Intrinsically Safe Series
2-way, 3-way and 4-way Valves

General Description:

For hazardous and low-power power applications

Today, intrinsically safe systems and products are recommended, or in some cases compulsory, where the highest level of protection from explosion is required. They are also employed in applications that require low power.

A hazardous (classified) location is where fire or explosion hazards exist due to the presence of flammable gases or vapors, flammable liquids, combustible dust, or easily ignitable fibers or flyings.

Parker Fluid Control Division (FCD) has long served industry with innovative and safety related products. Our Intrinsically Safe solenoid valves have approvals for use in the United States and Canada in hazardous classifications for Classes I, II, III, Division 1 and 2, and in the United Kingdom for Division 0, 1 and 2. In Europe our valves are approved according to ATEX standards. All countries in Western Europe now follow common (ATEX) standards. All ATEX member countries should recognize apparatus which have been tested and certified by any ATEX member country.

What is an intrinsically safe system?
An intrinsically safe system is most often an assembly of approved intrinsically safe apparatus, associated apparatus, and interconnecting cables. Approved I.S. apparatus are devices that are incapable, during normal operation or under fault conditions, of causing explosive atmospheres to ignite by spark or thermal effect. Explosive atmospheres are mixtures of flammable or combustible material in air in ignitable concentrations.

Solenoid valves are examples of I.S. apparatus and must be approved for use in specific hazardous (classified) locations. Associated apparatus, such as safety barriers, are devices which affect the energy in the I.S. circuit and are relied upon to maintain intrinsic safety.

How does intrinsic safety apply to solenoid valves?
When related to solenoid valves, intrinsic safety means that the coil’s current draw and resulting temperature is held to such a low level (by an approved safety barrier) that the valve no longer has the capability of igniting a mixture of flammable or combustible material, either during normal operation or under fault conditions.

When designed into an intrinsically safe system, FCD’s Intrinsically Safe solenoid valves provide a number of significant performance advantages.

Low Power Consumption
FCD’s Intrinsically Safe valves are rated at 24 VDC nominal, and are calibrated to operate at a minimum current draw as low as 29 milliamps (0.029 amps).

Low Temperature Rise
FCD Intrinsically Safe valve enclosures are designed to maintain a maximum outside surface temperature of less than 85°C. This meets the T6 classification assigned by Underwriters Laboratories Inc.

Variety of Mounting Possibilities
FCD Intrinsically Safe valves can be mounted in any position and still operate normally.

Media Compatibility
Intrinsically Safe FCD valves in 2-way constructions are suitable for use with oil, air, water, and inert gases. Our 3- and 4-way valves are suitable for use with air and inert gases only.

Watertight Construction
All Intrinsically Safe FCD coil enclosures are equivalent to NEMA Type 4X Watertight construction.

Note: See chart on page D51 for the allowable valve/coil combinations.
Intrinsically Safe
2-Way Direct Acting & Pilot Operated Valves

Mechanical Characteristics:
Standard Materials of Construction
• Body—Brass
• Seals—FKM, NBR
• Compatible Media
• Air, Inert Gas, Water and Lt. Oil (300 SSU)

Electrical Characteristics:
Based on coil selected. View the following coil and enclosure pages for detailed electrical information.

Miscellaneous:
For applications below 32°F, valves must be degreased. Consult Fluid Control Division prior to ordering.

Intrinsically Safe Solenoid Valves—Two-Position

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** For Coil Information, see page D48

Valve Reference D30

2-Way Normally Closed
Port Identification:
1-In/2-Out

For Coil Information, see page D48
Valve Reference D31

2-Way Normally Closed
Port Identification:
Flow arrow on body indicates flow direction. Ports are not marked.

Valve Reference D32

2-Way Normally Closed
Port Identification:
Flow arrow on body indicates flow direction. Ports are not marked.

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Intrinsically Safe
3-way Direct Acting, Pilot Operated and Manual Reset Valves

Mechanical Characteristics:

Standard Materials of Construction
• Body—Brass, Stainless Steel or Aluminum
• Seals—FKM, NBR

Electrical Characteristics:

Compatible Fluids
• Air and inert gases

Intrinsically Safe Solenoid Valves - Two Position, 3-way - Normally Closed ***

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* U133X5196 and U033X5156: Consult factory for available coil/enclosure options.
** For Coil Information, see page D48
*** U133X5196 is a 3-way, two position, Universal construction.

Valve Reference D33

3-Way Normally Closed
Port Identification:
1-Cylinder/2-Pressure/0-Exhaust

Parker Hannifin Corporation
Fluid Control Division
1 800 825 8305 (1 800 Valve05)
www.parker.com/fcd
Valve Reference D34

3-Way Normally Closed
Port Identification:
1-Pressure/2-Cylinder/0-Exhaust

Valve Reference D35

3-Way Universal
Port Identification:
1-Normally Closed/
2-Common/3-Normally Open
Valve Reference D36

3-Way Normally Closed
Port Identification:
2-Cylinder/1-Pressure/3-Exhaust

Valve Reference D37

3-Way Normally Closed
Port Identification:
2-Cylinder/1-Pressure/3-Exhaust
Valve Reference D38

3-Way Normally Closed
Port Identification:
1- Pressure/2-Cylinder/3-Exhaust

Valve Reference D39

3-Way Normally Closed
Port Identification:
P-Pressure/A-Cylinder/R-Exhaust
Intrinsically Safe

4-way Piped and 3/4-way NAMUR Direct Mount Valves

Mechanical Characteristics:
- Compatible Fluids
  - Air and inert gases

Electrical Characteristics:
- Based on coil selected. View the following coil and enclosure pages for detailed electrical information.

Skinner Intrinsically Safe Solenoid Valves

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** For Coil Information, see page D48
Valve Reference D41

4-Way 2 position single solenoid
Port identification:
Press-1/Cyl - 2, 4/EXH 3, 5

Valve Reference D42

4/2 4-Way Two Position
Port Identification:
1-Pressure/2, 4-Cylinder/3-Exhaust
Valve Reference D43

4/2 4-Way Two Position

Port Identification:
P-Pressure/B, A-Cylinder/S, R-Exhaust

Valve Reference D44

4-Way 2 position single solenoid

Port Identification:
Press-1/CYL-2,4/EXH 3,5
Valve Reference D45

4-Way 2 position dual solenoid
Port Identification:
Press-1/CYL-2,4/EXH 3,5

Valve Reference D49

4-Way 2 position dual solenoid
Port Identification:
Press-1/CYL-2,4/EXH 3,5

Manual override mechanical option
Valve Reference D51

4-Way 2 position dual solenoid
Port Identification:
1-Pressure/2, 4-Cylinder/3, 5-Exhaust

Valve Reference D62

5/2, 4-Way 2 Position Single Solenoid
Port Identification:
1-Pressure/2, 4-Cylinder/3, 5-Exhaust
Valve Reference D63

5/2, 4-Way 2 Position Dual Solenoid

Port Identification:
1-Pressure/2, 4-Cylinder/3, 5-Exhaust
Intrinsically Safe
Coil and Enclosure Information

Important: The intrinsically safe supply circuit should have enough capacity in all environmental and system conditions to insure delivery of at least the minimum specified operating current of the coil. Be sure to include the internal coil resistance and the bridge rectifier resistance (where applicable) when calculating circuit parameters.

Splice Box Enclosure with Strain Relief

Egress Specifications:

Protection Class
- IP 65 according to DIN 40050 and IEC 529 standards. Equivalent to NEMA 4 Watertight.

Construction
- Polyamid with fiberglass enclosure and cover.

Electrical Entry and Connections
- Cable entry through a blue cable gland M20 X 1.5. Screw terminals for leads 3 x 1.5mm. Additional ground connection possible with external screw terminal.

Enclosure
- Coil, printed circuit and other parts for I.S. specifications are completely encapsulated within the enclosure using epoxy material.

Dielectric Strength
- Greater than 500 V rms

Bridge Rectifier Resistance
- Less than 50 ohms at 29mA

Coil Internal Resistance
- 295 ohms at 20°C

Voltage
- 24 VDC nominal

Minimum Operating Current
- 29 milliamps

Coil Temperature Rise
- Less than 5°C

Maximum Enclosure Temperature
- <85°C (corresponding to T6 class) according to ATEX.

Ambient Temperature
- -13°F to +149°F (-25°C to +65°C)

F.M. Entity Parameters
- Vmax = 30 volts
- Imax = 100 mA
- Ci = 0
- Li = 0 mH

Options
- 1/2" NPT Conduit Hub Adaptor. Order part number U22-001.

Electrical Parts

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Valve Reference D46

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**INTEGRITY**

Parker Hannifin Corporation
Fluid Control Division
1 800 825 8305 (1 800 Valve05)
www.parker.com/fcd
Intrinsically Safe
Coil and Enclosure Information

Potted Lead Wire Coil with Strain Relief

Egress Specifications

Protection Class
- IP 67 according to DIN 40050 and IEC 529 standards. Equivalent to NEMA 4 Watertight.

Construction
- Epoxy coated metal enclosure and cover.

Electrical Entry and Connections
- Fixed and potted two core (2 x 1mm²) blue connection cable of 2m length. Other cable lengths on request. Entry gland pg 11 (18.6mm) (DIN 46320). Additional ground connection possible with external screw terminal.

Enclosure
- Coil, welded lead connections, printed circuit and other parts for I.S. specifications are completely encapsulated within the enclosure using epoxy material.

Dielectric Strength
- Greater than 500 V rms

Bridge Rectifier Resistance
- Less than 50 ohms at 29mA

Coil Internal Resistance
- 295 ohms at 20°C

Voltage
- 24 VDC nominal

Minimum Operating Current
- 29 milliamps

Coil Temperature Rise
- Less than 5°C

Maximum Enclosure Temperature
- <85°C (corresponding to T6 class) according to ATEX.

Ambient Temperature
- -40°F to + 149°F (-40°C to +65°C)

F.M. Entity Parameters
- Vmax = 30 volts
- Imax = 100 mA
- Ci = 0
- Li = 0 mH

Options
- 1/2" NPT Conduit Hub Adaptor. Order part number U22-001.

Electrical Parts

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Approvals</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>490890</td>
<td>FM/CSA</td>
<td>Class I, Div. 1, Grps A,B,C,D</td>
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<tr>
<td></td>
<td>LCIE 02 ATEX 6024X</td>
<td>Class II, Div. 1, Grps E,F,G</td>
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<td></td>
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<td>Class III, Div. 1</td>
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<td></td>
<td></td>
<td>tD A20 IP66 T80°C</td>
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<tr>
<td>488660.01</td>
<td>LCIE 02 ATEX 6024X</td>
<td>Ex la IIC T6</td>
</tr>
</tbody>
</table>

Valve Reference D47

(cable length)
Intrinsically Safe
Coil and Enclosure Information

Splice Box Enclosure with Booster Circuit and Strain Relief Egress Specifications

Protection Class
• IP 65 according to DIN 40050 and IEC 529 standards. Equivalent to NEMA 4 Watertight.

Construction
• Polyamid with fiberglass enclosure and cover.

Electrical Entry and Connections
• Screw terminals within terminal box. Cable connection through M20x1.5 cable gland. Additional ground connection possible with external ground terminal.

Enclosure
• Coil, printed circuit and other parts for I.S. specifications are completely encapsulated within the enclosure using epoxy material.

Booster Circuits
• The electronic booster circuit consists of capacitor, diodes, thyristor and Zener diode.

Voltage
• Nominal: 24 VDC nominal
• Maximum: 28 VDC
• Minimum at Attraction: 21.6 VDC

Circuit design must ensure that at least 21.6 VDC is available at the solenoid for proper operation.

Minimum Holding Current
• 60 mA

Coil Temperature Rise
• Less than 5°C

Maximum Enclosure Temperature
• <85°C (corresponding to T6 class) according to ATEX.

Ambient Temperature
• 13°F to + 140°F (-25°C to +60°C)

Required Time Delay for Renewed Valve Actuation after Booster Discharge
• Approximately 1-3 seconds at nominal voltage

Duty Cycle
• 100% solenoid duty

Options
• 1/2" NPT Conduit Hub Adaptor. Order part number U22-001.

Electrical Parts

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Approvals</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>495910</td>
<td>LCIE 03 ATEX 6464X</td>
<td>Ex ia IIC T6, T5, T4,</td>
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<td></td>
<td>Ex ia IIB T6, T5, T4,</td>
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<td>tD A20 IP67 T130°C/T95°C/T80°C</td>
</tr>
</tbody>
</table>

Valve Reference D48

Wiring Schematic for Booster Circuit

Note: Dimensions are shown in millimeters
Intrinsically Safe
Valve ordering information

<table>
<thead>
<tr>
<th>Pressure Vessel Part Number</th>
<th>Coil Part Numbers* and Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>U121K0490</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>U121K0690</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>U121K0890</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>U131E0390</td>
<td>obsolete obsolete obsolete obsolete obsolete</td>
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<tr>
<td>U131K0490</td>
<td>X X X X X X</td>
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<tr>
<td>U131K0690</td>
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<tr>
<td>U131K0890</td>
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<tr>
<td>U131V5490</td>
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<tr>
<td>U321G3690</td>
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<td>U321G3990</td>
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<td>U321G4090</td>
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<td>U321H1590</td>
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<tr>
<td>U331B7490</td>
<td>X X X X X X</td>
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<tr>
<td>U331L2190</td>
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<tr>
<td>U341B3490</td>
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<tr>
<td>U341L2190</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>U347L1190</td>
<td>X X X X X X</td>
</tr>
</tbody>
</table>

*Coil Part Numbers ending in ‘N7’ are ATEX and those ending in ‘L8’ are FM/CSA listed
“Drop the first two digits (‘49’ or ‘48’) of the coil part number and add to Pressure Vessel Part Number to create the complete valve part number (i.e. U121K0490 with coil 495910N7 becomes U121K04905910N7)

**Note:** For U133X5196 and U033X5196, consult factory for available coils and enclosures
Specialty

### Hazardous (Classified) Locations
(In accordance with Article 500, National Electrical Code-1984)

#### Hazardous Classifications (Class)

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>UK and ATEX (BS5501: Part 1 EN 50 014)</th>
<th>US National Electrical Code Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Gasses or Vapors</td>
<td>Ethane, propane, butane, pentane, hexane, heptane, octane, nonane, decane, acetic acid, acetone, methanol, toluene, ethyl acetate</td>
<td>Group D: Acetone, hydrocarbons, acetates, alcohols, etc.</td>
</tr>
<tr>
<td>Class II</td>
<td>Dust</td>
<td>Ethylene, Coke, oven gas, dimethyl ether, diehyd ether, ethylene oxide</td>
<td>Group C: Ether, UDMH, ethylene, etc.</td>
</tr>
<tr>
<td>Class III</td>
<td>Fibers</td>
<td>Hydrogen</td>
<td>Group B: Acetylene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carbon Disulphide</td>
<td>No Classification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acetylene</td>
<td>Group A: Acetylene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethyl Nitrate</td>
<td>No Classification</td>
</tr>
</tbody>
</table>

#### Hazardous Atmosphere Classifications

- **Division 1**: Hazardous vapors present
- **Division 2**: Hazardous vapors contained but may be present
- **Division 1**: Surface accumulated non-air suspended
- **Division 2**: Handled, manufactured or used
- **Division 2**: Handled and stored

#### Typical Gasses in Atmosphere Class I
- Ethane, propane, butane, pentane, hexane, heptane, octane, nonane, decane, acetic acid, acetone, methanol, toluene, ethyl acetate
- Ethylene, Coke, oven gas, dimethyl ether, diehyd ether, ethylene oxide
- Hydrogen
- Carbon Disulphide

#### UK and ATEX
- Ethane, propane, butane, pentane, hexane, heptane, octane, nonane, decane, acetic acid, acetone, methanol, toluene, ethyl acetate: Group D
- Ethylene, Coke, oven gas, dimethyl ether, diehyd ether, ethylene oxide: Group C
- Hydrogen: Group B

#### Surface Temp/Agency Code Cross Reference

<table>
<thead>
<tr>
<th>Maximum Surface Temperature</th>
<th>US Standard (U. L.)</th>
<th>ATEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>450°C</td>
<td>T1</td>
<td>T1</td>
</tr>
<tr>
<td>300°C</td>
<td>T2</td>
<td>T2a - 280°C</td>
</tr>
<tr>
<td>200°C</td>
<td>T3</td>
<td>T3a - 180°C</td>
</tr>
<tr>
<td>150°C</td>
<td>T4</td>
<td>T4a - 120°C</td>
</tr>
<tr>
<td>100°C</td>
<td>T5</td>
<td>T5</td>
</tr>
<tr>
<td>85°C</td>
<td>T6</td>
<td>T6</td>
</tr>
</tbody>
</table>

#### Hazardous Area Classifications

- **An explosive atmosphere is continuously present**: Division I Zone 0
- **An explosive atmosphere is intermittently present during normal operations**: Division I Zone 1
- **An explosive atmosphere is present during abnormal conditions**: Division II Zone 2

Note: These charts are provided for reference only. Consult the U.S. National Electrical Code or rating agencies such as Factory Mutual or Underwriter's Laboratories for specific details.