

# Certificate



**No.: V 467.01/15**

**Product tested** 3/2 Solenoid Valve Redundant Supply & Exhaust Assemblies **Certificate holder** MAC Valves Europe Inc. Rue Marie Curie 12 4431 Loncin Belgium

**Type designation** 52, 54 and 67 series

**Codes and standards** IEC 61508 Parts 1-2 and 4-7:2010 EN ISO 13849-1:2008  
IEC 61511 Parts 1-3:2004 EN 13611:2007+A2:2011

**Intended application** Safety function: Closing (NC) or Opening (NO) by spring force

The valves are suitable for operation in safety-related systems with a Safety Integrity Level (SIL) of up to SIL 3 acc. to IEC 61508 and IEC 61511 due to its internal redundancy. Constraints of the calculated probability of dangerous failures acc. to the frequency of demand and Proof Test Intervals have to be considered.

In the application area of EN ISO 13849-1 the valves may be used up to PL e, if sufficient external diagnostic of the 2 channels is realized by sensors and plausibility checks by the upstream safety controller (DC low for PL d, resp. DC medium for PL e). If they are used in a redundant configuration (HFT=1), separate external diagnostic means are not requested.

**Specific requirements** The instructions of the associated Installation and Operating Manual must be considered.

Summary of test results see back side of this certificate.

Valid until 2020-01-30

The issue of this certificate is based upon an examination, whose results are documented in Report No. V 467.01/15 dated 2015-01-30.

This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

**TÜV Rheinland Industrie Service GmbH**

Bereich Automation  
Funktionale Sicherheit

Am Grauen Stein, 51105 Köln

Köln, 2015-01-30

Certification Body for FS-Products

Dipl.-Ing. Stephan Häb

Certificate No.	<b>V 467.01/15 – Page 2</b>
Manufacturer	<b>MAC Valves Inc.</b>
Product Tested	<b>3/2 solenoid valves redundant supply &amp; exhaust assemblies 52, 54, 67</b>

### Device specific values

Series			<b>52 / 54</b>	<b>67</b>
B <sub>10d</sub> value	B <sub>10d</sub>	[-]	10 500 000	5 500 000
Internal Hardware Fault Tolerance	HFT <sub>int</sub>	[-]	1	
Safe Failure Fraction per internal channel	SFF	[%]	60 - < 90	
Diagnostic Coverage	DC	[-]	0	
Common Cause Factor	β <sub>int</sub> <sup>(1)</sup>	[%]	10	
Type of Subsystem Acc. IEC 61508-2, 7.4.4.1.3		[-]	Type A	
Mode of Operation Acc. IEC 61508-4, 3.5.16		[-]	High and Low Demand Mode	
Dangerous Failure Rate	λ <sub>D</sub>	[1/h]	See below	
<b>Low Demand Mode</b>				
Probability of Dangerous Failure on Demand	PFD <sub>avg</sub>	[-]	4.65 E-05	
Assumed Proof Test Interval	T <sub>i</sub>	[y]	1	
Assumed demand frequency	n <sub>op</sub>	[1/y]	1	
<b>High Demand Mode</b>				
Probability of Dangerous Failure per hour	PFH <sub>D</sub>	[1/h]	See below	
Mean Time to Dangerous Failure	MTTF <sub>D</sub>	[h]	See below	

(1): The Common Cause Factor is always to be examined taking into consideration the safety-related overall system with regard to the certain application.

### Test results

The suitability for certain applications can only be realised through the evaluation of the respective safety-related overall system including all safety-related components and the calculation of the application oriented PFH<sub>D</sub>, MTTF<sub>D</sub> and λ<sub>D</sub> value.

PFH<sub>D</sub>, MTTF<sub>D</sub> and λ<sub>D</sub> depend on frequency of demand n<sub>op</sub> of the safety-related overall systems and will be calculated according the following equation.

$$PFH_D = \lambda_D = \frac{1}{MTTF_d} = \frac{0.1}{B_{10d}} \times n_{op}$$

### Useful lifetime under specified operating conditions

If the manufacturer's specification according operating conditions, installation and storage are obeyed, the useful lifetime is 5 years, with an additional period of maximal 1.5 years for storage before first use. Further, the maximum cycle lifetime is limited to the B<sub>10d</sub> value of the test item.

### Quality Management

The validity of this certificate is bound to the proven employment of a safety related quality management system by the manufacturer.