



1 CERTIFICATE OF TEST

REPORT DATE: December 12, 2017

PROJECT NUMBER: RDP-105-17-041

CLIENT: TMK-Premium Services
Morozova Str. 30, Taganrog, RUSSIA 347928

TEST DATES: September 20, 2017 – October 21, 2017

CONNECTION IDENTIFICATION: TMK UP CENTUM

PIPE SIZE / GRADE: 13.375 in. OD-72 lb-Q125

TEST PROCEDURE: Test Proposal Edition 12 (TP PS-02-01-2017)

TEST TYPE: ISO 13679: FDIS 2002 CAL IV Reduced Series A

NUMBER OF SPECIMEN: 3 (Specimen 1V3, 3V3, 5V3)

SURFACE TREATMENTS: Specimen 1V3, 3V3, 5V3:
Zn. Phosphate Pins and Mn. Phosphate Coupling

TEMPERATURES USED: 27°C (80°F) for Ambient Temperature Testing

IDENTIFICATION OF TEST PERSONNEL: Engineer In-Charge: Pavel Sidorenko
Project Manager: Manish Nawal

For Tests performed at TMK-IPSCO R&D

Test Engineers: Kevin Henry
Technicians: Brian Baker, Andrico Henderson, Steve Waters, Jose Zapata, Kenneth Brown, Mohammed Alshaikly, Donald Anderson, Alex Ruiz, Harold Sanford, Jason Ward, Guy Forester.

THIRD PARTY MONITORING: SOCOTEC Oil and Gas:
Stephen Murphy

2 CONNECTION SPECIFICATIONS & RATINGS

The 13-3/8 x 72# Q125 TMK UP CENTUM connection was tested per ISO 13679: 2002 CAL IV Reduced Series A requirements as defined in the test protocol (TP PS-02-01-2017, TWELFTH EDITION). Qualification tests were performed to the ratings and specifications listed below.

Coupling OD: 14.375 in.

Coupling Length: 13.386 in.

Make – Up Loss: 6.099 in.

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Drift: 12.191 in.
Pipe ID: 12.347 in.
Thread Compound Used: BestOLife 72733
Torque (min. /opt. /max.): 38,500 / 42,800 / 47,100 ft–lbs

Connection data sheet ratings **Min. Test Rating (% of PBYS)**

		SP1V3 Series A
API Burst Pressure:	8,410 psi (100% PBYS)	95.0
API Collapse Pressure:	2,900 psi (100% PBYS)	100.0
Tensile Load:	2,597,000 lbs (100% PBYS)	95.0
Compression Load:	2,597,000 lbs (100% PBYS)	95.0
Bending (Dogleg):	42.2° / 100 ft	N/A

3 SPECIMEN PREPARATION & TEST LOCATIONS

Mechanical Property Testing: Exova,
9925 Regal Row, Houston, TX. 77040

Specimen Machining and Surface Treatments: Superior Threaded Products (STP),
9405 E. Sam Houston Pkwy N. Houston, TX 77044

Make and Breaks: TMK–IPSCO R&D Center,
10120 Houston Oaks Dr., Houston, TX 77064

Series A Sealability: TMK–IPSCO R&D Center,
10120 Houston Oaks Dr., Houston, TX 77064

4 PHYSICAL TESTING SUMMARY

Specimen 1V3 successfully met all ISO 13679: 2002 CAL IV reduced Series A requirements as defined in the test protocol (TP PS–02–01–2017, TWELFTH EDITION). Make and break trials were performed on Specimen 3V3, 5V3. A summary of test locations and dates are provided in Table A.1.

Specimen	Make & Break	Bake-Out	Series A
Location	TMK–IPSCO	TMK–IPSCO	TMK–IPSCO
1V3	10/03/2017	10/12/2017	10/21/2017
3V3	09/20/2017	N/A	N/A
5V3	09/21/2017	N/A	N/A

Table A.1: Test Summary

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The surface finish on the specimen seal and thread areas were in accordance with Table A.2.

Specimen/Side	Coupling	Pin
1V3A	Mn phosphate	Zinc phosphate
1V3B	Mn phosphate	Zinc phosphate
3V3A	Mn phosphate	Zinc phosphate
3V3B	Mn phosphate	Zinc phosphate
5V3A	Mn phosphate	Zinc phosphate
5V3B	Mn phosphate	Zinc phosphate

Table A.2: Surface Finish Conditions on Field End

5 LIST OF AMENDMENTS TO ISO 13679: 2002

The following amendments were made to ISO 13679: 2002 Series A per the test protocol (TP PS-02-01-2017, TWELFTH EDITION):

1. The number of specimens and load points was reduced (Section 6.1 of the test protocol)
2. The specified wall thickness was used to determine loads as indicated in Table A.15(Section 6.5 of the test protocol)
3. The specified yield strength was used to determine loads as indicated in Table A.15(Section 6.5 of the test protocol)
4. The specified outer diameter was used to determine loads as indicated in Table A.15(Section 6.5 of the test protocol)
5. Additional Make and Break Cycle (see section 6.2 of the test protocol)
6. Exercising specimen during bake-out (see section 6.4 of the test protocol)

6 TEST RESULTS:

6.1 Specimen Preparation

Test specimens were machined from JFE (Heat# 3--88606) casing stock and V&M (Heat# 284299) coupling stock. The pins were machined according to drawing no: *TMK UP CENTUM 13 3/8. 001, Revision 1* and couplings were machined according to drawing no: *TMK UP CENTUM 13 3/8. 002, Revision 1*. All the test specimen satisfied the thread and seal interference ranges outlined in API RP 5C5:2017.

6.2 Make and Breaks

Test samples were made up using horizontal tongs with 1.79 RPM max. API modified thread compound (BestOLife 72733) per the quantities listed in Table A.3 were used.

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	Dope quantity on pin, grams	Dope quantity on box, grams
Minimum	28±1	57±1
Maximum	33±1	69±1

Table A.3: Quantity of Dope Used During Make and Break Trials

Recommended torque values ranged between 38,500 and 47,100 ft-lb (52,200 and 63,800 N.m). A detailed description of the recommended make-up torque ranges are indicated in Table A.4 and Table A.6. The minimum, optimum and maximum make-up torques in Table A.4 and Table A.6 match the corresponding values listed in the connection data sheet. The shoulder torques on all specimens were within acceptable limits. All torque shoulders were grooved prior to FMU. Details of all Make and Breaks are shown in Table A.7 –Table A.12 below.

	N.m		ft-lb	
Minimum recommended torque	52,200		38,500	
Optimum recommended torque	58,000		42,800	
Maximum recommended torque	63,800		47,100	
	Minimum	Maximum	Minimum	Maximum
High Make-Up Torque range	99,598	100,330	73,460	74,000
Low Make-Up Torque range	57,620	58,435	42,500	43,100

Table A.4: Make-Up Torque Ranges for Specimen 1V3

	N.m		ft-lb	
Minimum recommended torque	52,200		38,500	
Optimum recommended torque	58,000		42,800	
Maximum recommended torque	63,800		47,100	
	Minimum	Maximum	Minimum	Maximum
High Make-Up Torque range	61,480	63,800	45,400	47,100
Low Make-Up Torque range	52,200	54,520	38,500	40,300

Table A.5: Make-Up Torque Ranges for all other Specimens

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Specimen 3V3B exhibited acceptable and repairable levels of galling during make and break trials. A short summary on the observed galling and the repair action is included in Table A.6 and Figure A.1.

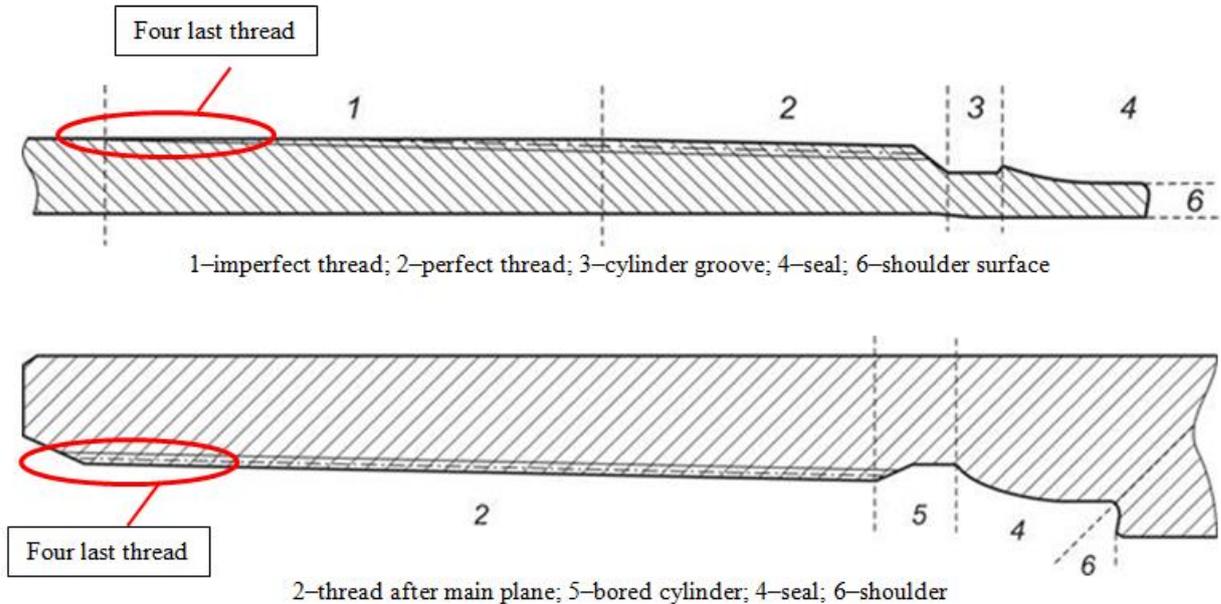


Figure A.1: Thread Galling Locations

All galling events listed in Table A.6 were evaluated by TMK-PS personnel. All galling events were deemed acceptable. All repairs were performed by TMK-PS authorized personnel.

Specimen	Cycle #	Galling Severity	Location (Refer Figure A.1)		Repair Area	Repair Equipment	Repair Time (min.)
			Pin	Box			
Specimen 3V3B	3	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Sand-paper	15

Table A.6: Make and Break Galling Summary

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Specimen 1V3 Make & Break Side A							
BOX: 1001A/ PIN:101							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
FMU	73,747	-	-	28.0	56.1	0.026	22,709

Table A.7: Specimen 1V3 Make & Break Side A

Specimen 1V3 Make & Break Side B							
BOX: 1001B/ PIN:103							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	43,117	46,736	N	28.5	57.8	0.011	23,207
2	43,783	47,319	N	27.9	57.3	0.019	17,763
3	43,586	47,889	N	27.2	57.2	0.015	17,948
FMU	43,613	-	-	28.2	57.9	0.017	18,344

Table A.8: Specimen 1V3 Make & Break Side B

Specimen 3V3 Make & Break Side A							
BOX: 1006A/ PIN:204							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	46,655	51,292	N	28.1	58.0	0.008	36,545
2	46,455	49,464	N	28.8	56.8	0.014	30,839
3	46,835	50,017	N	29.5	56.4	0.010	32,352
4	47,154	50,883	N	28.9	57.3	0.006	35,450
5	47,237	63,564	N	28.0	57.6	0.008	31,369

Table A.9: Specimen 3V3 Make & Break Side A

Specimen 3V3 Make & Break Side B							
BOX: 1006B/ PIN:205							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	47,072	47,507	N	28.7	57.7	0.010	34,947
2	46,765	49,900	N	28.9	56.7	0.012	29,245
3	47,219	49,649	Y	28.8	57.8	0.012	31,761
4	46,788	49,974	N	29.0	57.0	0.013	30,676
5	46,688	50,753	N	27.5	57.4	0.012	29,999

Table A.10: Specimen 3V3 Make & Break Side B

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Specimen 5V3 Make & Break Side A							
BOX: 1007A/ PIN:206							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	46,621	55,555	N	28.2	57.3	0.008	35,822
2	47,083	52,467	N	28.4	57.0	0.010	33,805
3	46,839	53,285	N	28.7	57.2	0.006	37,187
4	46,816	50,964	N	27.5	57.3	0.011	35,927
5	46,734	59,441	N	28.9	57.6	0.011	34,668

Table A.11: Specimen 5V3 Make & Break Side A

Specimen 5V3 Make & Break Side B							
BOX: 1007B/ PIN:207							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	46,939	49,722	N	28.7	58.0	0.011	31,870
2	47,264	53,457	N	27.0	56.5	0.088	33,064
3	46,928	53,144	N	28.6	56.0	0.010	33,791
4	46,806	52,693	N	28.5	57.1	0.012	30,678
5	47,169	53,085	N	28.7	56.9	0.011	30,195

Table A.12: Specimen 5V3 Make & Break Side B

6.3 Specimen Bake Out

Samples were baked out at 356°F for 24 hours. During Bake out, the specimen went through 6 tension/compression cycles at ± 1000kips

6.4 Sealability Tests

Ported couplings were used for external pressure testing. The coupling was ported to allow external pressure to reach the seal. Ported couplings were included at customer’s request and are not mandated by ISO 13679: 2002. Specimen 1V3 was ported prior to make and breaks trials. The port was drilled in the connection’s dope relief groove. The external pressure port status during the test for each specimen is indicated in Table A.13. The mediums used for internal and external pressure is listed in Table A.14. The variables used to calculate individual loads are listed in Table A.15.

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Test Phase	External Coupling Pressure Port Status	
	Specimen 1V3	All Other Specimens
Make and Breaks	Closed	N/A
Specimen Bake Out	Closed	N/A
Series A Test	Open	N/A

Table A.13: External Pressure Port Status

	Series A
Internal Pressure	Nitrogen
External Pressure Ambient	Water

Table A.14: Fluid / Air Mediums for Leak Detection

Temperature	Variable	Internal pressure		External pressure		
		Hoop	Axial	Hoop	Axial	API collapse
Ambient	<i>D</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>
	<i>wall</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>
	<i>MYS</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>	<i>Specified</i>
	<i>D, mm</i>	339.72	339.72	339.72	339.72	339.72
	<i>D, in</i>	13 3/8	13 3/8	13 3/8	13 3/8	13 3/8
	<i>wall, mm</i>	13.06	13.06	13.06	13.06	13.06
	<i>wall, in</i>	0.514	0.514	0.514	0.514	0.514
	<i>MYS, MPa</i>	862.00	862.00	862.00	862.00	862.00
	<i>MYS, ksi</i>	124.9	124.9	124.9	124.9	124.9

Table A.15: Variables Used to Determine Loads

The load ratings specified in Section 2 were used on all tested specimens (1V3). The applied loads (tension/compression) and pressures (internal/external) for each specimen assembly are provided in Figure A.2. All test loads followed the test procedure as specified, except as described in Section 7. Specimen 1V3 met the displacement requirements per ISO 13679: 2002.

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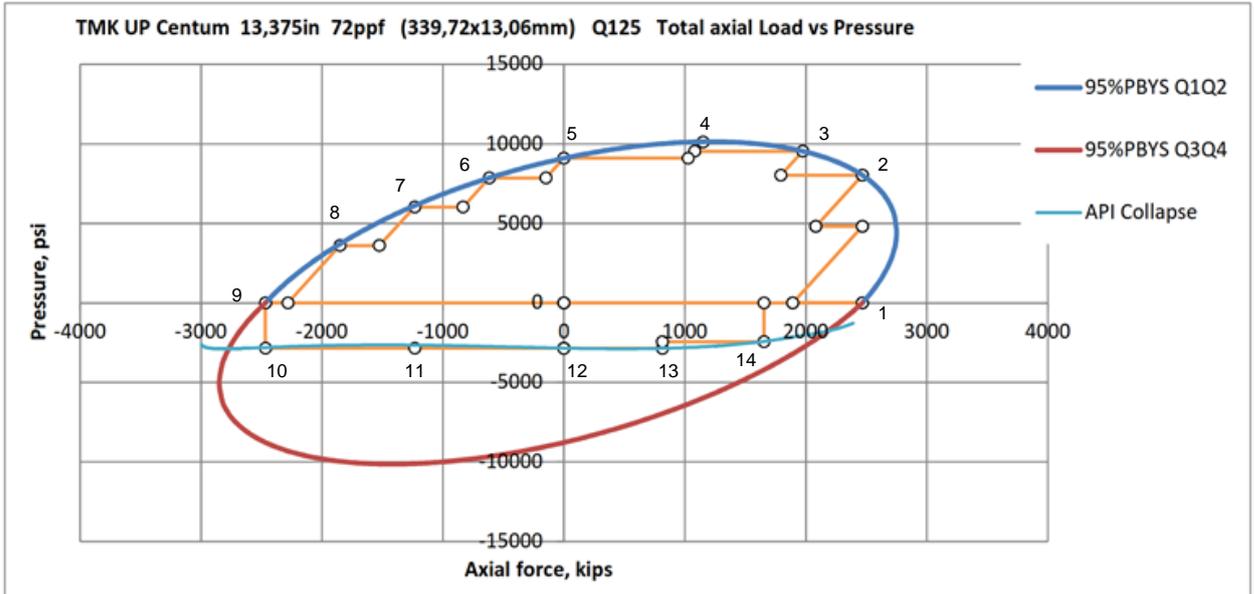


Figure A.2: Test Envelope for TMK UP CENTUM Specimen 1V3 Series A (Ambient Temperature)

7 DEVIATIONS/ANOMALIES:

7.1 Sealability Testing

Specimen 1V3 Series A:

1. LS6 (LP2) Pressure could not be maintained. It was found that the B-side end cap was leaking. The end cap was broken out, and Hunting Seal Lube was applied to end cap before it was made up again.
2. LS30 (LP13) a total displacement of 1.2cc was observed over the 15 minute hold period. The load step was run a second time with an observed displacement of .9cc. The sensitivity checked earlier determined that the maximum displacement allowed during the hold points was .8cc. At this point all pressure and loads were removed, and the sensitivity checks were repeated. The repeated sensitivity check demonstrated that any displacement above .7cc in 15 minutes would require leak evaluation protocol. After sensitivity was completed the test was restarted on Load Step #28, VME Load Point #12. Tension load was applied as stipulated in Load Step #30, VME Load Point #13. The sample was allowed to stabilize for 30 minutes before the hold started. Total displacement observed for the 15 minute hold was .7cc.

8 ADDITIONAL TESTS:

No additional tests were performed

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9 CONCLUSION:

The 13.375 x 72 Q125 TMK UP CENTUM (Variant 3) connection was successfully qualified in accordance with ISO 13679: 2002 CAL IV Reduced Series A per the test Proposal with 100% tension and 100% compression efficiencies. The internal and external pressures correspond to 100% PBYS.

10 APPROVAL SIGNATURES:

Prepared By: _____
Connection Testing Engineer Kevin Henry Date

Approved By: _____
Engineer in Charge Pavel Sidorenko Date

Reviewed By: _____
General Manager of Technology Dr. Dhiren Panda Date

Test Witnessed By: _____
SOCOTEC Representative Stephen Murphy Date

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