

Inspection Report

Pressure Cycling Test & Vibration Tests for Stainless Steel Fittings

Brand name: TBI

Location of inspection: Hydieling Industry Park, Xiantang Town, Dongyuan Country,
Heyuan City, Guangdong Province, China

Date of inspection: 28 & 29 October 2015

To:

Topbuild Investments Ltd.
(Attn: Miss Olivia Chow)

Inspected by:


W.K. Leung
(Inspector)

Approved by:


K.K. Ho
(Technical Manager)

Inspection Report

Customer : Topbuild Investments Ltd.

Address : Unit 2A, 1/F, Tower 1, Harbour Centre, 1 Hok Cheung Street, Hung Hom, Kowloon

Brand name : TBI

Subject : Inspection of Stainless Steel Fittings (Pressure Cycling Test & Vibration Tests)

Assigned inspector : Mr. W.K. Leung

At the request of "Topbuild Investments Ltd.", a factory inspection of the manufactured products for installation at the project has been carried out with details as follow:

1. Date of inspection : 28 & 29 October 2015
2. Location of inspection : Hydieling Industry Park, Xiantang Town, Dongyuan Country, Heyuan City, Guangdong Province, China
3. Applicable document : Customer's method statement ref: TBI 201501 dated 06-10-2015 with reference to prEN10352: 2010 Annex F and TBI 201502 dated 06-10-2015 with reference to prEN10352: 2010 Annex H
4. Scope of works :
 - (1) Witnessing pressure cycling test
 - (2) Witnessing vibration tests
 - (3) Review of customer's documentation and verification of measuring & testing equipments for validity
 - (4) Conclusion
 - (5) Submission of inspection report

5. Inspection details & results :

| Item no. | Sample description | Nominal diameter (mm) | Body marking | Quantity of sample for inspection | |
|----------|---------------------------------|------------------------------------|------------------|-----------------------------------|----------------------|
| | | | | Pressure cycling test (set) | Vibration test (set) |
| 1 | Elbow 90° | 15, 22, 28, 35, 42 & 54 | TBI (size) - 304 | 1 | N/A |
| | Straight coupling | 15, 22, 28, 35, 42 & 54 | | | |
| | Reducer | 22x15, 28x22, 35x28, 42x35 & 54x42 | | | |
| 2 | Elbow 90° and straight coupling | 15 | | N/A | 1 |
| 3 | Elbow 90° and straight coupling | 22 | | N/A | 1 |
| 4 | Elbow 90° and straight coupling | 28 | | N/A | 1 |
| 5 | Elbow 90° and straight coupling | 35 | | N/A | 1 |
| 6 | Elbow 90° and straight coupling | 42 | | N/A | 1 |
| 7 | Elbow 90° and straight coupling | 54 | | N/A | 1 |

Table 1 – Details of test samples

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(1) Witnessing pressure cycling test

- The test assembly of tubes and different sizes of fittings (see item no.1 of Table 1 for details) were filled with water, and with air expelled prior to the commencement of the test. The test assembly was allowed to attain test temperature of $23 \pm 5^{\circ}\text{C}$ before test started. The test assembly was then subjected to pressure cycling between two positive pressure limits (See Table 2 below). Pressurizing device for applying and regulating the water pressure in the test samples to the high and low pressure limits and number and frequency of cycles was employed in the test. After pressure cycling, the test assembly was subjected to a hydrostatic pressure test (Test pressure: 24 ± 1 bar; test duration: 1 hr).

(Remark: Typical drawing of test arrangement provided by the Customer is attached in Appendix C of this report.)

- Recorded parameters during inspection:

- a) Test temperature at start: 24°C
- b) Free length on each side of fittings under test: End 1 of 300mm and End 2 of 300mm
- c) Pressure at start, intermittent and completion of test: within specified low and high pressure limits.
- d) Number of elapsed cycles from digital counter after pressure cycling: 10,000
- e) Total time elapsed for the complete pressure cycling: 6 hours 3 minutes
- f) After pressure cycling, test pressure: 24 bar; test duration: 1 hr.

- Observation: There were no visible signs of leakage observed from fittings after completion of the whole test.

| Pressure limit | | Number of cycles | Frequency of cycles per min | Number of test pieces per size |
|----------------|--------------|------------------|-----------------------------|--------------------------------|
| Low bar | High bar | | | |
| 1 ± 0.5 | 25 ± 0.5 | 10,000 | 30 ± 5 | 3 |

Table 2 – Pressure cycling test parameters

(2) Witnessing vibration tests

- The test assembly of tubes, two elbows and two straight couplers of the same nominal diameter (see items no.2 to 7 of Table 1 for details) were filled with water, and with air excluded prior to the commencement of the test. The test assembly was then subjected to specified number of cycles and frequency of cycles of vibration under specified water pressure and deflection (See Table 3 below). For each test assembly of the same nominal diameter, an independent drive which incorporates an eccentric disc to produce a specified displacement at the free end of the assembly and providing a vibration at the specified frequency of cycles was employed in the test. After vibration test, each test assembly was subjected to a hydrostatic pressure test (Test pressure: 24 ± 1 bar; test duration: 1 hr).

(Remark: Typical drawings of test arrangement provided by the Customer is attached in Appendix D of this report.)

| Test pressure | Deflection (mm) | Number of cycles | Frequency of cycles Hz | Number of test pieces per size |
|------------------|-----------------|------------------|------------------------|--------------------------------|
| 15 ± 0.5 bar | ± 1 | 1,000,000 | 20 | 4 |

Table 3 – Vibration test parameters

- Recorded parameters during inspection:

| Nominal diameter (mm) | 15 | 22 | 28 | 35 | 42 | 54 |
|---------------------------------|--|--|--|--|--|--|
| Deflection | within specified deflection of $\pm 1\text{mm}$ | within specified deflection of $\pm 1\text{mm}$ | within specified deflection of $\pm 1\text{mm}$ | within specified deflection of $\pm 1\text{mm}$ | within specified deflection of $\pm 1\text{mm}$ | within specified deflection of $\pm 1\text{mm}$ |
| Test pressure (at start) | within specified test pressure of $15\pm 0.5\text{ bar}$ | within specified test pressure of $15\pm 0.5\text{ bar}$ | within specified test pressure of $15\pm 0.5\text{ bar}$ | within specified test pressure of $15\pm 0.5\text{ bar}$ | within specified test pressure of $15\pm 0.5\text{ bar}$ | within specified test pressure of $15\pm 0.5\text{ bar}$ |
| Test pressure (at intermittent) | | | | | | |
| Test pressure (at completion) | | | | | | |
| Number of cycles | 1,000,072 | 1,000,034 | 1,000,029 | 1,000,106 | 1,000,089 | 1,000,063 |
| Total time elapsed | 13 hrs 50 mins | 13 hrs 49 mins | 13 hrs 47 mins | 14 hrs 2 mins | 13 hrs 56 mins | 13 hrs 52 mins |

- For each test assembly of the same nominal diameter after vibration test, test pressure: 24 bar; test duration: 1 hr.

- Observation: There were no visible signs of leakage observed from fittings after completion of the whole test.

(3) Review of customer's documentation and verification of measuring & testing equipments for validity

| Appendix no. | Document type | Remark |
|--------------|--|--------------------|
| A | Customer's method statement for testing the resistance of joints with tube to pressure cycling Ref. no. TBI 201501 dated 06-10-2015 with reference to prEN10352: 2010 Annex F | For reference |
| B | Customer's method statement for testing the resistance of joints with tube to vibration Ref. no. TBI 201502 dated 06-10-2015 with reference to prEN10352: 2010 Annex H | For reference |
| C | Customer's drawing for set up in testing of the resistance of joints with tube to pressure cycling | For reference |
| D | Customer's drawings for set up in testings of the resistance of joints with tube to vibration | For reference |
| E | Calibration certificate of thermometer | Check for validity |
| F | Calibration certificate of pressure gauge | Check for validity |
| G | Calibration certificate of measuring tape | Check for validity |
| H | Calibration certificate of vernier caliper | Check for validity |
| I | Calibration certificate of timing device | Check for validity |

(4) Conclusion

- Based on our inspection results, there were no visible signs of leakage observed from fittings after completion of pressure cycling test / vibration tests when tested in accordance with the procedures documented in Customer's method statement ref: TBI 201501 dated 06-10-2015 with reference to prEN10352: 2010 Annex F and TBI 201502 date 06-10-2015 with reference to prEN10352: 2010 Annex H.

End of Report