



1 **TYPE EXAMINATION CERTIFICATE**

2 **IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety Related Systems  
- Equipment forming a defined Subsystem -**

3 Type Examination Certificate Number: **Baseefa03SR0011X**

4 Equipment: **A Range of Worcester Controls Series 44/45/59, 459/599, 51/52, 53/54, 519/529, E51/52, 55/56, 819/829, 81 and 49/50 Ball Valves**

5 Manufacturer: **Flowserve Flow Control UK Ltd.**

6 Address: **Haywards Heath, West Sussex, RH16 1TL**

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Baseefa (2001) Ltd. certifies that this equipment has been found to comply with the following standards  
**IEC 61508-1 IEC 61508-2 (in respect of requirements related to sub-systems)**

9 The examination and test results are recorded in confidential Report No. 02(C)0042 dated 5 March 2003

10 If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions of safe use specified in the schedule to this certificate.

11 This TYPE EXAMINATION CERTIFICATE relates only to the design of the specified equipment and not to specific items of equipment subsequently manufactured.

12 The highest Safety Integrity Level that can be claimed for a safety function in which this equipment is an essential single in-line subsystem is **SIL 3 when operating in Low Demand Mode**

This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa (2001) Ltd. Customer Reference No. 1537

Project File No. 02/0042

This certificate is granted subject to the general terms and conditions of Baseefa (2001) Ltd. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

**Baseefa (2001) Ltd.**

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R S SINCLAIR

DIRECTOR

On behalf of

Baseefa (2001) Ltd.

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## Schedule

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Certificate Number Baseefa03SR0011X

### 15 Description of Equipment

The Series 44/45/59 and Series 459/599 Ball Valves comprise a ball and two seats mounted within a short body held between two body connectors that each provide a threaded connection for pipework. (Alternatively, body connectors are provided for welding to pipework.)

The Series 51/52, 53/54, 519/529, E51/52, 55/56 and 819/829 Ball Valves comprise a ball and two seats mounted within a long body having integral flanges for connecting to flanged pipework. The ball and seats are held by an insert screwed in from one end of the body or by a body connector bolted to the body by an interface flange.

The Series 49 Wafer Ball Valves are similar to the Series 51/52, etc., but have no flange, being intended for mounting directly between the flanges of the associated pipework.

The Series 81 Ball Valves are constructed similar to the Series 51/52, etc, but have pipe attachment similar to the Series 44/45/59, etc. The valve body is welded after factory assembly and no adjustment of pressure on the valve seats is possible.

In all cases, the action of the valves is identical, with a hole through the ball, in line, providing free passage when in the open position and the ball being turned 90 degrees to obscure the hole and block the passage in the closed position. The ball position is controlled by the valve stem, which is provided with various sealing arrangements to ensure no loss of fluid from the pipeline. The valve stem may be provided with a hand actuating lever or be connected to a pneumatic actuator.

### 16 Subsystem Parameters in accordance with IEC 61508-2 Clause 7.4.7.3

#### a) Functional Specification

The Valve is intended for use (in conjunction with a controlling solenoid valve and a pneumatic actuator) as a final element in an E/E/PE Safety Related System. The range of valves can control the flow of pipeline fluid but for the purposes of defining the safety related system the valve is considered as having only two states: open and closed. The flow rate and transition time of the valve will depend upon the exact versions chosen. Optionally, an electrical signal is available from position detectors (mounted on the pneumatic actuator) to indicate the open and closed positions of the valve.

A minor leakage of fluid through a closed valve or to the environment from the valve stem is not regarded as a dangerous failure.

#### b) Estimated Rates of Failure Detected by Diagnostic Tests

1 in 1,000,000 operations (with diagnosis provided by feedback from the position detectors when fitted)

#### c) Estimated Rates of Failure Undetected by Diagnostic Tests

1 in 1,000,000 operations if position detectors are not fitted or not used.

1 in 10,000,000 operations if position detectors are fitted and used.

#### d) Environmental Limits

The rates of failure are for a normal industrial environment. Different material combinations are available to handle different pipeline fluids and must be chosen accordingly otherwise the performance will be eroded. Solid material that has entered the pipeline inadvertently could prevent the valve from closing fully or could damage the valve. If necessary, precautions must be taken to ensure this cannot happen.

#### e) Lifetime Limits

There are no lifetime limits provided that maintenance is undertaken when necessary.

f) Periodic Proof Test and Maintenance

For valves that remain in one position for long periods of time, it is recommended that at defined intervals the valve should be "exercised" to confirm that it will move and to break any developing adhesion due to corrosion or other chemical effects. The frequency of such exercising must be developed for each application as an analysis of the whole safety related system, but should normally be at least monthly.

The normal mode of failure of a valve is for leakage to occur, both as seepage through a closed valve and along the valve stem. This is not defined as a dangerous failure in relation to the operation of the safety system, but should be taken as an indication that the valve requires maintenance, using a repair kit available from the manufacturer.

g) Diagnostic Coverage

Diagnostic coverage is obtained via the position detectors mounted on the associated pneumatic actuator (when fitted and used). This is not internal to the actuator/valve part of the subsystem but must be integrated into the final subsystem. The diagnostic coverage is not less than 90%.

h) Diagnostic Test Interval

The diagnostic test interval is set as part of the integration of the subsystem, taking account of the intended operating regime. (See (f) and (g) above)

i) Mean Time to Restoration

Not applicable.

j) Safe Failure Fraction

At least 90%, based on the definition of a dangerous failure as failure to open or close and the definition of a safe failure as seepage through a closed valve or leakage along the valve stem.

k) Hardware Fault Tolerance

The fault tolerance is zero.

l) Application Limits

None additional to the environmental limits given at (d) above.

m) Safety Integrity Level

The highest safety integrity level that can be claimed for a safety function which uses this subsystem as a single output is restricted because of the architecture according to IEC 61508-2 Table 2, with Hardware Fault Tolerance = 0 and Safe Failure Fraction  $90\% < 99\%$ , to SIL 3.

In Low Demand Mode, the target failure measures according to IEC 61508-1 Table 2 for SIL 3 are significantly bettered.

In High Demand Mode, the target failure measures according to IEC 61508-1 Table 3 are met for SIL 1 without diagnostic tests and for SIL 2 with diagnostic tests, when assuming an operating rate of one operation per hour.

n) Configuration Management

This analysis is generic and is based on the evidence available at the date of compilation. Since the main constraint is architectural, according to IEC 61508-2 Table 2, it is considered that the analysis is likely to remain valid for similar valves and actuators.

o) Documentary Evidence of Validation

This certificate and associated report provide evidence of evaluation.

## 17 Special Conditions for Safe Use

1. The purchaser must specify the pipeline fluid to enable suitable material combinations to be selected.
2. The parameters relating to the chosen solenoid valve and pneumatic actuator shall be established and integrated in the overall calculations for the safety function.



3. The valve shall be examined at regular intervals to detect leakage. The periodicity of this examination should be determined for each application but should be at least once per 25,000 operations. The valve and actuator should be maintained in accordance with the Installation, Operating and Maintenance Instructions using the repair kit available from the manufacturer.
4. The valve should only be used in High Demand Mode after further analysis of operating rates.

**18 Drawings and Documents**

<b>Number</b>	<b>Sheet</b>	<b>Issue</b>	<b>Date</b>	<b>Description</b>
44-00-0026-Q797	-	A	01/02/98	Series 44 Ball Valves (Typical GA Drawing)
PB 44/59 IOM	-	-	11/02	Installation, Operation and Maintenance Instructions for Series 44/59 Ball Valves
PB 459/599 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 44/45/59/459/599 Ball Valves
F800-0515-0001	-	C	17/06/99	Series 819/829 Ball Valves (Typical GA Drawing)
F800-2080-0001		H	29/07/2002	Series 819/829/859 Ball Valves (Typical GA Drawing)
PB 51/52 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 51/52 Ball Valves
PB 53/54 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 53/54 Ball Valves
PB 519 IOM	-	-	11/02	Installation, Operation and Maintenance Instructions for Series 519 /529 Ball Valves
PB STEM IOM			7/02	Installation, Operation and Maintenance Instructions for the Envirosafe Stem as used with Series E51/52 Ball Valves
PB 55/56 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 55/56 Ball Valves
PB 819 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 819/829 Ball Valves
A49-00-0001/P615		OA	5/2/80	Series 49 Wafer Ball Valves (Typical GA Drawing)
50-00-0001		OE	26/6/84	Series 50 Wafer Ball Valves (Typical GA Drawing)
PB 49 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 49 Ball Valves
K81-00-0001		B	06/5/97	Series 81 Welded Ball Valves (Typical GA Drawing)
PB 81 IOM			11/02	Installation, Operation and Maintenance Instructions for Series 81 Welded Ball Valves
F819-15-204R-ESSBMO	-	A	26/04/01	Typical Valve and Actuator Assembly