NELES® VALVGUARD VG9000
INTELLIGENT SAFETY SOLENOID

Metso’s Neles ValvGuard VG9000 is a new generation intelligent safety solenoid with partial stroke testing features. It can be used both with emergency shutdown (ESD) and emergency venting (ESV) valves. Its unique and advanced functions and features are specially designed for safety applications. Together with HART & FOUNDATION fieldbus communication it offers unbeatable value for our customers with increased efficiency, reliability and safety.

VG9000 is IEC 61508 compliant up to SIL 3, certified by TÜV Rheinland. Based on the automatic partial stroke testing (PST) and other diagnostics data, VG9000 increases safety and plant safety targets can be reached more economically than with traditional solutions. Also, unnecessary and expensive manual testing can be avoided. This increases safety and can simultaneously create major cost savings at a plant.

VG9000 HART version is operated by 4-20 mA signal and the diagnostics part of the device can be alive all the time. VG9000 FOUNDATION fieldbus version communication is done via the bus. Safety part is isolated from the fieldbus part and is powered with the separate binary 24 V DC signal. This is a true user benefit and gives maximum availability of the diagnostics information. VG9000 is thus capable to record emergency trips with graph and key figures related to it. The availability of the safety valves is maximized through unique diagnostics features, directly integrated into the device functionality. Diagnostic information is presented in an easily understandable form using a graphical FDT/DTM user interface, such as Metso FieldCare™. This enables the predictive maintenance of potentially failing valve assemblies before they have chance to impact on the process.

KEY FEATURES

- Valve and self tests
- Partial stroke test (automatic or manual)
- Self test for internal electronics and pneumatics
- Emergency trip test
- High pneumatic capacity eliminates the need of additional instrumentation in most cases
- Device is powered during the trip and can collect diagnostics information
- Easy of use local / remote operation
- Advanced device diagnostics including
  - Self-diagnostics
  - Online diagnostics
  - Performance diagnostics
  - HART communication
  - FOUNDATION fieldbus communication

TÜV Certificate

Neles ValvGuard VG9000 is TÜV Rheinland certified according to IEC61508 to be used in safety applications up to and including safety integrity level 3 (SIL 3).

Designed for harsh environments

Neles ValvGuard VG9000 is developed for use in harsh environments with epoxy coated anodised aluminum as standard material for the whole enclosure. Even the most corrosive environments can be handled with our full 316 stainless steel enclosure.

Open solution

- Metso is committed to delivering products that freely interface with software and hardware from a variety of manufacturers. This open architecture allows the ValvGuard to be integrated with other field devices and systems.
- FDT and EDD based multi-vendor support configuration
- Support files for VG9000 are available from our internet page, at http://www.metso.com/vg9000 - choose Link to valve related software

VG9000 with option P (Partial stroke test device)

When ValvGuard is used only for partial stroke testing and an additional solenoid valve is used for controlling the fail-safe action, VG9000 with P-option is an optimum choice. VG9000H_P partial stroke test device provides excellent protection against the spurious trips. Even an electric failure or a cable break does not create an unwanted trip as the valve remains in the normal position even when ValvGuard is de-energized.

ValvGuard VG9000 with P-option is available with HART communication and the device is powered by analog 4 to 20 mA signal. VG9000H with P-option will give additional security against unauthorized usage by disabling all the testing, if input signal from the DCS is below 8 mA and also prevents an accidental calibration, if the signal is below 12 mA.

Options

- Full stainless steel enclosure (VG9300)
- High pneumatic capacity (VG923_)
- Integrated limit switches
- External junction box for wiring
- Version for partial stroke test only (VG9000H_P). Safety valves fail-safe action to be controlled via separate solenoid valve
  - Remote Communication Interface (RCI9H2) for VG9000H 24 VDC retrofit installations. (See type coding for RCI9H2 option and technical bulletin 9RCI21EN for all technical details)
  - Local Control Panel (LCP9H) for VG9000H. (See type coding for LCP9H option)
**Lower total cost of ownership**
- Automated valve testing and testing documentation
- Low energy and air consumption
- Future proof design allows further options at a reduced cost

**Easy installation and configuration**
- Same unit for linear and rotary valves, double and single-acting actuators
- Simple calibration and configuration
  - Using local user interface
  - Using Metso FieldCare or any FDT compliant software in a remote location

**Easy to maintain**
- Optimized spares program. Reduced number of spares
- Fewer components to maintain than in a traditional instrumentation solution
- Ability to attach options to mechanics
- Visibility to the safety valve operation

**Mounting**
- Can be mounted on single and double acting pneumatic actuators
- Can be mounted on both rotary and linear valves
- Extensive selection of mounting kits for 3rd party actuators

**Product reliability**
- Designed to operate in harsh environmental conditions
  - Epoxy coated anodised aluminium or full stainless steel enclosure
  - Rugged modular design
  - Excellent temperature characteristics
  - Vibration and impact tolerant
  - IP66 enclosure
  - Protected against humidity
- Maintenance free operation
  - Resistant to dirty air
  - Wear resistant and sealed components
  - Contactless position measurement

**Predictive maintenance**
- Easy access to collected data with Metso FieldCare software
  - Logical trend collection
  - Information collected on service conditions
  - Fast notifications with on-line alarms
  - Condition monitoring tool available

**VG9000F in FOUNDATION fieldbus networks**
- Approved interoperability
- Host interoperability ensured
- FOUNDATION fieldbus ITK version 6 certified
- Unique communication diagnostics
- Digital communication via the FOUNDATION fieldbus includes not only the diagnostics, but also the position feedback signal from the position sensor.
- Back up LAS functionality available
- Multipurpose functionality
- Open and close information directly available via the FOUNDATION fieldbus
- Open and close detection is based on either position measurement (soft limit switch) or optional internal limit switch information

**Technical description**
Neles ValvGuard VG9000 is a 4-20 mA loop-powered microcontroller-based intelligent safety solenoid with partial stroke testing and HART communication. The device stays alive even at 3.7 mA input signal and communicates via HART. Optional RCI unit is required if the safety system output is binary (DO) 24 V DC.

Neles ValvGuard VG9000F is a microcontroller-based intelligent safety solenoid with partial stroke testing and FOUNDATION fieldbus communication. In addition to FOUNDATION fieldbus there is also a separate binary 24 V DC signal. It is isolated from the fieldbus and powers the safety part.

The device contains a Local User Interface enabling local configuration. A PC with Metso FieldCare software can be used for advanced configuration and diagnostics.

The powerful 32-bit microcontroller controls the valve position during partial stroke and other special testing.

The measurements include:
- Input signal (VG9000H)
- Safety signal (VG9000F)
- Valve position with contactless sensor
- Actuator pressures, two independent measurements
- Supply pressure
- Device temperature
- Housing pressure

Advanced self-diagnostics ensures that all measurements operate correctly. Failure of any measurement does not cause the valve to go to fail-safe position.

Operating principle of VG9000 is based on pneumatic solenoid valve (SV) and prestage (PR) which is controlled by microcontroller (μC). Information from the various sensors is used for the operation.
NELES® VALVGUARD VG9000 IN TELLIGENT SAFETY SOLENOID

TECHNICAL SPECIFICATIONS

Neles ValvGuard VG9000H & VG9000F

General
VG9000H: Loop powered 4 - 20 mA, no external power supply required.
VG9000F: FOUNDATION fieldbus powered diagnostics, 24 VDC power from safety system for the safety part.
Suitable for rotary and linear valves.
Actuator connections in accordance with VDI/VDE 3845 and IEC 60534-6 standards.
Action: Double or single acting
Travel range: Linear: 10–120 mm
Rotary: 45–95°
Measurement range: 110° with freely rotating feedback shaft

Environmental influence
Standard temperature range: -40° to +85 °C / -40° to +185 °F
Influence of temperature on valve position: < 0.5 % / 10 °K
Influence of vibration on valve position:
No effect when measured impulse 2g 5–150 Hz, 1g 150–300 Hz, 0.5g 300–2000 Hz.
No effect on PST if max. response 4g measured at housing.
No unintended valve movements if max. response 15g measured at housing

Enclosure
Material: Epoxy coated anodised aluminum alloy and glass window (VG92_, not E2) or full 316 stainless steel enclosure (VG93_)
Protection class: IP66, NEMA 4X
Mechanical position indicator and LUI visible through the main cover (VG92_, not E2)
Pneumatic ports:
VG9_1_ 1/4 NPT
VG9235 1/2 NPT
VG9237 1 NPT (1/2 NPT supply) (single acting only)
Conduit entry thread: M20 x 1.5
Weight:
VG921_ 3.0 kg / 6.6 lb
VG9235 4.6 kg / 10.1 lb
VG9237 5.0 kg / 11 lb
VG9315 9.0 kg / 19.8 lb
VG92_ with extension housing plus 1.0 kg / 2.2 lb
VG93_ with extension housing plus 3.0 kg / 6.6 lb

Pneumatics
Supply pressure: 3.0–7.5 bar / 44–109 psi
Output pressure: 3.0–7.5 bar / 44–109 psi
Air quality:
According to ISO 8573-1:2001
Solid particles: Class 6
Humidity: Class 1
(dew point 10 °C / 50 °F below minimum temperature is recommended)
Oil class: 3 (or <1 ppm)
Capacity with 4 bar / 60 psi supply:
VG9212 7 Nm³/h / 4.1 scfm (Cv = 0.06)
VG9215 90 Nm³/h / 53 scfm (Cv = 0.7)
VG9235 380 Nm³/h / 223 scfm (Cv = 3.2)

VG9237 feed 380 Nm³/h / 223 scfm (Cv = 3.2)
exhaust 700 Nm³/h / 412 scfm (Cv = 6.4)
Consumption with 4 bar / 60 psi supply:
actuator pressurized 0.22 Nm³/h / 0.13 scfm,
actuator vented 0.25 Nm³/h / 0.15 scfm
Consumption with 4 bar / 60 psi supply (VG9000H_P):
0.25 Nm³/h / 0.15 scfm

VG9000H electronics (input)
Electrical connections: 0.25–2.5 mm²
Supply power: Loop powered, 4–20 mA
Signal range: 3.7–22 mA
Signal details (VG9000H):
0.0–3.7 mA (trip state; diagnostics not available)
3.7–6.0 mA (trip state; diagnostics available)
6.0–16.0 mA (hysteresis range; diagnostics available)
16.0–22.0 mA (normal state; diagnostics available)
Signal details (VG9000H_P):
0.0–3.7 mA (de-energized state; diagnostics not available)
3.7–6.0 mA (normal state; diagnostics available)
6.0–8.0 mA (normal state; PST and diagnostics available)
8.0–22.0 mA (normal state; PST, calibration and diagnostics available)
Load voltage:
up to 9.7 V DC / 20 mA (corresponding 485 Ω)
Voltage:
max 30 V DC
Polarity protection: -30 V DC
Over current protection: active over 36 mA

VG9000H electronics (output)
Usage: Position transmitter (T) / device status output (S)
Electrical connections: 0.25–2.5 mm²
Output signal: Defined by type code option T or S
T: 4–20 mA = 0–100 % position
S: 4 mA = OK
5 mA = Pneumatics test
6 mA = PST test
7 mA = ETT test
8 mA = Warning
10 mA = Alarm
12 mA = Safety position requested by LCP
Fault modes indicated by levels 3.5 and 22 mA
Galvanic isolation: 600 V DC
Supply voltage: 12–30 V
Resolution: 16 bit / 0.244 μA
Linearity: <0.05 % FS
Temperature effect: <0.35 % FS
External load: max 0–780 Ω

LCP9H interface
Electrical connections: 0.25–2.5 mm²

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**VG9000F safety signal (Binary input)**

Connections: 24 VDC '+' and '-'
Min voltage: 11 V DC
Max output resistance: $R_o = 285 \, \Omega$

**VG9000F FOUNDATION fieldbus**

Connections: H1: '+' and '-'
Power supply: taken from bus
Bus voltage: 9 to 32 V DC, reverse polarity protection
Max basic current: 14.2 mA
Operating current: 20.7 mA
Fault current (FDE): 6.3 mA

**VG9000F FOUNDATION fieldbus function block execution times**

MDO 15 ms
MDI 15 ms
AI 20 ms

**Local user interface functions**

- Monitoring of valve position, temperature, supply pressure, actuator pressure difference, input signal, safety signal status and device usage option (VG9000F)
- Guided start-up function
- LUI may be locked remotely to prevent unauthorised access
- Automatic travel calibration
- Parameter selection
- Testing
- Language selection: English, German and French
- Alarm and warning state indications
- Latest event view

**Safety**

IEC 61508 compliant up to and including SIL 3 by TÜV Rheinland (not applicable to VG9000H_P)

**Electromagnetic protection**

Electromagnetic compatibility
Emission acc. to EN 61000-6-4
Immunity acc. to EN 61000-6-2

**CE marking**

89/336/EEC
Electromagnetic compatibility
94/9/EC
ATEX

**Interoperability**

FDT/DTM: VG9000 DTM certified by FDT group
HART: DD registered by HCF
FF: DD registered by FOUNDATION fieldbus

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Fig. 2. Local User Interface enables real time awareness of device parameters.

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![Fig. 3. Configuration and diagnostics are easy to do with Metso Valve Manager™, graphical user interface.](image-url)
## APPROVALS AND ELECTRICAL VALUES, VG9000H

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Approval</th>
<th>Electrical values</th>
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<td>VG9 U</td>
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Other hazardous area approvals
CCOE / PESO Ex d, Ex ia, Ex nA nL GOST R Ex d, Ex ia KOSHA Ex d NEPSi Ex d ITRI Ex d

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## APPROVALS AND ELECTRICAL VALUES, VG9000F

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<td>II 1 G Ex ia IIC T6...T4 Ga Safety signal: Ui ≤ 28 V, li ≤ 150 mA, Pi ≤ 1.0 W, Ci ≤ 15 nF, Li ≤ 220 μH FF signal: Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Device conforms to the FISCO field device according to the standard IEC60079-11.</td>
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## INMETRO

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<td>CSA 1980091</td>
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DIMENSIONS (mm)

**VG921_(J)_**

**VG921_/L_ , /K_ , /D_ or VG921_L_**
VG931_J

VG931_with extension housing

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**HOW TO ORDER**

**NELES VALVGUARD VG9000**

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<td>H</td>
<td>E6</td>
<td>/</td>
<td>D33</td>
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*) Slash shall always be marked in places shown above.

### 1. sign
**PRODUCT GROUP**

- VG: Neles ValGuard VG9000, intelligent safety solenoid.

### 2. sign
**SERIES CODE**

- 9: Series 9000 intelligent safety solenoid with universal shaft and attachment face according to standard VDI/VDE 3845. Relevant shaft adapter included in mounting kits. When VG9000 is separate delivery, shaft adapter kit needs to be ordered separately (see type coding for accessories).

### 3. sign
**ENCLOSURE**

- IP66 / NEMA 4X: Standard temperature range -40° to +85 °C / -40° to +185 °F. M20 x 1.5 conduit entry; 1 pcs (VG9_H), 2 pcs (VG9_F) in extension housing.
- Standard epoxy coated anodized aluminum enclosure.
- Full 316 stainless steel enclosure, no glass window.

### 4. sign
**SPOOL VALVE**

- Restricted capacity, Stroke volume of actuator 0.3 - 6.7 dm³
  - S, C1, C2 = 1/4 NPT
- Standard capacity, Stroke volume of actuator > 0.6 dm³
  - S, C1, C2 = 1/4 NPT
- High capacity, Stroke volume of actuator > 3.5 dm³
  - Not applicable to 3. sign "S"
- Extended capacity, for single acting actuators
  - Stroke volume of actuator > 6.5 dm³
    - Not applicable to 3. sign "S"

### 5. sign
**COMMUNICATION / INPUT SIGNAL RANGE**

- H: 4-20 mA, HART communication.
- F: FOUNDATION fieldbus, physical layer according to IEC 61158-2.

### 6. sign
**APPROVALS FOR HAZARDOUS AREAS**

- **ATEX and IECEx certifications:**
  - I I 1 G Ex ia IIC T6...T4 Ga
  - I I 1 D Ex ia IIC T95 °C...T125 °C Da
  - II 2 G Ex ib IIC T95 °C...T125 °C Db
  - Temperature range: T4 or T125 °C: < +80 °C; T5 or T110 °C: < +65 °C; T6 or T95 °C: < +50 °C.
  - Available without limit switches or with certified inductive limit switches.
- **cCSAus certifications:**
  - IS Class I, Division 1, Groups A, B, C, and D; T4/T5/T6
  - IS Class I, Zone 0; AEX ia IIC T4/T5/T6 Ga
  - Temperature range: T4: < +80 °C; T5: < +65 °C; T6: < +50 °C.
    - Available without limit switches or with certified inductive limit switches.
- **INMETRO certification:**
  - Ex e nA IIC T6...T4 Gc
  - T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C.
    - Applicable to 5. sign "H"
    - Not available with limit switches.

### 7. sign
**OPTIONS**

- **Several options can be selected, but the order shown below needs to be maintained.**

- **T**: Internal 2-wire (passive) position transmitter output.
  - Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 VDC, external load resistance 0 – 780 Ω
  - Not applicable to 5. sign "T" or 7. sign "S".

- **S**: Internal 2-wire (passive) device status output.
  - Analog device status feedback signal, output 4-20mA, supply voltage 12 - 30 VDC, external load resistance 0 – 780 Ω
  - Not applicable to 5. sign "S" or 7. sign "T" or "P".

- **P**: For partial stroke test (PST) only, to be used together with additional solenoid valve for safety action. 4 mA normal state, signal failure does not affect to the valve position.
  - Applicable to 5. sign "H" and 6. sign "E6" (other approvals pending).
  - Not applicable to 7. sign "S".

- **J**: External junction box, 2 pcs M20x1.5 conduit entry.
  - Junction box for all 4-20 mA wirings, including position transmitter, if applicable. Junction box is attached to the standard enclosure.
  - Not applicable to 7. sign "L1".

- **L1**: Extension housing with additional conduit entries, 2 pcs M20x1.5.
  - Applicable to 5. sign "H" and 7. sign "T" or "P".
  - If additional conduit entry is required.
  - Not applicable to 7. sign "T" or "P" or limit switches (8.sign).

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### LIMIT SWITCH TYPE

<table>
<thead>
<tr>
<th>8. sign</th>
<th>Inductive proximity sensors, 2 pcs.</th>
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<tr>
<td>D33</td>
<td>Metso; SST Sensor Dual Module, N0, 8-125 VDC / 24 - 125 VAC. Temperature range: -40 to +80 °C / -40 to +176 °F. Usable up to SIL3 acc. to IEC61508. Applicable to 6. sign “E”, “ES” or “N6M”.</td>
</tr>
<tr>
<td>D44</td>
<td>Metso; Namur Sensor Dual Module, 6 - 29 VDC, &gt; 3 mA &lt; 1 mA, NAMUR NC. Temperature range: -40 to +80 °C / -40 to +176 °F. Usable up to SIL3 acc. to IEC61508. Applicable to 6. sign “E”, “ES” or “N6M”.</td>
</tr>
</tbody>
</table>

### OPTIONAL DEVICES FOR VG9000H

<table>
<thead>
<tr>
<th>RC9H2</th>
<th>Remote Communication Interface with Status Relays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TÜV Rheinland SIL 3 certified according to IEC61508. Safety input: 0/24/48 VDC: Output: 4/20 mA + MARTH; Power supply: 24/48 VDC Temperature range: -20 to +60 °C IP20</td>
</tr>
<tr>
<td></td>
<td>Includes integrated isolated barrier for intrinsic safe applications. ATEX certification: II (1) G (Ex ia G) IIC IECEx certification: (Ex ia Ga) IIC</td>
</tr>
</tbody>
</table>

### Local Control Panel (LCP)

ADDITIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>FILTER REGULATORS</th>
<th>DRIVER SETS FOR ROTARY ACTUATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VG921S</td>
<td>Driver sets including the needed parts when assembling VG9000 on Neles B-series actuators with VDI/VDE 3845 or Heles attachment face or QP actuators. Select the correct driver set according to the actuator and the pneumatic connections of valve controller or gauge block when applicable. <strong>Note</strong>! Earlier the driver set was delivered with bareshaft positions as default. This practise is no longer valid, the needed driver set must be ordered as an accessory.</td>
</tr>
<tr>
<td>K</td>
<td>DS02 Driver set for VG9, VG9, 15 on B1J, B1C and QP actuators (VDI mounting face), H116181. Set includes the 1/4NPT plug for single acting actuators. The driver set should also be applied with all VG with gauge blocks A3, A7 or A10.</td>
</tr>
<tr>
<td>K2</td>
<td>DS03 Driver set for VG9235 and VG9237 on B1J, B1C and QP actuators (VDI mounting face), H116182. Set includes the 1/2NPT plug for single acting actuators. The driver set can also be applied with VG with gauge block A8.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONDUIT ENTRY NIPPLES</th>
<th>3RD PARTY MOUNTING SETS / Rotary actuators</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE09</td>
<td>Mounting sets between the VG9000 and rotary actuators, including bracket and feedback system. <strong>Note</strong>! Sets are including the 1/4&quot; pneumatic plugs needed when used with single acting actuators.</td>
</tr>
<tr>
<td>CE19</td>
<td>MS21 Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 80X30-20. (H036898)</td>
</tr>
<tr>
<td></td>
<td>MS22 Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 80X30-30. (H074705)</td>
</tr>
<tr>
<td></td>
<td>MS23 Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 130X30-30. (H036899)</td>
</tr>
<tr>
<td></td>
<td>MS24 Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 130X30-50. (H074708)</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>CABLE GLANDS</th>
<th>PNEUMATIC PLUGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG6 M20 x 1.5 blue/plastic, IP66, Ex e</td>
<td>Pneumatic plugs for blocking the unused VG9000 pneumatic port when in single acting use. <strong>Note</strong>! Choose the correct plug according to VG9000 or gauge block applied. <strong>Note2</strong>! Driver sets (DS_) for rotary actuators include a plug.</td>
</tr>
</tbody>
</table>

Pressure gauges other than module A10: scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40°C... +82°C / -40°F... +180°F. K option includes a thread nipple 1/4”NPT to 1/4”NPT which is suitable with VG9200 & VG9300 option A3 (1/4”NPT AIR CONNECTION). A large capacity filter regulator (not K) must be used for actuator bigger than BC 40 and BJ 32 installation with mounting bracket. Use large capacity filter regulator also with VG923_.

VG9300 Stainless steel (AISI 316) filter regulator for supply air. Filter size 5 μm. Pressure gauge, scale bar/psi/kpa/g/kg/cm², silicone oil, AISI 316, Temperature range -40°C... +80°C / -40°F... +176°F.

Pressure gauges with connections 1/2 NPT (S) and Pressure gauges with connections 1/4 NPT (S, C1, C2)

**Note!** The pressure gauge for air pressure, module A10, has a 1/2" NPT and 1/4" NPT pressure gauge for VG931_. Gauges AISI316 for severe off-shore use, with safety glass window. Block AISI316.

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www.metso.com/valves

Subject to change without prior notice.