REPORT OF THIRD-PARTY INSPECTION

Report No. & Version:	316768, Rev 00
Project Number:	8113550
Applicant:	FX FLOW CONTROL BV.
Contact Person:	Mr. Yang
Inspection Place:	Wenzhou City, Zhejiang province, China.
Inspector:	Jeff Cheng

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

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TYPE APPROVAL TEST (TAT) OF INDUSTRIAL VALVE

10” 900LB, Trunnion Ball Valve, RF, Body: A105N, Bi-directional

Nature Of Inspection

This is to certify that we, TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Office at the request of FX FLOW CONTROL BV. conducted the following valve inspection and the test result is compliance with SPE 77/300-2022--- PROCEDURE AND TECHNICAL SPECIFICATION FOR DESIGN VALIDATION TESTING OF INDUSTRIAL VALVES

Signature by TÜV SÜD:

Jeff. Cheng

Reviewed by TUV SÜD:

Way Zhong Xing

Date of issue: Dec. 30, 2024

Test Valve Information:

Item no.:	7	Stem diameter (mm):	75
Serial no.:	FX2412-S1	Gasket diameter (mm):	430
Type of valve:	Trunnion Ball Valve	Product standard:	API 6D
Size:	NPS 10	Material of Body/Bonnet:	ASTM A105N
Material of Trim	ASTM A182 F316/ DEVLON	Class:	900LB
Type of flange sealing:	RF	Design Temp. Rang:	-29°C to +120°C
Test Temp. Rang:	-29°C to +120°C	FE test class	B
Method of sealing:	Ball: ASTM A182 F316, Seat: DEVLON		

Qualified Information:

- ✧ Manufacturer: FX FLOW CONTROL BV.
- ✧ Manufacturer Location: Upscale Digital Pump and Valve Industrial Park, Qiaoxia Town, Yongjia County, Wenzhou City, Zhejiang Province
- ✧ Test Location: Wenzhou City, Zhejiang province, China.
- ✧ Type of Test: Design Validation Testing
- ✧ Test Standard: MESC SPE 77/300-2022
- ✧ Testing Product: 10” 900LB, Trunnion Ball Valve, RF, Body: A105N, Bi-directional
- ✧ Qualified Range: DN100~DN350(NPS 4" FB~14" FB);
  Class 150LB; 300LB; 600LB; 900LB;
  Remark: the qualification shall be subject to the limit according to the clause 5 and APPENDIX C of SPE 77/300-2022.
- ✧ Validity: Valve prototype test results accepted by Shell Global Solutions remain valid for a period of 5 years, starting from the approval of the test report, provided there are no significant changes in design or manufacturing procedures or sites.

Remark: Test detais please refer to inspection report no. 316767 Rev.0.

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Report No. & Version:	308999, Rev 00
Project Number:	8113550
Applicant:	FX FLOW CONTROL BV
Address:	Upscale Digital Pump and Valve Industrial Park, Qiaoxia Town, Yongjia County, Wenzhou City, Zhejiang Province
Manufacturer:	FX FLOW CONTROL BV
Address:	Upscale Digital Pump and Valve Industrial Park, Qiaoxia Town, Yongjia County, Wenzhou City, Zhejiang Province
Contact Person:	Mr. Yan
Inspection Place:	Wenzhou City, Zhejiang province, China.
Inspector:	Jeff Cheng
Department:	IS

Revisions

Revision	Date	Changes
00	2024.12.30	First version
/	/	/

This report supersedes any previous revisions.

Product/Article List

Item No.	Commodity Description	Drawing Number	Quantity	Product Serial Number	Remarks
7	NPS 10 900LB, Trunnion Ball Valve, RF, Body: A105N, Bi-directional	10"Q347N-900LB-1	1	FX2412-S1	/

Nature of Inspection: 1. Design Validation Testing

This is to report that we, TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch at the request of FX FLOW CONTROL BV conducted the following inspections according to SPE 77/300-2022.

1. Inspection Summary

As per the manufacturer's arrangement, TÜV SÜD inspector Mr. Jeff Cheng visited Wenzhou Haichuan Inspection and Test Co. Ltd. to carry out the design validation testing for above list valve, the results were acceptable.

2. Personnel Met

- Mr. Qu Zhaoquan—Test Engineer--Haichuan
- Mr. Jeff Cheng --Inspector--TÜV SÜD

3. Reference Documents and Standard

- Drawing: 10"Q347N-900LB-1
- SPE 77/300-2022
- ASME B16.34

4. Inspection Activities

4.1 Pre-test condition check

- ✧ The inspector verified calibration status of all gauges & test equipment engaged in the test course. All instruments certificates were provided for review & they were all in valid periods.
- ✧ Verified the sampled valve for testing as per provided drawing.
- ✧ The test medium was Nitrogen & Helium. Analysis certificate of test medium-Helium was reviewed & accepted with purity more than 97%.
- ✧ Verified the test rig arrangement basically conform to SPE 77/300 C.2.5, instrumentation general arrangement for TAT. Proper thermocouples' number & type was verified prior to testing & were arranged respectively for environment, body & near closure member.
- ✧ Verified the testing sample valve position that is compliance with the requirement of the Annexure reference clauses of SPE 77/300 C2.12 table.

4.2 Test course

As per the design temperature range of the valves on the drawings, -29~120°C for ball valve and -29~120°C for test temperature, as per the design temperature range of the valves, according to SPE 77/300, C.3.2, test sequences no. 8 was applied for the test course of the ball valve.

4.3 TAT Process

4.3.1 Initial ambient test

- ✧ Considering the valve size is 10inch, 75x mechanical cycles at 100% DP for run-in have been applied for the ball valve;
- ✧ LP (2bar) seat leakage test for both side has been performed & no leak bubbles were observed in 5mins. BTO torque and ETC torque have been recorded at the 1st mechanical cycle & with 4 additional cycles followed.
- ✧ Incremental pressure seat leakage test for both side has been performed (35%, 70% & 110% DP) & no leak bubbles were observed in 5min for each step. After each step, one cycle was followed as specified. ETC torque of each step was recorded for ball valve.
- ✧ Shell/body test was performed at 110% DP & the duration time was 15mins according to table C.10 & dynamic & static FE testing followed at 100% DP. Before FE leakage detecting, 17x cycles for ball valve as specified. The test results of shell & FE were acceptable. No pressure dropped during shell test & FE results in the acceptable range for Cl. B. Soap water was sprayed on the body of ball valve & no bubble was observed.
- ✧ High pressure seat leakage test for both side has been performed at 100% DP & no leak bubbles were observed in 5mins. BTO torque was recorded when cycling. ETC torque was recorded for ball valve.

4.3.2 Elevated Temp. Test

- ✧ When the final test temperature (+120°C, with 5% or ±15°C variation which is less applicable) achieved & stably maintained, elevated temperature test was performed for sample valve as follow steps.
- ✧ LP (2bar) seat leakage test for both side has been performed & no leak bubbles were observed in 5mins. BTO torque have been recorded at the 1st mechanical cycle & with 4 additional cycles followed.
- ✧ Incremental pressure seat leakage test for both side has been performed (33%, 66% & 100% DP) & no leak bubbles were observed in 5mins for each step. After each step, one cycle was followed as specified. ETC torque of each step was recorded for ball valve.
- ✧ Shell/body test was performed at 100% DP & the duration time was 15mins according to table C.10 & dynamic & static FE testing followed. Before FE leakage detecting, 18x cycles for ball valve as specified. The test results of shell & FE were acceptable. No pressure dropped during shell test & FE results in the acceptable range for Cl. B.
- ✧ High pressure seat leakage test for both side has been performed at 100% DP & no leak bubbles were observed in 5mins. BTO torque have been recorded when cycling. ETC torque was recorded for ball valve.

4.3.3 Low Temp. Test

- ✧ When the final test temperature (-29°C, with 5% or ±15°C variation which is less applicable) achieved & stably maintained, elevated temperature test was performed for sample valve as follow steps.
- ✧ LP (2bar) seat leakage test for both side has been performed & no leak bubbles were observed in 5mins. BTO torque have been recorded at the 1st mechanical cycle & with 4 additional cycles followed.
- ✧ Incremental pressure seat leakage test for both side has been performed (35%, 70% & 110% DP) & no leak bubbles were observed in 5mins for each step. After each step, one cycle was followed as specified. ETC

torque of each step was recorded for ball valve.

- ✧ Shell/body test was performed at 110% DP & the duration time was 15mins according to table C.10 & dynamic & static FE testing followed. Before FE leakage detecting, 17x cycles for ball valve as specified. The test results of shell & FE were acceptable. No pressure dropped during shell test & FE results in the acceptable range for Cl. B.
- ✧ High pressure seat leakage test for both side has been performed at 100% DP & no leak bubbles were observed in 5mins. BTO torque have been recorded when cycling. ETC torque was recorded for ball valve.

4.3.4 Final ambient test

- ✧ Final ambient test was performed after the valve temperature recovered to environment temperature.
- ✧ LP (2bar & 7bar) seat leakage tests for both side has been performed, no leak bubbles were observed in 5mins, before test, the ETC torque were checked and record.
- ✧ High pressure seat leakage test for both side has been performed at 100% DP & no leak bubbles were observed in 5mins. BTO torque have been recorded when cycling. ETC torque was recorded for ball valve

4.3.5 Post-test inspection

After all the TAT courses finished, the valve was later disassembled & no excessive wearing or damage was found out for internal seal parts.

5 Measuring & Testing Equipment

See test table below

6 Results and conclusions

Acceptable

7 Overall order status

N/A

8. Annexes:

1) Copy of Drawing No.: 10"Q347N-900LB-1
2) Copy of Test Record of TAT No.: HCT2024VB06723

Testing table as below:

Test details for NPS 10 900LB Trunnion Ball Valve (Bi-directional)					
Initial ambient test					
Test pressure & duration	Test type	Cycles	Actual measuring	Acceptance criteria	Conclusion
153.2bar	Max. DP Run-in test	75	Smooth	Smooth operation	Accepted
2bar/5min (Side A)	LP seat	1+4	0	0ml/min	Accepted
2bar/5min (Side B)	LP seat	1+4	0	0ml/min	Accepted
Side A	Torque test BTO/ETC	1st of 5	7.6N.m/9.2N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	1st of 5	5.8N.m/8.5N.m	≤44.1N.m	Accepted
54bar/5min (Side A)	35%DP seat	1	0ml/min	0ml/min	Accepted
107bar/5min (Side A)	70%DP seat	1	0ml/min	0ml/min	Accepted
168.6bar/5min (Side A)	110%DP seat	1	0ml/min	0ml/min	Accepted
54bar/5min (Side B)	35%DP sea	1	0ml/min	0ml/min	Accepted
107bar/5min (Side B)	70%DP seat	1	0ml/min	0ml/min	Accepted
168.6bar/5min (Side B)	110%DP seat	1	0ml/min	0ml/min	Accepted
168.6bar/10min	Shell test, 110%DP	/	0	0	Accepted
154bar	FET (He)	17	See below	See below	Accepted
154bar/5min (Side A)	HP seat	1	0ml/min	0ml/min	Accepted
154bar/5min (Side B)	HP seat	1	0ml/min	0ml/min	Accepted
Side A	Torque test BTO/ETC	/	8.5N.m/29.1N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	/	7.8N.m/33.6N.m	≤44.1N.m	Accepted
Position	Static/dynamic	mbar*l/s	Allowable leakage	mbar*l/s	Conclusion
Body seal	2.07E-07	mbar*l/s	2.40E-05	mbar*l/s	Accepted
Stem packing	2.27E-07	mbar*l/s	1.60E-05	mbar*l/s	Accepted
Stem	8.61E-07/1.09E-06	mbar*l/s	1.33E-04	mbar*l/s	Accepted
@120°C, elevated temperature test					
Test pressure & duration	Test type	Cycles	Actual measuring	Acceptance criteria	Conclusion
2bar/5min (Side A)	LP seat	1+4	0	0ml/min	Accepted

2bar/5min (Side B)	LP seat	1+4	0	0ml/min	Accepted
Side A	Torque test BTO/ETC	1st of 5	8.9N.m/13.7N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	1st of 5	9.2N.m/12.7N.m	≤44.1N.m	Accepted
41.8bar/5min (Side A)	33%DP seat	1	0ml/min	0ml/min	Accepted
84.4bar/5min (Side A)	66%DP seat	1	0ml/min	0ml/min	Accepted
126.7bar/5min (Side A)	100%DP sea	1	0ml/min	0ml/min	Accepted
41.8bar/5min (Side B)	33%DP seat	1	0ml/min	0ml/min	Accepted
84.4bar/5min (Side B)	66%DP seat	1	0ml/min	0ml/min	Accepted
126.7bar/5min (Side B)	100%DP seat	1	0ml/min	0ml/min	Accepted
126.7bar/10min	Shell test, 100%DP	/	0	0	Accepted
126.7bar	FET, 100%DP (Helium)	18	See below	See below	Accepted
126.7bar/5min (Side A)	HP seat	1	0	0ml/min	Accepted
126.7bar/5min (Side B)	HP seat	1	0	0ml/min	Accepted
Side A	Torque test BTO/ETC	/	11.0N.m/31.2N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	/	10.3N.m/30.1N.m	≤44.1N.m	Accepted
Position	Static/dynamic	mbar*l/s	Allowable leakage	mbar*l/s	Conclusion
Body seal	3.54E-06	mbar*l/s	2.40E-05	mbar*l/s	Accepted
Stem packing	2.15E-06	mbar*l/s	1.60E-05	mbar*l/s	Accepted
Stem	1.69E-05/6.63E-05	mbar*l/s	1.33E-04	mbar*l/s	Accepted
@-29°C, low temperature test					
Test pressure & duration	Test type	Cycles	Actual measuring	Acceptance criteria	Conclusion
2bar/5min (Side A)	LP seat	1+4	0	≤0ml/min	Accepted
2bar/5min (Side B)	LP seat	1+4	0	≤0ml/min	Accepted
Side A	Torque test BTO/ETC	1st of 5	9.5N.m/11.7N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	1st of 5	10.7N.m/11.9N.m	≤44.1N.m	Accepted
54bar/5min (Side A)	35%DP seat	1	0ml/min	0ml/min	Accepted
108bar/5min (Side A)	70%DP seat	1	0ml/min	0ml/min	Accepted
169bar/5min (Side A)	110%DP seat	1	0ml/min	0ml/min	Accepted
54bar/5min (Side B)	35%DP seat	1	0ml/min	0ml/min	Accepted

69.4bar/5min (Side B)	70%DP seat	1	0ml/min	0ml/min	Accepted
169bar/5min (Side B)	110%DP seat	1	0ml/min	0ml/min	Accepted
168.6bar/15min	Shell test, 110%DP	/	0	0	Accepted
153.5bar	FET (He)	17	See below	See below	Accepted
153.5bar/5min (Side A)	HP seat	1	0ml/min	≤0ml/min	Accepted
153.5bar/5min (Side B)	HP seat	1	0ml/min	≤0ml/min	Accepted
Side A	Torque test BTO/ETC	/	10.7N.m/40.0N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	/	11.6N.m/39.2N.m	≤44.1N.m	Accepted
Position	Static/dynamic	mbar*l/s	Allowable leakage	mbar*l/s	Conclusion
Body seal	1.63E-05	mbar*l/s	2.40E-05	mbar*l/s	Accepted
Stem packing	1.38E-05	mbar*l/s	1.60E-05	mbar*l/s	Accepted
Stem	6.21E-06/9.80E-06	mbar*l/s	1.33E-04	mbar*l/s	Accepted
Final ambient temperature test					
Test pressure & duration	Test type	Cycles	Actual measuring (ml/min)	Acceptance criteria (ml/min)	Conclusion
2bar/5min (Side A)	LP seat	0	0	0ml/min	Accepted
2bar/5min (Side B)	LP seat	0	0	0ml/min	Accepted
7bar/5min (Side A)	LP seat	0	0	0ml/min	Accepted
7bar/5min (Side B)	LP seat	0	0	0ml/min	Accepted
154bar/5min (Side A)	100%DP seat	1	0	0ml/min	Accepted
154bar/5min (Side B)	100%DP seat	1	0	0ml/min	Accepted
Side A	Torque test BTO/ETC	/	10.3N.m/24.4N.m	≤44.1N.m	Accepted
Side B	Torque test BTO/ETC	/	9.5N.m/23.0N.m	≤44.1N.m	Accepted
Post-test inspection					
No excessive wearing or damage was found out for internal seal parts.					

Inspected by: Jeff Cheng

Signature: 

Date: Dec. 30, 2024

Reviewed by: Wang Zhongxiang

Signature:

Date: Dec. 30, 2024