CRYOGENIC TEST PROCEDURE AT -196°C
ACCORDING TO THE TECHNICAL SPECIFICATION FMC FE117_000_rev8_fr

AUDIT COMPANY: __________________________ DATE: 22/07/11
DOC. REF Nr: C840_TEST_03_11 DRAWING Nr: __________
VALVE FIG.: 515 BORE: 3"
SEAT MATERIAL: TFM-1600 RATING: ANSI 150 LBS.
BODY: MATERIAL / EAT Nr: CF8M / RTZ TEMPERATURE: -196°C
CONNECTOR: MATERIAL / EAT Nr: A316 / 99574

1. GENERAL CONDITIONS:
   - The valve must have passed successfully the standard JC tests.
   - The valve must be thoroughly cleaned and degreased.
   - To install one thermocouples in the bore of the valve (internal)
   - The fluid used to detect leakage is helium.

2. TEST PROCEDURE:

   COOLING PROCESS AT -196°C
   - During the cooling time let helium circulate inside the valve at 0.5 Bar (to avoid ice formation inside)
   - The test can be started when the temperature of the valve is -190°C.

   WORKING PROCESS TEST AT -196°C
   - Close the valve and relieve the downstream pressure.
   - Pressurize for the upstream at test pressure (22 bar).
   - Open and close the valve, measure and record the valve opening and closing torques.

<table>
<thead>
<tr>
<th>OPENING TORQUE (mKg)</th>
<th>CLOSING TORQUE (mKg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

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C. Centenaire 2 – 5900 Liege, Belgium
Tel: +32 4 246 03 03 – Fax: +32 4 246 03 03
mail: technical@jc-valves.com – http://www.jc-valves.com
LEAKAGE TEST AT -196°C

- Leave the valve half open and relieve pressure in the circuit.
- Close the valve and pressurize at test pressure (22 bar)

<table>
<thead>
<tr>
<th>TEST PRESSURE</th>
<th>MAXIMUM LEAKAGE ALLOWED</th>
<th>DETECTED LEAKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 bar</td>
<td>45 ml / min.</td>
<td>Oral / min.</td>
</tr>
</tbody>
</table>

(15 ml x inch)

WARMING-UP PROCESS

- After having completed the tests, leave the valve half-open and de-pressurize the whole circuit.
- Disconnect the valve from the circuit.
- Leave the valve to warm-up up to ambient temperature.
- Make a visual inspection without disassembling the valve.

REALIZED: TONI AGUILERA
R&D Department

CHECKED: JOSÉ TEJEDOR
Technical Manager
CRYOGENIC TEST PROCEDURE AT -196°C
ACCORDING TO THE TECHNICAL SPECIFICATION FMC FE117_000_rev8_fr

AUDIT COMPANY: ____________________________ DATE: 26/02/11
DOC. REF Nr: CRYO_TEST_04_11 DRAWING Nr: ____________
VALVE FIG.: 515 BORE: __"__
SEAT MATERIAL: TPM -1600 RATING: ANSI 150Lb.
BODY: MATERIAL / EAT Nr: CF8N / RT2 TEMPERATURE: -196°C
CONNECTOR: MATERIAL / EAT Nr: A316 / 99548

1. GENERAL CONDITIONS:
   ➢ The valve must have passed successfully the standard JC tests.
   ➢ The valve must be thoroughly cleaned and degreased.
   ➢ To install one thermocouples in the bore of the valve (internal)
   ➢ The fluid used to detect leakage is helium.

2. TEST PROCEDURE:

   COOLING PROCESS AT -196°C
   ➢ During the cooling time let helium circulate inside the valve at 0.5 Bar (to avoid ice formation inside)
   ➢ The test can be started when the temperature of the valve is -190°C.

   WORKING PROCESS TEST AT -196°C
   ➢ Close the valve and relieve the downstream pressure.
   ➢ Pressurize for the upstream at test pressure (22 bar).
   ➢ Open and close the valve, measure and record the valve opening and closing torques.

<table>
<thead>
<tr>
<th>OPENING TORQUE (mKg)</th>
<th>CLOSING TORQUE (mKg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>7.5</td>
</tr>
</tbody>
</table>
LEAKAGE TEST AT -196°C

- Leave the valve half open and relieve pressure in the circuit.
- Close the valve and pressurize at test pressure (22 bar)

<table>
<thead>
<tr>
<th>TEST PRESSURE</th>
<th>MAXIMUM LEAKAGE ALLOWED</th>
<th>DETECTED LEAKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 bar</td>
<td>30 ml/min.</td>
<td>0 ml/min.</td>
</tr>
</tbody>
</table>

(15 ml x inch)

WARMING-UP PROCESS

- After having completed the tests, leave the valve half-open and de-pressurize the whole circuit.
- Disconnect the valve from the circuit.
- Leave the valve to warm-up up to ambient temperature.
- Make a visual inspection without disassembling the valve.

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CRYOGENIC TEST PROCEDURE AT -196°C
ACCORDING TO THE TECHNICAL SPECIFICATION FMC FE117_000_rev8_fr


DOC. REF Nr: CRYO TEST 06. I

VALVE FIG.: 530

BORE: A

SEAT MATERIAL: TEM - 1600

RATING: Ausi 300 L/s

BODY: MATERIAL / EAT Nr: CF8M / A570

TEMPERATURE: -196°C

CONNECTOR: MATERIAL / EAT Nr: CF8M / A570

1. GENERAL CONDITIONS:

➢ The valve must have passed successfully the standard JC tests.
➢ The valve must be thoroughly cleaned and degreased.
➢ To install one thermocouples in the bore of the valve (internal)
➢ The fluid used to detect leakage is helium.

2. TEST PROCEDURE:

COOLING PROCESS AT -196°C

➢ During the cooling time let helium circulate inside the valve at 0.5 Bar (to avoid ice formation inside)
➢ The test can be started when the temperature of the valve is -190°C.

WORKING PROCESS TEST AT -196°C

➢ Close the valve and relieve the downstream pressure.
➢ Pressurize for the upstream at test pressure (56 bar).
➢ Open and close the valve, measure and record the valve opening and closing torques.

<table>
<thead>
<tr>
<th>OPENING TORQUE (mKg)</th>
<th>CLOSING TORQUE (mKg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>

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1/2
LEAKAGE TEST AT -196°C

- Leave the valve half open and relieve pressure in the circuit.
- Close the valve and pressurize at test pressure (56 bar)

<table>
<thead>
<tr>
<th>TEST PRESSURE</th>
<th>MAXIMUM LEAKAGE ALLOWED</th>
<th>DETECTED LEAKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 bar</td>
<td>15 ml/min.</td>
<td>0 ml/min.</td>
</tr>
</tbody>
</table>

(15 ml x inch)

WARMING-UP PROCESS

- After having completed the tests, leave the valve half-open and de-pressurize the whole circuit.
- Disconnect the valve from the circuit.
- Leave the valve to warm-up up to ambient temperature.
- Make a visual inspection without disassembling the valve.

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