



# T M K U P C E N T U M T E S T

10120 Houston Oaks Dr., Houston, TX 77064  
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## 1 CERTIFICATE OF TEST

**REPORT DATE:** December 17, 2017

**PROJECT NUMBER:** RDP-105-17-055

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

**TEST DATES:** November 20, 2017 – December 15, 2017

**CONNECTION IDENTIFICATION:** TMK UP CENTUM

**PIPE SIZE / GRADE:** 6.625 in. OD-24 lb-K55

**TEST PROCEDURE:** Test Proposal Edition 1 (TP PS-15-01-2017)

**TEST TYPE:** API RP 5C5: 2017 CAL IV M&B Only

**NUMBER OF SPECIMEN:** 4 (Specimen 3, 5, 3R1, 5R1)

**SURFACE TREATMENTS:** Specimen 3, 5:  
Zn. Phosphate Pins and Mn. Phosphate Coupling  
Specimen 3R1, 5R1:  
Zn. Phosphate + GW Coating Pins and Mn. Phosphate + GW Coating Coupling

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

**IDENTIFICATION OF TEST PERSONNEL:** Engineer In-Charge: Alexey Prokofyev  
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, Chris Coode, David Tchamanzar.

**THIRD PARTY MONITORING:** Not Applicable

## 2 CONNECTION SPECIFICATIONS & RATINGS

The 6-5/8 x 24# K55 TMK UP CENTUM connection was tested per API RP 5C5: 2017 CAL IV M&B only. Qualification tests were performed to the ratings and specifications listed below.

**Coupling OD:** 7.390 in.

**Coupling Length:** 12.598 in.

**Make – Up Loss:** 4.555 in.

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**Drift:** 5.796 in.  
**Pipe ID:** 5.921 in.  
**Thread Compound Used:** BestOLife 72733  
**Torque (min. /opt. /max.):** 9,600 / 10,600 / 11,700 ft–lbs

**Connection data sheet ratings**

**API Burst Pressure:** 5,110 psi (100% PBYS)  
**API Collapse Pressure:** 4,550 psi (100% PBYS)  
**Tensile Load:** 382,000 lbs (100% PBYS)  
**Compression Load:** 382,000 lbs (100% PBYS)  
**Bending (Dogleg):** 37.5° / 100 ft

**3 SPECIMEN PREPARATION & TEST LOCATIONS**

**Mechanical Property Testing:** TMK–IPSCO R&D Center,  
 10120 Houston Oaks Dr., Houston, TX 77064  
**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

**4 PHYSICAL TESTING SUMMARY**

Make and break trials were performed on Specimen 3, 5, 3R1, and 5R1 for the purpose of testing galling resistance. A summary of test locations and dates are provided in Table A.1.

Specimen	Make & Break
	TMK–IPSCO
3V2	11/21/2017
5V2	12/15/2017
5R1V2	11/20/2017
5R1V2	11/20/2017

**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
3A	Mn phosphate	Zn phosphate
3B	Mn phosphate	Zn phosphate
5A	Mn phosphate	Zn phosphate
5B	Mn phosphate	Zn phosphate
3R1A	Mn phosphate + GW Coating	Zn phosphate + GW Coating
3R1B	Mn phosphate + GW Coating	Zn phosphate + GW Coating
5R1A	Mn phosphate + GW Coating	Zn phosphate + GW Coating
5R1B	Mn phosphate + GW Coating	Zn phosphate + GW Coating

**Table A.2:** Surface Finish Conditions on Field End

**5 LIST OF AMENDMENTS TO API RP 5C5:2017**

The following amendments were made to API RP 5C5:2017 per the test protocol (TP PS-15-01-2017, FIRST EDITION):

1. Make and Break testing only
2. Additional Make and Break Cycle (see section 6.2 of the test protocol)

**6 TEST RESULTS:**

**6.1 Specimen Preparation**

Test specimens were machined from US Steel (Heat# X84609) casing stock and Volzhsky (Heat# 241964) coupling stock. The pins were machined according to drawing no: *TMK UP CENTUM 6 5/8 001, Revision 1* and couplings were machined according to drawing no: *TMK UP CENTUM 6 5/8 002, 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 2.27 RPM max. API modified thread compound (BestOLife 72733) per the quantities listed in Table A.3 were used.

	Dope quantity on pin, grams	Dope quantity on box, grams
Minimum	15±1	27±1
Maximum	18±1	33±1

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

TMK IPSCO Confidential and Proprietary Information	TEST: 6.625" 24ppf K55 TMK UP CENTUM			PG: A.3 of A.9
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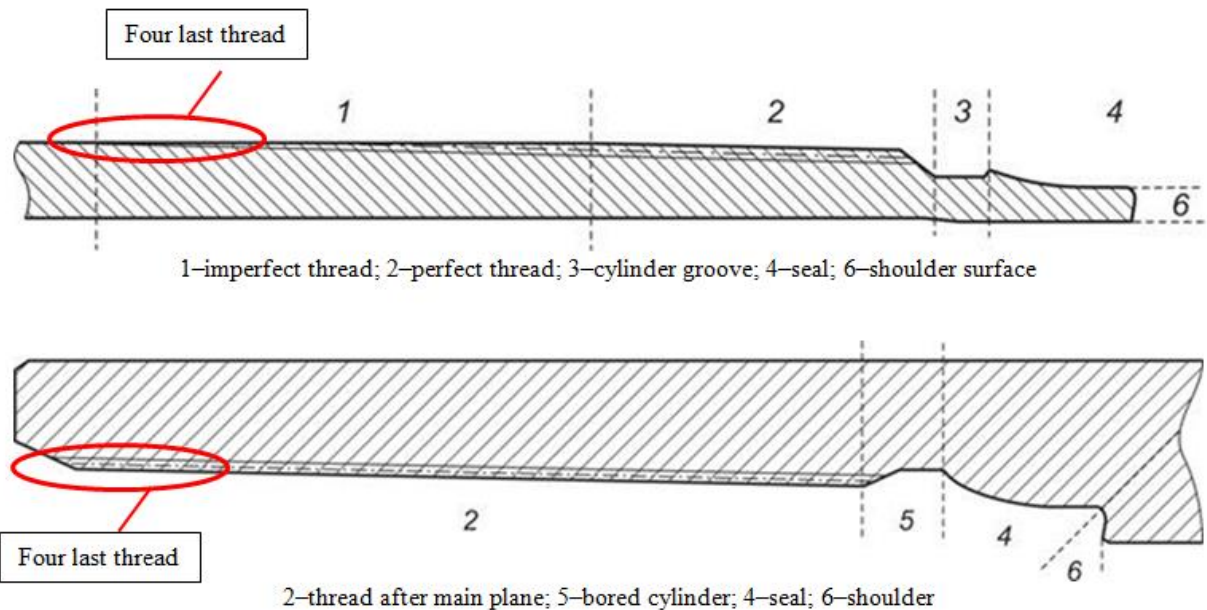
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Recommended torque values ranged between 9600 and 11700 ft-lb (13000 and 15800 N.m). A detailed description of the recommended make-up torque ranges are indicated in Table A.4. The minimum, optimum and maximum make-up torques in Table A.4 match the corresponding values listed in the connection data sheet. The shoulder torques on all specimens were within acceptable limits. Details of all Make and Breaks are shown in Table A.6– Table A.13 below.

	N.m		ft-lb	
Minimum recommended torque	13,000		9,600	
Optimum recommended torque	14,400		10,600	
Maximum recommended torque	15,800		11,700	
	Minimum	Maximum	Minimum	Maximum
High Make-Up Torque range	15,240	15,800	11,280	11,700
Low Make-Up Torque range	13,000	13,560	9,600	10,020

**Table A.4:** Make-Up Torque Ranges for All Specimens

Specimen 3A, 5A, and 5B exhibited acceptable and repairable levels of galling during make and break trials. The seventh make up graph for specimen 3B showed signs of possible yielding; further Make and Break testing was stopped on this specimen. A short summary on the observed galling and the repair action is included in Table A.5 and Figure A.1.



**Figure A.1:** Thread Galling Locations

TMK IPSCO Confidential and Proprietary Information	TEST:	6.625" 24ppf K55	TMK UP CENTUM	PG: A.4 of A.9
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All galling events listed in Table A.5 were evaluated by TMK–PS personnel. Any galling events that were deemed acceptable were repaired by TMK–PS authorized personnel.

Specimen	Cycle #	Galling Severity	Location (Refer Figure A.1)		Repair Area	Repair Equipment	Repair Time (min.)
			Pin	Box			
Specimen 3A	8	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Sand–paper	10
	9	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Sand–paper	10
	10	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Sand–paper	10
Specimen 3B	7	Light	Area 1: Last thread	Area 2: First thread	Graph showed yielding, causing M&Bs to stop		
Specimen 5A	6	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Scotch Bright	10
	7	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Scotch Bright	10
	8	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Scotch Bright	10
	9	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Scotch Bright	10
	10	Light	Area 1: Last thread	Area 2: First thread	Not repaired		
Specimen 5B	6	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Sand–paper	10
	7	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Sand–paper	10
	8	Light	Area 1: Last thread	Area 2: First thread	Pin and box	Sand–paper	10
	9	Light	Area 1: Last two threads	Area 2: First two threads	Pin and box	Sand–paper	10
	10	Light	Area 1: Last thread	Area 2: First thread	Not repaired		

**Table A.5: Make and Break Galling Summary**

TMK IPSCO Confidential and Proprietary Information	TEST: 6.625" 24ppf K55 TMK UP CENTUM			PG: A.5 of A.9
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Specimen 3 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
1	18,131	16,375	N	15.6	26.7	0.037	8,065
2	18,087	17,327	N	17.2	27.3	0.033	7,296
3	18,141	17,499	N	16.0	26.8	0.041	6,187
4	18,027	16,468	N	16.0	27.8	0.038	6,668
5	18,071	17,159	N	14.4	27.6	0.036	7,174
6	18,246	16,101	N	14.8	26.0	0.025	8,202
7	18,168	15,409	N	15.1	26.7	0.028	7,820
8	18,121	15,343	Y	14.8	26.6	0.032	7,657
9	18,245	15,963	Y	15.0	27.9	0.024	9,343
10	18,060	15,453	Y	15.2	27.5	0.037	8,623

**Table A.6:** Specimen 3 Make & Break Side A

Specimen 3 Make & Break Side B							
BOX: 1001B/ PIN:102							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	18,019	16,411	N	15.5	27.5	0.035	8,719
2	18,000	15,682	N	14.8	27.8	0.029	7,199
3	18,154	16,045	N	15.4	26.8	0.040	5,672
4	18,014	16,262	N	15.2	27.7	0.045	5,672
5	18,104	16,325	N	14.7	26.7	0.047	6,821
6	18,082	16,978	N	15.0	26.3	0.035	7,520
7	17,561	14,210	Y	16.0	27.9	0.057	7,513

**Table A.7:** Specimen 3 Make & Break Side B

TMK IPSCO Confidential and Proprietary Information	TEST: 6.625" 24ppf K55 TMK UP CENTUM			PG: A.6 of A.9
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Specimen 5 Make & Break Side A							
BOX: 1002A/ 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	16,235	17,195	N	14.9	27.3	0.019	10,408
2	16,176	16,314	N	15.6	27.0	0.051	7,994
3	15,967	13,815	N	14.9	27.1	0.031	7,097
4	16,037	13,999	N	15.4	26.4	0.043	6,224
5	16,095	15,330	N	14.5	27.5	0.031	7,629
6	14,320	13,283	Y	15.2	26.9	0.016	8,266
7	14,274	14,476	Y	15.9	27.6	0.020	7,994
8	14,176	14,820	Y	14.0	26.1	0.098	4,749
9	14,290	14,429	Y	14.2	28.0	0.025	7,535
10	14,229	14,593	Y	15.9	27.8	0.026	6,941

**Table A.8:** Specimen 5 Make & Break Side A

Specimen 5 Make & Break Side B							
BOX: 1002B/ PIN:104							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	11,310	16,802	N	15.6	27.5	0.050	9,609
2	16,126	14,696	N	16.0	27.7	0.026	8,786
3	16,093	15,582	N	16.0	26.8	0.035	7,034
4	16,137	16,353	N	16.0	27.8	0.038	7,813
5	16,175	16,242	N	15.8	27.5	0.032	7,913
6	14,246	14,110	Y	14.6	27.1	0.021	8,047
7	14,200	12,912	Y	15.1	28.0	0.060	6,066
8	14,162	12,843	Y	14.3	27.2	0.019	7,786
9	14,312	13,240	Y	16.0	27.0	0.119	4,596
10	14,297	15,033	Y	14.4	28.0	0.024	6,884

**Table A.9:** Specimen 5 Make & Break Side B

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Specimen 3R1 Make & Break Side A							
BOX: 1003A/ PIN:105							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	15,048	17,495	N	—	—	0.043	13,028
2	16,092	22,028	N	—	—	0.035	12,382
3	16,090	15,817	N	—	—	0.023	12,933
4	16,153	15,683	N	—	—	0.022	12,602
5	16,155	13,082	N	—	—	0.014	13,672

**Table A.10:** Specimen 3R1 Make & Break Side A

Specimen 3R1 Make & Break Side B							
BOX: 1003B/ PIN:106							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	15,992	14,298	N	—	—	0.063	12,317
2	16,137	16,319	N	—	—	0.032	12,092
3	16,120	17,078	N	—	—	0.040	11,540
4	16,027	16,643	N	—	—	0.022	12,834
5	16,181	15,065	N	—	—	0.014	13,724
Yield	22,581	N/A	N	—	—	0.047	21,120

**Table A.11:** Specimen 3R1 Make & Break Side B

Specimen 5R1 Make & Break Side A							
BOX: 1004A/ PIN:107							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	18,035	18,284	N	—	—	0.060	13,416
2	18,125	18,022	N	—	—	0.035	12,280
3	18,125	19,177	N	—	—	0.029	12,672
4	18,089	16,292	N	—	—	0.037	12,250
5	18,190	16,433	N	—	—	0.025	13,065

**Table A.12:** Specimen 5R1 Make & Break Side A

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Specimen 5R1 Make & Break Side B							
BOX: 1004B/ PIN:108							
Make Up	MU Torque ft-lbs	BO Torque ft-lbs	Galling (Y/N)	Dope Pin grams	Dope Box grams	Delta Turns	Shoulder Torque
1	18,013	15,690	N	—	—	0.056	11,878
2	18,063	17,000	N	—	—	0.039	11,511
3	18,126	16,453	N	—	—	0.033	11,816
4	18,197	16,594	N	—	—	0.028	12,058
5	18,162	16,370	N	—	—	0.027	12,230

Table A.13: Specimen 5R1 Make & Break Side B

**7 DEVIATIONS/ANOMALIES:**

No deviations other than the galling listed in section 6.2 occurred.

**8 ADDITIONAL TESTS:**

No additional tests were performed

**9 CONCLUSION:**

The 6-5/8 x 24 K55 TMK UP CENTUM connection met the make and break requirements listed in the test protocol (TP PS-15-01-2017, FIRST EDITION).

**10 APPROVAL SIGNATURES:**

**Prepared By:** \_\_\_\_\_  
**Connection Testing Engineer** Kevin Henry Date \_\_\_\_\_

**Approved By:** \_\_\_\_\_  
**Engineer in Charge** Alexey Prokofyev Date \_\_\_\_\_

**Reviewed By:** \_\_\_\_\_  
**General Manager of R&D** Dr. Dhiren Panda Date \_\_\_\_\_

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