10120 Houston Oaks Dr., Houston, TX 77064
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ACCREDITED Certificate No. 3425.01

Section 1: Executive Summary

Report Date: September 05, 2018

Testing Dates: August 9, 2018 – August 26, 2018

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

Project Number: RDP–105–18–1001

Pipe Specifications: 9.625 In. OD–53.50 lb.–P110

Connection Identification:

Connection Specifications and Ratings			
Connection OD:	10.630 in		
Connection Length:	13.386 in		
Make – Up Loss:	5.103 in		
Drift:	8.379 in		
Connection ID:	8.642 in		
Thread Compound Used:	BESTOLIFE 72733		
Torque (min. /opt. /max.):	39,200 / 43,500 / 47,900 ft–lbs		
	Connection data sheet ratings	**Min. %PBYS Tested Ratings, and (API RP 5C5:2017 requirements)**	
		Ambient Temperature	**Elevated Temperature**
API Burst Pressure:	14,100 psi	88%* (95%)	82%** (90%)
API Collapse Pressure:	7,950 psi	N/A	N/A
Tensile Load:	2,107,000 lbs	84%* (90%)	78%** (90%)
Compression Load:	2,107,000 lbs	84%* (90%)	78%** (90%)
Bending (Dogleg):	58.6º / 100 ft	10 º / 100 ft (20 º / 100 ft)	

* -Testing loads were reduced (limited) due to high pipe body strain during preload testing.
** - Elevated Yield Strength was calculated by the equation in section 5.5.2.6 of API RP 5C5 draft (dated 2014-04-06) based on the above mentioned revised Ambient Yield Strength.

Table 1-1: Connection Specifications

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Specimen Preparation & Test Locations

Mechanical Property Testing:	Element Materials Technology, 14805 Yorktown Plaza Drive, Houston, TX 77040
Specimen Machining and Surface Treatments:	Custom Threading (CTI), 5835 Cheswood, Houston, TX 77087
Make and Breaks:	TMK–IPSCO R&D Center, 10120 Houston Oaks Dr., Houston, TX 77064
Sealability (Series B):	TMK–IPSCO R&D Center, 10120 Houston Oaks Dr., Houston, TX 77064

Table 1-2: Specimen Preparation and Test Locations

Test Procedure

Test Type: CAL IV (1 specimen rehearsal)

Planned deviations from API RP 5C5 2017:

- Testing is planned for Specimen 1 Series B only.
- Testing based on reduced Material strength.
- Additional M&B cycle on the B-side

Number of Specimens: 1 (Specimen 1V5)

Test Temperatures: 96ºF (35.5ºC) for Ambient Temperature Testing
356 ºF (180 ºC) for Elevated Temperature Testing/ Bake Out

Pressure Medium Used for Testing: Nitrogen

Testing Dates & Location

Specimen	Make & Break	Bake-Out	Series B
Location	TMK IPSCO	TMK IPSCO	TMK IPSCO
1V5	08/09/2018	08/15/2018	08/26/2018

Table 1-3: Test Schedule

Identification of Test Personnel

Engineer in Charge (EIC): Pavel Sidoenko
Project Manager: Manish Nawal
Test Engineer: Kevin Henry
Technicians: Jason Park, Steven Waters, Kenneth Brown, Guy Forester, Barry Fisher, Alejandro Ruiz.

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3rd Party Monitoring

Not Applicable

Deviations and Anomalies

The actual material yield strength was 134ksi, but the load schedule was calculated based on 125ksi yield strength (93% of the actual).

The elevated temperature yield strength was calculated by the equation in section 5.5.2.6 of API RP 5C5 draft (dated 2014-04-06) based on the reduced ambient yield strength.

The Bending dogleg was reduced to 10 °/100ft.

Testing Summary

Specimen Preparation

Test specimens were machined from Vallourec (Heat# G50032) casing stock and JFE (Heat# 3-16665) coupling stock. The pins were machined according to drawing no: TMK UP CENTUM 9 5/8. 001, Revision 1 and couplings were machined according to drawing no: TMK UP CENTUM 9 5/8.002, Revision 1. All test specimens satisfied the thread and seal interference ranges outlined in API RP 5C5:2017.

Specimen/Side	Box Finish	Pin Finish
Specimen 1V5	Mn Phosphate	Bead Blasting + Molybdenum Disulfide

Table 1-4: End Surface Finish

Make & Break Testing

Test specimens were made up using horizontal tongs with 1.76 RPM. API modified thread compound (BestOLife 72733) per the quantities listed in Table 1-5 were used.

	Dope Quantity on Pin (g)	Dope Quantity on box (g)
Minimum	20±1	40±1
Maximum	24±1	48±1

Table 1-5: Make & Break Dope Quantity

Recommended torque values ranged between 39,200 and 47,900 ft-lb (53,100 and 64,900 N.m). A detailed description of the recommended make–up torque ranges are indicated in Table 1-6.

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	Nm		ft-lb	
Minimum recommended torque	53100		39200	
Optimum recommended torque	59000		43500	
Maximum recommended torque	64900		47900	
	Minimum	**Maximum**	**Minimum**	**Maximum**
High Make–Up Torque range	62500	64900	46200	47900
Low Make–Up Torque range	53100	55500	39200	40900

Table 1-6: Make-Up Torque Ranges

Bake out

Specimen 1V5 was baked out at 375ºF (190ºC) for 24 hours with load cycles as shown in Table 1-7.

Cycle	Machine Load, kips	Internal Pressure. psi	Hold time	Temperature
Heating up to 180±15°C (356 ±27°F)				
1	1000	0	1 hour	180±15°C (356±27°F)
	-1000		1 hour	
2	1000		1 hour	
	-1000		1 hour	
3	1000		1 hour	
	-1000		1 hour	
…	1000		1 hour	
	-1000		1 hour	
n	1000		1 hour	
	-1000		1 hour	

Table 1-7: Bake Out Load Cycle Schedule

Sealability Testing

The load ratings specified in Table 1-1 were used on all tested specimens (1V5). The applied loads (tension/compression) and internal pressures for each specimen assembly are provided in Figure 1-1 through Figure 1-4. All specimens met the displacement requirements per API RP 5C5:2017.

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Series B: Specimen 1V5

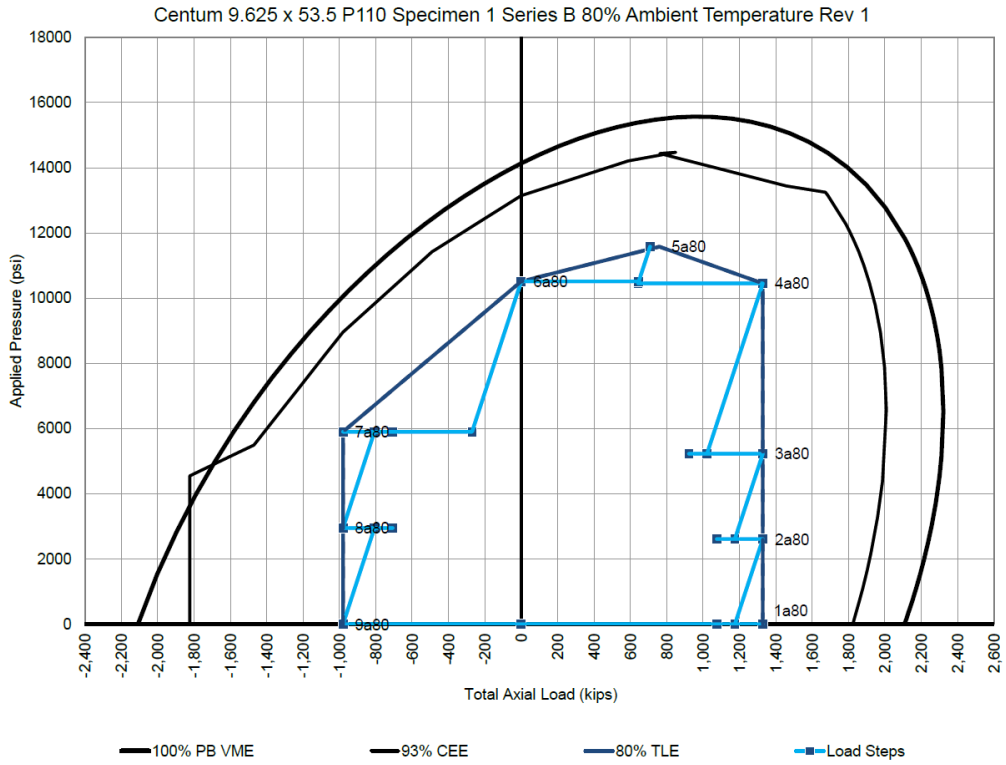

Figure 1-1: Test Envelope for TMK UP Centum Specimen 1V5 Series B (80% Ambient)

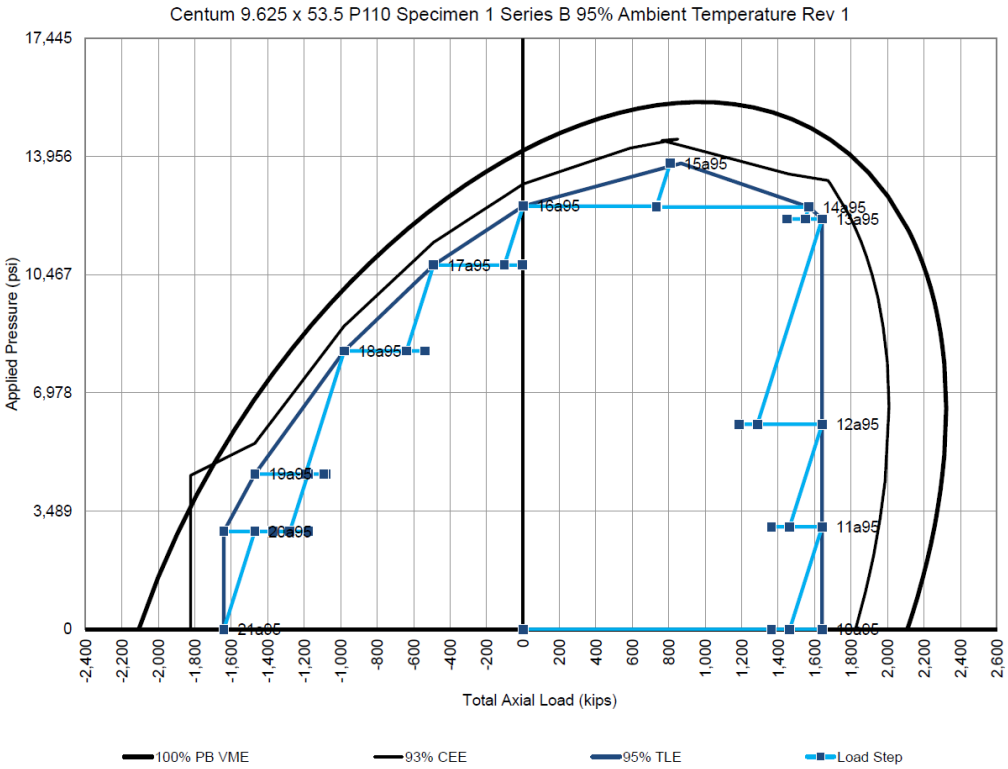

Figure 1-2: Test Envelope for TMK UP Centum Specimen 1V5 Series B (95% Ambient)

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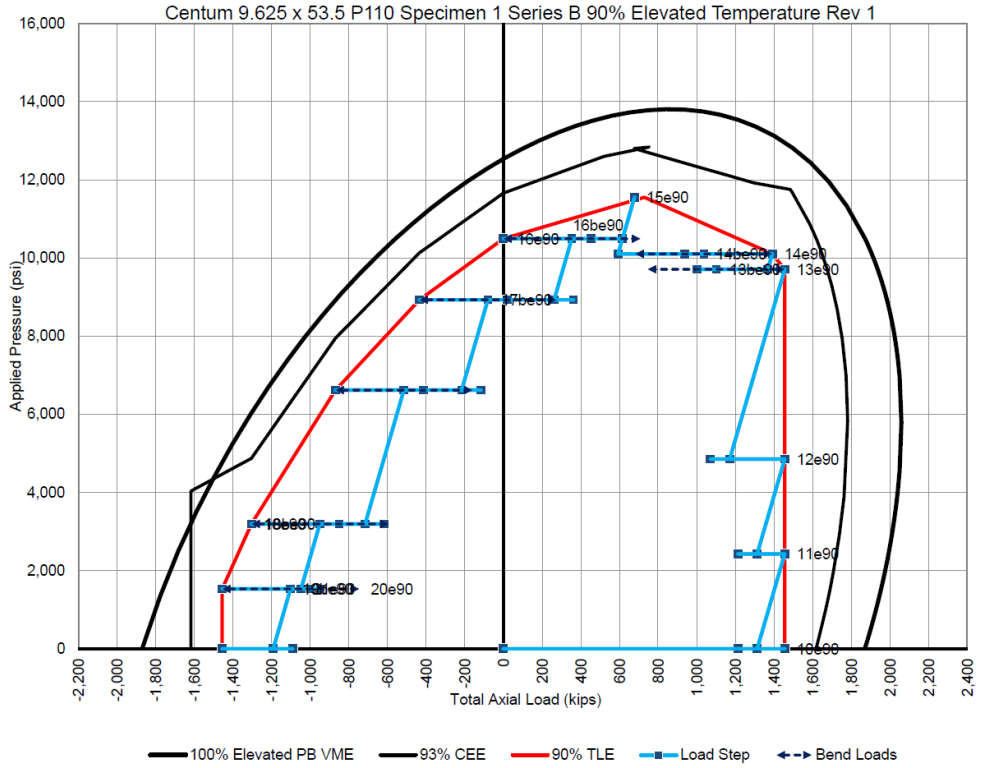

Figure 1-3: Test Envelope for TMK UP Centum Specimen 1V5 Series B (90% Elevated)

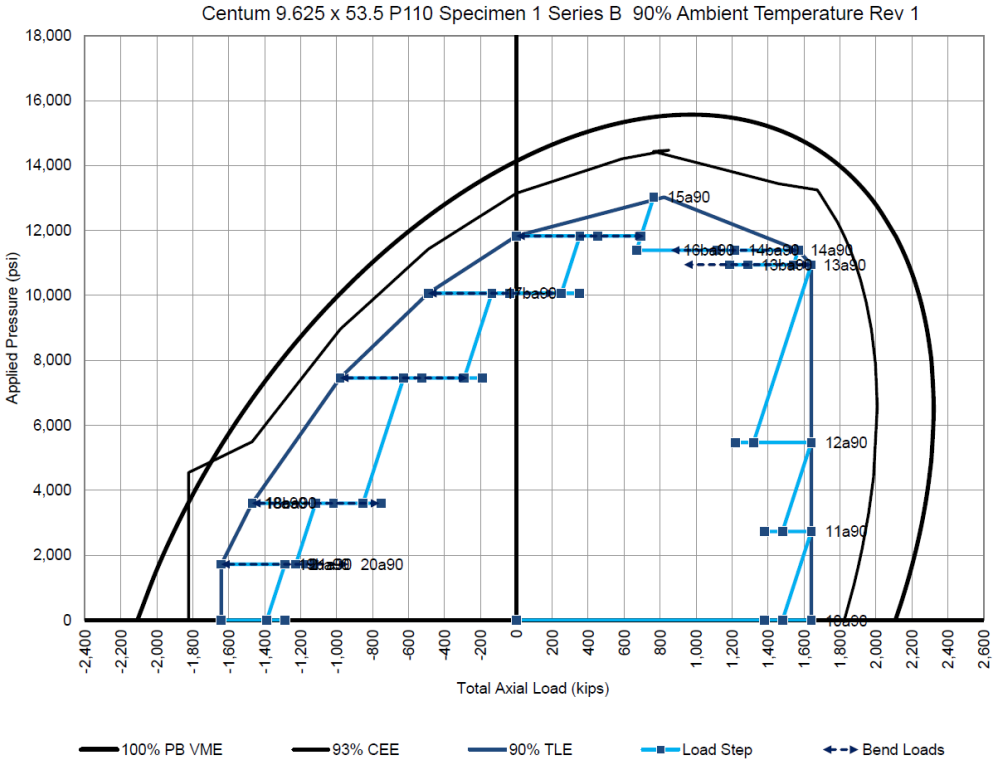

Figure 1-4: Test Envelope for TMK UP Centum Specimen 1V5 Series B (90% Ambient)

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Limit Loads:

Not Applicable

Supplemental Testing

Not Applicable

Conclusion

The 9.625” x 53.50# P110 TMK UP Centum connection Specimen 1V5 was met applicable API RP 5C5:2017 requirements per the test proposal TP PS–07–01–2018 Revision 3 with 93% tension and 93% compression efficiencies. The internal pressures corresponded to 88% PBYS respectively.

Approval Signatures

Prepared By: **Connection Test Engineer**	Kevin Henry Kevin Henry	2018.09.18 14:20:04 -05'00' Date
Reviewed By: **Design Engineer (EIC)**	Alexey Prokofyev Alexey Prokofyev	2018.09.18 15:27:21 -05'00' Date
Approved By: **General Manager of R&D**	Dhiren Panda Dhiren Panda	2018.11.15 18:14:20 -06'00' Date