thickness (but not more than 100% of the specified wall) See Table 1-11.

The actual average wall thickness (but not more than the specified wall thickness) shall be used to determine loads. See Table 1-11.

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Test Pressure				
	Series B	**Series C**	**Series A**	**Limit Load**
Internal Pressure	Nitrogen	Nitrogen	Nitrogen	Water
External Pressure Elevated	N/A	N/A	Heat Transfer Oil	N/A
External Pressure Ambient	N/A	N/A	Water	Water

Table 1-3: Fluid Mediums Used

Testing Dates & Location

Specimen	Make & Break	Bake-Out	Series B	Series C	Series A	Limit Load
1	10/10/2018*****	10/16/2018	10/26/2018	10/29/2018	11/13/2018*	11/30/2018*
2	10/10/2018*	10/18/2018	11/2/2018	N/A	N/A	N/A
2R1	11/14/2018*	11/20/2018	11/21/2018	N/A	N/A	N/A
2R2	11/30/2018*	12/3/2018*	12/6/2018*	12/8/2018*	12/29/2018	1/4/2019*
3	10/10/2018*	10/19/2018	11/5/2018	11/7/2018	11/28/2018*	11/30/2018*
4	10/10/2018*	10/20/2018	11/13/2018	11/16/2018	11/5/2018	12/6/2018
5	10/10/2018*	N/A	N/A	N/A	N/A	12/10/2018*
3R1	2/11/2019*	N/A	N/A	N/A	N/A	N/A
5R1	2/11/2019*	N/A	N/A	N/A	N/A	N/A

***** testing was conducted at Stress Engineering Services. All other testing was conducted at TMK IPSCO
Note: Red highlight indicates testing was stopped. Green indicates successful completion.

Table 1-4: Test Schedule

Identification of Test Personnel

For Tests Performed at TMK IPSCO R&D

Engineer in Charge (EIC): Pavel Sidorenko
Project Manager: Manish Nawal
Test Engineer: Kevin Henry
Premium Connection Specialist: Erick Coronado

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Technicians: Justin Cumberledge, Jason Park, Steven Waters, Donald Anderson, Christopher Coode, Kenneth Brown, Guy Forester, Barry Fisher, Alejandro Ruiz, David Tchamanzar, Jose Zapata.

For Tests Performed at Stress Engineering Services (SES)

Project Manager: Ryan Schmidt

Technicians: Tod Philips, Ethan Williams

3rd Party Monitoring

Texas International Engineering Consultants (TIEC):
Chris Harris, Mike Smith, Angel Sanchez, Matt Gregory, John Hidalgo, Raul Garcia, Eddie Durante Jr., Garry Sheilds

Testing Summary

Specimen Preparation

Test specimens were machined from Tenaris (Heat# 15209) casing and Timken (Heat# L8340) coupling stock. The final material map showing the test specimens used and their location on the mother tubes is found on Appendix E. The pins were machined according to drawing no: TMK UP CENTUM 178.001, Revision 2 and couplings were machined according to drawing no: TMK UP CENTUM 178.002, Revision 2. All test specimens satisfied the thread and seal interference ranges outlined in API RP 5C5:2017. Port holes were drilled into the coupling per Figure 1-1 to allow external pressure to reach the seal during Series A testing and Specimen 2 limit load testing. These ports remained closed during make and breaks, bake out, Series B testing, series C testing, and internal pressure limit load testing.

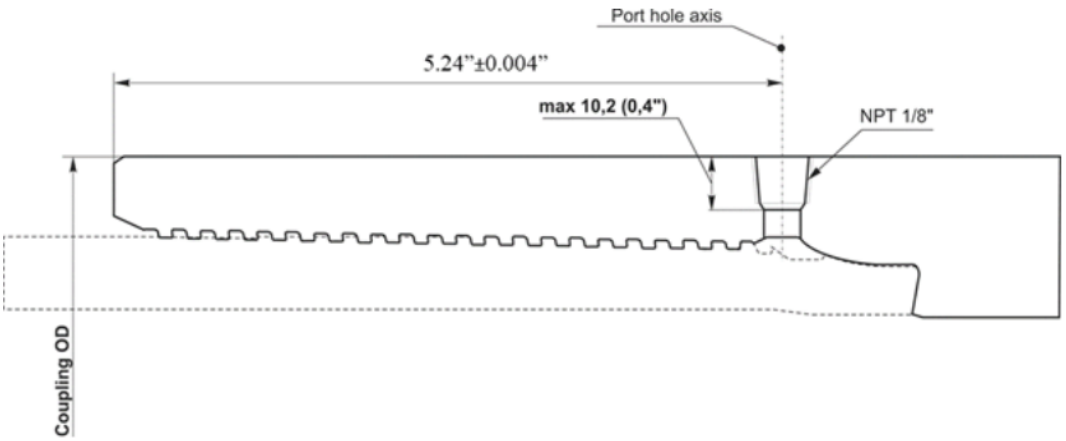

Figure 1-1: Port Holes Location And Size

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Specimen	Box Finish	Pin Finish
Specimen 1	Mn Phosphate	Zn Phosphate
Specimen 2	Mn Phosphate	Zn Phosphate
Specimen 2R1	Mn Phosphate	Zn Phosphate
Specimen 2R2	Mn Phosphate	Zn Phosphate
Specimen 3	Mn Phosphate	Zn Phosphate
Specimen 4	Mn Phosphate	Zn Phosphate
Specimen 5	Mn Phosphate	Zn Phosphate
Specimen 3R1	Cu Plating	As Machined
Specimen 5R1	Cu Plating	As Machined

Table 1-5: End Surface Finish

Make & Break Testing

Test specimens were made up using horizontal tongs with 2.5 RPM. API modified thread compound (BestOLife 72733) per the quantities listed in Table 1-6 were used.

	Dope Quantity on Pin (g)	Dope Quantity on Box (g)
Minimum	15±1	30±1
Maximum	18±1	35±1

Table 1-6: Make & Break Dope Quantity

Recommended torque values ranged between 18,400 and 22,600 ft-lb (25,000 and 30,600 N.m). A detailed description of the recommended make–up torque ranges are indicated in Table 1-7. Make–up and break-out cycles for each full-scale test specimen are shown in Table 1-8. Make and break data is captured in Appendix D.

	N.m		ft-lb	
Minimum yield torque	52,300		38,600	
Minimum recommended torque	25,000		18,400	
Optimum recommended torque	27,800		20,500	
Maximum recommended torque	30,600		22,600	
Minimum shoulder torque	1,400		1,100	
	Minimum	**Maximum**	**Minimum**	**Maximum**
High Make–Up Torque range	29,500	30,600	21,800	22,600
Low Make–Up Torque range	25,000	26,100	18,500	19,240

Table 1-7: Make-Up Torque Ranges

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Specimen #	End A	End B
1	Final Make Up (FMU)	3+FMU
2	FMU	FMU
2R1	FMU	FMU
2R2	FMU	FMU
3	3+FMU	FMU
4	FMU	3+FMU
5	3+FMU	3+FMU
3R1	3+FMU	3+FMU
5R1	3+FMU	3+FMU

Table 1-8: Make-up and Break-out Cycles

Bake out

All Specimens were baked out at 375ºF (190ºC) for 24 hours with load cycles as shown in Table 1-9

Cycle	Machine Load, kips	Internal Pressure. psi	Hold time	Temperature
Heating up to 180±15°C (356 ±27°F)				
1	500	0	1 hour	180±15°C (356±27°F)
	-500		1 hour	
2	500		1 hour	
	-500		1 hour	
3	500		1 hour	
	-500		1 hour	
4	500		1 hour	
	-500		1 hour	
5	500		1 hour	
	-500		1 hour	
Bake-out with no loading for the remaining time.				

Table 1-9: Bake-out Loading Cycles

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Sealability Testing

The minimum material yield strength from mechanical tests, the gauged wall thickness and nominal pipe OD was used to calculate test loads. The variables used to calculate individual loads are listed in Table 1-10.

Temperature	Variable	Internal Pressure		External Pressure		
		Hoop	Axial	Hoop	Axial	API collapse
Ambient	*OD*	Max Avg.	Max Avg.	Max Avg.	Max Avg.	Max Avg.
	wall	Min	Avg.	Min	Avg.	Avg.
	ID	Max	Max	Max	Max	Max Avg.
	MYS	Actual min YS	Actual min YS	Actual min YS	Actual min YS	Actual min YS
Elevated	*OD*	Max Avg.	Max Avg.	Max Avg.	Max Avg.	Max Avg.
	wall	Min.	Avg.	Min.	Avg.	Avg.
	ID	Max	Max	Max	Max	Max Avg.
	MYS	Ktemp	Ktemp	Ktemp	Ktemp	Ktemp

Table 1-10: Variables Used to Determine Loads

The variables in Table 1-10 defined for individual specimen are included in Table 1-11

Specimen	Spec. OD (in.)	OD (in.)	Wall Thickness (in.)					
			Actual Minimum	95% of Specified	Actual Average	Specified	Used Minimum	Used Average
1	7.000	7.056	0.445	0.430	.464	.453	0.445	.453
2	7.000	7.054	0.446	0.430	.466	.453	0.446	.453
2R1	7.000	7.084	0.444	0.430	.464	.453	0.444	.453
2R2	7.000	7.059	0.450	0.430	.466	.453	0.450	.453
3	7.000	7.054	0.451	0.430	.463	.453	0.451	.453
4	7.000	7.055	0.451	0.430	.464	.453	0.451	.453
5	7.000	7.057	0.446	0.430	.466	.453	0.446	.453

Specimen	Material Yield Strength (ksi)*	
	Ambient Temperature	Elevated Temperature

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	Minimum	Specified	Collapse (PSI)	Minimum
1	120.9	110	10,780	106.1
2	123.3	110	10,780	108.2
2R1	121.3	110	10,780	108.1
2R2	124.1	110	10,780	110.6
3	122.5	110	10,780	107.6
4	121.3	110	10,780	106.6
5	121	110	10,780	107.8

Table 1-11: Measured Dimensions and Material Properties for Individual Test Specimen

* – Material yield strengths are rounded off to the nearest whole number for representation. Load schedules were generated using values rounded off to the second decimal place. Elevated temperature yield strengths are calculated using the elevated temperature scaling factor (ETSF).

The load ratings specified in Table 1-1 were used on all tested specimens. The applied loads (tension/compression) and pressures (internal/external) for each specimen assembly are provided in Figure 1-2 through Figure 1-11. All specimens met the displacement requirements per API RP 5C5:2017.

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Series B: Specimen 1

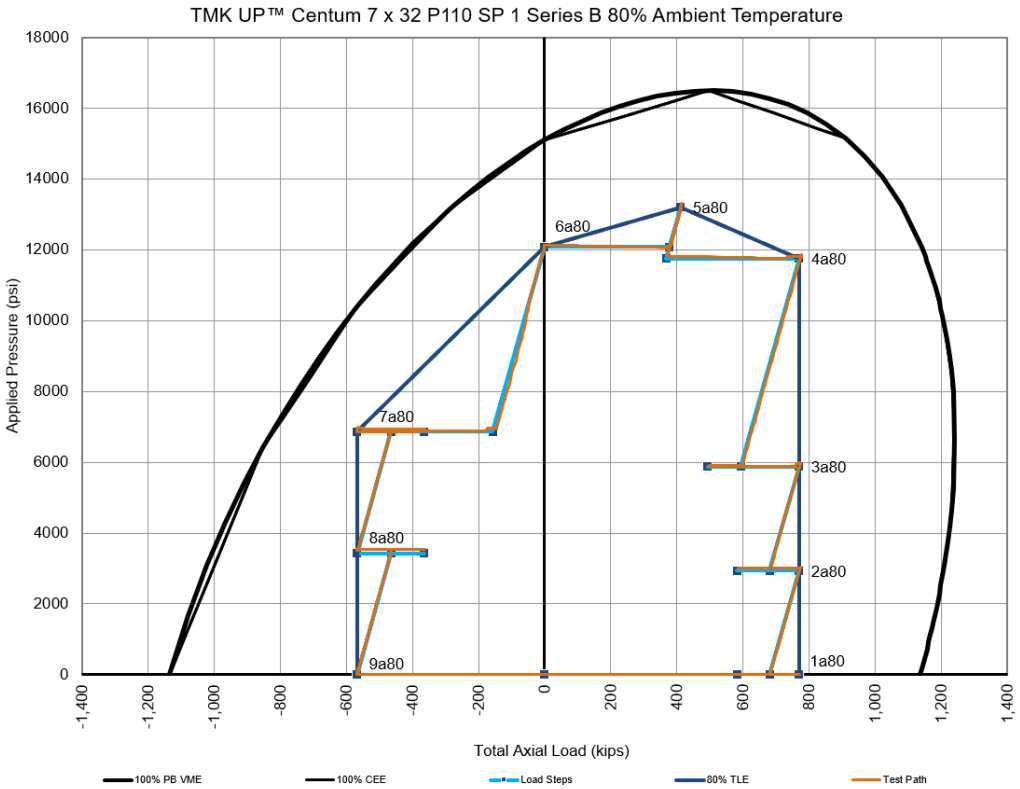

Figure 1-2: Test Envelope for TMK UP CENTUM Specimen 1 Series B (80% Ambient)

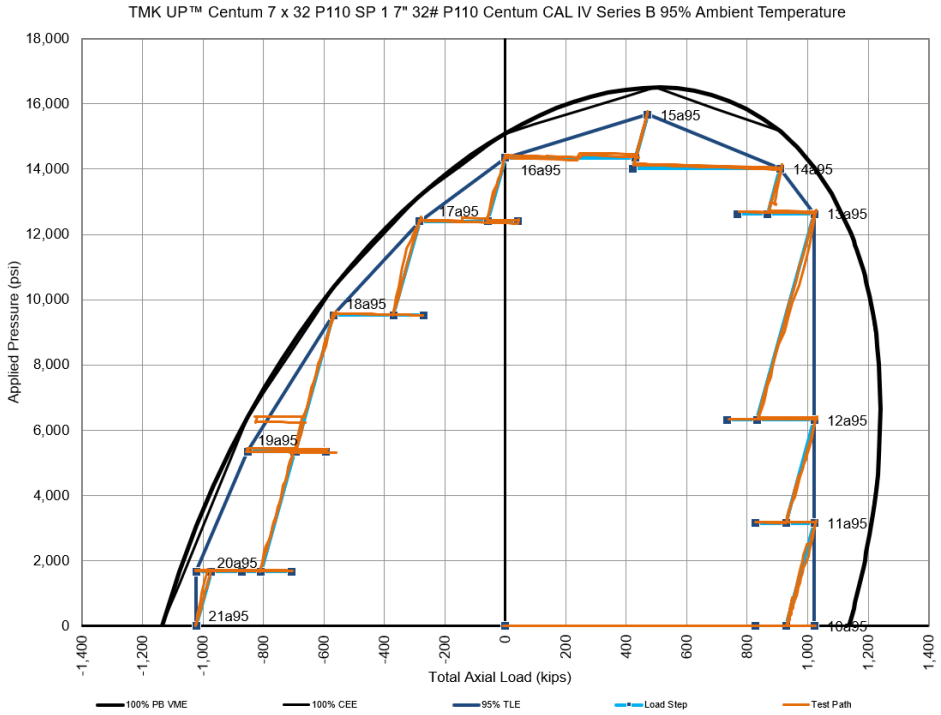

Figure 1-3: Test Envelope for TMK UP CENTUM Specimen 1 Series B (95% Ambient)

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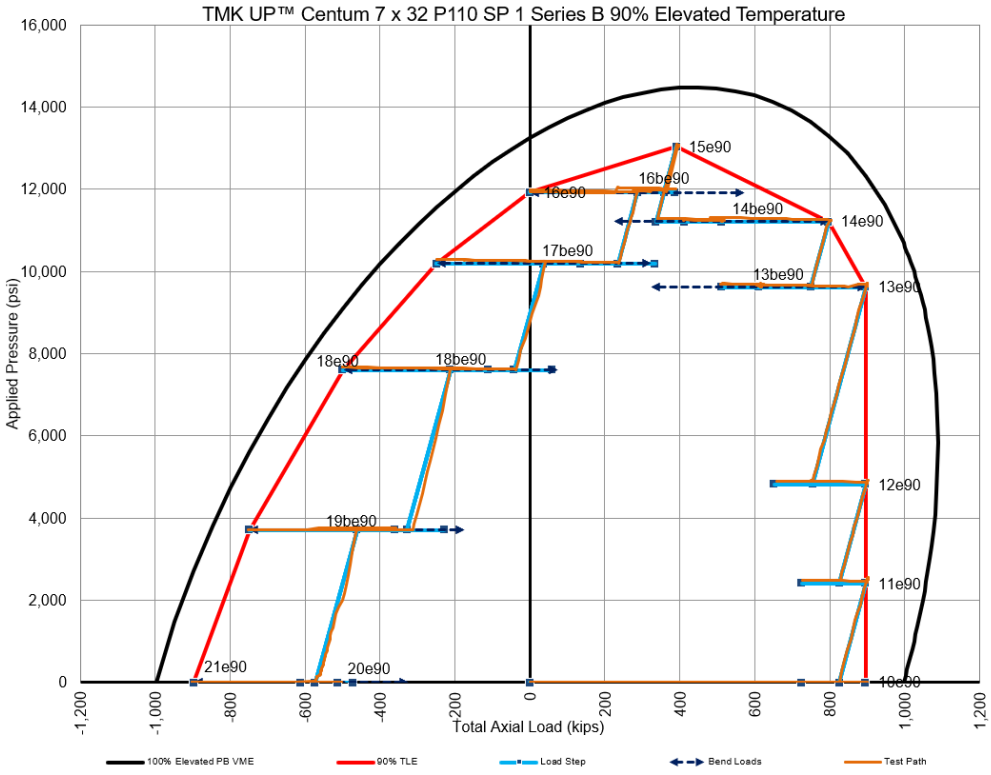

Figure 1-4: Test Envelope for TMK UP CENTUM Specimen 1 Series B (90% Elevated)

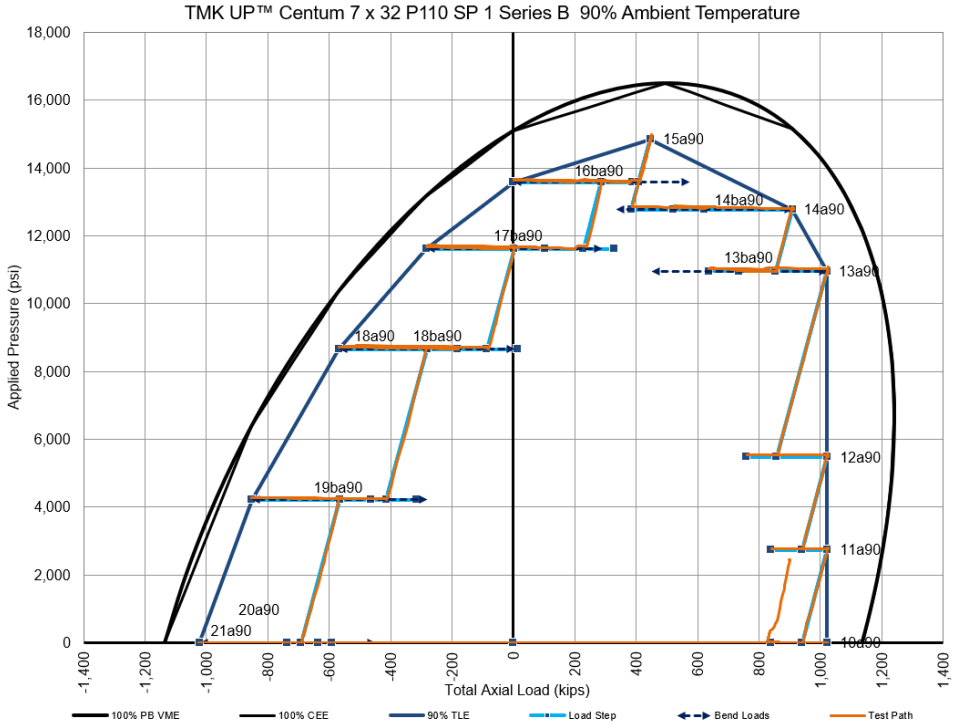

Figure 1-5: Test Envelope for TMK UP CENTUM Specimen 1 Series B (90% Ambient)

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Series C: Specimen 1

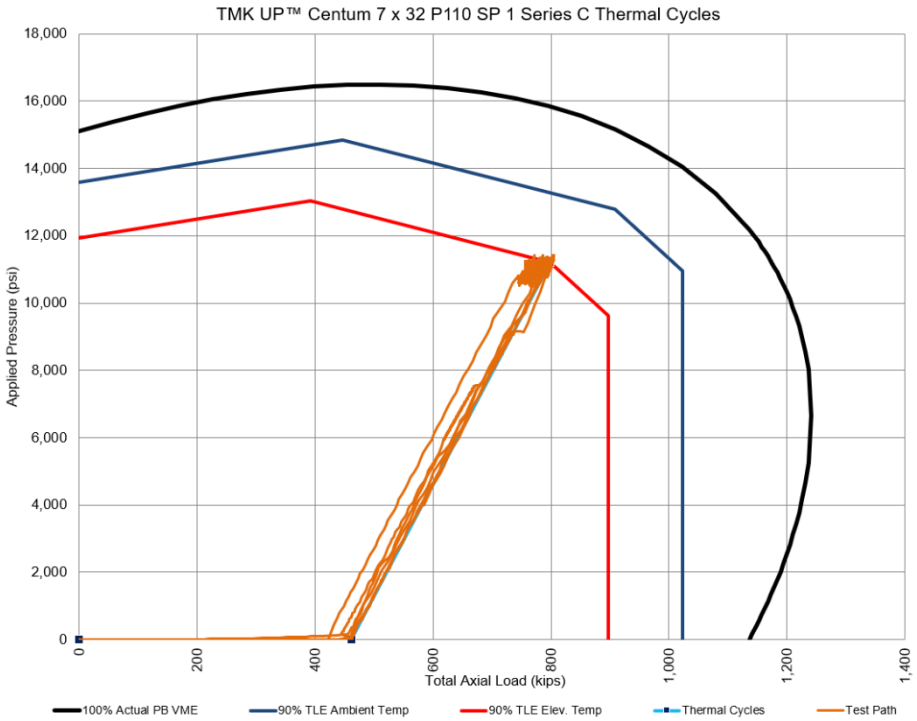

Figure 1-6: Test Envelope for TMK UP CENTUM Specimen 1 Series C Thermal Cycles

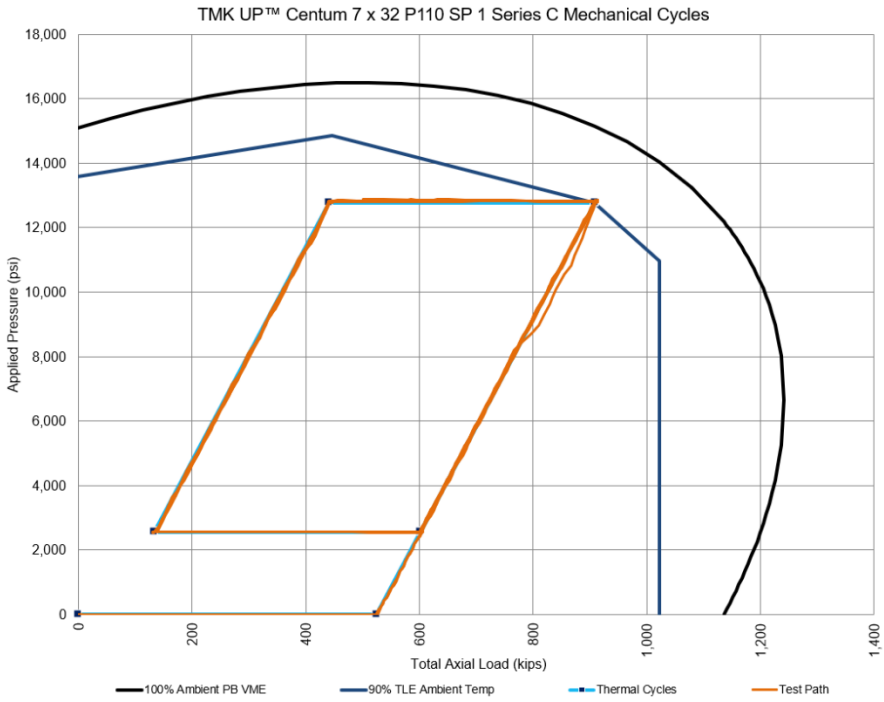

Figure 1-7: Test Envelope for TMK UP CENTUM Specimen 1 Series C Mechanical Cycles

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Series A: Specimen 1

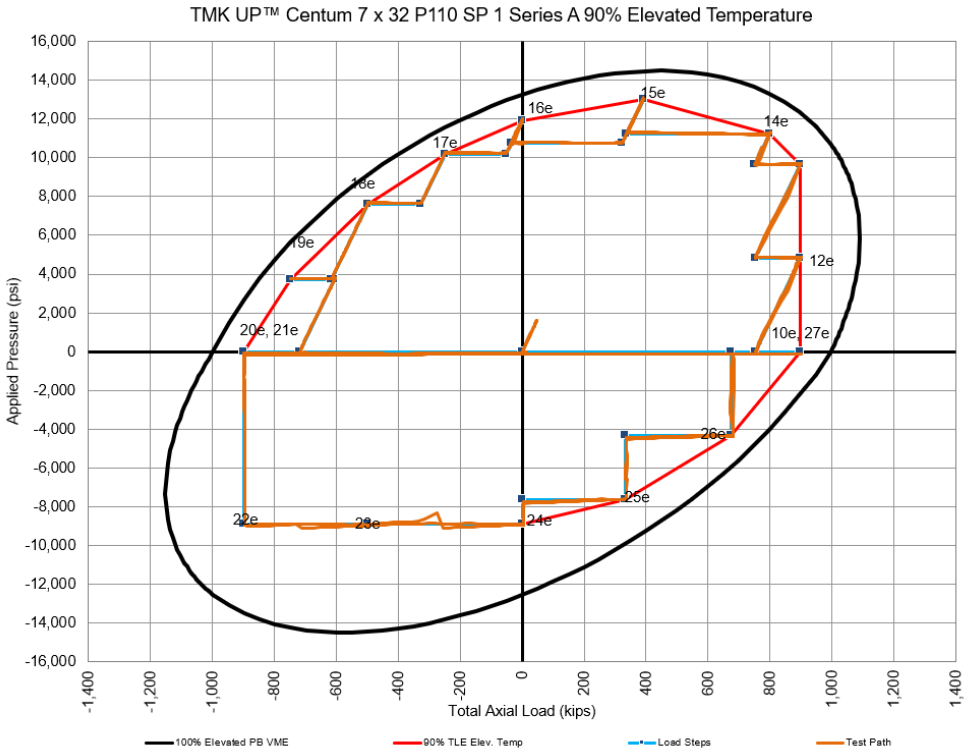

Figure 1-8: Test Envelope for TMK UP CENTUM Specimen 1 Series A (90% Elevated)

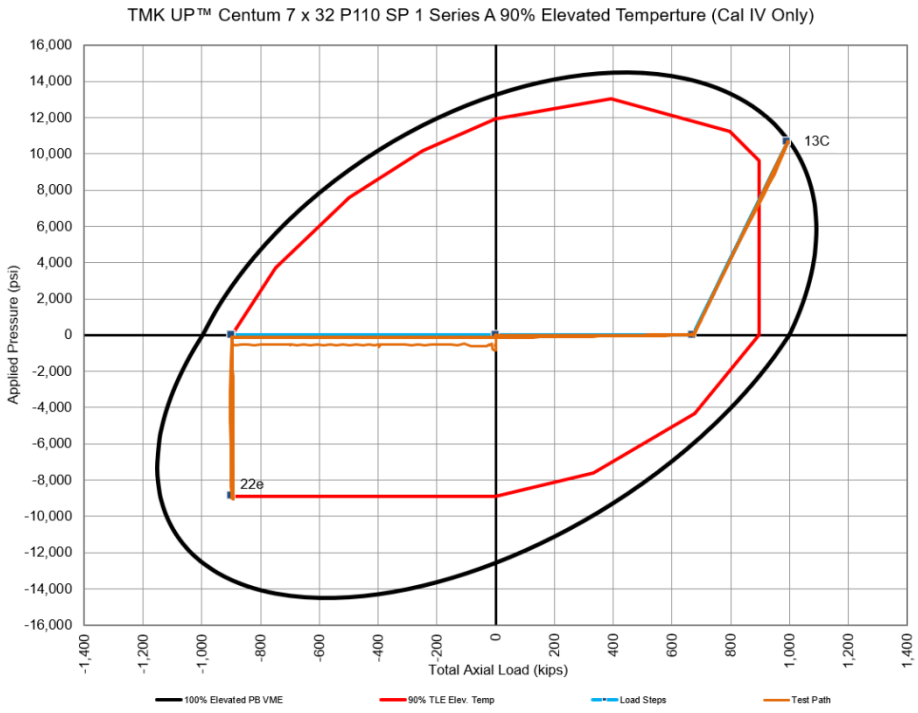

Figure 1-9: Test Envelope for TMK UP CENTUM Specimen 1 Series A QI-QIII Cycles

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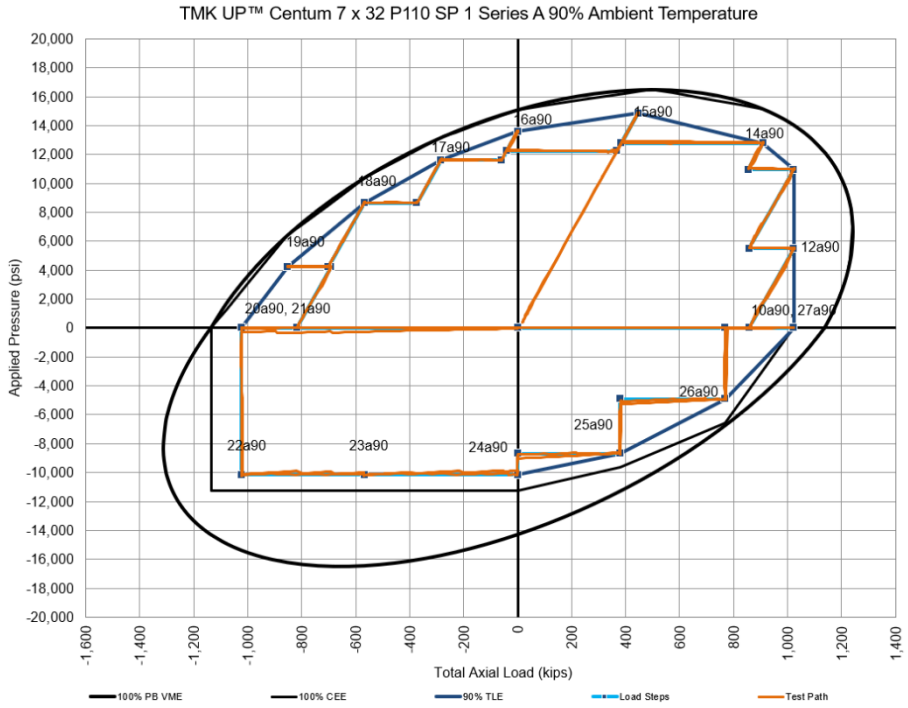

Figure 1-10: Test Envelope for TMK UP CENTUM Specimen 1 Series A (90% Ambient)

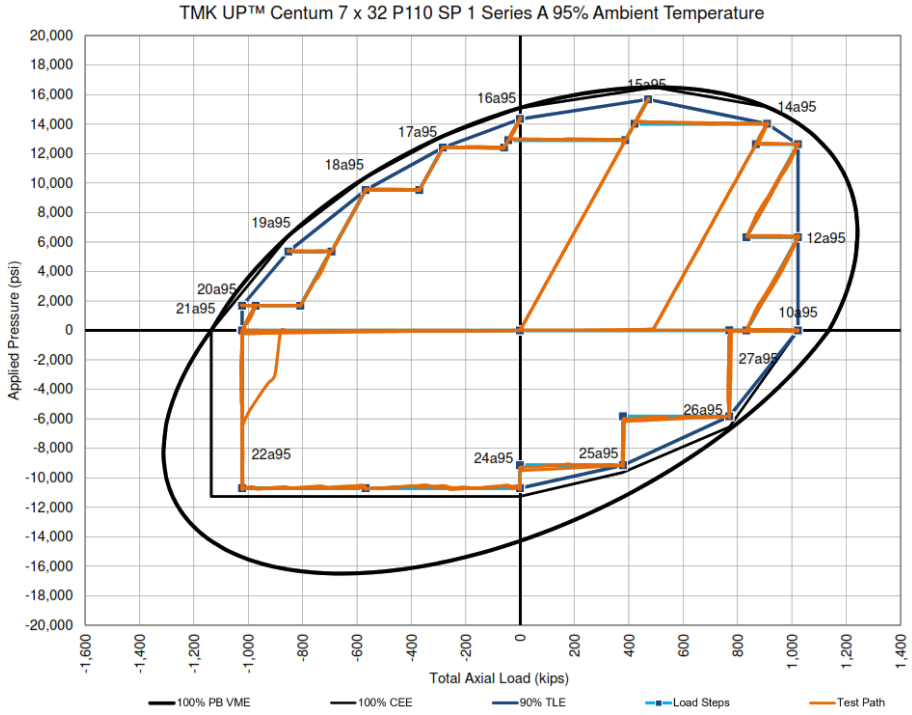

Figure 1-11: Test Envelope for TMK UP CENTUM Specimen 1 Series A (95% Ambient)

Limit Load: Specimen 1

A Limit Load Test was performed on Specimen 1 at stress engineering. The Limit Load Test Path is shown in Figure 1-12 and the failure loads are captured in Table 1-12.

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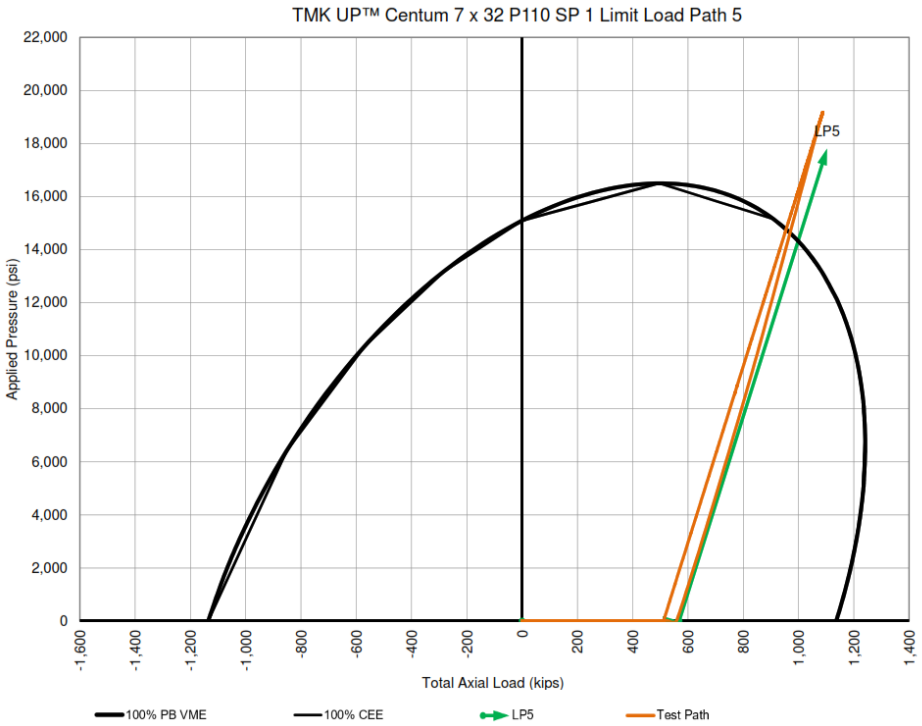

Figure 1-12: Limit Load Path for TMK UP CENTUM Specimen 1

Load Step	Action	Total Axial Load (Kips)	Internal Pressure (psi)
1	Add Tension	511.5	0
2	Add Internal Pressure To Failure	1,087.4	19,170

Table 1-12: Limit Load Failure condition specimen 1

At 18,825 pipe body failure occurred on Side A.

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Series B: Specimen 2

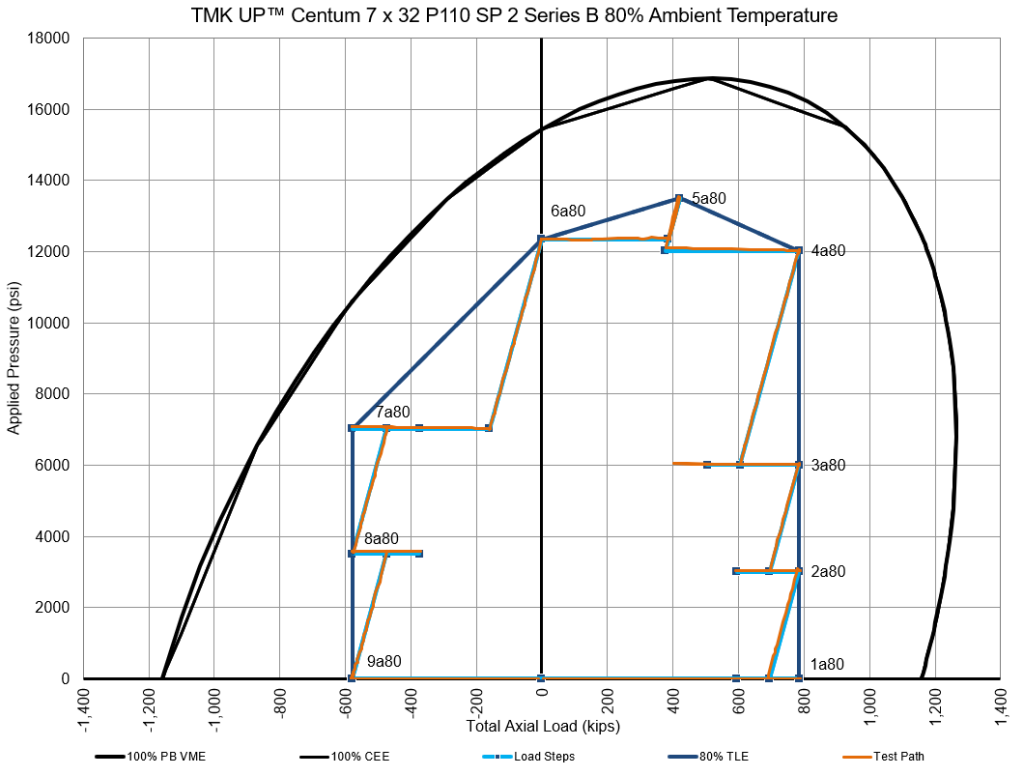

Figure 1-13: Test Envelope for TMK UP CENTUM Specimen 2 Series B (80% Ambient)

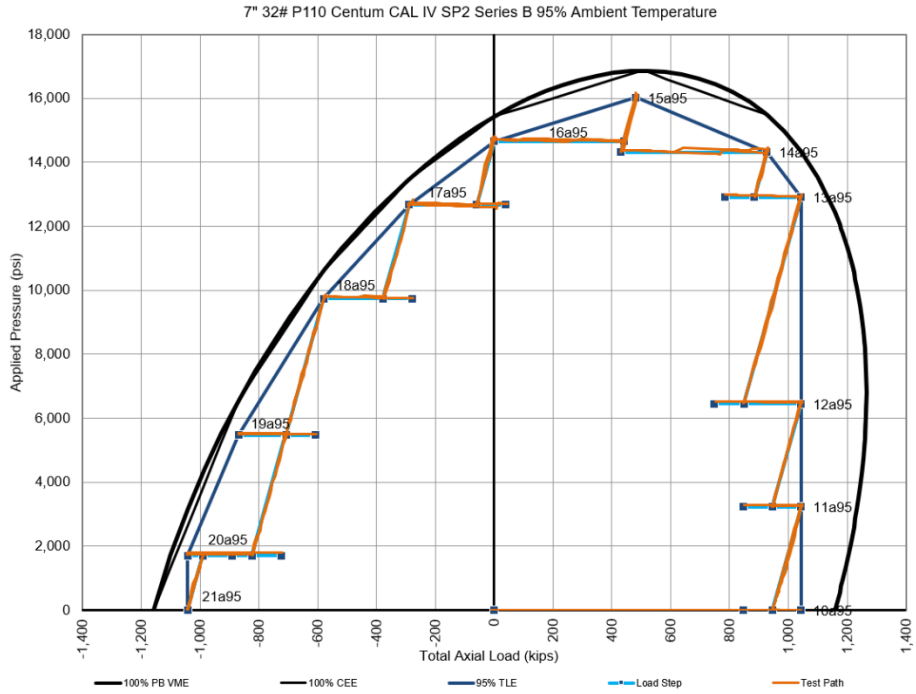

Figure 1-14: Test Envelope for TMK UP CENTUM Specimen 2 Series B (95% Ambient)

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Series B: Specimen 2R1

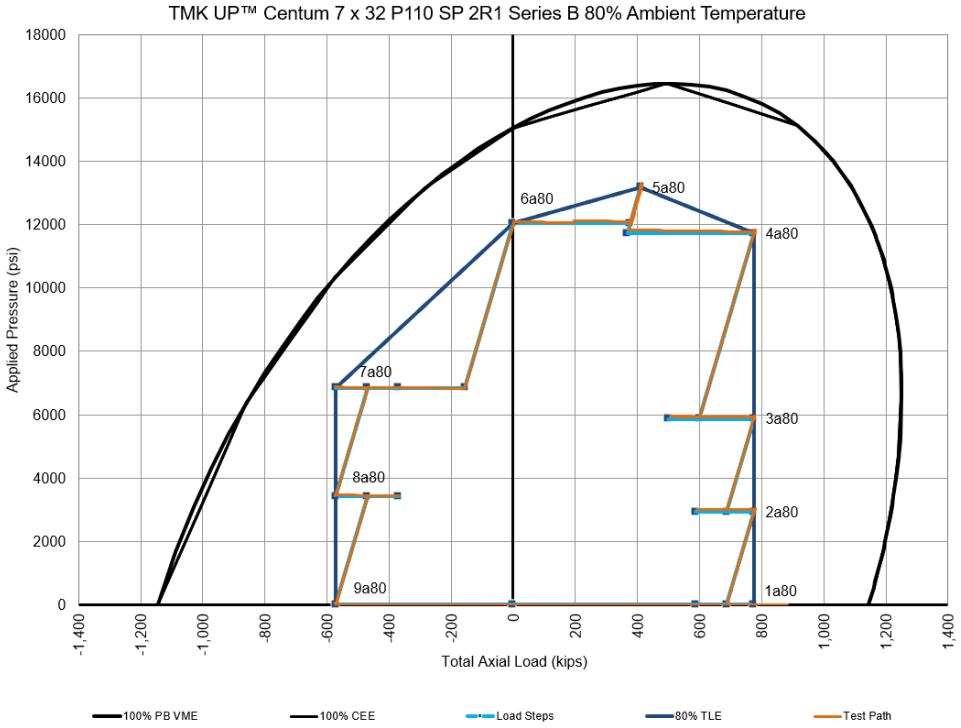

Figure 1-15: Test Envelope for TMK UP CENTUM Specimen 2R1 Series B (80% Ambient)

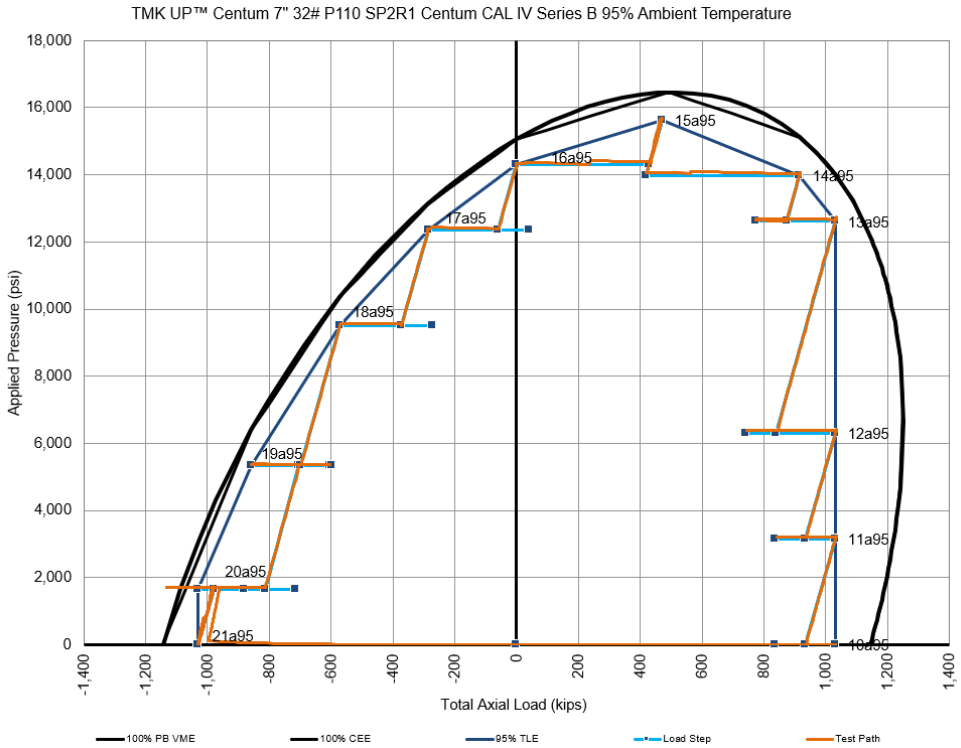

Figure 1-16: Test Envelope for TMK UP CENTUM Specimen 2R1 Series B (95% Ambient)

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Series B: Specimen 2R2

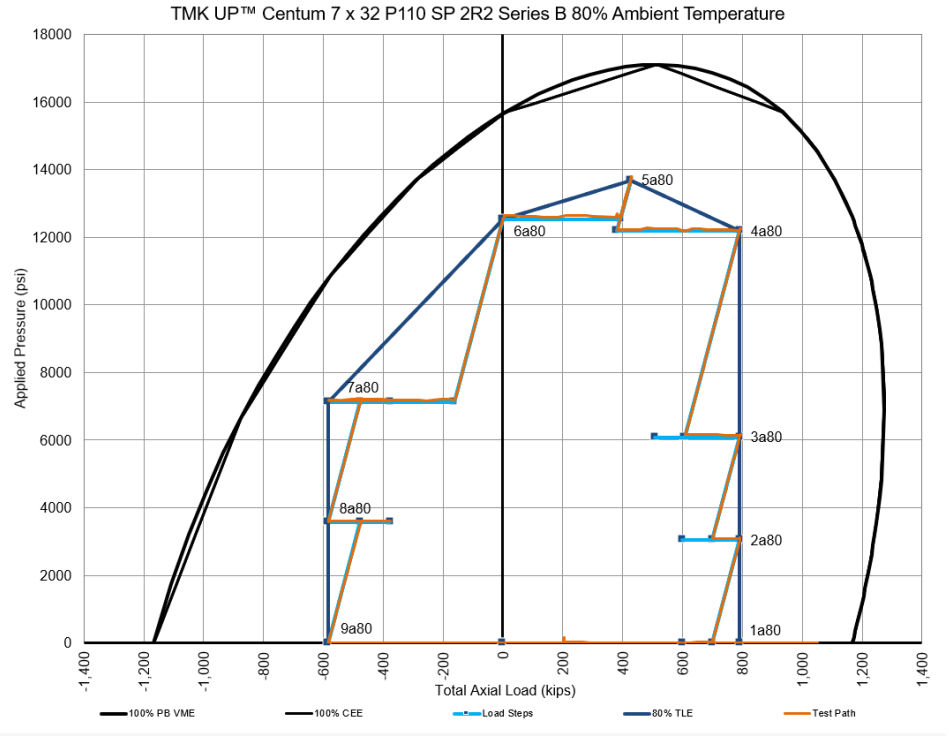

Figure 1-17: Test Envelope for TMK UP CENTUM Specimen 2R2 Series B (80% Ambient)

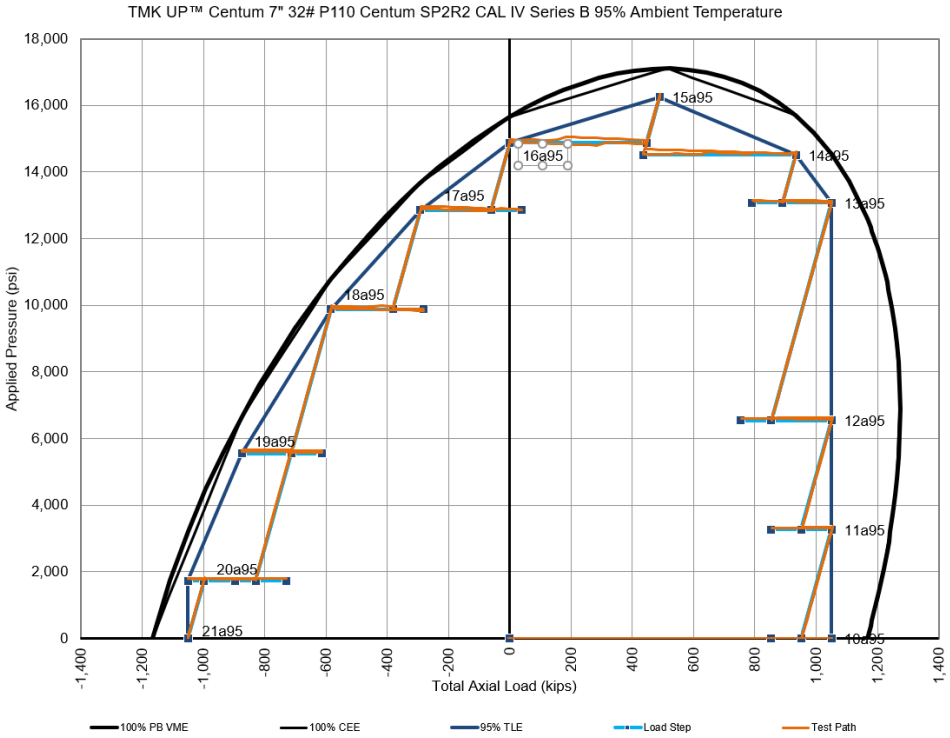

Figure 1-18: Test Envelope for TMK UP CENTUM Specimen 2R2 Series B (95% Ambient)

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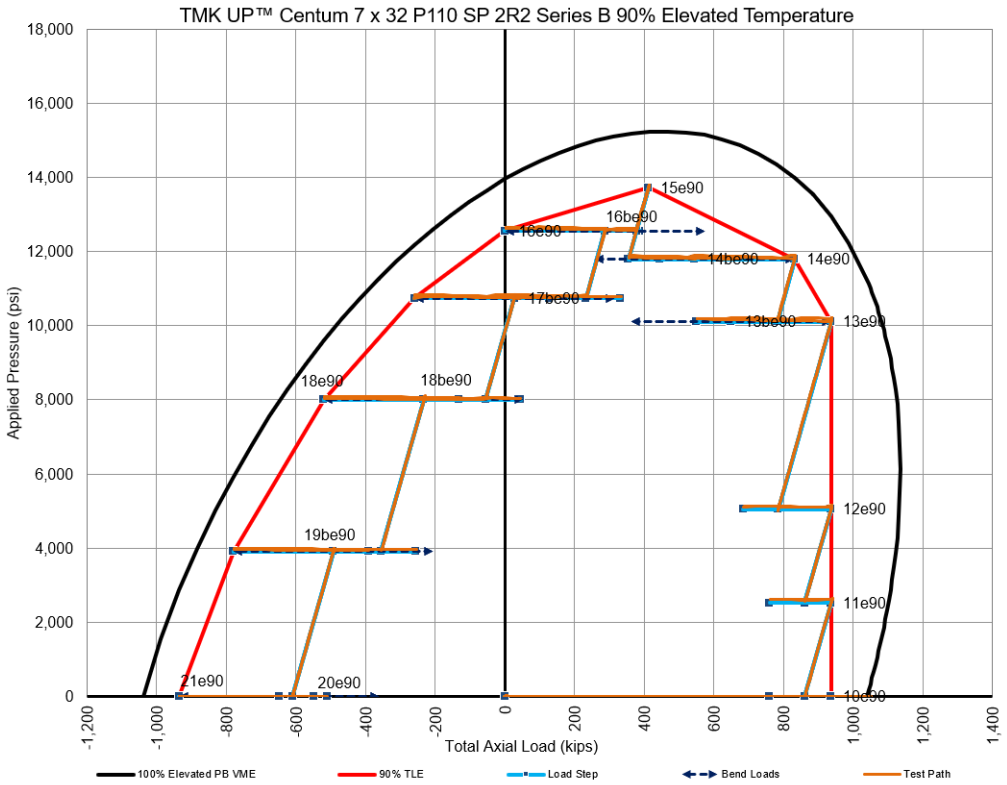

Figure 1-19: Test Envelope for TMK UP CENTUM Specimen 2R2 Series B (90% Elevated)

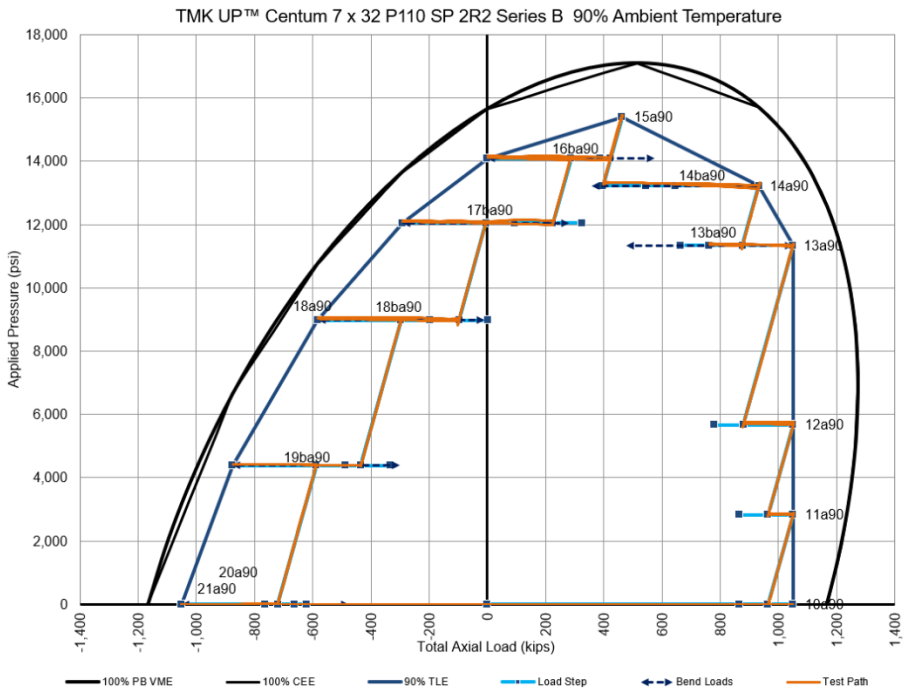

Figure 1-20: Test Envelope for TMK UP CENTUM Specimen 2R2 Series B (90% Ambient)

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Series C: Specimen 2R2

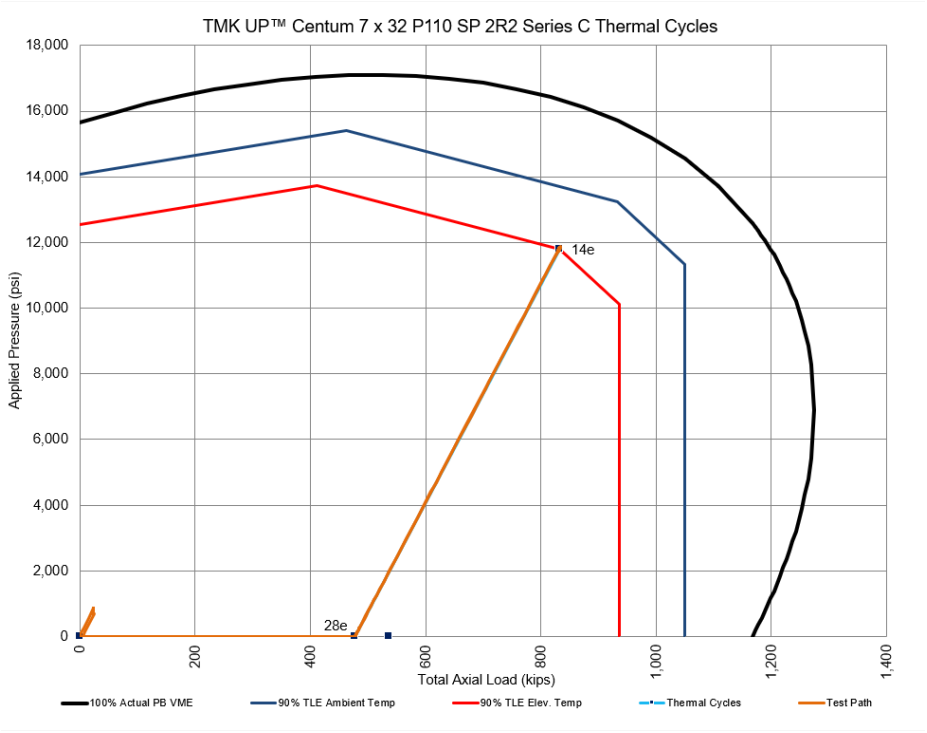

Figure 1-21: Test Envelope for TMK UP CENTUM Specimen 2R2 Series C Thermal Cycles

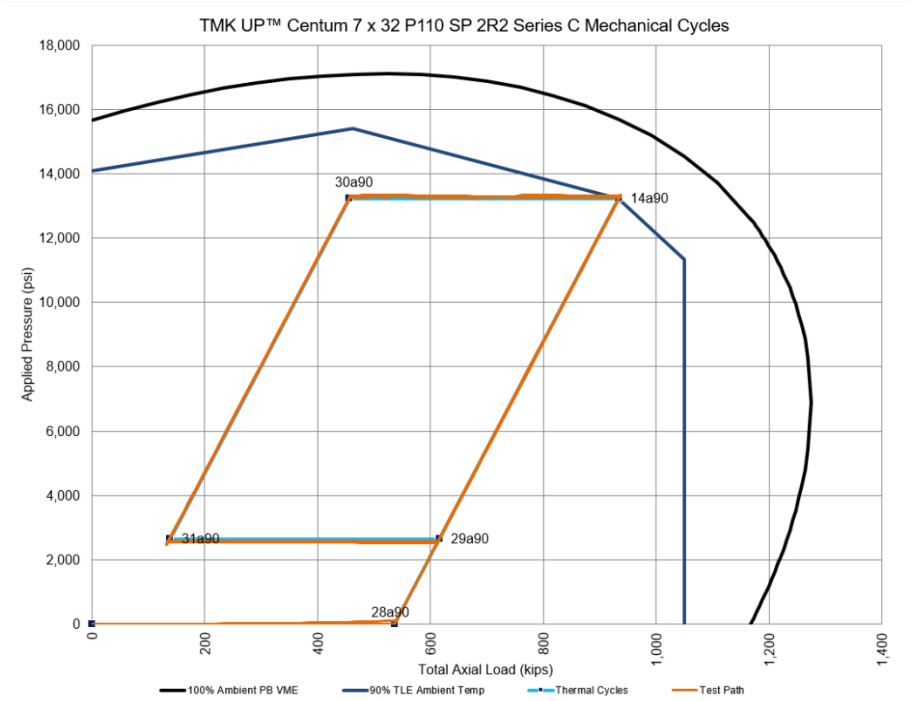

Figure 1-22: Test Envelope for TMK UP CENTUM Specimen 2R2 Series C Mechanical Cycles

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Series A: Specimen 2R2

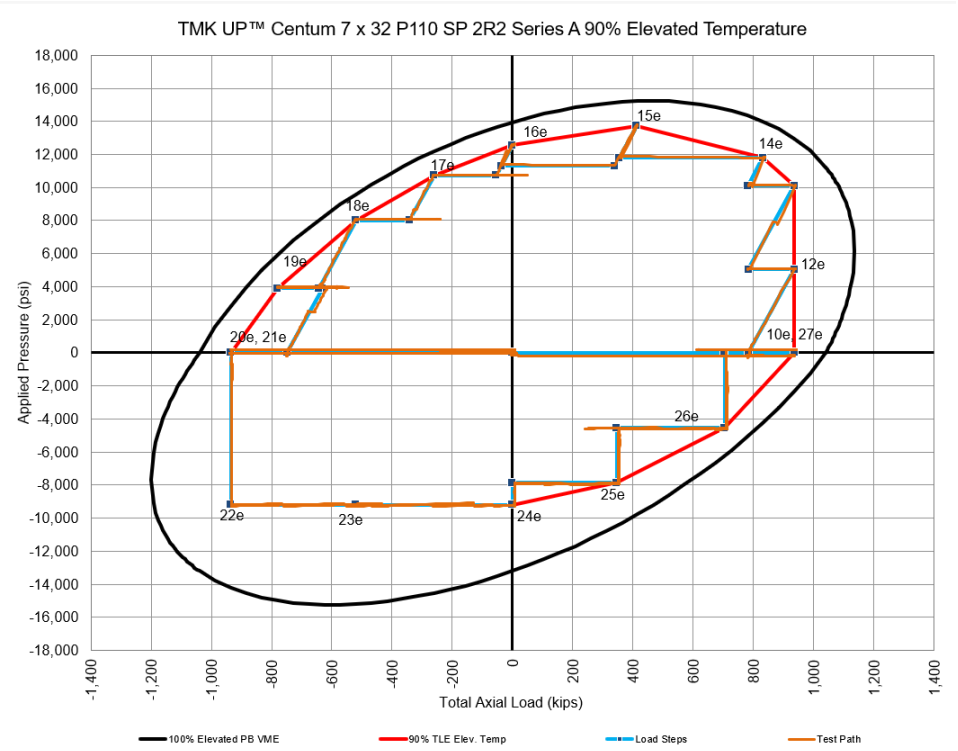

Figure 1-23: Test Envelope for TMK UP CENTUM Specimen 2R2 Series A (90% Elevated)

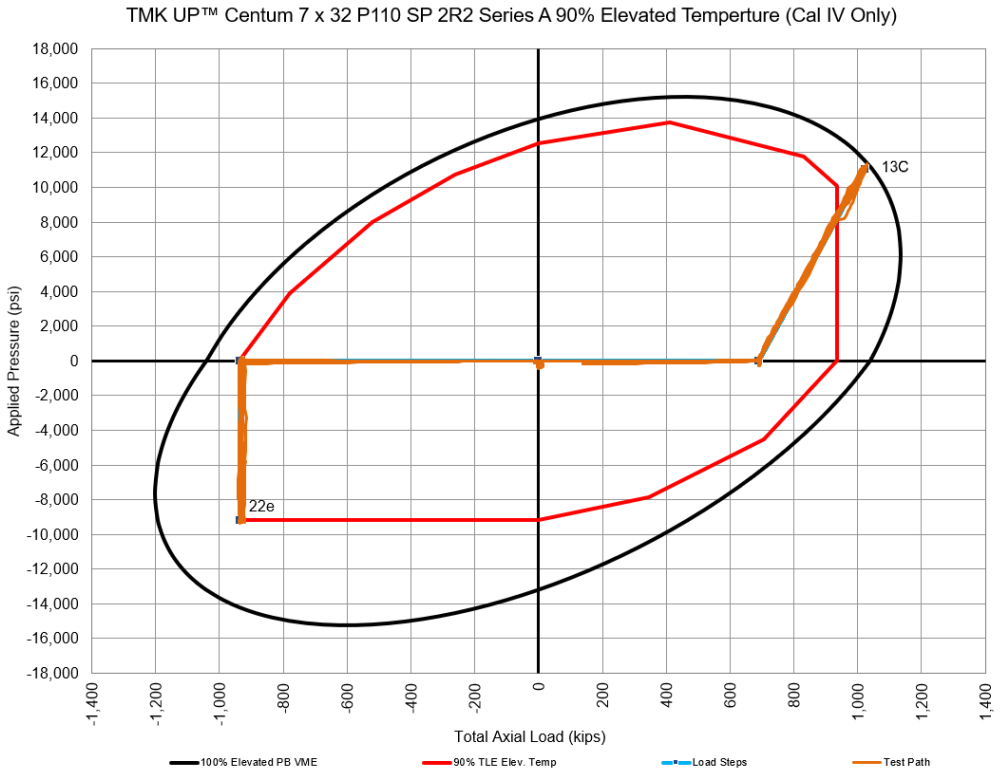

Figure 1-24: Test Envelope for TMK UP CENTUM Specimen 2R2 Series A QI-QIII Cycles

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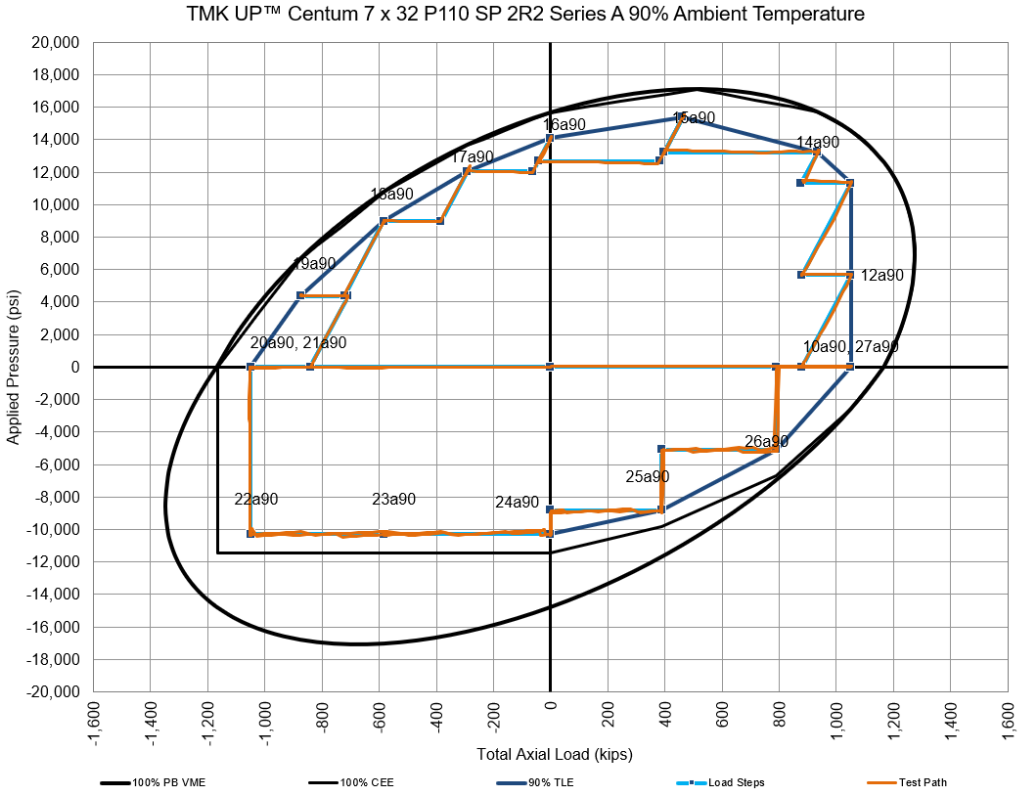

Figure 1-25: Test Envelope for TMK UP CENTUM Specimen 2R2 Series A (90% Ambient)

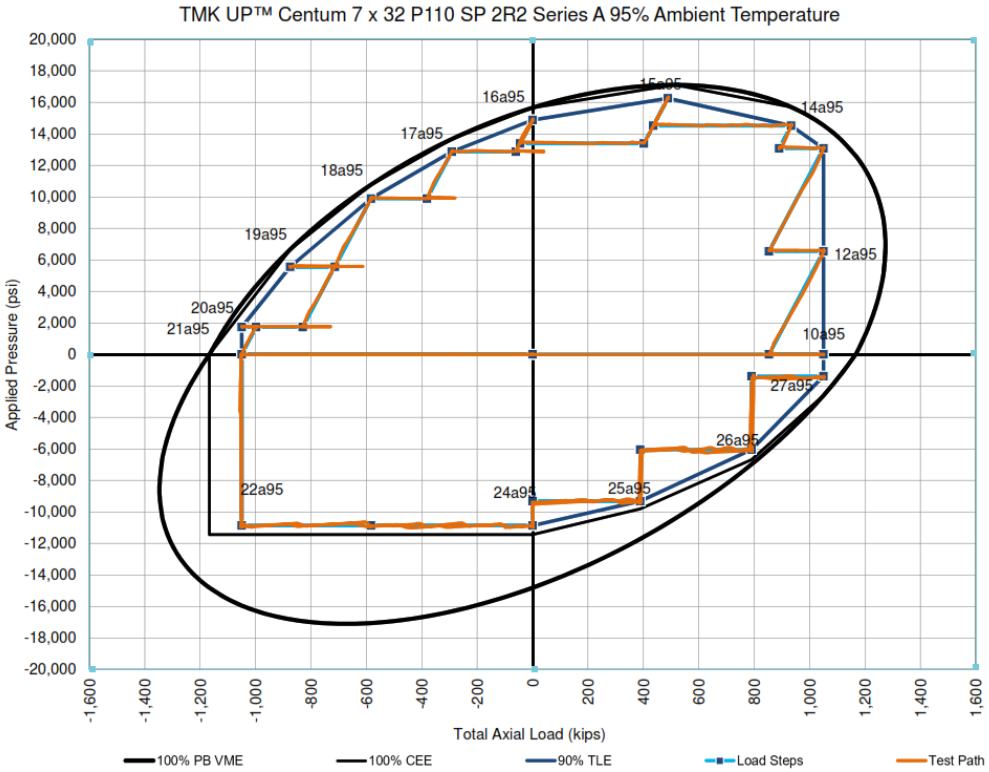

Figure 1-26: Test Envelope for TMK UP CENTUM Specimen 2R2 Series A (95% Ambient)

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Limit Load: Specimen 2R2

A Limit Load Test was performed on Specimen 2R2 at stress engineering. The Limit Load Test Path is shown in Figure 1-27 and the failure loads are captured in Table 1-13.

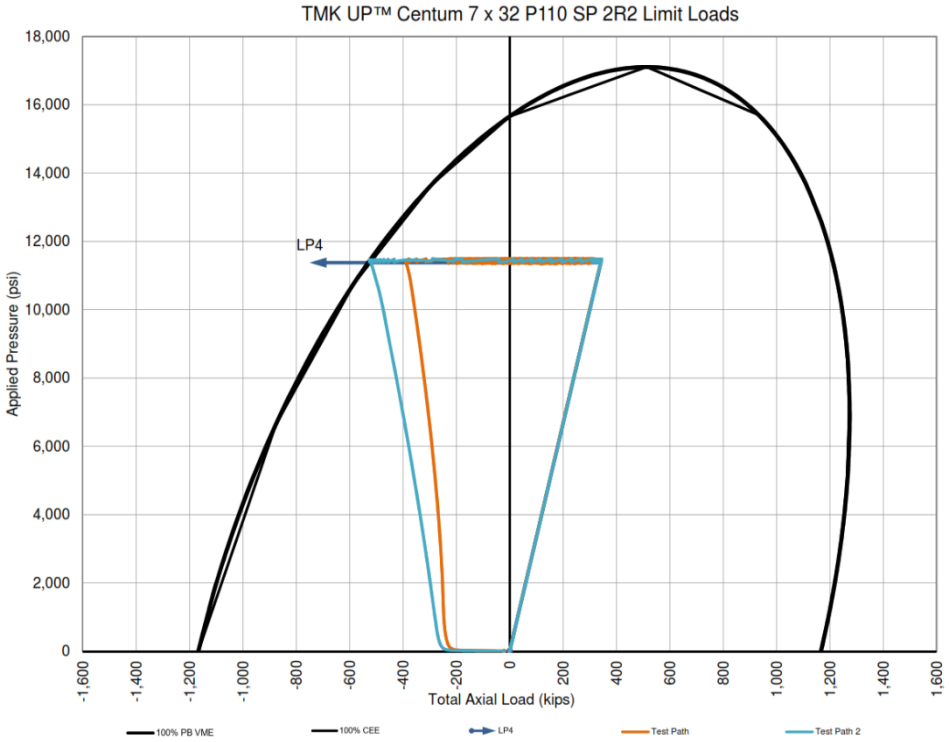

Figure 1-27: Limit Load Path for TMK UP CENTUM Specimen 2R2

Load Step	Load Step	Action	Total Axial Load (Kips)	Internal Pressure (psi)
First Run	1	Add internal Pressure	343.9	11,474
	2	Add Compression to Failure	-366.5*	11,474
Second Run	1	Add internal Pressure	341.9	11,379
	2	Add Compression to Failure	-525.0	11,448

* Testing was prematurely stopped due to initial signs of yielding; no leak was observed and load was continuing to build. Limit load was repeated.

Table 1-13: Limit Load Failure condition specimen 2R2

After reaching -869 kips machine load on the second run, the load was no longer increasing. Testing was terminated to avoid equipment damage.

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Series B: Specimen 3

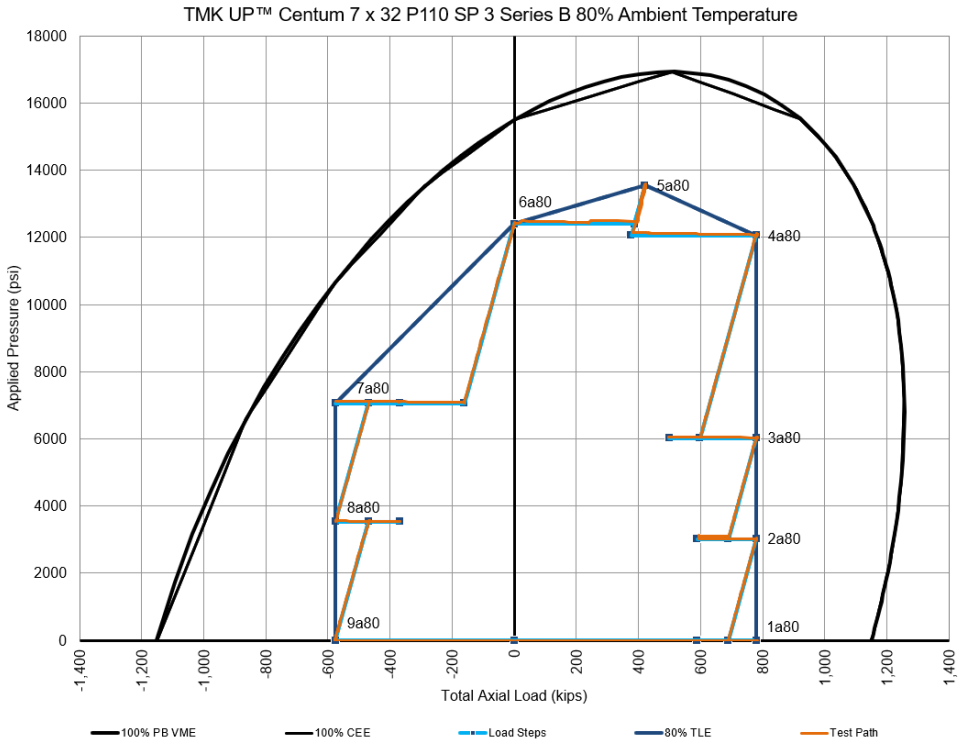

Figure 1-28: Test Envelope for TMK UP CENTUM Specimen 3 Series B (80% Ambient)

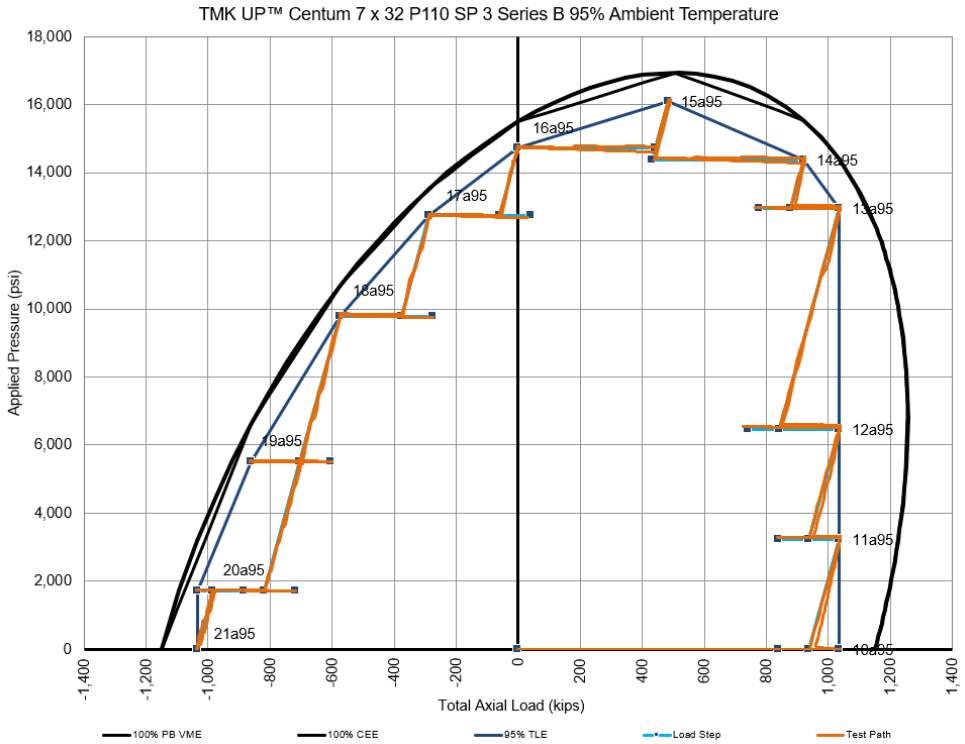

Figure 1-29: Test Envelope for TMK UP CENTUM Specimen 3 Series B (95% Ambient)

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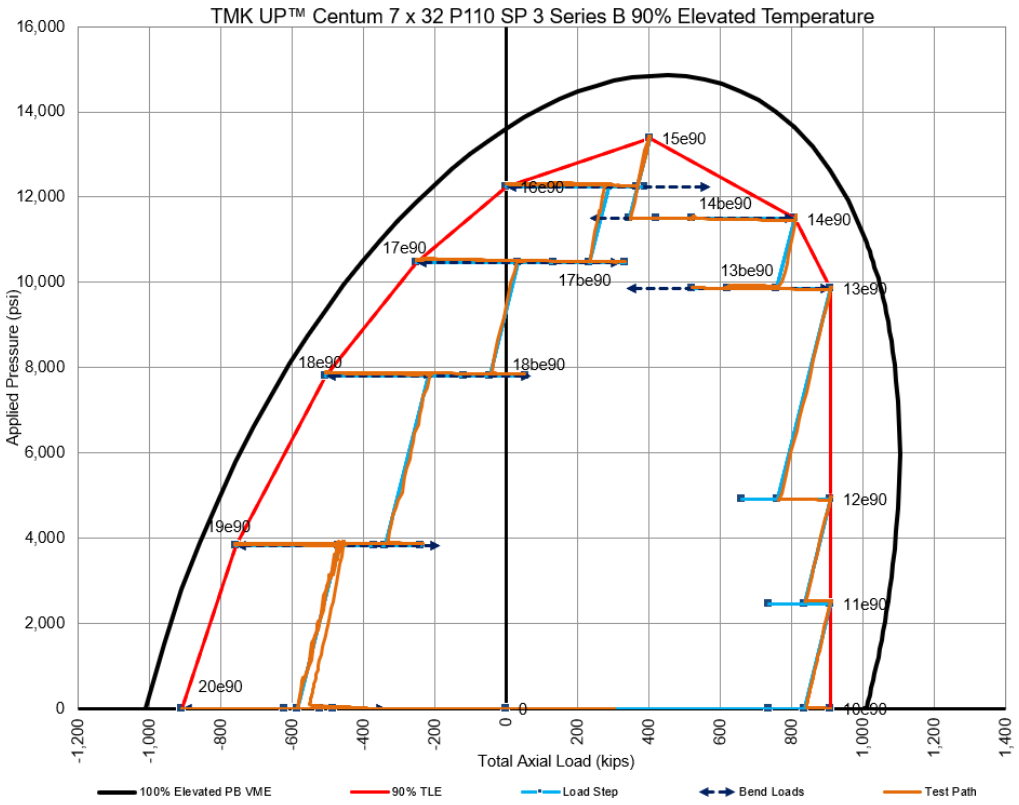

Figure 1-30: Test Envelope for TMK UP CENTUM Specimen 3 Series B (90% Elevated)

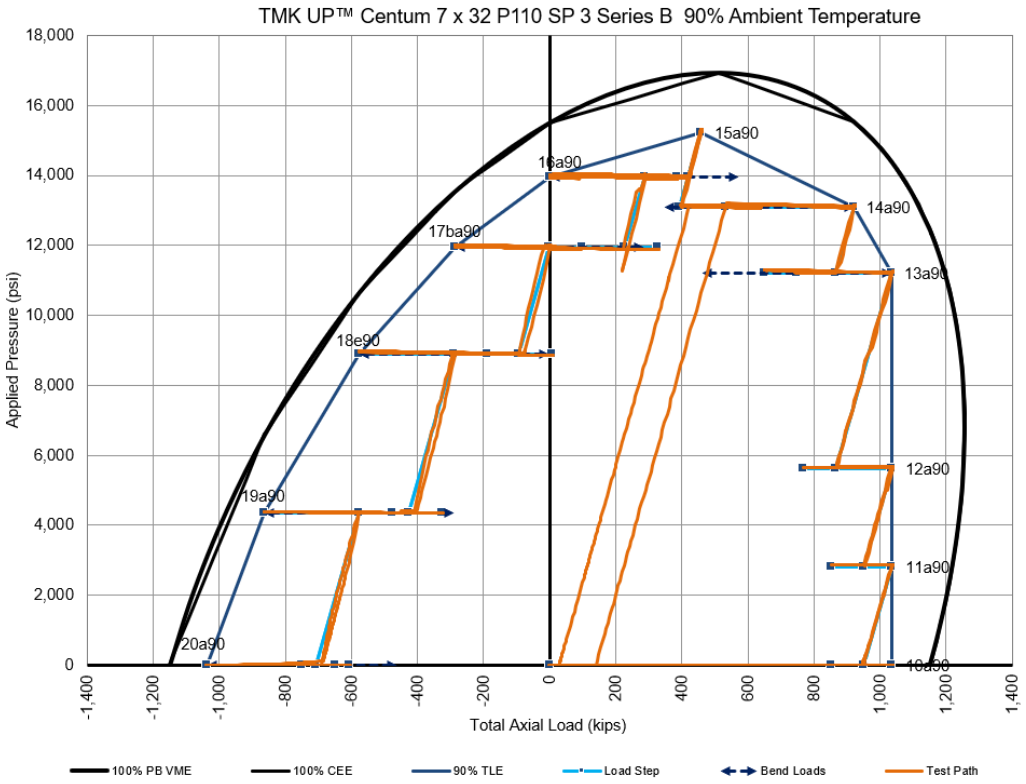

Figure 1-31: Test Envelope for TMK UP CENTUM Specimen 3 Series B (90% Ambient)

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Series C: Specimen 3

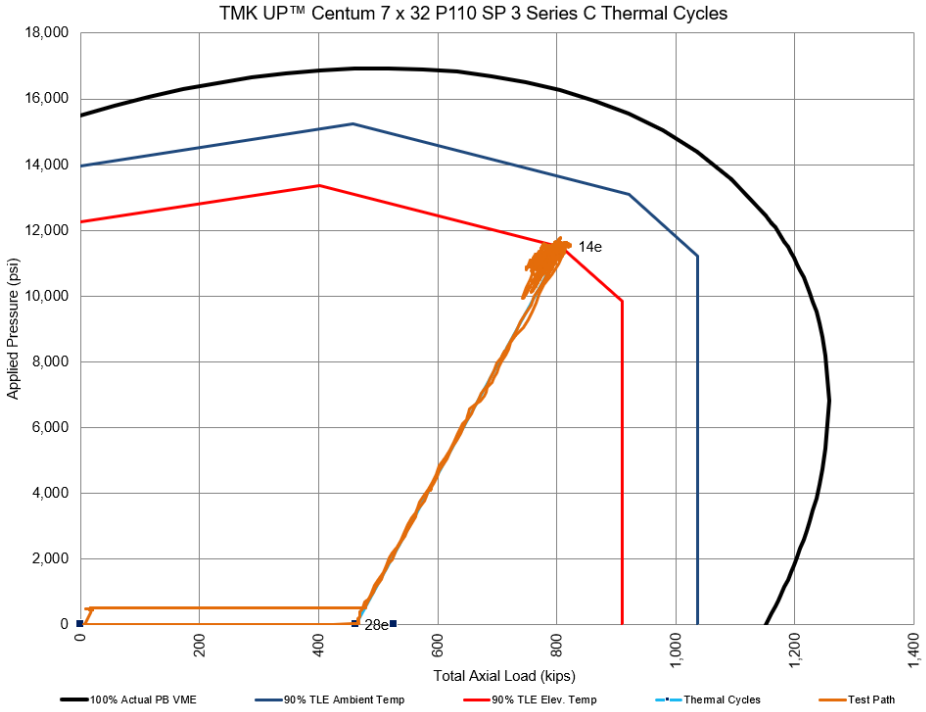

Figure 1-32: Test Envelope for TMK UP CENTUM Specimen 3 Series C Thermal Cycles

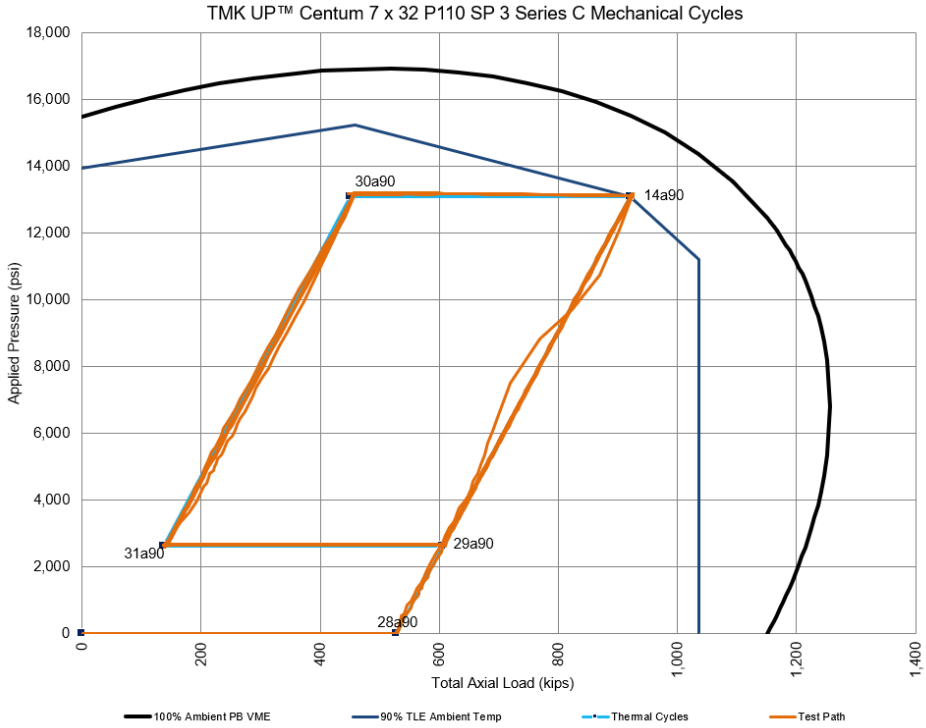

Figure 1-33: Test Envelope for TMK UP CENTUM Specimen 3 Series C Mechanical Cycles

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Series A: Specimen 3

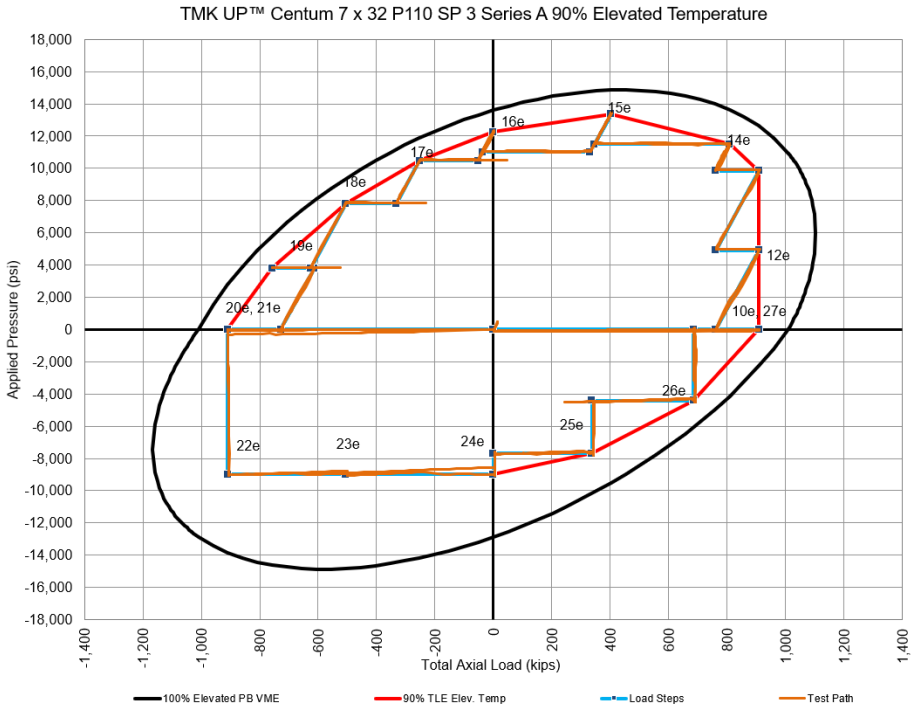

Figure 1-34: Test Envelope for TMK UP CENTUM Specimen 3 Series A (90% Elevated)

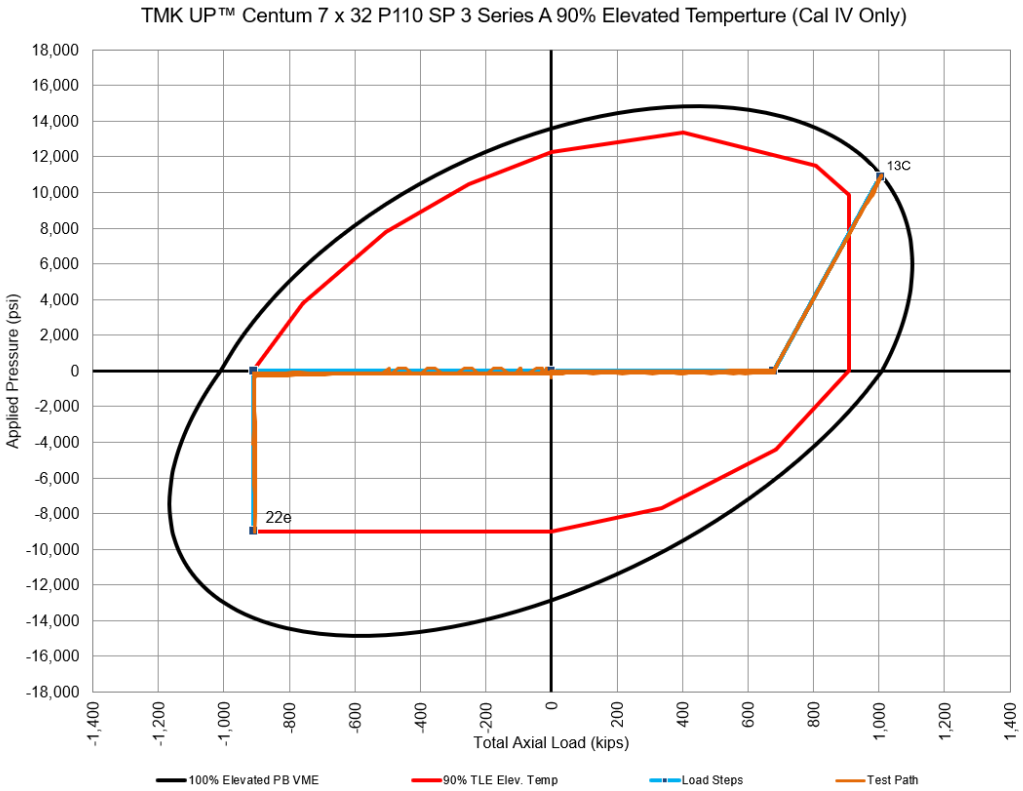

Figure 1-35: Test Envelope for TMK UP CENTUM Specimen 3 Series A QI-QIII Cycles

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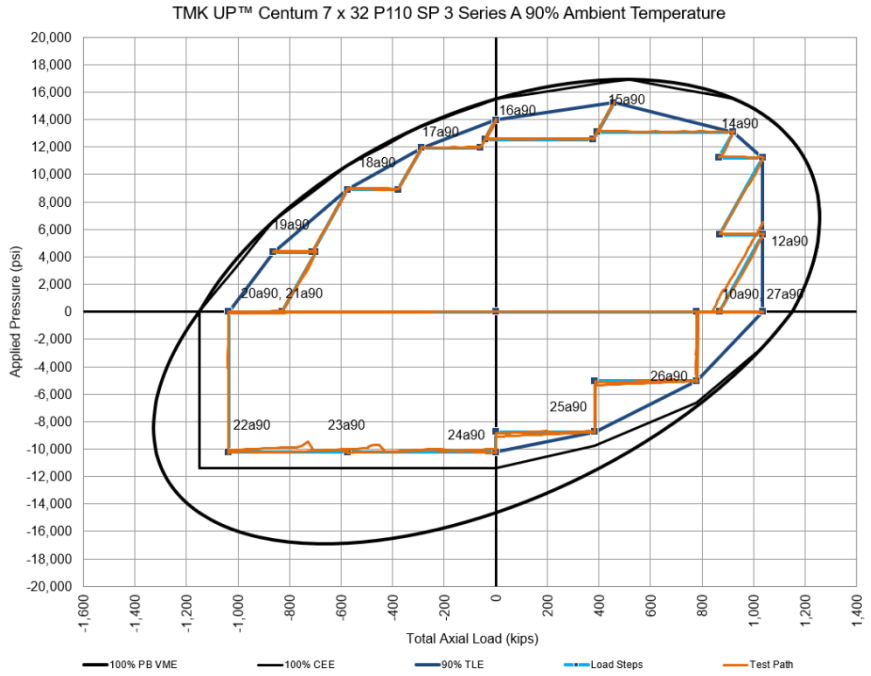

Figure 1-36: Test Envelope for TMK UP CENTUM Specimen 3 Series A (90% Ambient)

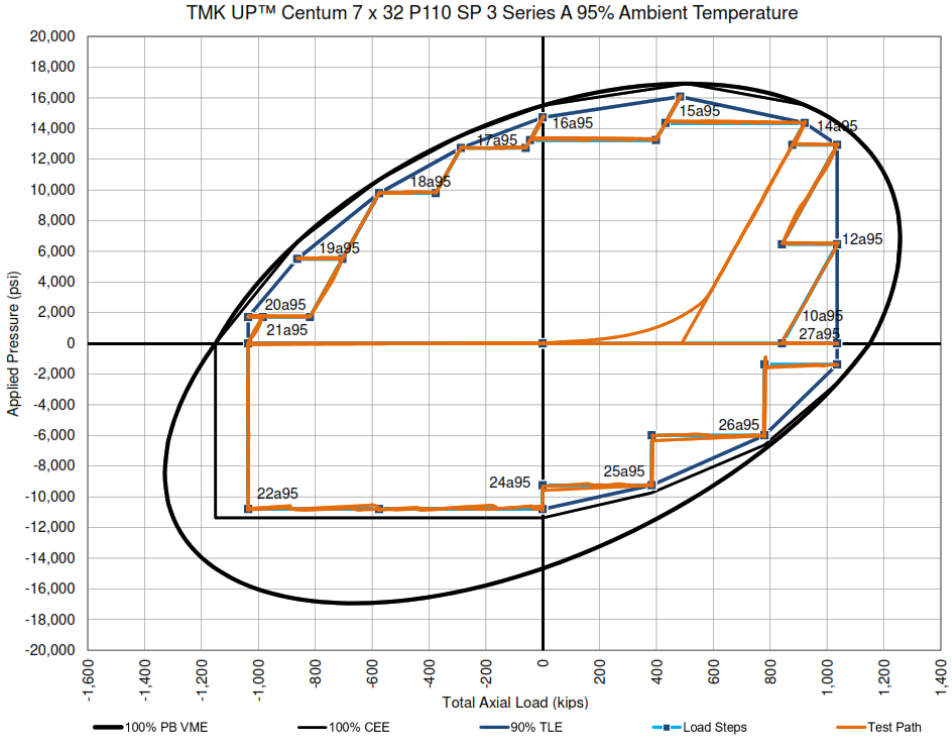

Figure 1-37: Test Envelope for TMK UP CENTUM Specimen 3 Series A (95% Ambient)

Limit Load: Specimen 3

A Limit Load Test was performed on Specimen 3 at stress engineering. The Limit Load Test Path is shown in Figure 1-38 and the failure loads are captured in Table 1-14.

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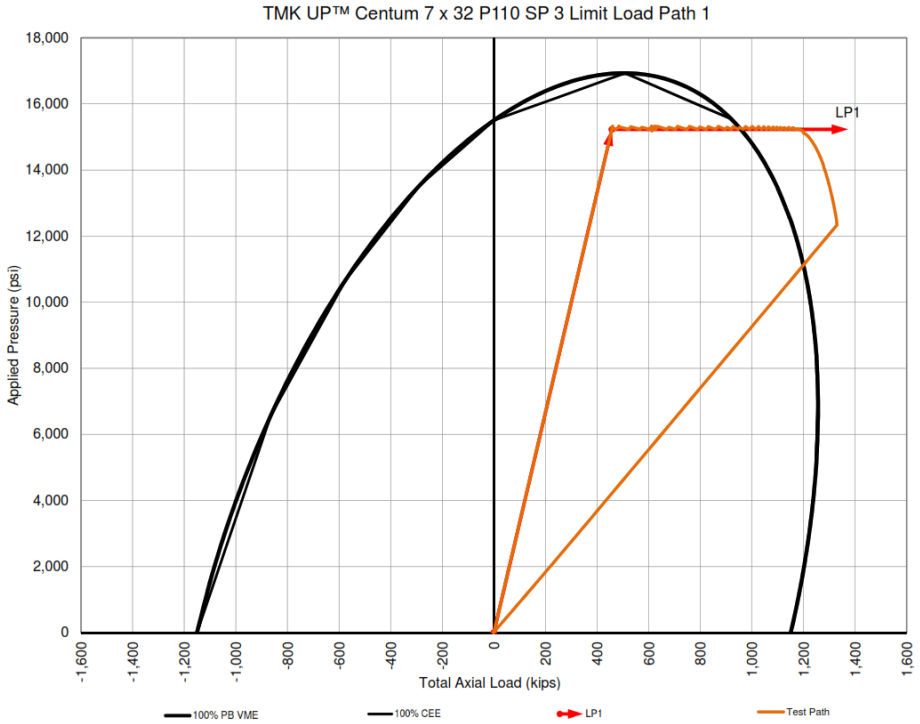

Figure 1-38: Limit Load Path 1 for TMK UP CENTUM Specimen 3

Load Step	Action	Total Axial Load (Kips)	Internal Pressure (psi)
1	Add Internal Pressure	0	15,251
2	Add Tension to Failure	1,329.2	12,328

Table 1-14: Limit Load Failure condition specimen 3

Pin side A fractured after reaching the load and pressure stated in Table 1-14.

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Series B: Specimen 4

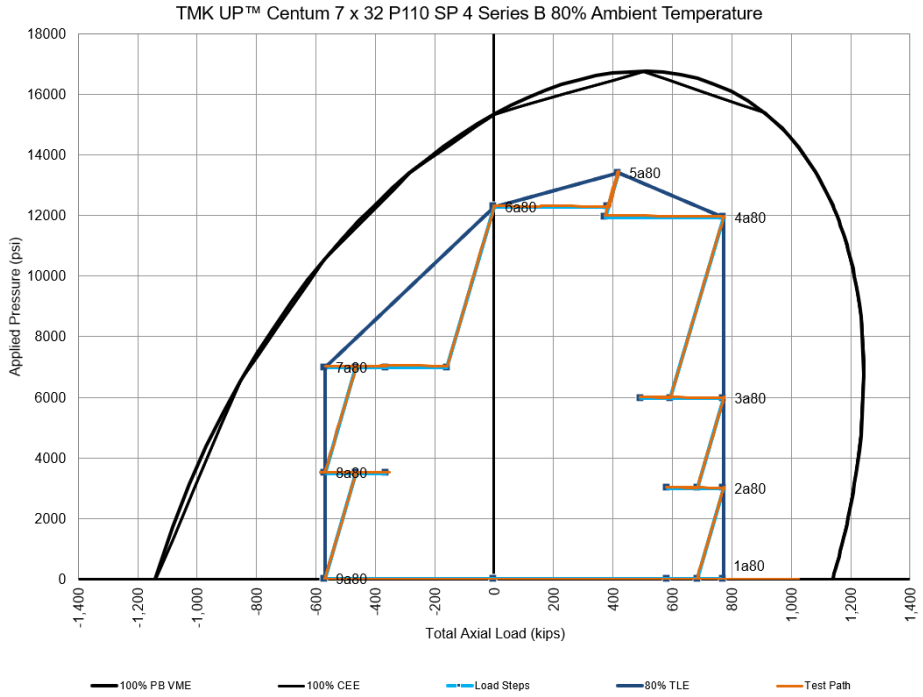

Figure 1-39: Test Envelope for TMK UP CENTUM Specimen 4 Series B (80% Ambient)

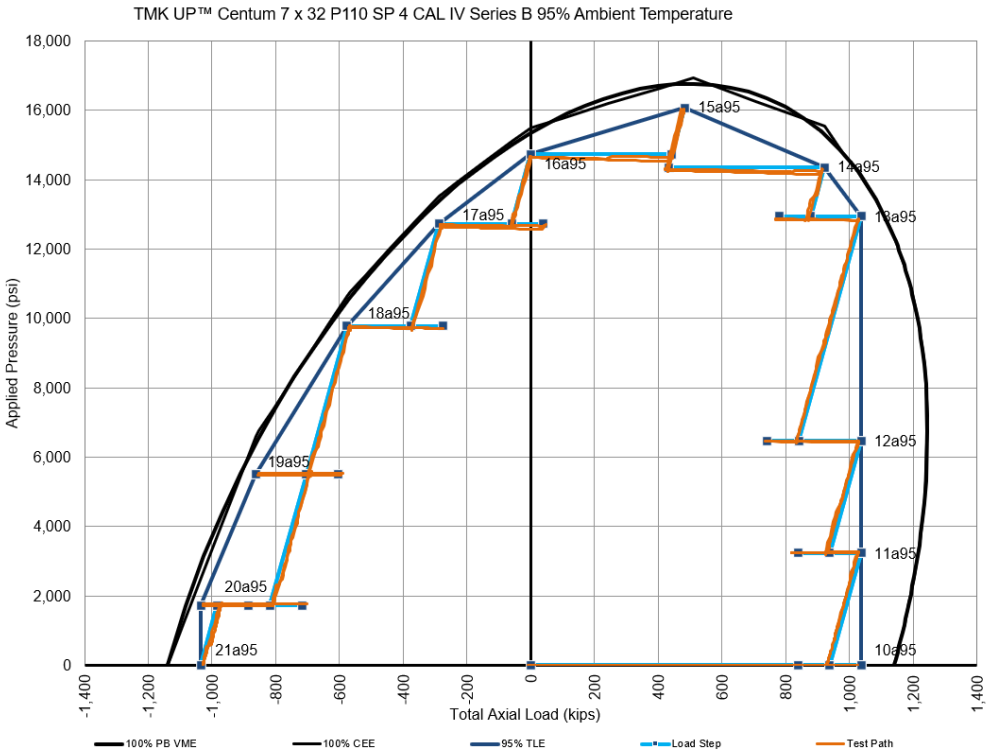

Figure 1-40: Test Envelope for TMK UP CENTUM Specimen 4 Series B (95% Ambient)

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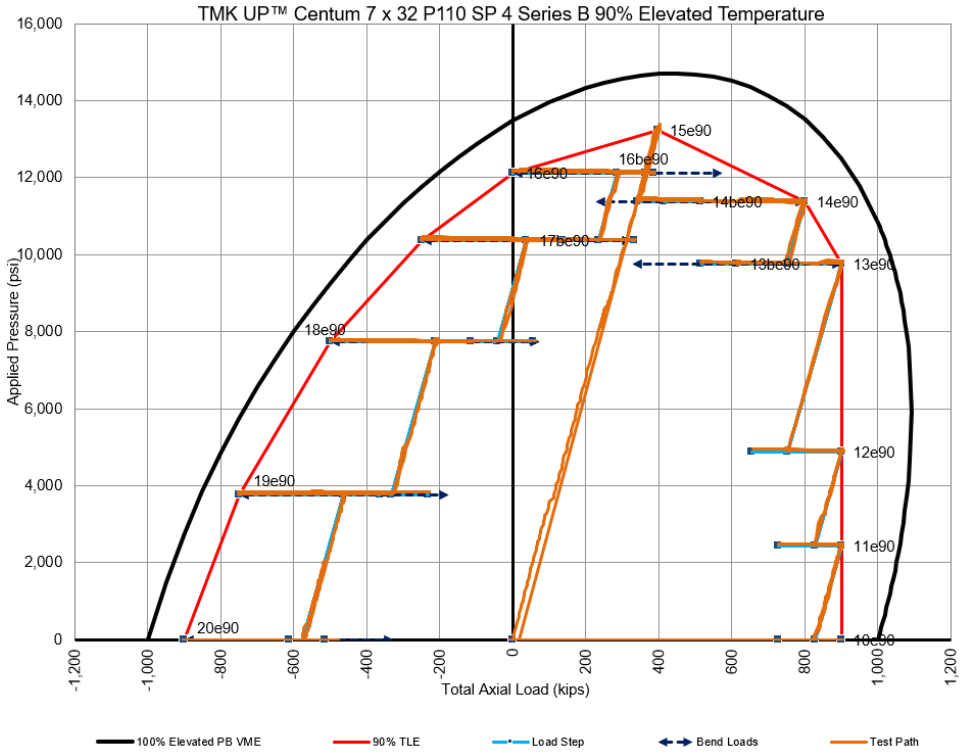

Figure 1-41: Test Envelope for TMK UP CENTUM Specimen 4 Series B (90% Elevated)

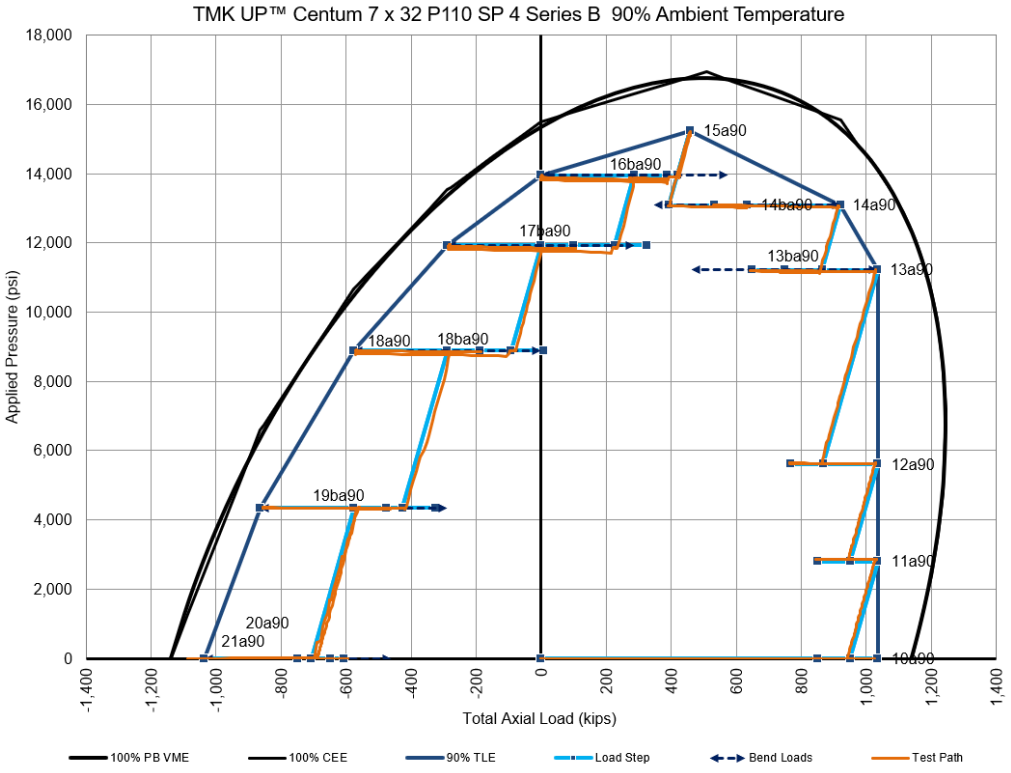

Figure 1-42: Test Envelope for TMK UP CENTUM Specimen 4 Series B (90% Ambient)

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Series C: Specimen 4

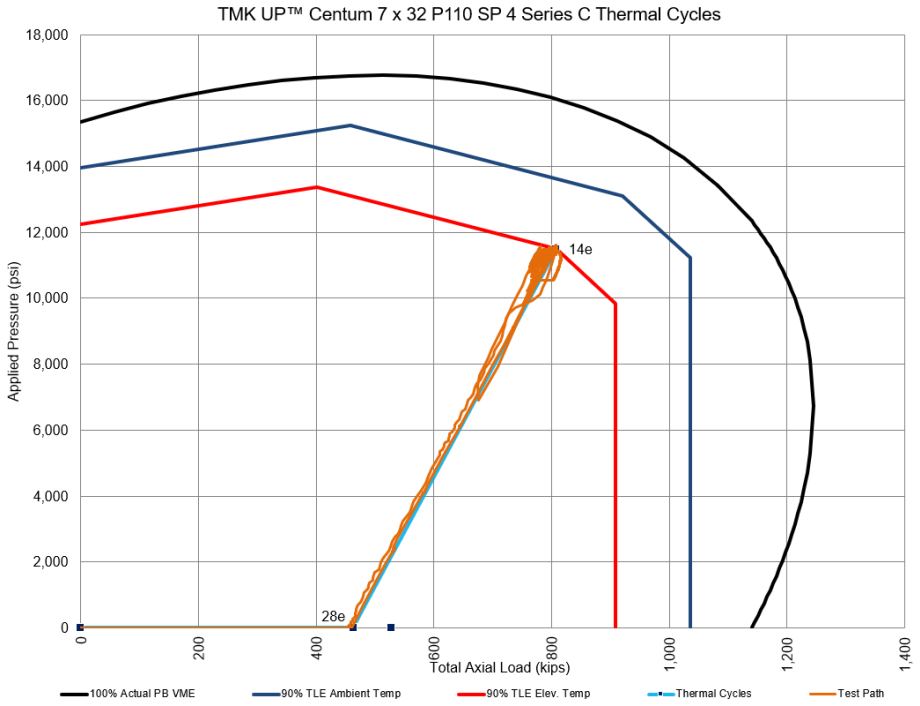

Figure 1-43: Test Envelope for TMK UP CENTUM Specimen 4 Series C Thermal Cycles

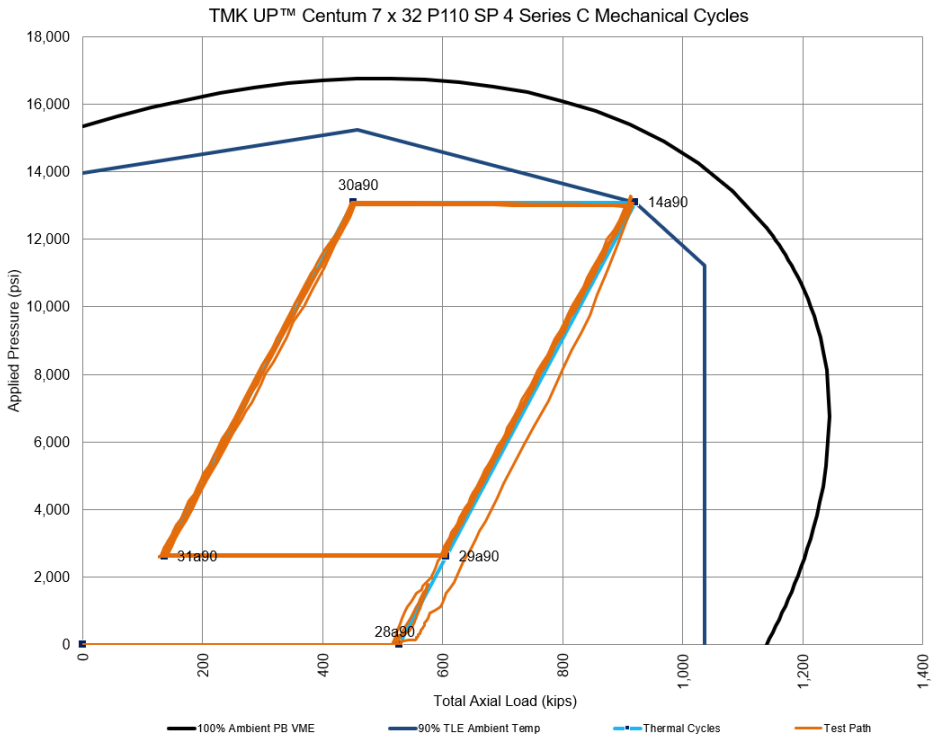

Figure 1-44: Test Envelope for TMK UP CENTUM Specimen 4 Series C Mechanical Cycles

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Series A: Specimen 4

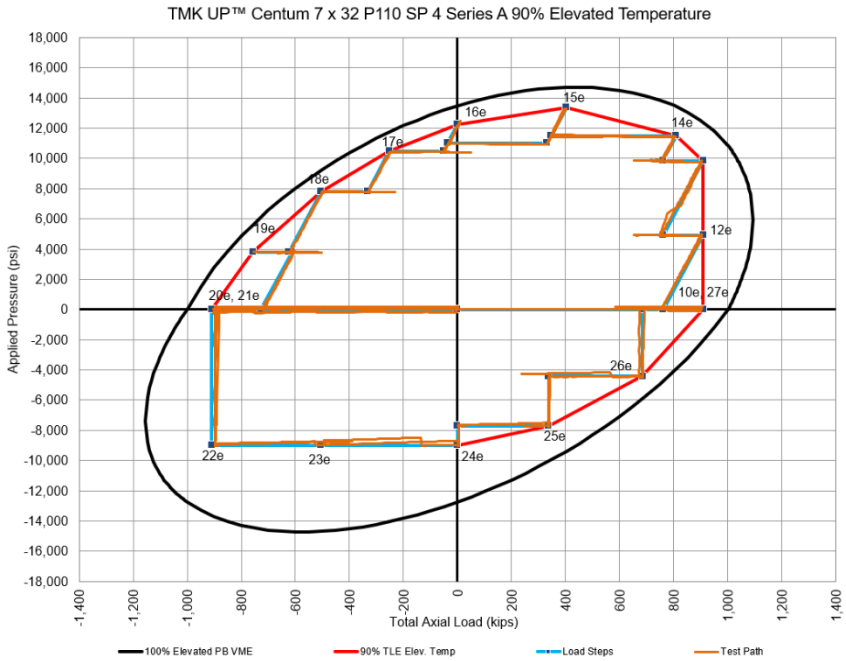

Figure 1-45: Test Envelope for TMK UP CENTUM Specimen 4 Series A (90% Elevated)

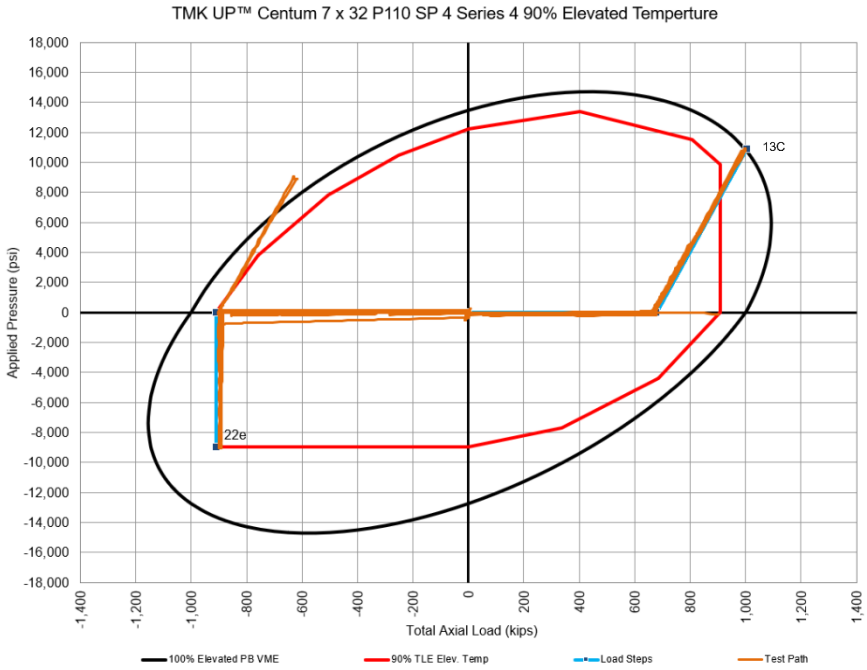

Figure 1-46: Test Envelope for TMK UP CENTUM Specimen 4 Series A QI-QIII Cycles

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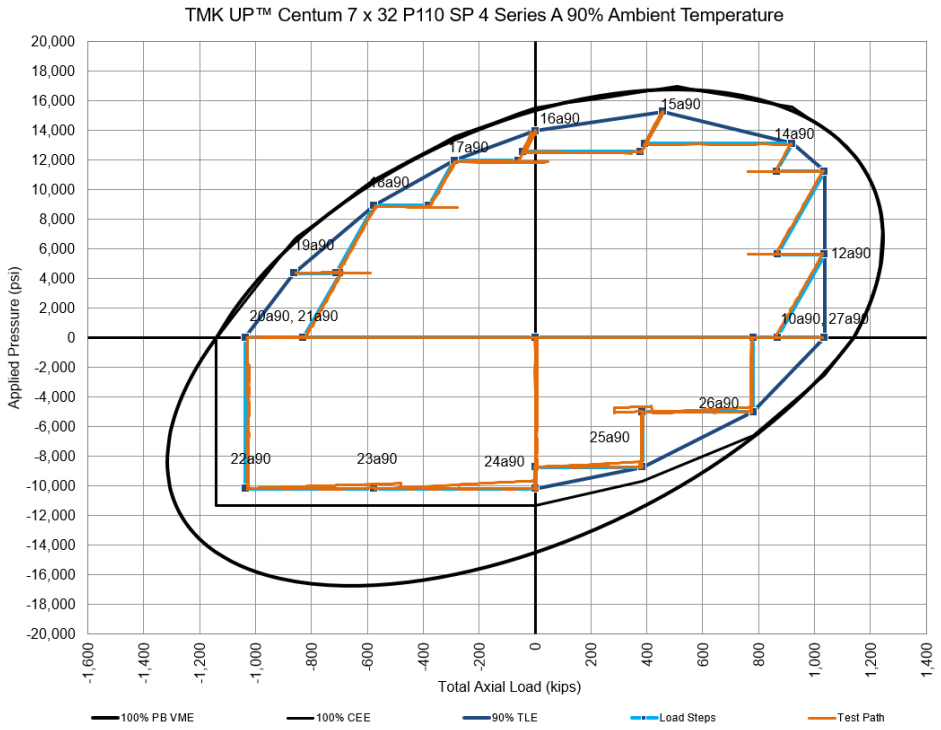

Figure 1-47: Test Envelope for TMK UP CENTUM Specimen 4 Series A (90% Ambient)

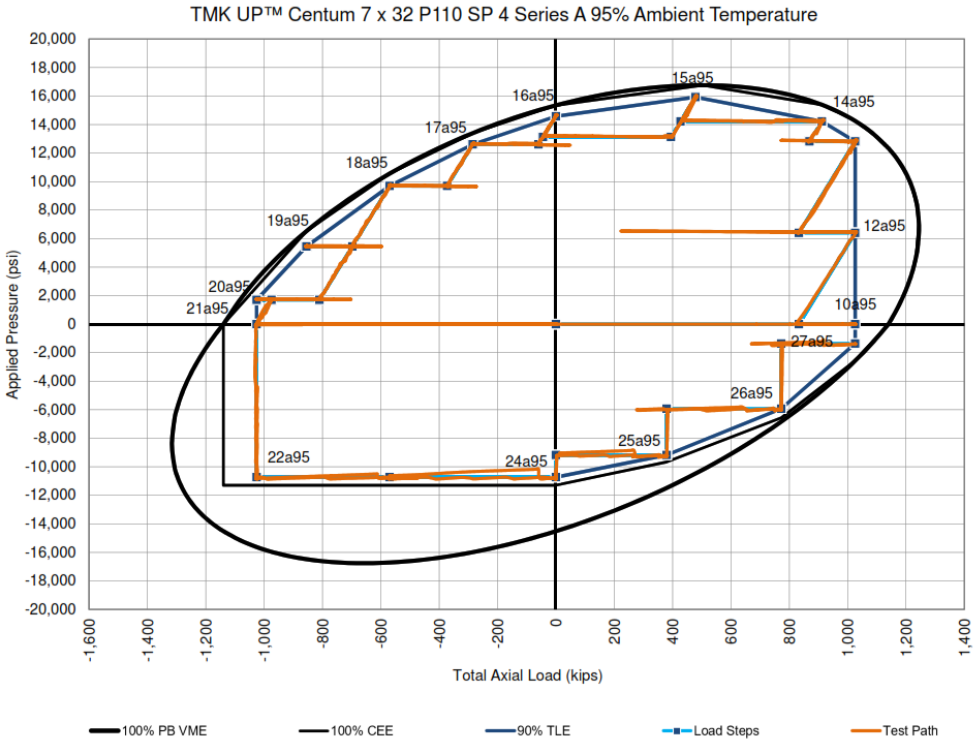

Figure 1-48: Test Envelope for TMK UP CENTUM Specimen 4 Series A (95% Ambient)

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Limit Load: Specimen 4

A Limit Load Test was performed on Specimen 4 at TMK IPSCO R&D Center. The Limit Load Test Path is shown in Figure 1-49 and the failure loads are captured in Table 1-15.

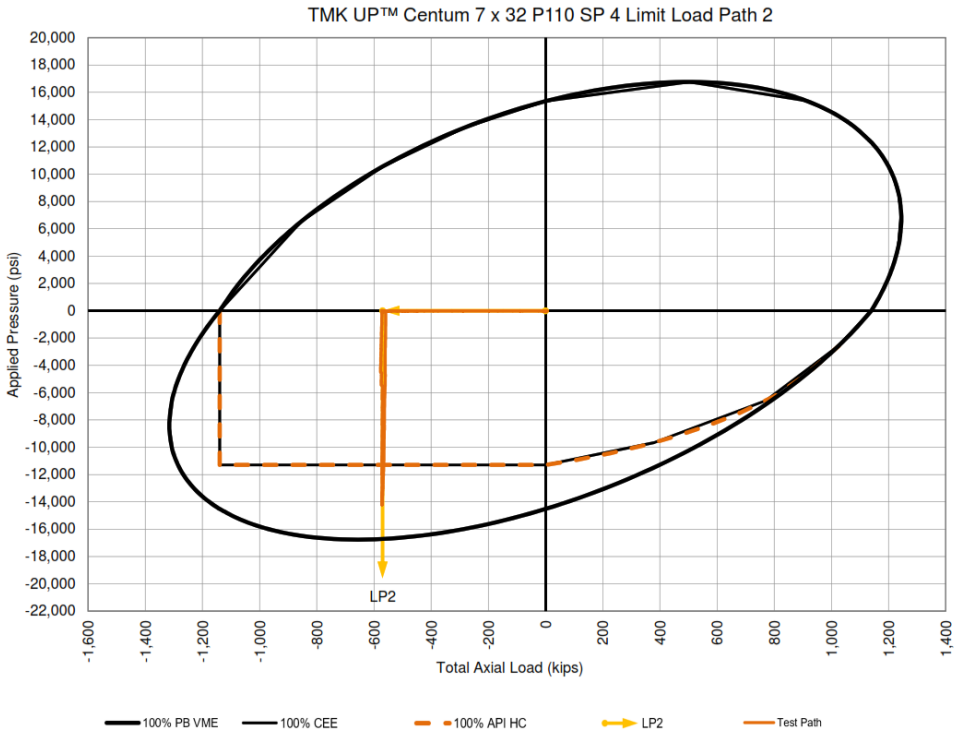

Figure 1-49: Limit Load Path for TMK UP CENTUM Specimen 4

Load Step	Action	Total Axial Load (Kips)	External Pressure (psi)
1	Add Compression	-572.5	0
2	Add External Pressure to Failure	-572.5	14,208

Table 1-15: Limit Load Failure condition specimen 4

At 14,208 PSI, greater than 120% of CEE, no leak was observed and testing was stopped.

Limit Load Specimen 5

A Limit Load Test was performed on Specimen 5 at stress engineering. The Limit Load Test Path is shown in Figure 1-50 and the failure loads are captured in **Table 1-16.**

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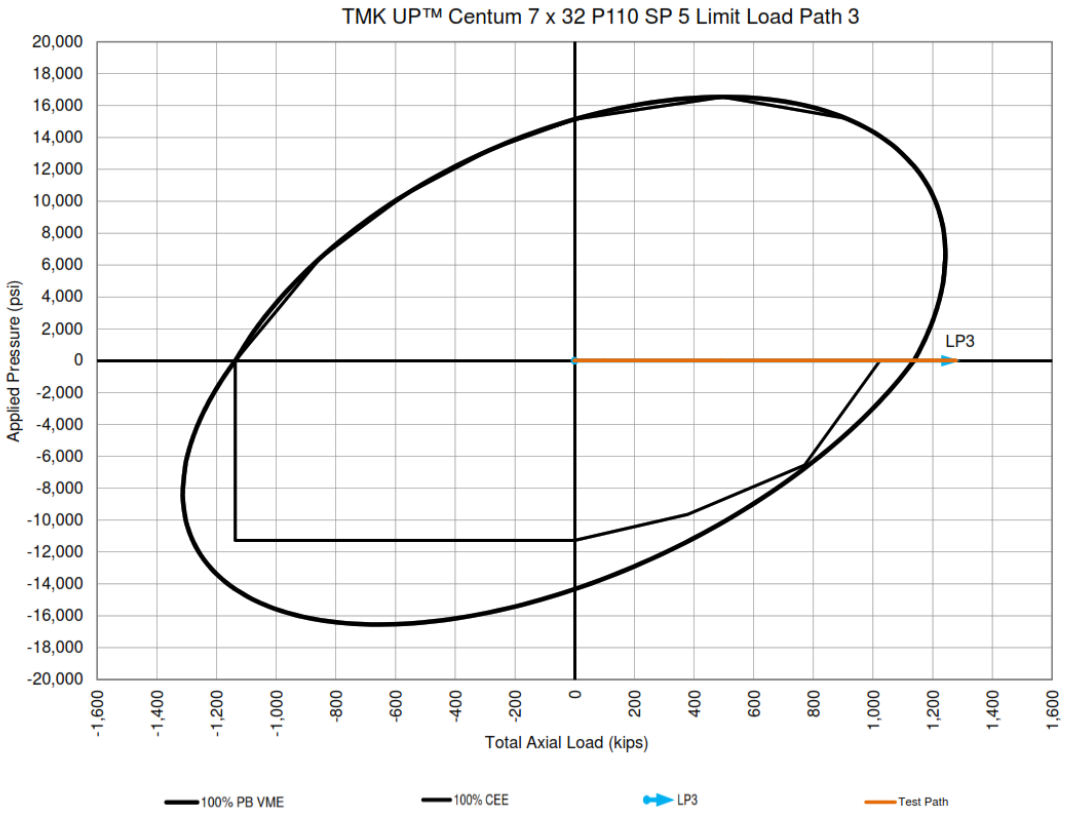

Figure 1-50: Limit Load Path for TMK UP CENTUM Specimen 5

Load Step	Action	Total Axial Load (Kips)	Internal Pressure (psi)
1	Add Tension to Failure	1,278.1	0

Table 1-16: Limit Load Failure condition specimen 5

Pipe body failure (Parting) was observed on Side B.

Supplemental Testing

In addition to API RP 5C5:2017 CAL IV testing, additional specimens, 7” 29# L80 13cr, were added for make and break testing (3R1, 5R1). The additional specimens were tested to qualify an alternative size and surface treatments per Shell’s internal procedure. The make and breaks are captured in Appendix D.

Specimen Failures

Specimen 2

During the 95% ambient portion of the series B test, yielding was observed on hoop and axial strain gauges as is shown in Figure 1-52. As bending is calculated using the strain

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gauge readings, a residual bend was induced. Due to the large separation observed in the strain gauges, it was decided to terminate testing on Specimen 2 and issue a replacement.

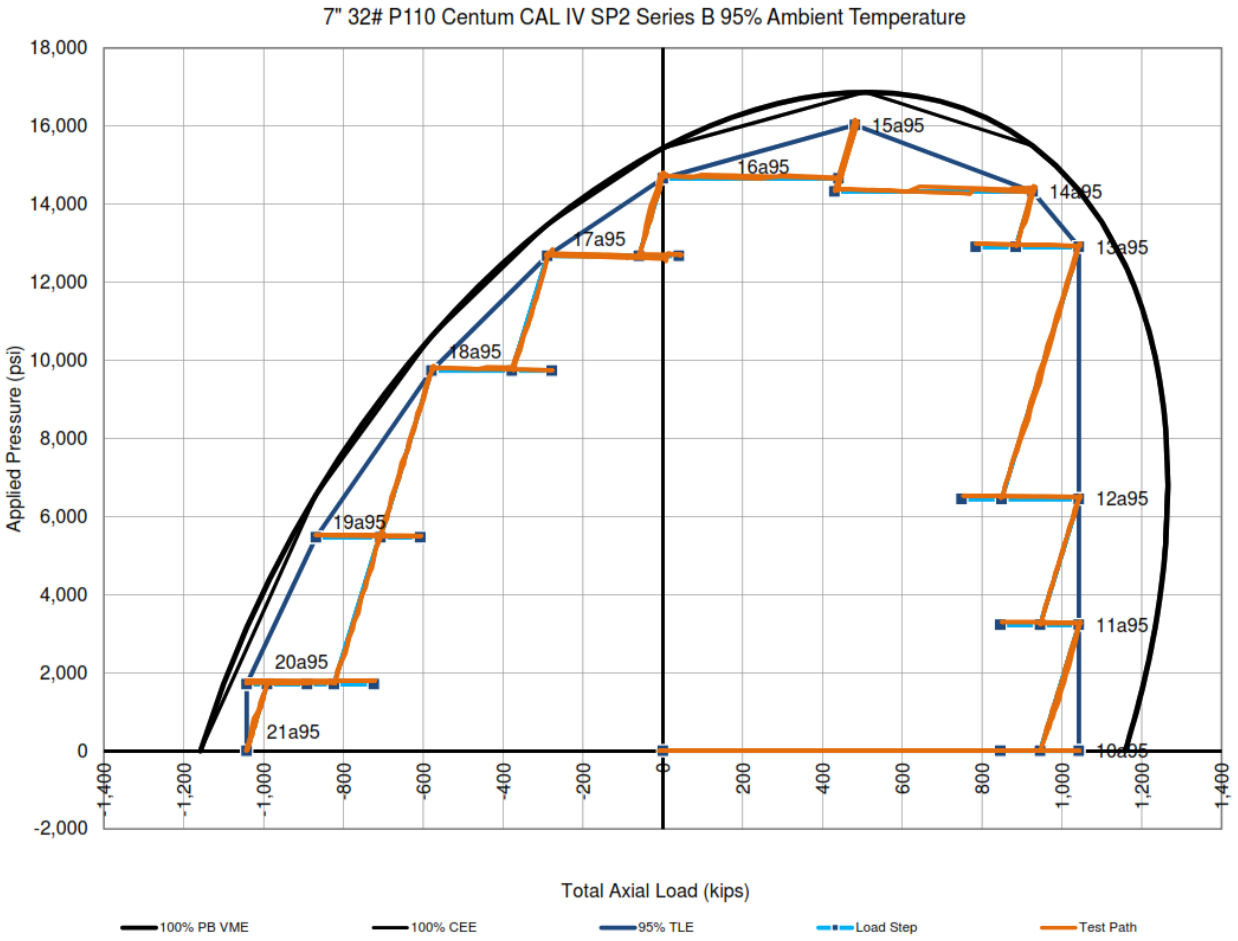

Figure 1-51: Specimen 2 Series B 95% Test Path

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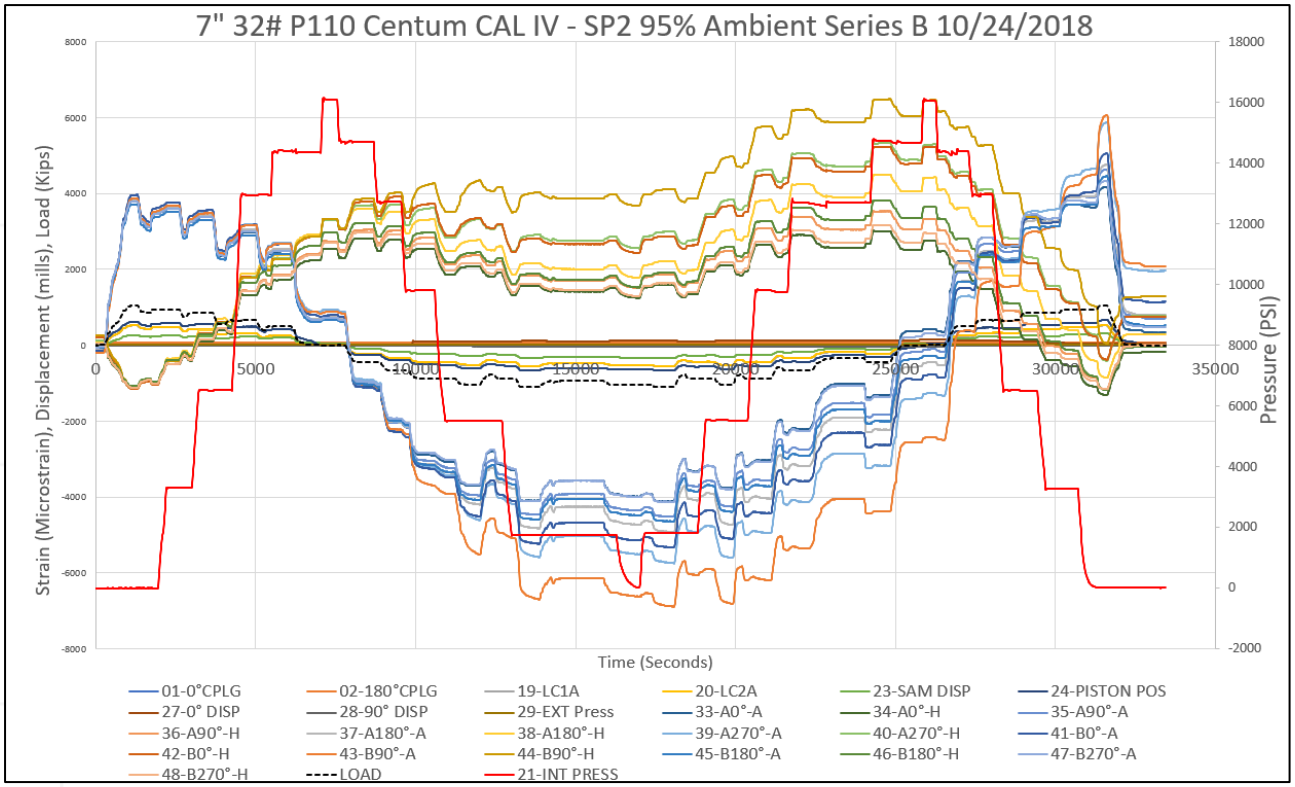

Figure 1-52: Specimen 2 Series B Strain Gage Data

Specimen 2R1

During the 95% ambient portion of the series B testing, the specimen was overloaded. The operator misread the load schedule and added an additional 100 kips. The induced combined loading fell outside of the TLE and VME as is shown in Figure 1-54. After review of the strain gauge data, it was determined that the sample was in risk of being compromised and testing was stopped on specimen 2R1. Specimen 2R2 was machined as a replacement.

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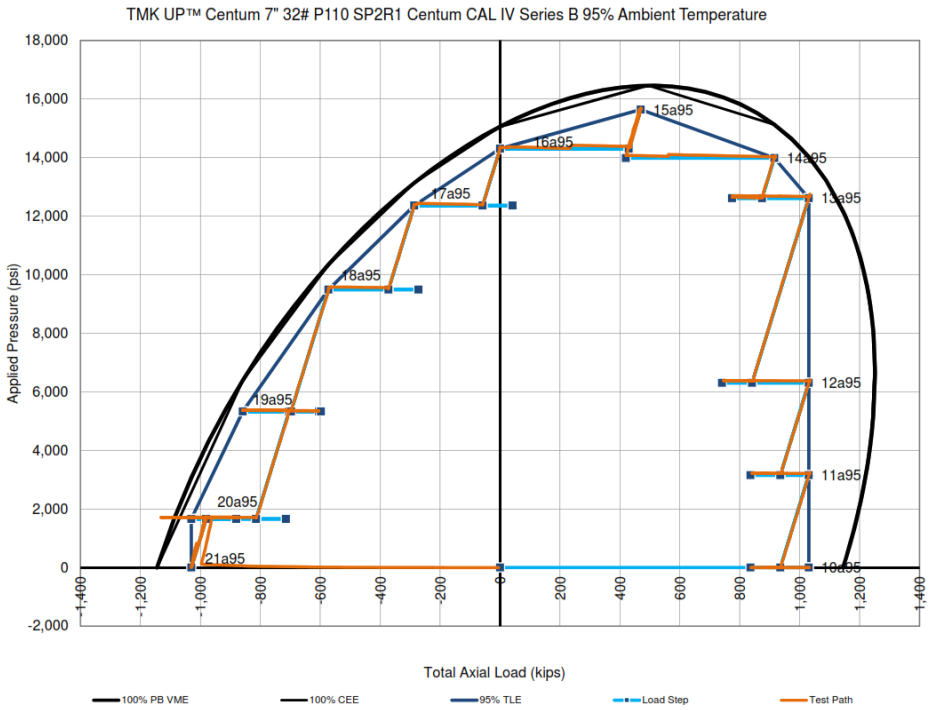

Figure 1-53: Specimen 2R1 Series B 95% Test Path

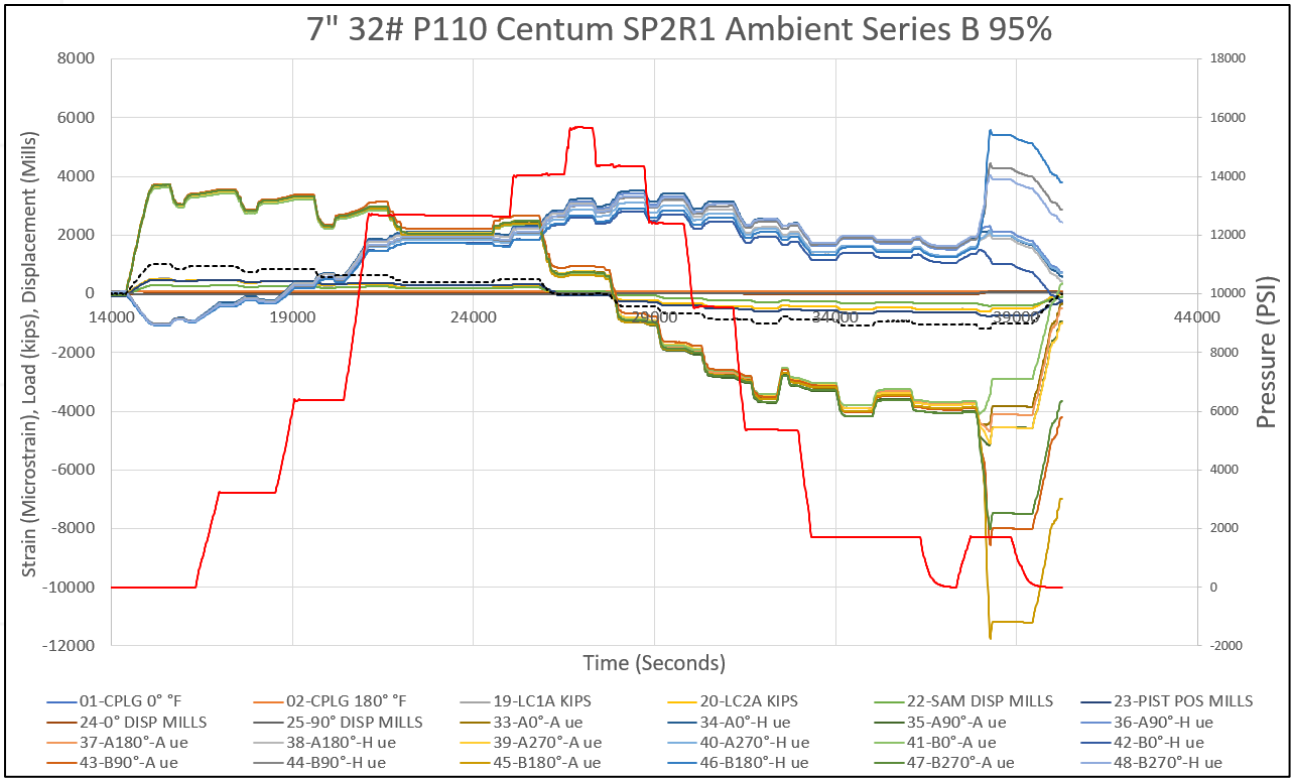

Figure 1-54: Specimen 2R1 Series B 95% Strain Gage Data

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Deviations/ Anomalies

Note: Deviations and Anomalies for specimens tested at Stress Engineering Services are captured in the SES executive summary in Appendix D.

1) During 90% elevated series A testing of SP4 the specimen was briefly overloaded. Load step 134 the operator added roughly 9000 psi of internal pressure instead of external pressure. The induced combined loading took the sample outside of the TLE and VME as is shown in Figure 1-55. It was decided that the damage was minimal, and subsequent SP4 testing was completed successfully.

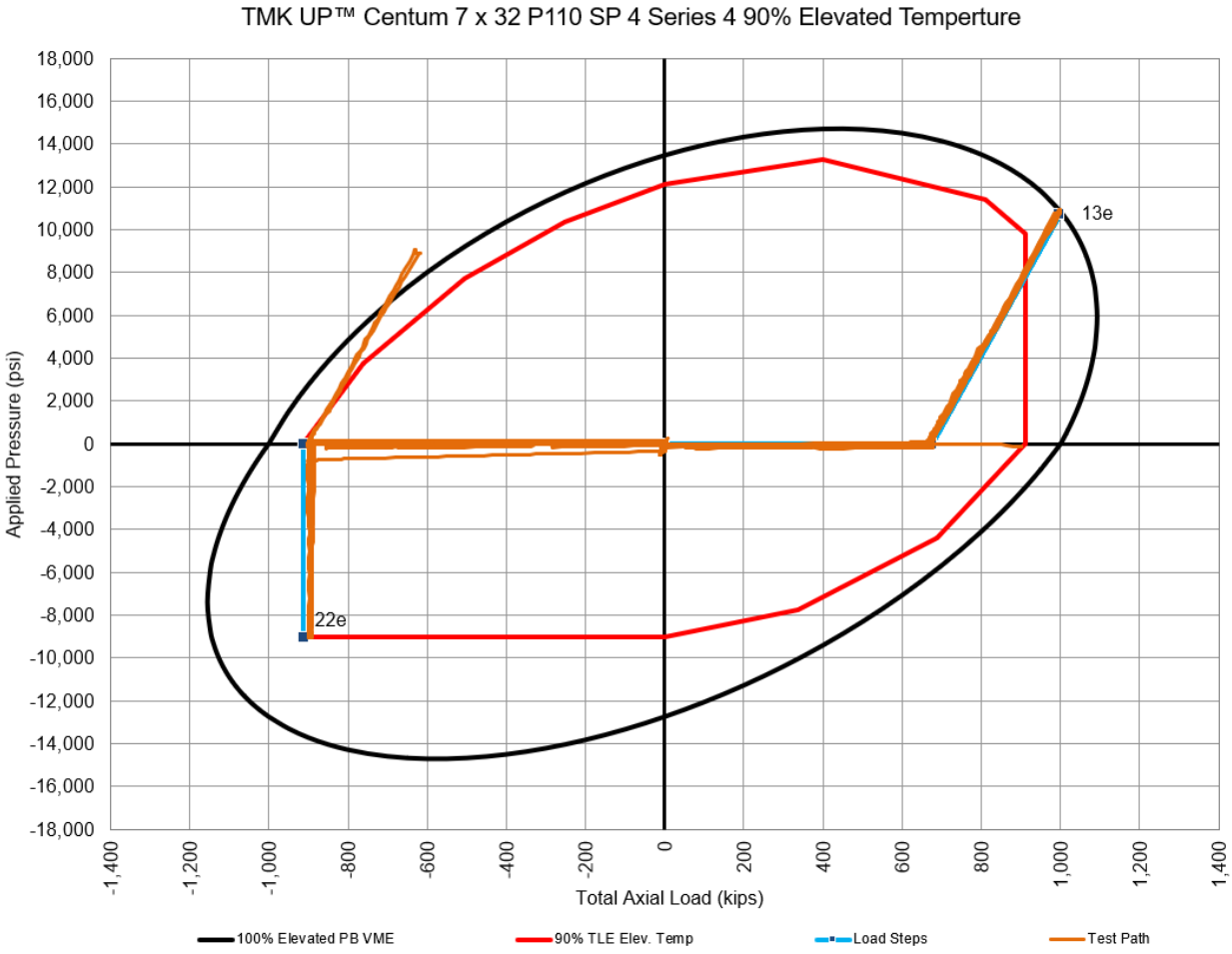

Figure 1-55: Specimen 4 Series A 90% Test Path Overload

2) The difference between the average coupling stock material and the minimum average pipe yield strength per API RP 5C5:2017 is 10 KSI. The material used had a difference of 11.5 KSI.
3) Specimen 1 Series C - (Load point 14e) LS 3 - 1.6 displacement was observed on side A, 1.7cc displacement was observed on side B during a 1-hour hold. It was believed that the sample had not yet had sufficient time to stabilize, the soak period was increased by three hours and the hold was repeated. No displacement was observed after restarting the hold again. See DSR-20 for further information.

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4) Specimen 2R2 Limit Load- testing was prematurely stopped before failure occurred at SES. The limit load test was repeated and achieved a higher compressive load before failure. Table 1-13 contains the data for the two runs.
5) Specimen 3 Series B (Load point 17) LS 266 - During a 10-minute hold, a displacement of 1.5 cc was observed on side A during the first 5-minute increment. The hold was extended for a total of 30 minutes. No additional displacements were observed during this hold.
6) Specimen 4 Series B (Load Point 16be) LS 110 - During a 10-minute hold, 1.1CC displacement was observed on side B. The load was extended for a total hold time of 25 minutes. No additional displacements were observed.
7) Specimen 4 Series A - (Load point 14e) LS 11 during a 10 minute hold the following displacements were observed: 1.7cc side A/ 1.1 cc displacement side B. The hold was extended for an additional 20 minutes with no additional displacements observed.

Conclusion

The 7.0" x 32# P110 TMK UP CENTUM connection was successfully qualified in accordance with API RP 5C5:2017 with 100% tension and 100% compression efficiencies. The internal and external pressures correspond to 100% and 100% PBYS respectively.

Approval Signatures

Prepared By: **Premium Connections Specialist**	Erick Coronado Erick Coronado	Digitally signed by Erick Coronado DN: cn=Erick Coronado gn=Erick Coronado c=United States l=US e=ecoronado@tmk-ipsco.com Reason: I am the author of this document Location: Date: 2019-03-13 17:27-05:00 Date
Reviewed By: **Design Engineer (EIC)**	Pavel Sidorenko	2019.03.14 08:58:25 +03'00' Date
Approved By: **General Manager of Technology**	Dhiren Panda	2019.03.19 16:02:02 -05'00' Date
Test Witnessed By: **TIEC Representative**	Angel Sanchez	2019.03.21 12:45 Date