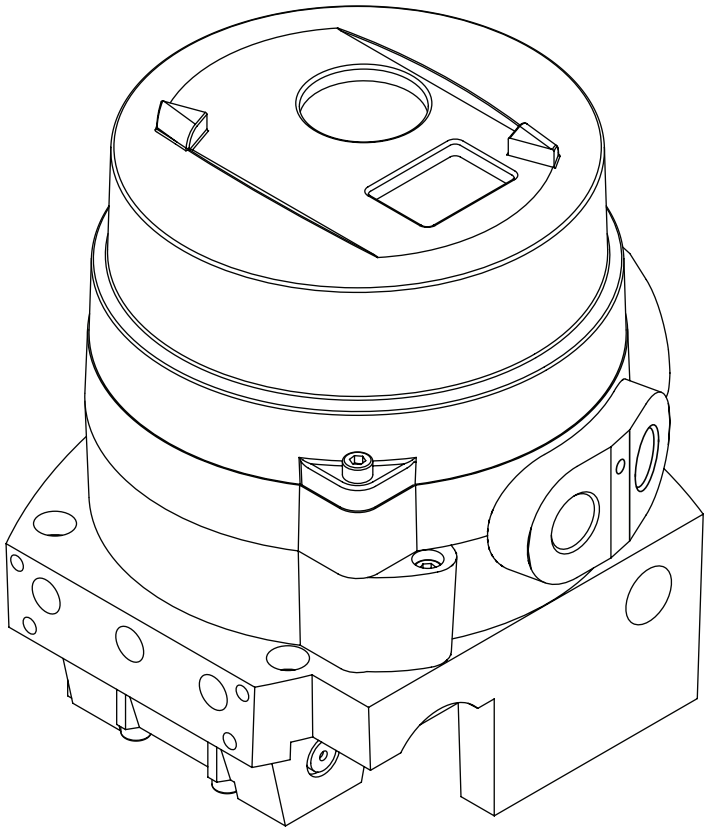
Neles™ ValvGuard™ VG9000F Rev 2.0

Safety manual



Functional Safety Type Approved

TÜVRheinland® FS

Table of Contents

1. General information

Neles ValvGuard VG9000F is SIL 3 certified intelligent safety valve controller and thus a safety related product. Extra attention is required to make sure it is used in a way it is intended to be used and in a safe manner. The VG9000F Installation, Maintenance and Operating Instructions 7VG9F70EN (later referred as IMO) shall be used together with this safety manual when installing and operating this product.

2. Structure of safety valve controller

2.1 System components and description of use

See the IMO for the detailed technical description of the device and the system architecture.

2.2 Permitted device types

The information in this manual pertaining to functional safety applies to all device variants mentioned in the device type coding in the IMO.

2.3 Supplementary device documentation

1. 7VG9F70EN; VG9000F Installation, Maintenance and Operating Instructions
2. Neles Valve Manager (DTM) help file (later referred as DTM manual)

These are available from Valmet or for download from www.neles.com/VG9000

3. Description of safety requirements

3.1 Safety function

Spool valve and prestage unit are the only components, which takes part of the safety action. Prestage unit is coil operated flapper valve, which is open when de-energized. De-energized is the safe state of the device prestage unit coil. Prestage unit is controlling the spool valve, which is operated by spring force to fail safe position and by pneumatic force to the normal position. 24 V DC binary input signal is used to energize the coil of the prestage unit. Prestage will be de-energized when the binary input signal is below 9 V DC (nominal 0 V DC). That will cause the emergency shutdown valve to close or open depending on the application type. The closing (or opening) time depends e.g. on the size and type of the pneumatics actuator and the valve.

Foundation fieldbus signal in VG9000F is only used for communication and supplying power to the CPU and the measurement electronics. It is galvanically isolated from the safety control part and does not have effect on the safety function.

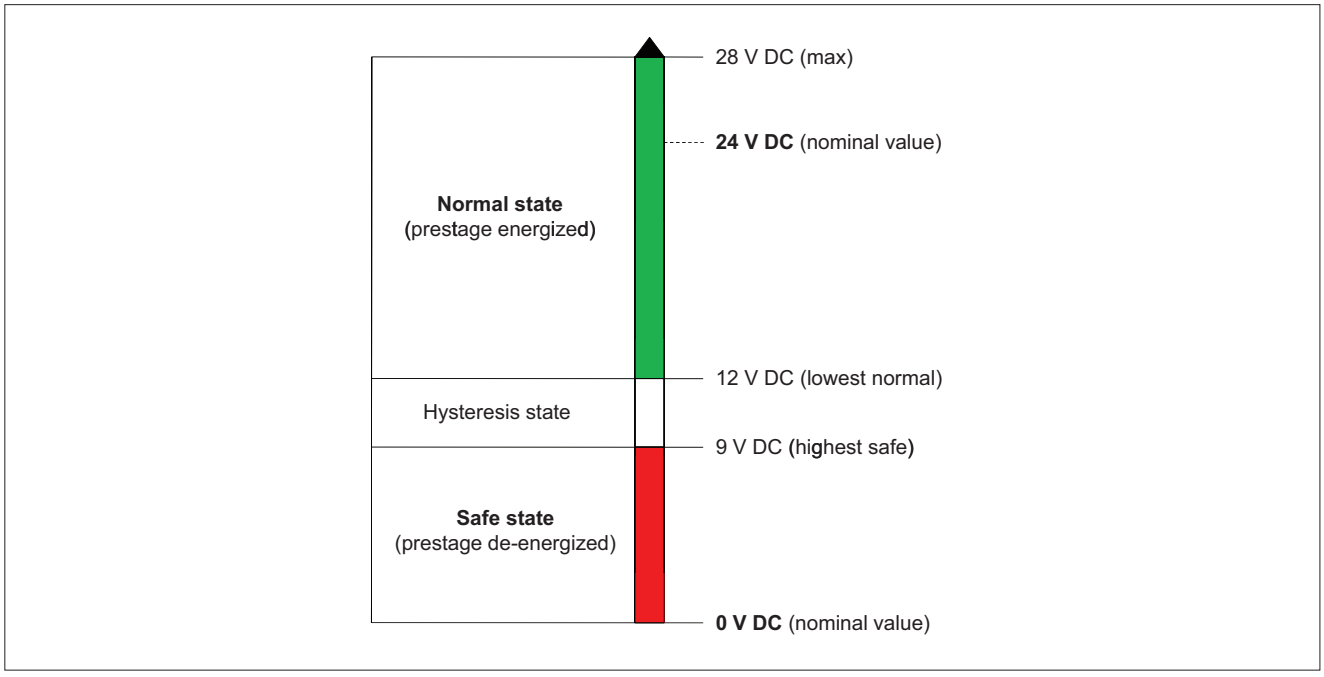


Fig. 1. Voltage thresholds.

3.2 Restrictions for use in safety-related applications

Please ensure that the safety valve controller is used correctly for the application in question and that the ambient conditions and air supply quality are taken into account. The instructions for installation conditions, as detailed in the IMO, shall be observed. The specifications in the IMO shall not be exceeded.

3.3 Functional safety indicators

The table below shows the specific indicators for functional safety.

Results of assessment

Route of Assessment		2_H / 1_S
Type of Sub-system		Type A
Mode of Operation		Low Demand Mode
Hardware Fault Tolerance	HFT	0
Systematic Capability		SC 3

Without testing, i.e. no diagnostics (DC = 0%)

Dangerous Failure Rate	λ_D	6,33 E-07 / h	633 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	2,77 E-03	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	2,86 E-04	

Assumptions for the calculations above: T_1 = 1 year, DC = 0, $_{1002}$ = 10 %

With diagnostics testing, i.e. PST or internal pneumatics test (DC = 75%)

Dangerous Failure Rate	λ_D	1,58 E-07 / h	158 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	6,92 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	6,89 E-05	

Assumptions for the calculations above: T_1 = 1 year, DC = 0, $_{1002}$ = 10 %
Useful lifetime of approximately 12 years is expected for VG9000.

3.4 Behavior of device

3.4.1 During power-up

It may take up to 9 seconds for device diagnostics to power up and the device to be fully operational in the diagnostics point of view. This is valid when the FOUNDATION Fieldbus signal is switched on. This does not effect to the safety function of the device.

3.4.2 During operation

Once the binary input signal is switched on the device energizes the prestage and the supply air will be fed to the pneumatic actuator by spool valve. That will eventually cause the valve to go to its normal operating position, which is open or close depending on the application type. Valve will remain in its normal operating position when the binary input signal is above 12 V DC (nominal 24 VDC).

3.4.3 During emergency trip

See section 3.1.

3.4.4 In the event of alarms and warnings

Device alarms or warnings do not cause the device to go to fail safe.
See the ‘behavior of device during operation’ above.

3.5 Installation

3.5.1 Hardware fault tolerance

The required hardware fault tolerance of the installation is zero. If hardware fault tolerance of 1 is required, then a dual redundant configuration of the valve installation shall be used.

3.5.2 Installation and commissioning

The installation of the device needs to be done according to the IMO. Every parameter related to the device type in question and mentioned in the IMO needs to be checked and compared against the device settings. If any deviations exist the safety of the installation cannot be guaranteed.

The VG9000F shall be configured before commissioning. The parameters configured to the VG9000F shall be read back and verified before commissioning using the FOUNDATION fieldbus Device Description (DD) or Neles Valve Manager (DTM) for VG9000F.

3.5.3 Orientation

Orientation of the device is described in the IMO.

3.5.4 Diagnostics coverage

To obtain the best possible diagnostic coverage, the automatic test intervals and the various alarm limits in the VG9000F shall be set, see Section 4 in the IMO. The diagnostic coverage factor for an ESD-valve (a fail to close valve) can be assumed to be around 75% (valve + actuator), depending on the valve and actuator types. The diagnostic coverage factor for an ESV-valve (fail to open valve) can be assumed to be around 90% (valve + actuator), depending on the valve and actuator types. For more accurate estimates contact Valmet.

3.5.5 Parameters write protection

The parameters programmed in the VG9000F shall be write-protected. If the organizational procedures are established, this can be done using the user access levels in the configuration software. See section

3.6 in the IMO.

3.7 Operation

See the IMO for the operation of the device.

3.8 Maintenance

See the IMO for maintenance instructions.
During maintenance work on the device, alternative safety function methods shall be taken to ensure process safety.

4. Proof-tests

4.1 Internal tests

Proof-test is referred as internal pneumatics test, which is described below.

4.1.1 Pneumatics test

Device can perform internal pneumatics test for its pneumatics function. The operation of the prestage and spool valve will be checked during the test. For procedure and details see IMO and DTM manual.

This test does not affect the operation of the safety shutdown valve.

4.1.2 Valve 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.

This proof test can be performed e.g. by using VG9000F's Emergency Trip Test (later referred as ETT). For procedure and further info see DTM manual.

5. Repair

Any repair to the device shall be carried out by the manufacturer only. Device failures must be reported to the manufacturer. The user shall provide a detailed report to the manufacturer describing the failure and any possible effects.

Certificate

SIL/PL Capability

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ID 0600000000

No.: 968/V 1146.05/22

Product tested	Intelligent Safety Solenoids and Partial Stroke Test Device	**Certificate holder**	Valmet Flow Control Oy Vanha Porvoontie 229 FI-01380 Vantaa Finland
Type designation	VG9000F, VG9000H (Intelligent Safety Solenoids) and VG9000H_P (Partial Stroke Test Device) (Versions see current "Version Release List")		
Codes and standards	IEC 61508 Parts 1-2 and 4-7:2010		
Intended application	Safety Function: Prestage valve open by springforce when current below 6 mA (VG9000H) or below 9 VDC (VG9000F) and contemporaneous failsafe position of spool valve. The VG9000F and VG9000H are of Type A and have a Safety Capability of SC 3 acc. to IEC 61508. Accordingly they can be used in applications up to SIL 3 acc. to IEC 61508 and IEC 61511-1. The valves are suitable for use in a safety instrumented system up to SIL 2 (low demand mode). Under consideration of the minimum required hardware fault tolerance of HFT = 1 of the complete final element the test items may be used in a redundant architecture up to SIL 3. The VG9000H_P does not adversely affect the safety function of a connected ESD solenoid valve. It can therefore be used in safety related systems to enable partial stroke testing to improve the diagnostic coverage (DC).		
Specific requirements	The instructions of the associated Installation, Operating and Safety Manual shall be considered.		

Summary of test results see back side of this certificate.

The issue of this certificate is based upon an evaluation in accordance with the Certification Programs CERT FSP1 V1.0:2017, CERT FSP1 V1.0:2017 in their actual version, whose results are documented in Report No. 968/V 1146.05/22 dated 2022-10-19. This certificate is valid only for products, which are identical with the product tested. Issued by the certification body accredited by DAkkS according to DIN EN ISO/IEC 17065. The accreditation is only valid for the scope listed in the annex to the accreditation certificate D-ZE-11052-02-01.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit

Köln, 2022-12-15 — Certification Body Safety & Security for Automation & Grid — Dipl.-Ing. (FH) Wolf Rückwart

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