DVC6000 Series FIELDVUE® Digital Valve Controllers

DVC6000 Series FIELDVUE® digital valve controllers (figures 1 and 2) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the traditional function of converting a current signal to a valve-position pressure signal, DVC6000 Series digital valve controllers, using HART® communications protocol, give easy access to information critical to process operation. This can be done using a 375 Field Communicator at the valve or at a field junction box, or by using a personal computer or a system console within the control room. Using HART communication protocol, information can be integrated into a control system or received on a single loop basis.

DVC6000 Series digital valve controllers can be used on single- or double-acting actuators. The digital valve controller receives feedback of the valve travel position plus supply and actuator pneumatic pressure. This allows the instrument to diagnose not only itself, but also the valve and actuator to which it is mounted. This provides you with very cost effective maintenance information, as the required maintenance can be performed on the instrument and valve when there really is a need.

Wiring is economical because DVC6000 Series digital valve controllers use two-wire 4 to 20 mA loop power. This provides for low cost replacement of existing analog instrumentation. The DVC6000 Series digital valve controller’s two-wire design avoids the high cost of running separate power and signal wiring.

Note
Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.
Specifications

Available Configurations

Valve-Mounted Instrument:
- **DVC6010**: Sliding-stem applications
- **DVC6020**: Rotary applications and long-stroke sliding-stem applications
- **DVC6030**: Quarter-turn rotary applications

Remote-Mounted Instrument(1):
- **DVC6005**: Base unit for 2-inch pipestand or wall mounting
- **DVC6015**: Feedback unit for sliding-stem applications
- **DVC6025**: Feedback unit for rotary or long-stroke sliding-stem applications
- **DVC6035**: Feedback unit for quarter-turn rotary applications

DVC6000 Series digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators.

Input Signal

**Point-to-Point:**
- Analog Input Signal: 4-20 mA DC, nominal; split ranging available
- Minimum Voltage Available at Instrument Terminals must be 10.5 VDC for analog control, 11 VDC for HART communication (see instrument instruction manual for details)
- Minimum Control Current: 4.0 mA
- Minimum Current w/o Microprocessor Restart: 3.5 mA
- Maximum Voltage: 30 VDC
- Overcurrent Protection: Input circuitry limits current to prevent internal damage
- Reverse Polarity Protection: No damage occurs from reversal of loop current

**Multi-drop:**
- Instrument Power: 11 to 30 VDC at approximately 8 mA
- Reverse Polarity Protection: No damage occurs from reversal of loop current

Output Signal

Pneumatic signal as required by the actuator, up to 95% of supply pressure
- **Minimum Span**: 0.4 bar (6 psig)
- **Maximum Span**: 9.5 bar (145 psig)
- **Action**: Double, Single Direct, and Single Reverse

Supply Pressure(2)

- **Minimum Recommended**: 0.3 bar (5 psig) higher than maximum actuator requirements
- **Maximum**: 10.0 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower

Steady-State Air Consumption(3,4)

**Standard Relay:**
- At 1.4 bar (20 psig) supply pressure: Less than 0.38 normal m³/hr (14 scfh)
- At 5.5 bar (80 psig) supply pressure: Less than 1.3 normal m³/hr (49 scfh)

**Low Bleed Relay(5):**
- At 1.4 bar (20 psig) supply pressure: Average value 0.056 normal m³/hr (2.1 scfh)
- At 5.5 bar (80 psig) supply pressure: Average value 0.184 normal m³/hr (6.9 scfh)

**Maximum Output Capacity(3,4)**
- At 1.4 bar (20 psig) supply pressure: 10.0 normal m³/hr (375 scfh)
- At 5.5 bar (80 psig) supply pressure: 29.5 normal m³/hr (1100 scfh)

**Independent Linearity(6)**

±0.50% of output span

Electromagnetic Interference (EMI)

Tested per IEC 61326-1 (Edition 1.1). Meets emission levels for Class A equipment (industrial locations) and Class B equipment (domestic locations). Meets immunity requirements for industrial locations (Table A.1 in the IEC specification document). Immunity performance is shown in table 2.

IEC 61010 Compliance Requirements
(Valve-Mounted Instruments Only)

**Power Source**: The loop current must be derived from a separated extra-low voltage (SELV) power source

**Environmental Conditions**: Installation Category I

(continued)
Specifications (continued)

Electrical Classification

**Hazardous Area:**
- Explosion proof, Division 2, Dust-Ignition proof, Intrinsically Safe
- Explosion proof, Non-incendive, Dust-Ignition proof, Intrinsic Safety
- ATEX Flameproof, Type n, Intrinsic Safety
- IECEx Flameproof, Type n, Intrinsic Safety
- Flameproof, Intrinsic Safety

Refer to tables 3, 4, 5, 6, 7, and 8 for specific approval information

**Electrical Housing:** Meets NEMA 4X, CSA Type 4X, IEC 60529 IP66

Other Classifications/Certifications

- TIIS Japan
- KISCO Korea Industrial Safety Corp.
- FSETAN Russian – Federal Service of Technological, Ecological and Nuclear Inspectorate

Contact your Emerson Process Management sales office for classification/certification specific information

Connections

**Supply Pressure:** 1/4 NPT internal and integral pad for mounting 67CFR regulator
**Output Pressure:** 1/4 NPT internal
**Tubing:** 3/8-inch metal, recommended
**Vent (pipe-away):** 3/8 NPT internal
**Electrical:** 1/2 NPT internal conduit connection. Optional—M20 internal conduit connection, spring clamp terminal connection(?)

Operating Ambient Temperature Limits

-40 to 80°C (−40 to 176°F) for most approved valve-mounted instruments
-60 to 125°C (−76 to 257°F) for remote-mounted feedback unit.
-52 to 80°C (−62 to 176°F) for valve-mounted instruments utilizing the Extreme Temperature option (fluorosilicone elastomers).

Construction Materials

**Housing, module base and terminal box:**
- ASTM B85 A03600 low copper aluminum alloy (standard)
- CF8M (cast 316 stainless steel) (optional for valve-mounted instruments only)
**Cover:** Thermoplastic polyester
**Elastomers**
- Standard: Nitrile
- Optional: Fluorosilicone

Stem Travel

**DVC6010, DVC6015:**
0 to 102 mm (4 inches) maximum travel span
0 to 6.35 mm (0.25 inch) minimum travel span

**DVC6020, DVC6025:**
0 to 606 mm (23.875 inches) maximum travel span

Shaft Rotation (DVC6020, DVC6025, DVC6030 and DVC6035)

0 to 50 degrees minimum
0 to 90 degrees maximum

Mounting

Designed for direct actuator mounting or remote pipestand or wall mounting. Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.
Specifications (continued)

Weight

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Valve-Mounted Instruments</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>3.5 kg (7.7 lbs)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>7.7 kg (17 lbs)</td>
</tr>
<tr>
<td>Remote-Mounted Instruments</td>
<td></td>
</tr>
<tr>
<td>DVC6005 Base Unit</td>
<td>4.1 kg (9 lbs)</td>
</tr>
<tr>
<td>DVC6015 Feedback Unit</td>
<td>1.3 kg (2.9 lbs)</td>
</tr>
<tr>
<td>DVC6025 Feedback Unit</td>
<td>1.4 kg (3.1 lbs)</td>
</tr>
<tr>
<td>DVC6035 Feedback Unit</td>
<td>0.9 kg (2.0 lbs)</td>
</tr>
</tbody>
</table>

Options

- Supply and output pressure gauges or
- Tire valves,
- Integral mounted filter regulator,
- Stainless steel housing, module base and terminal box (valve-mounted instruments only),
- Low-Bleed Relay,
- Extreme Temperature

Features

- **Improved Control**—Two-way digital communications give you current valve conditions. You can rely on this real-time information to make sound process management decisions. By analyzing valve dynamics through AMS™ ValveLink® Software you can identify control areas needing improvement and maintain a high level of system performance.

- **Environmental Protection**—You can avoid additional field wiring by connecting a leak detector or limit switch to the auxiliary terminals in the DVC6000 Series digital valve controller. In this way, the instrument will issue an alert if limits are exceeded.

- **Enhanced Safety**—You can check instrument and valve operation and keep the process running smoothly and safely from a remote location. Access is possible at a field junction box, marshalling panel, or within the safety of the control room using either a 375 Field Communicator, a notebook PC, or a system workstation. Your exposure to hazardous environments is minimized and you can avoid having to access hard-to-reach valve locations.

- **Hardware Savings**—DVC6000 Series digital valve controllers, when used in an integrated system, allow you to realize significant hardware and installation cost savings by replacing other devices in the process loop, such as positioners and limit switches, with a FIELDVUE digital valve controller.

- **Built to Survive**—Field-tough DVC6000 Series digital valve controllers have fully encapsulated printed wiring boards that resist the effects of vibration, temperature, and corrosive atmospheres. A separate weather-tight field wiring terminal box isolates field-wiring connections from other areas of the instrument.

- **Increased Uptime**—With the self-diagnostic capability of DVC6000 Series digital valve controllers, you can answer questions about a valve’s performance, without pulling the valve from the line. You can run diagnostics (I/P and relay integrity, travel deviation, and on-line friction and deadband analysis and trending) while the valve is in service and operating. You can also compare the present valve/actuator signature (bench set, seat load, friction, etc.) against previously stored signatures to discover performance changes, before they cause process control problems.

- **Faster Commissioning**—The two-way communication capability allows you to quickly commission loops by remotely identifying each instrument, verifying its calibration, reviewing stored maintenance notes, and more.

- **Easy Maintenance**—DVC6000 Series digital valve controllers are modular in design. The module base can be removed from the instrument housing without disconnecting the field wiring, pneumatic connections or stem linkages. This module contains the critical sub-modules so component removal is quick and simple.
Table 1. DVC6000 Product Level Capabilities

<table>
<thead>
<tr>
<th>CAPABILITY</th>
<th>DIAGNOSTIC TIER LEVEL</th>
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<tr>
<td></td>
<td>AC</td>
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<tr>
<td>Auto Calibration</td>
<td>X</td>
</tr>
<tr>
<td>Burst Communication</td>
<td>X</td>
</tr>
<tr>
<td>Custom Characterization</td>
<td>X</td>
</tr>
<tr>
<td>Alerts</td>
<td>X</td>
</tr>
<tr>
<td>Step Response, Drive Signal Test &amp; Dynamic Error Band, Valve Signature</td>
<td>X</td>
</tr>
<tr>
<td>Performance Tuner</td>
<td>X</td>
</tr>
<tr>
<td>Travel Control – Pressure Fallback</td>
<td>X</td>
</tr>
<tr>
<td>Performance Diagnostics</td>
<td>X</td>
</tr>
<tr>
<td>Partial Stroke Testing</td>
<td>X</td>
</tr>
<tr>
<td>Lead/Lag Input Filter(2)</td>
<td>X</td>
</tr>
</tbody>
</table>

2. Refer to brochure part # D351146X012 / D351146X412 for information on Fisher optimized digital valves for compressor antisurge applications.

- **Travel Control — Pressure Fallback**—Valve position feedback is critical to the operation of a digital valve controller. Without this feedback, the control valve assembly traditionally goes to its fail safe position. DVC6000 Series digital valve controllers can detect position feedback problems caused by a travel sensor failure or linkage failure and continue to operate in “pressure control” mode. If a problem with the valve position feedback is detected, the instrument will automatically disable the travel sensor, send an alert, and control its output pressure much like an I/P transducer. This allows the valve assembly to continue to operate with reduced accuracy until maintenance can be scheduled.

**Diagnostics**

DVC6000 Series digital valve controllers are packed with user-configurable alerts and alarms. When integrated with a HART communication-based system, these flags provide real-time notification of current and potential valve and instrument problems. With AMS ValveLink Software, tests can be performed to identify problems with the entire control valve assembly. Diagnostic capabilities available are Performance Diagnostics (PD) and Advanced Diagnostics (AD). Refer to table 1 for details on the capabilities of each diagnostic tier.

**Performance Diagnostics**

Performance Diagnostics enables the use of diagnostics while the valve is in service and operating.

- Red/Yellow/Green Condition Indicator (see figure 3)
- I/P and Relay Integrity Diagnostic
- Travel Deviation Diagnostic
- One-Button Diagnostic

The One-Button Diagnostic, (shown in figure 4), is a 20 second sweep which runs the I/P and Relay Integrity, Relay Adjustment Travel Deviation, Supply Pressure, and Air Mass Flow Performance Diagnostic tests. When the sweep is complete, AMS ValveLink Software will show any errors, possible causes, and recommended actions to resolve the error(s).

- On-Line/In-Service Friction and Deadband Analysis (see figure 5)
- Friction and Deadband Trending

While all diagnostics can be run while the valve is inline, only the Performance Diagnostics can be performed while the valve is in service and operating.
E1035
ERROR
DETECTED (RED)
POSSIBLE CAUSE
ERROR TYPE
RECOMMENDED ACTION
Figure 4. One-Button Sweep—Air Mass Flow Diagnostic

Figure 3. Red/Yellow/Green Condition Indicators, Shown in AMS™ ValveLink® Software
Advanced Diagnostics

Advanced Diagnostics include the following dynamic scan tests:

- Valve Signature (see figure 6)
- Dynamic Error Band
- Instrument Drive Signal

These diagnostic scans vary the positioner set point at a controlled rate and plot valve operation to determine valve dynamic performance. The valve signature test allows you to determine the valve/actuator friction, bench set, spring rate, and seat load. The Dynamic Error Band test is a combination of hysteresis and deadband plus “slewing.” Hysteresis and deadband are static measurements. However, because the valve is moving, a dynamic error, or “slewing” error is introduced.

Dynamic scan tests give a better indication of how the valve will operate under process conditions which are dynamic, not static.

Integration

- Non-HART® Systems—Because DVC6000 Series digital valve controllers operate with a traditional 4 to 20 mA control signal, they directly replace older analog instruments. Microprocessor-based electronics provide improved performance along with repeatable and reliable configuration and calibration.

- Modbus with AMS™ ValveLink® Software and HART® Multiplexers—HART communication allows you to extract more value from DVC6000 Series digital valve controllers beyond their inherent improved performance. When integrated into a multiplexer network and using AMS ValveLink Software, the device and valve information is real-time. From the safety of a control room, multiple instruments can be monitored for alerts and alarms. Additionally, tasks such as configuration, calibration and diagnostic testing do not require special trips to the field. AMS ValveLink Software can communicate via Modbus to the distributed control system (DCS) to provide critical information such as valve travel alerts and alarms (figure 7).
Integrated Control System—A control system with HART communication capabilities has the ability to directly gather information from DVC6000 Series digital valve controllers. Information such as valve travel, alerts and alarms can be seamlessly accessed to provide a view into the field device from the safety of the control room.

Communication

HART® Protocol Overview

The HART (Highway Addressable Remote Transducer) protocol gives field devices the capability of communicating instrument and process data digitally. This digital communication occurs over the same two-wire loop that provides the 4 to 20 mA process control signal, without disrupting the process signal (figure 8). In this way, the analog process signal, with its faster response, can be used for control. At the same time, the HART digital communication gives access to calibration, configuration, diagnostic, maintenance, and additional process data. The protocol provides total system integration via a host device.

The HART protocol gives you the capability of multidropping, where you can network several devices to a single communications line. This process is well suited for remote applications such as pipelines, custody transfer sites, and tank farms.

375 Field Communicator

You can perform configuration and calibration at the valve or anywhere on the two-wire loop via a 375 Field Communicator (figure 9). Powerful tools such as the Setup Wizard and Auto Travel Calibration automate the tasks of commissioning DVC6000 Series digital valve controllers. These automation tools not only save time, but also provide accurate and repeatable results.
Figure 9. Perform Configuration and Calibration at the Valve or Anywhere on the 4 to 20 mA Loop with the 375 Field Communicator

AMS™ ValveLink® Software

AMS ValveLink Software is a Windows®-based software package that allows easy access to the information available from DVC6000 Series digital valve controllers.

Using AMS ValveLink Software, you can monitor the performance characteristics of the valve and obtain vital information without having to pull the valve from the line. I/P and Relay Integrity and Travel Deviation Diagnostics, as well as On-Line Friction and Deadband Analysis and Trending can be run while the valve is in service and operating. Valve Signature, Dynamic Error Band, and Step Response are displayed in an intuitive user-friendly environment that allows easy interpretation of data.

Diagnostic graphs can be superimposed over those previously stored to view areas of valve degradation. This allows plant personnel to concentrate efforts on equipment that needs repair, avoiding unnecessary maintenance. This diagnostic capability is readily accessible and available to you either in the control room or on the plant floor. In addition to the diagnostic features, AMS ValveLink Software contains an Audit Trail, Batch Runner for automating repetitive tasks, and Trending to view valve performance.

AMS ValveLink Software provides integration into AMS and DeltaV™ systems, with HART and Fieldbus communications.

Principle of Operation

DVC6000 Series instruments (figures 10 and 11) receive a set point and position the valve where it needs to be.

- The input signal provides electrical power and the set point simultaneously. It is routed into the terminal box through a twisted pair of wires.
- The input signal is then directed to the printed wiring board assembly where the microprocessor runs a digital control algorithm resulting in a drive signal to the I/P converter.
- The I/P converter assembly is connected to supply pressure and converts the drive signal into a pressure output signal.
- The I/P output is sent to the pneumatic relay assembly. The relay is also connected to supply pressure and amplifies the small pneumatic signal from the I/P converter into a single larger pneumatic output signal used by a single-acting actuator. For double-acting actuators, the relay accepts the pneumatic signal from the I/P converter and provides two pneumatic output signals.
- The change in relay output pressure to the actuator causes the valve to move.
- Valve position is sensed through the feedback linkage by the instrument’s travel sensor. The travel sensor is electrically connected to the printed wiring board to provide a travel feedback signal used in the control algorithm.

The valve continues to move until the correct position is attained.
Figure 10. DVC6000 Series Digital Valve Controller Assembly (Valve-Mounted Instrument)
Figure 11. DVC6000 Series Digital Valve Controller Block Diagram
Installation

The DVC6010 digital valve controller is designed for yoke mounting to sliding stem actuators. Type DVC6020 digital valve controllers are designed for mounting to rotary actuators or long stroke sliding stem actuators (over 4-inches travel). Type DVC6030 digital valve controllers are designed for mounting on virtually any quarter-turn actuator. Dimensions for valve-mounted instruments are shown in figures 12, 13, and 14. Dimensions for remote-mounted instruments are shown in figures 15 and 16.

The DVC6005 digital valve controller base unit may be remote mounted on 2-inch pipestand or wall. The remote-mounted DVC6005 base unit connects to the DVC6015, DVC6025, or DVC6035 feedback unit mounted on the actuator. Feedback wiring and pneumatic tubing to the control valve assembly must be connected in the field.

The digital valve controllers are 4 to 20 mA loop powered and do not require additional power. Electrical connections are made in the terminal box.

All pressure connections on the digital valve controllers are 1/4 NPT internal connections. The digital valve controller outputs are typically connected to the actuator inputs using 3/8-inch diameter tubing. Remote venting is available.

Ordering Information

When ordering, specify:

1. Actuator type and size
2. Maximum actuator travel or rotation
3. Options
   a. Supply pressure regulator
   b. Supply and output gauges
   c. HART filter
   d. Stainless steel housing (valve-mounted instruments only)
   e. Remote mounting

Note

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Figure 13. Dimensions for Type DVC6020 Digital Valve Controller with Integrally Mounted Filter Regulator

Figure 14. Dimensions for Type DVC6030 Digital Valve Controller with Integrally Mounted Filter Regulator
Figure 15. Dimensions for Remote-Mounted Instruments—Type DVC6005 Base Unit
Figure 16. Dimensions for Remote-Mounted Instruments—Feedback Units
### Table 2. Immunity Performance

<table>
<thead>
<tr>
<th>PORT</th>
<th>PHENOMENON</th>
<th>BASIC STANDARD</th>
<th>TEST LEVEL</th>
<th>PERFORMANCE CRITERIA(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Point-to-Point Mode</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Electrostatic discharge (ESD)</td>
<td>IEC 61000-4-2</td>
<td>4 kV contact 8 kV air</td>
<td>A(2)</td>
</tr>
<tr>
<td></td>
<td>Radiated EM field</td>
<td>IEC 61000-4-3</td>
<td>80 to 1000 MHz @ 10V/m with 1 kHz AM at 80%</td>
<td>A</td>
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<tr>
<td></td>
<td>Rated power frequency magnetic field</td>
<td>IEC 61000-4-8</td>
<td>60 A/m at 50 Hz</td>
<td>A</td>
</tr>
<tr>
<td>I/O signal/control</td>
<td>Burst</td>
<td>IEC 61000-4-4</td>
<td>1 kV</td>
<td>A(2)</td>
</tr>
<tr>
<td></td>
<td>Surge</td>
<td>IEC 61000-4-5</td>
<td>1 kV (line to ground only, each)</td>
<td>A(2)</td>
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<tr>
<td></td>
<td>Conducted RF</td>
<td>IEC 61000-4-6</td>
<td>150 kHz to 80 MHz at 3 Vrms</td>
<td>A</td>
</tr>
</tbody>
</table>

1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.
2. Excluding auxiliary switch function, which meets Performance Criteria B.

### Table 3. Type DVC6000 Series, Hazardous Area Classifications for Canada—CSA

<table>
<thead>
<tr>
<th>CERTIFICATION BODY</th>
<th>TYPE</th>
<th>CERTIFICATION OBTAINED</th>
<th>ENTITY RATING</th>
<th>TEMPERATURE CODE</th>
<th>ENCLOSURE RATING</th>
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</thead>
<tbody>
<tr>
<td>CSA</td>
<td>DVC6005</td>
<td>(Intrinsic Safety) Class/Division Class IIII Division 1 GP A,B,C,D, E,F,G per drawing 29B3520</td>
<td>V&lt;sub&gt;max&lt;/sub&gt; = 30 VDC I&lt;sub&gt;max&lt;/sub&gt; = 226 mA C&lt;sub&gt;i&lt;/sub&gt; = 5 nF L&lt;sub&gt;i&lt;/sub&gt; = 0.55 mH</td>
<td>T&lt;sub&gt;6&lt;/sub&gt; (T&lt;sub&gt;amb&lt;/sub&gt; ≤ 60°C)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td>(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D</td>
<td>V&lt;sub&gt;max&lt;/sub&gt; = 30 VDC I&lt;sub&gt;max&lt;/sub&gt; = 226 mA C&lt;sub&gt;i&lt;/sub&gt; = 5 nF L&lt;sub&gt;i&lt;/sub&gt; = 0.55 mH</td>
<td>T&lt;sub&gt;6&lt;/sub&gt; (T&lt;sub&gt;amb&lt;/sub&gt; ≤ 60°C)</td>
<td>4X</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>T&lt;sub&gt;5&lt;/sub&gt; (T&lt;sub&gt;amb&lt;/sub&gt; ≤ 80°C)</td>
<td>4X</td>
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<tr>
<td></td>
<td>DVC6x0</td>
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<td>(Intrinsic Safety) Class/Division Class IIIII Division 1 GP A,B,C,D, E,F,G per drawing 29B3428</td>
<td>V&lt;sub&gt;max&lt;/sub&gt; = 30 VDC I&lt;sub&gt;max&lt;/sub&gt; = 226 mA C&lt;sub&gt;i&lt;/sub&gt; = 5 nF L&lt;sub&gt;i&lt;/sub&gt; = 0.55 mH</td>
<td>T&lt;sub&gt;5&lt;/sub&gt; (T&lt;sub&gt;amb&lt;/sub&gt; ≤ 80°C)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D</td>
<td>V&lt;sub&gt;max&lt;/sub&gt; = 30 VDC I&lt;sub&gt;max&lt;/sub&gt; = 226 mA C&lt;sub&gt;i&lt;/sub&gt; = 5 nF L&lt;sub&gt;i&lt;/sub&gt; = 0.55 mH</td>
<td>T&lt;sub&gt;6&lt;/sub&gt; (T&lt;sub&gt;amb&lt;/sub&gt; ≤ 80°C)</td>
<td>4X</td>
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<td></td>
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<td>CERTIFICATION BODY</td>
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<td>ENTITY RATING</td>
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<td>-----------------</td>
</tr>
<tr>
<td>DVC60x0 DVC60x0S</td>
<td>(x = 1,2,3)</td>
<td>(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D,E,F,G per drawing 29B3427</td>
<td>$V_{\text{max}} = 30 \text{ VDC}$ $I_{\text{max}} = 226 \text{ mA}$ $C_i = 5 \text{ nF}$ $L_i = 0.55 \text{ mH}$ $P_i = 1.4 \text{ W}$</td>
<td>T5 ($T_{\text{amb}} \leq 80^\circ \text{C}$)</td>
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<td></td>
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<td>(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D</td>
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<td>Class I Division 2 GP A,B,C,D</td>
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<tr>
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<td></td>
<td>Class II,III Division 1 GP E,F,G</td>
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</tr>
<tr>
<td>FM DVC6005</td>
<td></td>
<td>(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D,E,F,G per drawing 29B3521</td>
<td>$V_{\text{max}} = 30 \text{ VDC}$ $I_{\text{max}} = 226 \text{ mA}$ $C_i = 5 \text{ nF}$ $L_i = 0.55 \text{ mH}$ $P_i = 1.4 \text{ W}$ $V_{\text{oc}} = 9.6 \text{ VDC}$ $I_{\text{sc}} = 3.5 \text{ mA}$ $C_{\text{sa}} = 3.6 \mu\text{F}$ $L_{\text{sa}} = 100 \text{ mH}$ $P_{\text{o}} = 8.4 \text{ mW}$</td>
<td>T6 ($T_{\text{amb}} \leq 60^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Explosion Proof) Class/Division Class I, Division 1 GP C,D</td>
<td>− − −</td>
<td>T6 ($T_{\text{amb}} \leq 60^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class I Division 2 GP A,B,C,D</td>
<td>− − −</td>
<td>T6 ($T_{\text{amb}} \leq 60^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class II,III Division 1 GP E,F,G</td>
<td>− − −</td>
<td>T6 ($T_{\text{amb}} \leq 60^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class II,III Division 2 GP F,G</td>
<td>− − −</td>
<td>T6 ($T_{\text{amb}} \leq 60^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td>DVC60x5 (x = 1,2,3)</td>
<td></td>
<td>(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D,E,F,G per drawing 29B3521</td>
<td>$V_{\text{max}} = 10 \text{ VDC}$ $I_{\text{max}} = 4 \text{ mA}$ $C_i = 0 \text{ nF}$ $L_i = 0 \text{ mH}$ $P_i = 10 \text{ mW}$</td>
<td>T4 ($T_{\text{amb}} \leq 125^\circ \text{C}$) T5 ($T_{\text{amb}} \leq 95^\circ \text{C}$) T6 ($T_{\text{amb}} \leq 80^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Explosion Proof) Class/Division Class I, Division 1 GP A,B,C,D</td>
<td>− − −</td>
<td>T4 ($T_{\text{amb}} \leq 125^\circ \text{C}$) T5 ($T_{\text{amb}} \leq 95^\circ \text{C}$) T6 ($T_{\text{amb}} \leq 80^\circ \text{C}$)</td>
<td>4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class I Division 2 GP A,B,C,D</td>
<td>− − −</td>
<td>T4 ($T_{\text{amb}} \leq 125^\circ \text{C}$) T5 ($T_{\text{amb}} \leq 95^\circ \text{C}$) T6 ($T_{\text{amb}} \leq 80^\circ \text{C}$)</td>
<td>4X</td>
</tr>
</tbody>
</table>
Table 5. DVC6000 Series, Hazardous Area Classifications—ATEX

<table>
<thead>
<tr>
<th>CERTIFICATE</th>
<th>TYPE</th>
<th>CERTIFICATION OBTAINED</th>
<th>ENTITY RATING</th>
<th>TEMPERATURE CODE</th>
<th>ENCLOSURE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVC6005</td>
<td>Ⅱ 1 G D Gas</td>
<td>EEx ia IIC T5/T6—Intrinsic Safety Dust</td>
<td>T85°C (Tamb ≤ 80°C)</td>
<td>Uᵢ = 30 VDC  Iᵢ = 226 mA  Cᵢ = 5 nF  Lᵢ = 0.55 mH  Pᵢ = 1.4 W</td>
<td>T5 (Tamb ≤ 80°C)  T6 (Tamb ≤ 75°C)</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Ⅱ 2 G D Gas</td>
<td>EEx d IIB T5/T6—Flameproof Dust</td>
<td>T90°C (Tamb ≤ 85°C)</td>
<td>− − −</td>
<td>T5 (Tamb ≤ 80°C)  T6 (Tamb ≤ 75°C)</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Ⅱ 3 G D Gas</td>
<td>EEx nCL IIC T5/T6—Type n Dust</td>
<td>T85°C (Tamb ≤ 80°C)</td>
<td>− − −</td>
<td>T5 (Tamb ≤ 80°C)  T6 (Tamb ≤ 75°C)</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Ⅱ 1 G D Gas</td>
<td>EEx ia IIC T4/T5/T6—Intrinsic Safety Dust</td>
<td>T130°C (Tamb ≤ 125°C)</td>
<td>Uᵢ = 10 VDC  Iᵢ = 4 mA  Cᵢ = 0 nF  Lᵢ = 0 mH  Pᵢ = 10 mW</td>
<td>T4 (Tamb ≤ 125°C)  T5 (Tamb ≤ 95°C)  T6 (Tamb ≤ 80°C)</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Ⅱ 2 G D Gas</td>
<td>EEx d IIC T4/T5/T6—Flameproof Dust</td>
<td>T130°C (Tamb ≤ 125°C)</td>
<td>− − −</td>
<td>T4 (Tamb ≤ 125°C)  T5 (Tamb ≤ 95°C)  T6 (Tamb ≤ 80°C)</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Ⅱ 3 G D Gas</td>
<td>EEx nA IIC T4/T5/T6—Type n Dust</td>
<td>T130°C (Tamb ≤ 125°C)</td>
<td>− − −</td>
<td>T4 (Tamb ≤ 125°C)  T5 (Tamb ≤ 95°C)  T6 (Tamb ≤ 80°C)</td>
</tr>
</tbody>
</table>
### Table 6. DVC6000 Series, Hazardous Area Classifications—IECEX

<table>
<thead>
<tr>
<th>CERTIFICATE</th>
<th>TYPE</th>
<th>CERTIFICATION OBTAINED</th>
<th>ENTITY RATING</th>
<th>TEMPERATURE CODE</th>
<th>ENCLOSURE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>IECEx</td>
<td>Gas</td>
<td>Ex ia IIC T5/T6—Intrinsic Safety</td>
<td>Uᵢ = 30 VDC Iᵢ = 226 mA Cᵢ = 5 nF Lᵢ = 0.55 mH Pᵢ = 1.4 W</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Gas</td>
<td>Ex ia IIC T5/T6—Intrinsic Safety</td>
<td>Uᵢ = 30 VDC Iᵢ = 226 mA Cᵢ = 5 nF Lᵢ = 0.55 mH Pᵢ = 1.4 W</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>Ex d IIB/H2 T5/T6—Flameproof</td>
<td>- - -</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>Ex nC IIC T5/T6—Type n</td>
<td>- - -</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Gas</td>
<td>Ex ia IIC T4/T5/T6—Intrinsic Safety</td>
<td>Uᵢ = 10 VDC Iᵢ = 4 mA Cᵢ = 0 nF Lᵢ = 0 mH Pᵢ = 10 mW</td>
<td>T4 (Tᵢamb ≤ 125°C) T5 (Tᵢamb ≤ 95°C) T6 (Tᵢamb ≤ 80°C)</td>
<td>IP66</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>Ex d IIC T4/T5/T6—Flameproof</td>
<td>- - -</td>
<td>T4 (Tᵢamb ≤ 125°C) T5 (Tᵢamb ≤ 95°C) T6 (Tᵢamb ≤ 80°C)</td>
<td>IP66</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>Ex nA IIC T4/T5/T6—Type n</td>
<td>- - -</td>
<td>T4 (Tᵢamb ≤ 125°C) T5 (Tᵢamb ≤ 95°C) T6 (Tᵢamb ≤ 80°C)</td>
<td>IP66</td>
</tr>
</tbody>
</table>

### Table 7. DVC6000 Series, Hazardous Area Classifications—NEPSI

<table>
<thead>
<tr>
<th>CERTIFICATE</th>
<th>TYPE</th>
<th>CERTIFICATION OBTAINED</th>
<th>ENTITY RATING</th>
<th>TEMPERATURE CODE</th>
<th>ENCLOSURE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSI</td>
<td>Gas</td>
<td>Ex ia IIC T5/T6—Intrinsic Safety Dust DIP A21 T5</td>
<td>Uᵢ = 30 V Iᵢ = 226 mA Cᵢ = 5 nF Lᵢ = 0.55 mH Pᵢ = 1.4 W</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
<tr>
<td>DVC6005</td>
<td>Gas</td>
<td>Ex d IIC T5/T6(1)—Flameproof Dust DIP A21 T5</td>
<td>- - -</td>
<td>T5 (Tᵢamb ≤ 80°C) T6 (Tᵢamb ≤ 75°C)</td>
<td>IP66</td>
</tr>
</tbody>
</table>

1. Except acetylene.

### Table 8. DVC6000 Series, Hazardous Area Classifications—INMETRO

<table>
<thead>
<tr>
<th>CERTIFICATE</th>
<th>TYPE</th>
<th>CERTIFICATION OBTAINED</th>
<th>ENTITY RATING</th>
<th>TEMPERATURE CODE</th>
<th>ENCLOSURE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>INMETRO</td>
<td>BR–Ex ia IIC T5</td>
<td></td>
<td>Uᵢ = 30 V Iᵢ = 180 mA Cᵢ = 5 nF Lᵢ = 0.55 mH Pᵢ = 1.4 W</td>
<td>T5(Tᵢamb ≤ 80°C)</td>
<td>- - -</td>
</tr>
<tr>
<td></td>
<td>BR–Ex d IIB/H2 T6</td>
<td></td>
<td>- - -</td>
<td>T6 (Tᵢamb ≤ 75°C)</td>
<td>- - -</td>
</tr>
</tbody>
</table>