**INTRINSICALLY SAFE CIRCUIT**

In order to use an intrinsically safe valve in a hazardous location, the installation must be in accordance with the following installation diagram:

1. **FIELD DEVICE**
   This is defined as the device that will be used in the hazardous location. In this case, the field device will be the intrinsically safe valve.

2. **ASSOCIATED APPARATUS**
   This will be an energy limiting device also known as a barrier.

3. **FIELD WIRING**
   Wiring used to connect the two above devices.

When the MAC intrinsically safe valves were tested for approval, they were tested and approved for the following atmospheres:

- **Class I, II, & III**
- **Division 1**
- **Groups : A, B, C, D, E, F & G**

under the following parameters:

- **Vmax** : 30 VDC
- **Imax** : 175 ma
- **Ci** : 0
- **Li** : 0

Consult “Precautions” page 364 before use, installation or service of MAC Valves.
What this means is that the intrinsically safe valves were tested against each atmosphere with up to 30 VDC and 175 mA of current across the solenoid and found to still be safe. The other two parameters are values to indicate how much energy can be stored or created by the valve:

- **Ci**: Internal capacitance of the solenoid.
  - This indicates how much energy the solenoid is capable of storing.

- **Li**: Internal inductance of the solenoid.
  - This indicates the solenoid’s ability to create or increase energy beyond what is supplied.

When applying an intrinsically safe valve in a hazardous location, a proper barrier must first be selected. The barrier selection process must first take into account the parameters the valve was approved for and compared in the following way:

- **Vmax** must be greater than or equal to **Voc** of the barrier.
  - **Voc** = Voltage open circuit or maximum allowed out of the barrier
- **Imax** must be greater than or equal to **Isc** of the barrier.
  - **Isc** = Current short circuit or the maximum current allowed out of the barrier
- **Ci** plus field wiring must be less than **Ca** of the barrier.
  - **Ca** = Allowed capacitance
- **Li** plus field wiring must be less than **La** of the barrier.
  - **La** = Allowed inductance

When properly combined, the barrier will never allow more energy to the intrinsically safe valve than what it was tested and approved for.

The following page can be used as your guide to help ask the right questions when working with an intrinsically safe circuit. Also included is a partial list of intrinsically safe barriers that have been tested with the MAC intrinsically safe valves.
Approval: Factory Mutual Research 2X7A8.AX (3610)
Approved as intrinsically safe apparatus and associated apparatus for use in Class I, II, III - Division 1, Group: A, B, C, D, E, F & G.

Parameters:
- Vmax: 30 VDC
- Imax: 175 ma
- Ci: 0
- Li: 0
- Operating voltage greater than 11.5 volts
- Coil resistance: Approximately 250 ohms
- Current draw: 50 ma
- Wattage: 0.6 watts

Circuit Check Lists:
- Is Vmax greater than or equal to Voc?
- Is Imax greater than or equal to Isc?
- Is Ci less than Ca?
- Is Li less than La?
- Is the barrier capable of handling 50 ma draw?
- Is the internal resistance of the barrier 250 ohms or less?

If all answers to the above questions are “yes” the barrier may be a good choice in combination with the MAC intrinsically safe valve.

To calculate voltage across the solenoid, plug values into the following equations:

\[
\text{ITOTAL} = \frac{\text{SUPPLY VOLTAGE}}{250 + \text{BARRIER RESISTANCE}}
\]

Voltage at Solenoid = ITOTAL x 250 ohms = ________ volts

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model #</th>
<th>Barrier Res.</th>
<th>Voltage w/o Light</th>
<th>Voltage w/Light</th>
<th>Groups</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turck</td>
<td>MK72-S01-EX</td>
<td>234 OHMS</td>
<td>11.2 v</td>
<td>10.2 v</td>
<td>A-G</td>
<td>T.I.B.</td>
</tr>
<tr>
<td>Crouse-Hinds</td>
<td>5819140-MX2410</td>
<td>11.7 v</td>
<td>10.7 v</td>
<td>9.7 v</td>
<td>C-G</td>
<td>Zener</td>
</tr>
<tr>
<td>IMO Industries</td>
<td>114072</td>
<td>234 OHMS</td>
<td>12.0 v</td>
<td>11.4 v</td>
<td>C-G</td>
<td>Zener</td>
</tr>
<tr>
<td>Pepperl &amp; Fuchs</td>
<td>KHI2922/EX1</td>
<td>270 OHMS</td>
<td>11.6 v</td>
<td>11.06 v</td>
<td>A-G</td>
<td>Zener</td>
</tr>
<tr>
<td></td>
<td>KHI2922/EX2</td>
<td>270 OHMS</td>
<td>11.6 v</td>
<td>11.06 v</td>
<td>A-G</td>
<td>Zener</td>
</tr>
<tr>
<td></td>
<td>KHI2922/EX3</td>
<td>270 OHMS</td>
<td>11.6 v</td>
<td>11.06 v</td>
<td>A-G</td>
<td>Zener</td>
</tr>
<tr>
<td>Stahl</td>
<td>9001/01-290-165-10</td>
<td>80 OHMS</td>
<td>13.5 v</td>
<td>12.9 v</td>
<td>C-G</td>
<td>Zener</td>
</tr>
<tr>
<td></td>
<td>9351/10-14-10</td>
<td>80 OHMS</td>
<td>13.5 v</td>
<td>13.4 v</td>
<td>A-G</td>
<td>T.I.B.</td>
</tr>
<tr>
<td>Ronan</td>
<td>X57-2299</td>
<td>200 OHMS</td>
<td>12.7 v</td>
<td>12.05 v</td>
<td>C-G</td>
<td>Zener</td>
</tr>
<tr>
<td>Measurement Technology</td>
<td>MTL728P+</td>
<td>250 OHMS</td>
<td>11.9 v</td>
<td>11.4 v</td>
<td>A-G</td>
<td>Zener</td>
</tr>
<tr>
<td></td>
<td>MTL3022</td>
<td>15.0 v</td>
<td>14.5 v</td>
<td></td>
<td></td>
<td>T.I.B.</td>
</tr>
</tbody>
</table>

Above data is based on a 24 v DC supply voltage to the input of the barrier. A 12 v DC, 243 OHM, .6 watt intrinsically safe solenoid is used. The measurement with light is an LED with a current limiting resistor.

Groups indicate what atmosphere the barrier has been approved for. All MAC intrinsically safe valves have been approved for Class I, II and III, Division 1, Groups A, B, C, D, E, F and G indoor hazardous locations.

T.I.B. = Transformer Isolated Barrier
*= Not a recommended combination

Consult “Precautions” page 364 before use, installation or service of MAC Valves.
### VALVE OPTIONS

**MAC125A** - VXXX - XX - XYDA - 9

#### SERIES
- 125 Series
- 250 Series

#### REVISION LEVEL
- REV
- N/A

#### FUNCTION
1. Single Operator, 2 Position, Single Pressure
2. Double Operator, 2 Position, Single Pressure
3. Single Operator, 2 Position, Dual Pressure
4. Double Operator, 2 Position, Dual Pressure
5. 3 Position, Closed Center
6. 3 Position, Open Center
7. 3 Position, Dual Pressure, Pressure Center

#### ELECTRICAL CONN. IN TOP PLATE
- A 5 Pin (Ford Wiring)
- B 5 Pin (Chrysler Wiring)
- G 4 Pin Micro
- E 3 Pin (Ford Wiring)
- F 5 Pin Micro (Chrysler Wiring)

#### PILOT
- 1 Internal Pilot
- 3 External Pilot

#### VALVE ASSEMBLED TO BASE
SEE BELOW

### SOLENOID PILOT OPTIONS

#### XX - XX - YDA

#### PILOT EXHAUST
- FM Muffled exhaust
- FP Piped exhaust

#### DC VOLTAGE
- A5 12 VDC (0.6 W)
- A6 24 VDC (0.6 W)

#### MANUAL OPERATOR
- 0 No operator
- 1 Non-locking Recessed (std.)
- 2 Locking Recessed
- 3 Non-locking Extended
- 4 Locking Extended

ORDERING EXAMPLE: MAC125A-V1A1-FM-A51DA

### BASE/MANIFOLD TABLE

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PORT SIZE</th>
<th>INDIVIDUAL BASE</th>
<th>MANIFOLD BASE (bttm. cyl. ports)</th>
<th>MANIFOLD BASE (side &amp; btm. cyl. ports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC125</td>
<td>1/4&quot;</td>
<td>MAC125A-B21A</td>
<td>MAC125A-M21B</td>
<td>MAC125A-M21C</td>
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<tr>
<td></td>
<td>3/8&quot;</td>
<td>MAC125A-B31A</td>
<td>MAC125A-M31B</td>
<td>MAC125A-M31C</td>
</tr>
<tr>
<td>MAC250</td>
<td>1/2&quot;</td>
<td>MAC250A-B21A</td>
<td>MAC250A-M21B</td>
<td>MAC250A-M21C</td>
</tr>
<tr>
<td></td>
<td>3/4&quot;</td>
<td>MAC250A-B31A</td>
<td>MAC250A-M31B</td>
<td>MAC250A-M31C</td>
</tr>
<tr>
<td></td>
<td>1&quot;</td>
<td>MAC250A-B41A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Individual base available with side ports only.
**Requires End Plate Kit M-12002-01 (125 Series), M-25002-01 (250 Series)**

Bases & manifolds coded for internal pilot. For external pilot, last number of code is 2. ORDERING EXAMPLE: MAC125A-B22A.