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# Testing Procedure

## CONTROL STATEMENT



## REVISION LIST

| Revision | Description | Date |
|---|---|---|
| 0 | Initial document issued for use. | 20/02/09 |
| 1 | LR Comments Included | 20/03/09 |
| 2 | Test Duration and Temperature Increased | 08/05/09 |

## DOCUMENT APPROVAL

**Prepared By:** _____

(insert digital signature)

**Approved By:** _____

(insert digital signature)

**Customer Approval:** _____

(insert digital signature)

Lloyd's Register EMEA
Coventry Office
18/6/09
Lloyd's Register
COV0915218/2

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# Testing Procedure

# FIRE TESTING PROCEDURE – TP003

Fire Test for

Gearbox Operated Tomoe Tricentric Butterfly Valve

3" (80 mm Nom.), Class 150

## Generally in Accordance with ISO 10497 2nd Edition

***Exceptions – Test Temperature Limited to 540 ℃***

***For***

**C95800 Aluminium Bronze Valve.**

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| Document Number: | TP-003 |
|---|---|
| Revision: | 2 |

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## 1.0 PURPOSE

This procedure establishes the test conduct and set-up requirements for the Fire Testing of a Tomoe Tricentric 3" (80 mm Nom.) Class 150 triple offset Butterfly valve. The actuation of the Butterfly Valve is achieved via a manual gearbox.

## 2.0 RESPONSIBILITIES

2.1 Design Paradigm Limited personnel shall be responsible for conducting the test.

2.2 Safe working practices shall be adopted throughout the testing.

2.3 Any practicality problems experienced in complying with this procedure shall be resolved in conjunction with the customer.

## 3.0 SCOPE

3.1 This procedure details the sequence, method of test, and the equipment used together with the acceptance criteria for the third party witnessed fire type-testing for confirming the pressure-containment capability of a valve under pressure during and after the burn period. Definitions and the performance requirements followed in this procedure are those given in ISO 10497 2nd edition.




| Document Number: | TP-003 |
|---|---|
| Revision: | 2 |

## 4.0 TEST EQUIPMENT

4.1 The test was carried out within the purpose built Valve Testing Facility at Design Paradigm Ltd and witnessed by Lloyds Third Party Inspection Agency. The testing procedure and rig layout used is that prescribed in ISO 10497 2nd edition. A diagrammatic layout of the full test rig is shown in ISO 10497 as Figure 1 (a) system using a pump as the pressure source. The calorimeter cubes are made in accordance with the dimensions given in Figure 2.

4.2 During the tests the 4 thermocouples and 2 calorimeter cubes are located in the positions as shown in Figure 3. Two calorimeter cubes are used in the tests for valve sizes up to and including 6" nominal bore (DN150).

4.3 The Calibration Certificates for the equipment used during the tests, together with the material certificates for the test valve, are shown in Appendix A.

4.4 A purpose built gas fired heated enclosure is used to heat the test valve up to the required temperature levels, the free space envelope allowed around the test valve is as prescribed in ISO 10497 2nd edition.

4.5 The test fluid is water.

4.6 The test valve submitted for fire test was manufactured and built in accordance with the manufacturer's normal work practice and safeguards, and has satisfactorily passed all the relevant hydrostatic and air pressure tests prior to arriving at site.

## 5.0 PROCEDURE

5.1 The test procedure used is detailed is generally in accordance with ISO 10497 2nd edition. Mount the test valve in the horizontal position, with thermocouples and calorimeters positioned as shown in Figure 3. Start the pipe work cooling water. The water quantity is regulated to ensure steam does not escape from the downstream and upstream pipe work during the burn period.

Purge the system to exclude all air from the pipe work and test valve up to the seatings under test. Pressurise the system to 1.4 times the maximum permissible cold working pressure (28 Barg), and eliminate any leaks.

Determine the volume of any residual water present downstream of the valve seal under test, in order to eliminate collection of water that has not actually leaked through the test valve. *(See model developed for each test valve configuration)*

The test results are data logged throughout the complete test cycle onto a laptop computer using 4 thermocouples and 2 calorimeters to measure temperatures and a pressure transducer to measure pressure.

5.2 **Through Seat leakage during burn and cool-down testing**.

Pressurise the system to 75% of the maximum permissible seat working pressure at 20 °C, a test pressure of 15 barg as taken from ISO 10497 para 5.6.4.(b)

**Notes:** The acceptable tolerance on all test pressures is -0% +30%

The test pressure is to be maintained during the burn and cool down periods, although a momentary pressure loss of up to 50% of the test pressure is permissible provided that the pressure recovers within 2 minutes.

The test pressure is to be maintained for the burn period of 30 mins.

Open the fuel supply and establish a fire and monitor the flame, calorimeter and body/bonnet thermocouples.

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Temperatures are as stated below for each thermocouple

**Calorimeter Cube Thermocouples (TC1 and TC2)**

Average temperature of 540°C within 15mins of burn period and maintain, with no temperature recorded of less than 460°C.

**Body Thermocouple (TC3)**

For at least 5min of the test period the body thermocouple shall maintain a temperature of 540°C, the burn period may be extended by 5min to achieve this.

**Bonnet Thermocouple (TC6)**

For at least 15min of the test period the bonnet thermocouple shall maintain a temperature of 540°C, the burn period may be extended by 5min to achieve this.

**Flame Thermocouples (TC4 and TC5)**

Average temperature of 620°C within 2mins of the start of burn period, up to a maximum of 1000°C, with no temperature reading of less than 460°C during the burn period.

The results obtained for the valve are recorded onto the laptop, these have been verified by the Lloyds Surveyor who carried out Witness Inspection throughout the test that covered both a heating and cooling cycle.

## 5.3 External leakage

The external leakage from the valve body and gland was measured during both the burn and cool-down periods.

## 5.4 Seat leakage test at low-pressure test condition

This test is carried out once the valve has been cooled to < 100 °C, in accordance with ISO 10497 para 5.6.12. The low-pressure seat leakage test is applicable to valves of pressure ratings ANSI 600 and below, and therefore applied to the test valve. The test is carried out the low-test pressure of 2 barg for a period of 5 minutes.

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| Document Number: | TP-003 |
|---|---|
| Revision: | 2 |



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| Revision: | 2 |
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