

Certificate



Product Safety
Functional
Safety

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No.: 968/FSP 1343.00/16

Product tested	Intelligent Safety Solenoid including a position transmitter	Certificate holder	Metso Flow Control, Oy Vanha Porvoontie 229 01380 Helsinki-Vantaa Finland
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Type designation	VG9000H/T01
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Codes and standards	IEC 61508 Parts 1-7:2010
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Intended application	Safety-related Emergency Shut-down of a valve by releasing pressured air from the actuator in low demand mode applications up to SIL 3 (VG9000H). Sensing of a position of a valve and translating the position into a 4-20mA signal in low demand mode applications up to SIL 2 (T01 option).
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Specific requirements	The overall safety integrity depends mainly on the connected actuator and the final valve (ESD or ESV) to the safety solenoid. Therefore a hardware fault tolerance (HFT) of 1 in SIL 3 applications is strongly recommended. The instructions of the associated safety and installation manual shall be considered.
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Summary of test results see pages 2 and 3 of this certificate.

Valid until 2021-12-20

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1343.00/16 dated 2016-12-20.

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

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Köln, 2016-12-20

Certification Body Safety & Security for Automation & Grid

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Safety function: Sensing of the position of valves or actuators and sending the position using a 4-20mA signal.

Diagnostic measures: In case the current is <3 mA or >21 mA the sensor has an internal failure and the process has to be controlled in a way to lower the risk.

Characteristics as per IEC 61508	Value
SIL	SIL 2
HFT	0
Device Type	A
Assumed Proof Test Interval	5 years
Mode of operation	Low demand mode
Assumed Demands per Year	1
SFF	72,8%
λ_s	2,84E-08 /h
λ_d	1,07E-07 /h
λ_{dd}	7,03E-08 /h
λ_{du}	3,69E-08 /h
λ_{tot}	1,36E-07 /h
PFD _{avg} (5 years)	8,1E-04

λ total failure rate

λ_d Current deviates more than 5 % from the "real" value (valve position)

λ_s Current deviates less than 5 % from the "real" value (valve position)

λ_{dd} Current is <3mA or >21mA

λ_{du} Current deviates more than 5 % from the "real" value (valve Position), but is still within 3 to 21mA

Safe Failure Fraction SFF = $(\lambda - \lambda_{du}) / \lambda$

Note: Position transmitter is not available in a redundant configuration. Due to the SFF is smaller than 90 % and the limitation of HFT=0, they can only be used up to SIL 2.

The failure rates assume the following:

- < 5 % deviation from actual position is considered a safe failure
- > 5 % deviation from actual position is considered a dangerous failure

- If position transmitter produces feedback out of range (<3 mA or >21 mA) that is considered dangerous detected failure, the controller must perform the safety function

Proof test:

One complete open/closed cycle of the process valve along with confirmation of a successful cycle via the position feedback has to be performed. It shall be 4 mA when the valve is closed and 20 mA when the valve is open.

For a detailed description the instructions of the associated safety and installation manual shall be considered.

Safety function: Safety-related Emergency Shut-down (<6mA) of a valve by releasing pressured air from the actuator.

Operation with diagnostics tests enabled (pneumatics test and/or PST) for ValvGuard mechanical part				
Probability of Dangerous Failure on Demand	PFD _{spec}		2.61 E-05	
Assumed Valve Proof Test Interval	T _i	y	5	
Confidence Interval	1-α	%	95 %	
Safe Failure Fraction	SFF	%	> 90 %	
Hardware Fault Tolerance	HFT	[-]	0	
Diagnostic Coverage	DC	%	94.7 %	
Type of Sub System IEC 61508-2, 7.4.4.1.2/3		[-]	Typ A	
Mode of Operation IEC 61508-4, 3.5.16		[-]	Low demand	
Derived Values				
Assumed Demands per Year	f _{np}		1 /a	1.14E-04 /h
Total Failure Rate	λ _S + λ _D	1/h	1.06 E-06 /h	1058 FIT
Lambda Dangerous Detected	λ _{DD}	1/h	5.28 E-08 /h	53 FIT
Lambda Dangerous Undetected	λ _{DU}	1/h	2.98 E-09 /h	3 FIT
Lambda Safe Detected	λ _{SD}	1/h	8.42 E-08 /h	84 FIT
Lambda Safe Undetected	λ _{SU}	1/h	9.18 E-07 /h	918 FIT
MTBF total		h	9.45 E+08 h	1.08 E+05 a
MTBF (Dangerous Failures)	MTBF _D	h	1.79 E+07 h	2.05 E+03 a
Average Probability of Failure on Demand	PFD _{avg}		6.53 E-05	

Operation with diagnostics disabled for ValvGuard mechanical part				
Probability of Dangerous Failure on Demand	PFD _{spec}		3.35 E-05	
Assumed Valve Proof Test Interval	T _i	y	1	
Confidence Interval	1-α	%	95 %	
Safe Failure Fraction	SFF	%	> 90 %	
Hardware Fault Tolerance	HFT	[-]	0	
Diagnostic Coverage	DC	%	93.2 %	
Type of Sub System IEC 61508-2, 7.4.4.1.2/3		[-]	Type A	
Mode of Operation IEC 61508-4, 3.5.16		[-]	Low demand	
Derived Values				
Assumed Demands per Year	f _{np}		1 /a	1.14E-04 /h
Total Failure Rate	λ _S + λ _D	1/h	9.79 E-07 /h	979 FIT
Lambda Dangerous Detected	λ _{DD}	1/h	5.20 E-08 /h	52 FIT
Lambda Dangerous Undetected	λ _{DU}	1/h	3.82 E-09 /h	4 FIT
Lambda Safe Detected	λ _{SD}	1/h	6.40 E-08 /h	64 FIT
Lambda Safe Undetected	λ _{SU}	1/h	8.59 E-07 /h	859 FIT
MTBF total		h	1.02 E+06 h	116 a
MTBF (Dangerous Failures)	MTBF _D	h	1.79 E+07 h	2.05 E+03 a
Average Probability of Failure on Demand	PFD _{avg}		8.37 E-05	

Application Requirements:

The overall safety integrity depends mainly on the connected actuator and the final valve (ESD or ESV) to the safety solenoid. Therefore a hardware fault tolerance (HFT) of 1 in SIL 3 applications is strongly recommended.

Proof Test:

Safety shutdown valve proof-test is related to the required SIL level of the application. PFD calculations should define this safety shutdown valve proof test interval. The valve proof test can be performed by using VG9000H's Emergency Trip Test (ETT) and it is available via HART. ETT can only check the valve closing/opening time, but not the tightness. See the valve safety manual for further info regarding the proof testing. The whole safety loop shall be tested via the safety system / logic solver.

For a detailed description the instructions of the associated safety and installation manual shall be considered.