



Letter of Attestation

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Master Contract: 242437

Project: 70051724

Date Issued: October 28, 2015

Issued to: Pietro Fiorentini S.p.A.
Via Enrico Fermi 8/10
Arcugnano, Vicenza 36057
Italy

Attention: Armando Amadini

*CSA Group, Certification and Testing hereby confirms that it has completed an evaluation of:
Thermal Valve Models TVD1 and TVD2*

*CSA Group, Certification and Testing hereby attests that the products identified above and described
in test report 11-15 dated June 24th 2015
complies with the following tests, to the extent applicable:*

- *TVD1 & TVD2 – Flow Intervention at Set-Points 100°C, 130°C, 160°C*
- *TVD1 & TVD2 – Seal Test After Intervention at 140° Pressure Range 0.7 bar to 10 bar*
- *TVD1 & TVD2 – Integrity of Intervention of Temperature Range. 650°C, 800°C and 25*
- *TVD1 & TVD2 – Pressure Drop (Flow Capacity) Inlet Pressure Range 1 psig to 30 psig*


Issued by: _____

A handwritten signature in blue ink, appearing to read 'Richard Clark', written over a dashed line.

Richard Clark

THIS LETTER OF ATTESTATION DOES NOT AUTHORIZE THE USE OF THE CSA MARK ON THE SUBJECT PRODUCTS.

QUOTATIONS FROM THE TEST REPORT OR THE USE OF THE NAME OF THE CANADIAN STANDARDS ASSOCIATION AND CSA GROUP OR ITS REGISTERED TRADEMARK, IN ANY WAY, IS NOT PERMITTED WITHOUT PRIOR WRITTEN CONSENT OF THE CANADIAN STANDARDS ASSOCIATION OPERATING AS CSA GROUP, CERTIFICATION AND TESTING DIVISION.

| | | |
|--|----------------------|------------------------------------|
|  Pietro Fiorentini® Divisione Prodotti Residenziali e Commerciali: Via Faustinella 11/13/15 I-25015 Desenzano del Garda (BS) Tel. +39 030 91 48 511 Fax. +39 030 91 48 514 | <h1>TEST REPORT</h1> | TEST N° 11-15 |
|--|----------------------|------------------------------------|

| | |
|---|-------------------------------|
| PRODUCT TESTED Termal Valve TVD1 Termal Valve TVD2 | Start date 22/06/2015 |
| | End date 24/06/2015 |
| | REF. project N° Thermal Valve |

TEST OBJECT

Intervention Test; sealing test of thermal valve after intervention; pressure drop

TEST DESCRIPTION**Phase 1: intervention**

Target temperatures set:

- 100°C +/-10 (material PVC)
- 130°C +/-10 (material PE)
- 160°C +/-10 (material POM)

checking intervent:

| T (°C) | time (min) | Pe (bar) | Q (l/h air) | thermal valve trip | | | |
|--------|------------|----------|-------------|--------------------|-------------|-------------|----------|
| | | | | valve 1/2" | valve 1" | valve 1/2" | valve 1" |
| | | | | 100°C +/-10 | 130°C +/-10 | 160°C +/-10 | |
| 20-90 | 20 | 3,5 | 0 | open | open | open | open |
| 90 | 30 | 3,5 | 0 | open | open | open | open |
| 110 | 30 | 3,5 | 0 | open | open | open | open |
| 110 | 60 | 3,5 | 0 | open | open | open | open |
| 110 | 90 | 3,5 | 0 | closed | open | open | open |
| 120 | 30 | 3,5 | 0 | | open | open | open |
| 120 | 60 | 3,5 | 0 | | open | open | open |
| 140 | 30 | 3,5 | 0 | | closed | open | open |
| 150 | 30 | 4 | 0 | | | open | open |
| 150 | 60 | 4 | 0 | | | open | open |
| 170 | 30 | 4 | 0 | | | closed | closed |

Phase 2: sealing test of thermal valve after intervention

Leak test at intervention temperature

| Leak test after intervention | | | |
|------------------------------|----------------------|----------------------|----------------------|
| T (°C) | inlet pressure (bar) | model ½" | model 1" |
| | | leak (l/h air) | leak (l/h air) |
| 140 | 0,7 | < 3 (bobble test) | < 3 (bobble test) |
| 140 | 1 | < 3 | < 3 (bobble test) |
| 140 | 2 | < 3 | < 3 (bobble test) |
| 140 | 3 | 9,5 | < 3 (bobble test) |
| 140 | 4 | 13 | < 3 (bobble test) |
| 140 | 5 | 14 | < 3 (bobble test) |
| 140 | 6 | 15 | < 3 (bobble test) |
| 140 | 7 | 16,5 | < 3 (bobble test) |
| 140 | 8 | 17 | < 3 (bobble test) |
| 140 | 9 | 18 | < 3 (bobble test) |
| 140 | 10 | 18 | < 3 (bobble test) |

Phase 3: sealing test of thermal valve after intervention at maximum temperature and cooling at ambient temperature

Leak test at 650°C, 800°C and after cooling at ambient temperature

| Leak test at maximum temperature and cooling at ambient temperature | | | |
|---|----------------------|----------------------|----------------------|
| T (°C) | inlet pressure (bar) | model ½" | model 1" |
| | | leak (l/h air) | leak (l/h air) |
| 650 in 30' | 4 | < 3 (bobble test) | < 3 (bobble test) |
| | 8,6 | < 3 (bobble test) | < 3 (bobble test) |
| 800 for 90' | 8,6 | < 3 (bobble test) | < 3 (bobble test) |
| 25 | 0,7 | < 3 (bobble test) | < 3 (bobble test) |
| 25 | 4 | < 3 (bobble test) | < 3 (bobble test) |
| 25 | 8,6 | < 3 (bobble test) | < 3 (bobble test) |

Fase 4: pressure drop

Model TVD1:

Guaranteed Flow (stmc/h GN) in function of inlet pressure and relative pressure drop

| Pressure drop (mbar) | INLET PRESSURE | | | | | | |
|----------------------|--------------------|---------------------|---------------------|---------------------|----------------------|---------------------|---------------------|
| | (1 PSI) 69 mbar | (2 PSI) 138 mbar | (3 PSI) 210 mbar | (5 PSI) 345 mbar | (10 PSI) 690 mbar | (20 PSI) 1.4 bar | (30 PSI) 2.1 bar |
| 2 | 1,0 | 1,3 | 1,5 | 1,8 | 2,0 | | |
| 3 | 1,8 | 2,3 | 2,7 | 3,1 | 3,5 | | |
| 5 | 4,1 | 4,1 | 4,9 | 5,5 | 6,0 | 9,6 | 13,1 |
| 10 | 7,9 | 8,3 | 8,5 | 9,3 | 12,2 | 15,0 | 17,0 |
| 15 | 10,6 | 11,0 | 11,5 | 12,4 | 14,3 | 17,5 | 20 |
| 20 | 12 | 13 | 13,5 | 14 | 16 | 20 | 24 |
| 25 | 14 | 14,5 | 15 | 16 | 18 | 22 | 25 |
| 30 | 15 | 16 | 17 | 18 | 20 | 24 | 27 |
| 40 | | 18,5 | 19 | 21 | 23 | 27 | 29 |
| 50 | | 21 | 22 | 23 | 27 | 29 | 32 |
| 75 | | 26 | 27 | 28 | 32 | 35 | 40 |
| 100 | | 28 | 29 | 31 | 35 | 40 | 46 |
| 125 | | | 32 | 33 | 38 | 44 | 51 |
| 150 | | | 35 | 36 | 41 | 48 | 56 |
| 175 | | | | 38 | 44 | 52 | 60 |
| 200 | | | | 41 | 47 | 55 | 65 |

Model TVD2:

Guaranteed Flow (stmc/h GN) in function of inlet pressure and relative pressure drop

| Pressure drop (mbar) | INLET PRESSURE | | | | | | |
|----------------------|--------------------|---------------------|---------------------|---------------------|----------------------|---------------------|---------------------|
| | (1 PSI) 69 mbar | (2 PSI) 138 mbar | (3 PSI) 210 mbar | (5 PSI) 345 mbar | (10 PSI) 690 mbar | (20 PSI) 1.4 bar | (30 PSI) 2.1 bar |
| 1 | 14 | 18 | 22 | | | | |
| 2 | 22 | 24 | 27 | 31 | | | |
| 3 | 27 | 28 | 32 | 35 | 38 | | |
| 5 | 32 | 33 | 36 | 38 | 44 | 49 | 58 |
| 10 | 44 | 45 | 46 | 51 | 54 | 64 | 76 |
| 15 | 51 | 53 | 55 | 60 | 66 | 77 | 92 |
| 20 | 60 | 62 | 63 | 68 | 77 | 90 | 108 |
| 25 | 67 | 69 | 71 | 75 | 83 | 98 | 117 |
| 30 | 73 | 76 | 77 | 82 | 90 | 105 | 125 |
| 40 | | 88 | 90 | 92 | 102 | 122 | 141 |
| 50 | | 97 | 99 | 102 | 114 | 141 | 156 |
| 75 | | 114 | 115 | 125 | 142 | 166 | 195 |
| 100 | | 132 | 133 | 143 | 164 | 192 | 223 |
| 125 | | | 151 | 159 | 181 | 211 | 246 |
| 150 | | | 164 | 172 | 195 | 230 | 264 |
| 175 | | | | 184 | 207 | 251 | 284 |
| 200 | | | | 195 | 219 | 266 | 300 |

Responsabile laboratorio
prove

Marco Brena