BDO3G -5-120/60 (Voltage: e.g. 120/60, 24 vdc)

1a Operator Style

Code	Description
EBS	Solenoid
BS	"Classic" solenoid
BH	Manual lever
BK	Manual palm button
BC	Cam roller
BR	Remote pilot
BD	Differential pilot

1b Valve Operation

Code	Description
O	2-Position, spring return
R	2-Position, remote pilot return
S	2-Position, solenoid return
Y	3-Position, spring centered
E	2-Position, friction positioned*
D	3-Position, detent positioned*

*Only on BH and BK models

2 Port Style

Side Ported
2 = 1/4" NPTF
3 = 3/8" NPTF

3 Spool Configuration (Normally on 3-position valves, 2-position valves use a closed center spool)

blank = Closed center, all ports are blocked in the center position.
D = Regenerative center, ports 2 & 4 are connectect to port 1, ports 3 & 5 are blocked.
G = Float center, port 2 is connected to port 3, port 4 is connected to port 5, port 1 is blocked.

4 Solenoid Operator Form (If applicable)

blank = Available solenoids depends on operator style.
Refer to standard solenoids or "Classic" solenoids.

5 Valve Options

blank = No options selected.
Refer to each valve section for common options.
Most options that are available on our standard 1/4" and 3/8" soft seal valves are available on "B-Series" stack valves.

6 Valve O-Ring Option (Only applies to valve body O-Rings)

blank = Viton for port styles 2, 3 & 3P, Buna-N for port styles 4, 6, 8, 12, 4P, 8P &16P.
-1 = Neoprene for freon (-40°F to 225°F).
-2 = Silicon (-80°F to 400°F).
-3 = Viton for most aromatic gases (-20°F to 400°F, 600°F for short time).
-4 = Butyl Rubber (-60°F to 200°F).
-5 = Teflon (-250°F to 450°F).
-7 = Urethane, 70 Durometer (-65°F to 200°F).
-9 = Buna-N (-40°F to 250°F).

GENERAL INFORMATION

1/4" AND 3/8" SIZES — 4-WAY ACTION — VACUUM TO 250 PSI

Note: Most actuators can be mounted on either end of valve section. Sections can be arranged in any order. Inlet and exhaust ports can be on either end of the stack (See page 9 on how to order reversed operators).

The "B-Series" stack valve consists of individual sections sandwiched between two end plates, the stack being held together with three tie bolts. Sections, listed on page 122 through page 139, are available with a variety of actuators.

Pressure and exhaust connections are 1/2" NPTF on both the 1/4" and 3/8" sizes. They come in through threaded port holes on one end plate and are manifolded through to all sections. Cylinder connections come out threaded port holes, 1/4" or 3/8" NPTF, in the side of each section. On special orders the stack can be turned with all cylinder port holes facing up.

RATINGS

Valve bodies are rated for vacuum or compressed air up to 250 PSI. Not recommended for liquids. Solenoid sections are rated 50 PSI to 150 PSI for spring centered and spring return models, 25 PSI to 150 PSI for others. Higher or lower pressures can be handled by supplying external pilot pressure to each solenoid actuator.

Flow capacity is the same for 1/4" or 3/8" sizes. Only the cylinder port size is different. Capacity is sufficient to operate air cylinders up to 3" bore at normal speeds and larger cylinders at reduced speeds. Cylinder speeds can be controlled with flow control valves installed in cylinder lines.

HOW TO ORDER STACK VALVES

Individual parts can be ordered for user assembly or stacks can be assembled at the factory at no extra charge. When facing actuator side of stack, specify each section starting at the left side, BHO2, EBSO2, etc. One ported end plate PEP-4, one blank end plate BEP-4 and one BOS-4 spacer required for every stack. Ported end plate can be assembled on either end of stack. Specify left or right end. Tie rod kits and additional spacer plates will be added as necessary.

ASSEMBLING IN YOUR PLANT

Place all sections side by side in any desired order. On adjacent solenoid sections a spacer plate may be required (See spacer and end plate section). Place a threaded end plate PEP-4 on one end (Either end) and a blank end plate BEP-4 on the other end. Place a BOS-4 spacer on one end of the stack (Depending on which way the sections are turned), to support O-rings (See page 139 for typical configuration). You may also use two PEP-4 threaded end plates and one BOS-4 spacer plate to supply pilot pressure to both ends of the stack. This is usually used on stacks of 10 or more valves or in high flow applications.

Cut 3 tie rods to length from 5/16"-18 all-thread steel rod. Allow 1-5/16" for each valve section, 1" for PEP-4 threaded end plate, 5/8" for BEP-4 blank end plate, 1/8" for BOS-4 spacer and 3/4" for 2 washers and nuts.

Threaded tie rods can be purchased locally or is available in 18" and 36" length tie rod kits from the factory.

CYLINDER PORTS

Normal assembly is with cylinder ports down and nameplate up, with cylinder connections through a cut-out in the mounting surface. However, on special order, the stack can be assembled with all cylinder ports up (On solenoid valves, the manual override will remain on the name tag side.)

If override access is required from cylinder port side, valves must be ordered with OOK (Override Orientation Kit). One kit per solenoid is required except on EBSY models which requires only one kit. This kit will add 3/8" to overall length of valve per solenoid. These kits can be ordered separately and installed in the field or pre-assembled on original factory orders. Models EBSY can not be converted in the field to reorient the solenoid assembly and still be internally piloted.

Actuators are normally assembled as shown in the illustrations on page 122 through page 139. However, most actuators can be mounted on opposite end of valve body. Take off actuator and end cap and reverse their positions. **Note:** On manual lever, spring centered models, the lever must be removed before the end cap with attached spool can be pulled out. Remove lever by pressing out hinge pin. Check gasket orientation before disassembling valve and verify proper orientation during reassembly.

The handle of any section can be pointed up or down by removing 4 mounting screws, rotating the handle 180° and re-mounting.

SPACER AND END PLATES

PEP-4: End plate, 1" thick, with 1/2" NPTF threaded inlet and exhaust ports. Includes 3 O-ring seals.

BEP-4: Blank end plate 5/8" thick with 3 O-ring seals.

BOS-4: 1/8" spacer with 3 holes. Used between an end plate and adjacent section to support O-rings. One required on each stack.

PS-4: 5/16" spacer plate with 3 holes. Used between two adjacent solenoid valves when using explosion proof solenoids shown on page 127 or "Classic" solenoids shown on page 130 (Except "Classic" explosion proof - see XPS-4).

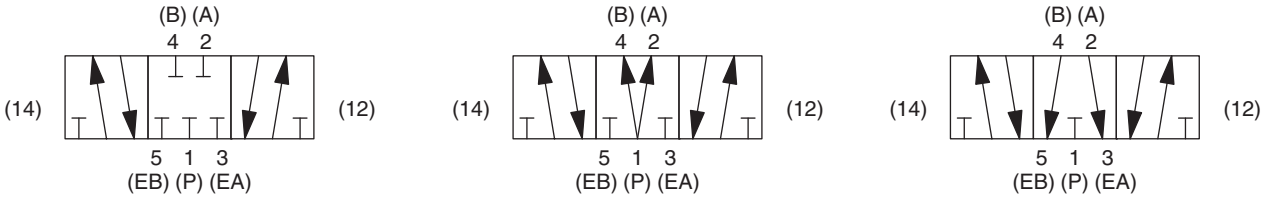
XPS-4: 1/2" spacer plate with 3 holes. Used between two adjacent solenoid valves when using "Classic" explosion proof solenoids shown on page 132 (On BSO3X not EBSO3X).

REPLACEMENT SEAL KIT

BRKV-3MP: One kit required for each valve section. Includes six V-39 Viton body O-rings, three V-110 Buna-N section O-ring seals, two EMG3 Buna-N solenoid gaskets and two ECG3 composition end cap gaskets.

VGK-3: AAA valve grease to lubricate body O-rings during valve overhaul (Each seal repair kit does supply enough grease for complete seal replacement).

SPOOL CONFIGURATION (FOR 3-POSITION VALVES):



STANDARD: Most valves are supplied with a "Closed Center" spool. In the center position, all ports are blocked. If a valve is only a 2-position valve, the actual function of the center position is not critical. So most 2-position valves are "Closed Center". Some designs do require softer transitions, so we offer alternate spool configurations on 2-position valves.

REGENERATIVE: Spool Option "D". In the center position or during transition, ports 2 and 4 are connected to port 1. We call this a "Regenerative" spool since both cylinder ports 2 and 4 are supplied with pressure and flow from port 1.

FLOAT CENTER: Spool Option "G". In the center position or during transition, port 2 is connected to port 3 and port 4 is connected to port 5. We call this a "Float Center" spool since both standard cylinder ports 2 and 4 are vented to an exhaust port and no pressure or flow from port 1 is supplied.

OPTIONAL O-RING MATERIALS:

Unless otherwise specified stack valves come standard with Viton O-rings. If a different material is required, use the dash numbers following the basic valve numbering code. In the example, model EBSY3G-2, will have Silicon O-rings installed for a low temperature application. On valves larger than 1", consult factory on availability of O-ring materials.

Dash No.	O-ring Description	Temperature Rating
-1	Neoprene for freon	-40°F to 225°F
-2	Silicon	-80°F to 400°F
-3	Viton for most aromatic gases	-20°F to 400°F, 600°F for short time
-4	Butyl Rubber	-60°F to 200°F
-5	Teflon	-250°F to 450°F
-7	Urethane, 70 Durometer	-65°F to 200°F
-9	Buna-N	-40°F to 250°F

We are constantly researching O-ring materials to evaluate performance and durability in the AAA valve product line. Above is a compilation of the most commonly requested O-ring materials and the associated dash number. If you have a particular application that requires an O-ring material that is not listed, please contact us. Since we utilize standard O-ring dimensions in our valves, we can respond to the most obscure O-ring material request.

Note: On standard solenoid model valves, the solenoid operator plunger seat is Viton. On "Classic" solenoid model valves, the solenoid operator plunger seat is Buna-N. Solenoid operators must be externally piloted when using gases not compatible with seal material. Consult factory for special plunger seat material.

STANDARD TEMPERATURE RANGE:

Unless otherwise stated in the valve description, solenoids operators normally require lower ambient temperatures.

Operating temperature is dependent upon the seal materials used. The following are temperatures for standard valves:

1/4" and 3/8"valves use Viton O-rings: -20°F to 400°F, 600°F for short time.

Caution: If it is possible that the ambient temperature may fall below freezing, the medium must be moisture free to prevent internal damage or unpredictable behavior.

AIR FLOW RATINGS:

RATED FLOW. Flow factor tests were made with the valve outlet vented to atmosphere and flow in the sonic region. The average flow factor was calculated from tests over a range of inlet pressures. The factor was then used to calculate expected flow at 100 PSIG. Reference page 100 for additional information on air flow ratings.

Rated Flow

Body Style	2	3
Port Size	1/4"	3/8"
SCFM Flow	73.9	97.1
Cv Factor	1.6	2.4

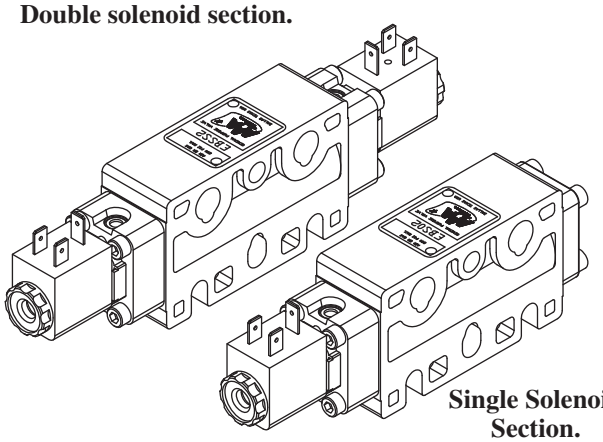
SCFM flow in the table was calculated for 100 PSIG (114.7 PSIA) inlet pressure. At other inlet pressures, SCFM flow will be in proportion to PSIA inlet pressure.

Example: Size 2 at 80 PSIG (94.7 PSIA) inlet pressure.
Ratio of 94.7 to 114.7 is 94.7 ÷ 114.7 = 0.826
Flow at 80 PSIG = 0.826 x 73.9 = 61.0 SCFM.

SOLENOID CONTROLLED, PILOT OPERATED AIR VALVES

SECTIONS FOR “B-SERIES” STACK VALVE ASSEMBLIES — 4-WAY 1/4" AND 3/8" SIZES — VACUUM TO 250 PSI

Double solenoid section.



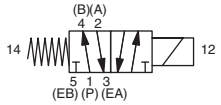
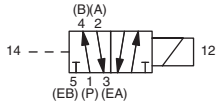
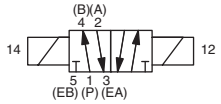
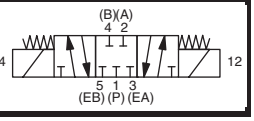
Single Solenoid Section.

PRESSURE RATING: Standard solenoid sections are assembled for “Internal Pilot” operation using end mount solenoids. Shifting pressure is obtained from the main body through holes drilled from the body into the solenoid base. **Caution**! Inlet pressure on standard solenoid operators must not exceed 150 PSI.

Models EBSR and EBSS (No internal springs) will shift reliably on a minimum line pressure of 25 PSI. Spring return (EBSO) and spring centered (EBSY) should not be operated on a line pressure less than 50 PSI.

Solenoid sections may be used on vacuum or on pressure below the above limits or up to 250 PSI, by ordering them with Option “Z” or converting them in the field to “External Pilot” operation, provided the pilot pressure is in the range of 50 PSI to 150 PSI. The external pilot pressure must be connected to the external pilot port on each solenoid base.

Select basic model (See page 121 for optional spools).

MODEL NUMBER Threaded body 1/4" NPTF	MODEL NUMBER Threaded body 3/8" NPTF	DESCRIPTION	SYMBOL
EBSO2	**EBSO3**	Single solenoid, 2-position, spring return. Spool returns to original position when solenoid is de-energized.	
EBSR2	**EBSR3**	Single solenoid, 2-position, pilot pressure returned spool. Pilot pressure from an external 3-way valve returns spool to its original position.	
EBSS2	**EBSS3**	Double solenoid, 2-position, no springs. Spool shifts and remains shifted when one solenoid or the other is momentarily or continuously energized.	
EBSY2	**EBSY3**	Double solenoid, 3-position, spring centered, closed center spool. All ports are blocked when both solenoids are de-energized (See page 121 for other spools).	

FLOW PATTERN:

When a solenoid is energized, this will cause air to flow from the pressure inlet out the cylinder port which is closest to the solenoid which is energized. The opposite solenoid, if applicable, must be un-energized.

“EXTERNAL PILOT” OPERATION:

To order a standard solenoid section factory assembled for “External Pilot” operation, add suffix “Z” following the regular model number (E.g. EBSO2Z 120/60 **manual override is facing down**).

CONVERSION TO “EXTERNAL PILOT” OPERATION:

This valve can be converted to “External Pilot” operation in the field by rotating the entire solenoid assembly 180°. **Manual override will be facing opposite the nameplate.**

To orient the override on the same side as the nameplate and still be externally piloted, you must use kit EPOOK (External Pilot Override Orientation Kit). It takes one kit per solenoid. On models EBSY, only one kit is required (Spring centered assembly is rotated instead of the solenoid assembly). This kit will add 1/8" to overall length of valve per solenoid. This kit can be ordered separately and installed in the field or pre-assembled on original factory orders.

SOLENOID OPERATOR FORMS:

STANDARD SOLENOID OPERATOR INFORMATION

The standard coils are a DIN 43650 style with 11mm/Industrial Form B connector pin pattern. DIN caps are ordered as a separate line item.*Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Pick-Up	Holding	Resistance
24 volts, 60 Hz	7.1 VA	5.8 VA	31.6 ohms
48 volts, 60 Hz	7.7 VA	6.2 VA	121 ohms
120 volts, 60 Hz	7.8 VA	6.3 VA	840 ohms
240 volts, 60 Hz	7.8 VA	6.3 VA	3400 ohms
12 volts D-C		4.6 Watts	31.6 ohms
24 volts D-C		4.8 Watts	121 ohms
60 volts D-C		4.3 Watts	840 ohms

DIN Caps (11mm style): Various styles of DIN caps are available as lose items, see below for more information.

Environmental Ratings: (With mounted plug-in connector per IEC 529) IP 65 (NEMA 4 without structural rating).

Certifications: This operator carries both a UL and CSA approval rating. The rating only applies to the operator and not the entire valve.

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

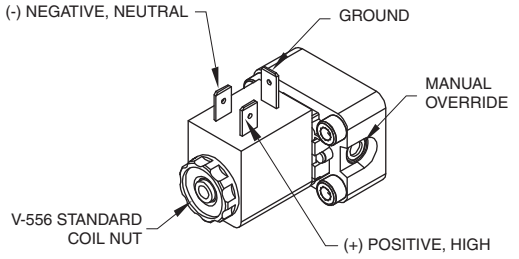
Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for "Internal Pilot" operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for "External Pilot" (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.

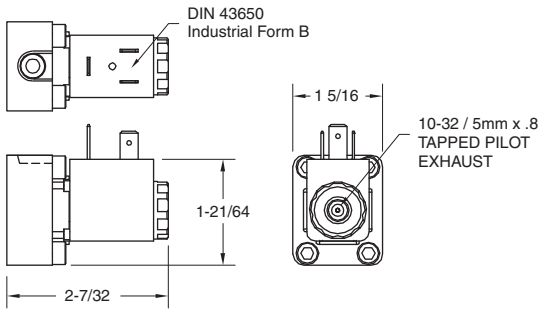
Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR. For locking overrides, see valve option "O" on page 128.



Solenoid Terminal Definitions



Standard Solenoid Operator

OPTIONAL DIN CAPS FOR STANDARD COILS

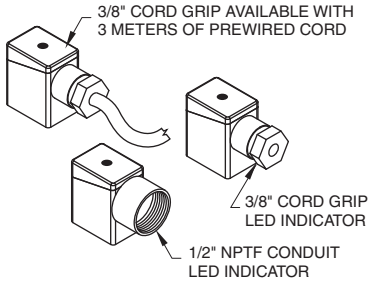
DIN caps are not supplied with standard solenoid valves. These caps must be ordered separately. Below are the DIN caps commonly used.

There are several styles of DIN caps. When ordering LED Indicator types, you must specify voltage of solenoid coil (E.g. DCL-120/60). All caps listed in table are for 11mm/Industrial Form B coils, consult factory for additional forms available. LED Indicator type caps are equipped with varistor surge protection (Diode surge protection available upon request).

Environmental Rating: IP 65

Model No.	Style	LED	Model No.	Style	LED
DCC	1/2" Conduit	no	DCCL	1/2" Conduit	yes
DCG	3/8" Grip	no	DCGL	3/8" Grip	yes
DC3M*	3 Meter Cord	no	DC3ML*	3 Meter Cord	yes

*Consult factory for other lengths of cord.



DIN Cap Styles

OPERATOR STYLE A: INTRINSICALLY SAFE SOLENOID COIL

When related to solenoid valves, intrinsic safety means that the coil's current draw and resulting temperature is held to such a low level (When used with 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.

Typically, they are used in situations where fire and explosive hazards exist due to the presence of flammable gases, vapors or liquids, combustible dusts or easily ignitable fibers.

These 24 VDC coils are approved according to EN 50 020 resp. DIN VDE 0170/0171 part 5. This coil is an ISO 4400 DIN style pin pattern. A non-indicator, cord grip style DIN cap provided.

To order solenoid valves with this coil type, use the suffix “A” (E.g. ESO2A). Intrinsically safe coils can not be placed on our standard solenoid assembly. This coil must be used with the proper operator and intrinsically safe barrier to function correctly. DIN caps are provided.

Electrical Characteristics: 21.6 - 28 VDC.

Max. Safe Valve: 28 VDC, 115 mA, 1.6W.

Electrical Characteristics: 37mA, 275 ohms ± 8%.

Environmental Ratings: (With mounted plug-in connector per IEC 529) IP 65 (NEMA 4 without structural rating).

Certifications: This operator carries both FM and CSA approval rating. The rating only applies to the operator and not the entire valve.

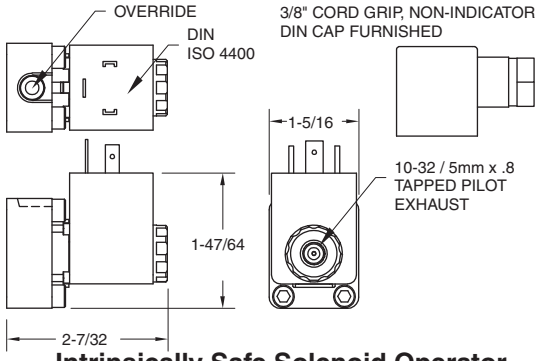
Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

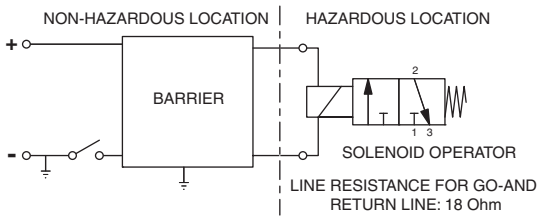
Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.



Intrinsically Safe Solenoid Operator



Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR. For locking overrides, see valve option “O” on page 128.

COMPATIBLE BARRIER MANUFACTURERS

(Contact information may change)

Pepperl & Fuchs® Inc. • Telephone (330) 425-3555 • FAX: (330) 425-4607
Pepperl+Fuchs, Inc., 1600 Enterprise Parkway, Twinsburg, Ohio 44087
E-mail: sales@us.pepperl-fuchs.com • www.am.pepperl-fuchs.com
Models: KFD2-SLS-EX2 and KFD2-SD-EX1.36

Measurement Technology LTD. • Telephone (905) 840-7850 • FAX: (905) 840-7852
MTL Canada Safety Instrumentation
20 Regan Road, Unit 17, Brampton, Ontario L7A 1C3
E-mail: cinfo@mtlnh.com • www.mtl-group.com
Model: MTL3021

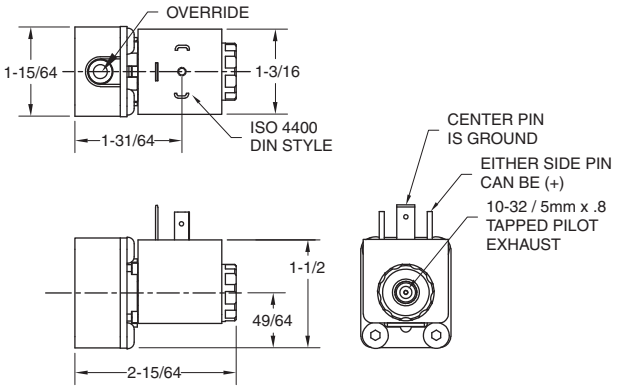
STAHL, INC. • Telephone: (603) 870-9500 • FAX: (603) 870-9290
Corporate Headquarters and Manufacturing
45 Northwestern Drive, Salem, New Hampshire 03079-4809
E-Mail: sales@rstahl.com • www.rstahl.com
Model: 9004/01-280-050-00

OPERATOR STYLE H: 30MM COIL, HIGH TEMPERATURE COIL

30MM coils have same characteristics and performance as our standard coils, but have a ISO 4400 connector pin pattern. DIN caps are ordered as a separate line item. This coil is capable of higher temperatures than the other coils. To order solenoid valves with this coil type, use the suffix "H" (E.g. ESO2H 24 vdc). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Inrush Current	Holding Current	Resistance
120 volts, 60 Hz	56 mA	34 mA	800 ohms
240 volts, 60 Hz	27 mA	17 mA	3205 ohms
12 volts D-C		218 mA	55 ohms
24 volts D-C		111 mA	216 ohms



High Temperature Solenoid Operator

DIN Caps (ISO 4400 style): Various styles of DIN caps are available as lose items, see below for more information.

Environmental Ratings: (With mounted plug-in connector) IP 65 (NEMA 4 without structural rating).

Certifications: This operator carries both UL and CSA approval rating. The rating only applies to the operator and not the entire valve.

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 190°F.

Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for "Internal Pilot" operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for "External Pilot" (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

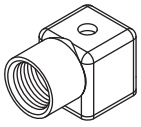
Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR. For locking overrides, see valve option "O" on page 128.

OPTIONAL DIN CAPS FOR 30MM COILS

DIN caps are not supplied with standard solenoid valves. These caps must be ordered separately. Below are the DIN caps commonly used.

There are several styles of DIN caps. When ordering LED Indicator types, you must specify voltage of solenoid coil (E.g. EDCL-120/60). All caps listed in table are for "ISO 4400", consult factory for additional forms available. LED Indicator type caps are equipped with varistor surge protection (Diode surge protection available upon request).



EDC Cap

Environmental Rating: IP 65

Model No.	Style	LED	Model No.	Style	LED
EDC	**1/2" Conduit**	**no**	**EDCL**	**1/2" Conduit**	**yes**

OPERATOR STYLE J: MOLD-OVER COIL

“Mold-Over” coils have same characteristics and performance as our standard coils, but have a molded 1/2"-14 NPT connection with 18" leads that are wired through the 1/2"-14 NPT connection. To order solenoid valves with this coil type, use the suffix “J” (E.g. ESO2J 24 vdc). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Pick-Up	Holding	Resistance
24 volts, 60 Hz	7.1 VA	5.8 VA	31.6 ohms
48 volts, 60 Hz	7.7 VA	6.2 VA	121 ohms
120 volts, 60 Hz	7.8 VA	6.3 VA	840 ohms
240 volts, 60 Hz	7.8 VA	6.3 VA	3400 ohms
12 volts D-C		4.6 Watts	31.6 ohms
24 volts D-C		4.8 Watts	121 ohms
60 volts D-C		4.3 Watts	840 ohms

Environmental Ratings: (With proper 1/2" NPT connection) IP 65 (NEMA 4 without structural rating).

Voltage Tolerance: ±10%.

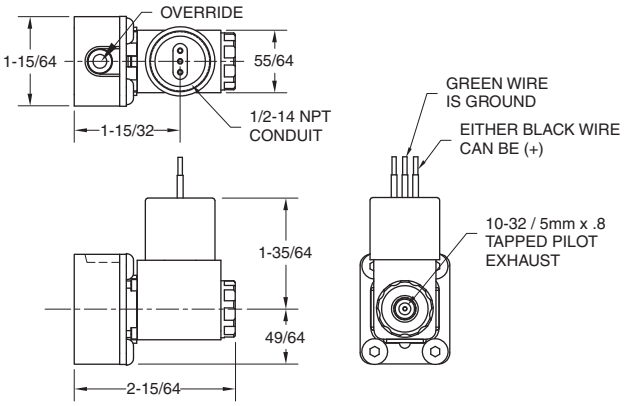
Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.



1/2" Conduit Solenoid Operator

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR. For locking overrides, see valve option “O” on page 128.

OPERATOR STYE M: FLYING LEAD SOLENOID COIL

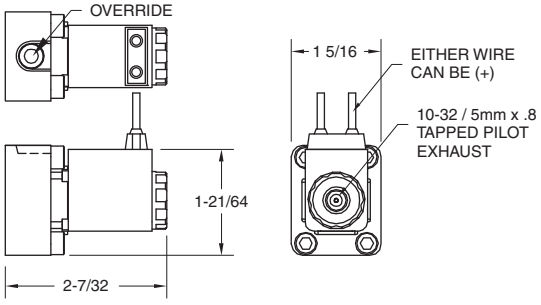
“Flying Lead” coils have same characteristics and performance as our standard coils, but have 18" lead wires molded with the coil. To order solenoid valves with this coil type, use the suffix “M” (E.g. EBSO2M 24 vdc). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Pick-Up	Holding	Resistance
24 volts, 60 Hz	7.1 VA	5.8 VA	31.6 ohms
48 volts, 60 Hz	7.7 VA	6.2 VA	121 ohms
120 volts, 60 Hz	7.8 VA	6.3 VA	840 ohms
240 volts, 60 Hz	7.8 VA	6.3 VA	3400 ohms
12 volts D-C		4.6 Watts	31.6 ohms
24 volts D-C		4.8 Watts	121 ohms
60 volts D-C		4.3 Watts	840 ohms

Environmental Ratings: IP 65 (NEMA 4 without structural rating).

Certifications: This operator carries both UL and CSA approval rating. The rating only applies to the operator and not the entire valve.



Flying Lead Solenoid Operator

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Stan-

dard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR models. For locking overrides, see valve option “O” on page 128.

OPERATOR STYLE X: EXPLOSION PROOF SOLENOID COIL

All “Explosion Proof” solenoid operators carry the FM and CSA label for Class I, Group C and D (Gasoline vapors, etc.), Class II, Groups E, F and G (Coal, coke and grain dusts). The connection is 1/2"-14 NPT conduit with 24" leads. **Note:** The FM and CSA label on an explosion proof solenoid operator covers only the electrical operator and does not cover the complete valve. To order solenoid valves with “Explosion Proof” operators, add suffix “X” to the basic part number (E.g. ESO2X 120/60). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Pick-Up	Holding	Resistance
120 volts, 60 Hz	11.5 VA	6.5 VA	530 ohms
12 volts D-C		4.5 Watts	31.6 ohms
24 volts D-C		4.5 Watts	121 ohms

Environmental Ratings: (With proper 1/2" NPT connection) IP 65 (NEMA 4 without structural rating).

Certifications: This operator carries both FM and CSA approval rating. The rating only applies to the operator and not the entire valve.

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

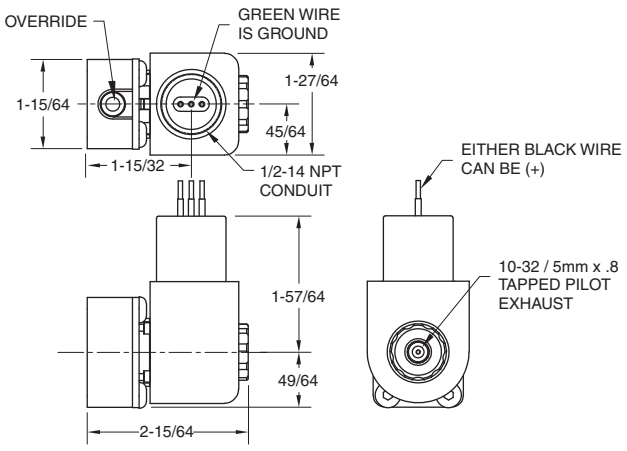
Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 150 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 150 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 150 PSIG).

Solenoid Seal Material: The internal gasket material is Viton, for both the plunger seat and override seal. Consult the factory for seals made of Buna-N or other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust.



Explosion Proof Solenoid Operator

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR. For locking overrides, see valve option “O” on page 128.

Adjacent Mounting Concern: When using this coil on adjacent solenoid valves in a stack arrangement, you must use PS-4 plate between the valves for clearance (See page 120 for information on spacer plates).

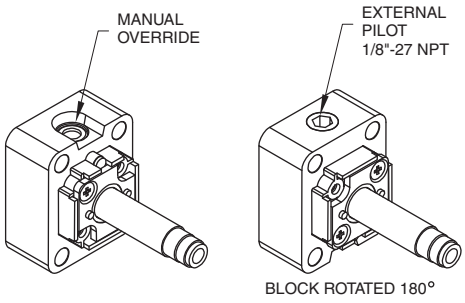
VALVE OPTIONS:

STANDARD: ALL SOLENOID FORMS PROVIDE

Tapped Exhaust: Solenoid stems are tapped 10-32/5mm-0.8 for piped exhaust. If the valve is ordered with Option “L” or “C”, the 10-32/5mm-0.8 exhaust will be covered by the nut and unusable.

Manual Override: Solenoid structures are equipped with a non-locking manual override on the side of the solenoid structure. To activate manual override, the inset plunger must be depressed. Spool will shift while the plunger is depressed but will return to original position on spring models EBSO and EBSY when plunger is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR.

Field Modification: Able to convert between internal or external solenoid pilot source in the field.



Solenoid Adapter

OPTION L: SINTERED BRONZE DUST EXCLUDER NUT

This option allows the exhaust from the solenoid assembly to be filtered through a sintered bronze element. This causes a reduction in noise and filtering of exhaust. With this option, the 10-32/5mm-0.8 tapped exhaust is inaccessible


V-567

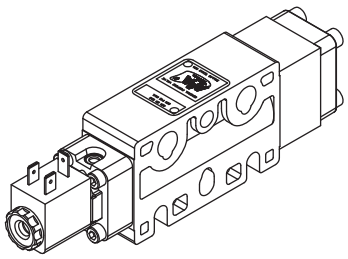
OPTION C: SIDE EXHAUST NUT

This option allows the exhaust from the solenoid assembly to be diffused. This causes a reduction in noise and diffusing of exhaust. With this option the 10-32/5mm-0.8 tapped exhaust is inaccessible.

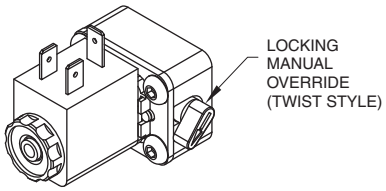

V-562

OPTION Q: 2-POSITION SPOOL DETENT

Available only on models EBSR and EBSS with body styles of 2, 3 and 3P. This option allows the spool to remain in position when shifting pressure is removed. This option is most often used in mobile applications where the vibrations may shift the spool when there is no holding pressure available. Overall length of the valve will increase by 1".



OPTION O: LOCKING MANUAL SOLENOID OVERRIDE



Locking Manual Solenoid Override

Locking Override: Solenoid structures with locking overrides are available on original factory orders. To activate manual override, the override knob must be twisted clockwise to the locked position. Spool will shift while the knob is in the override position, but will return to original position on spring models EBSO and EBSY when knob is returned to normal (Sufficient shifting pressure and pilot source is assumed). Spool will remain shifted on springless models EBSS and EBSR models. Converting to locking override from non-locking override in the field is not possible without replacing the entire solenoid assembly, Contact factory for details.

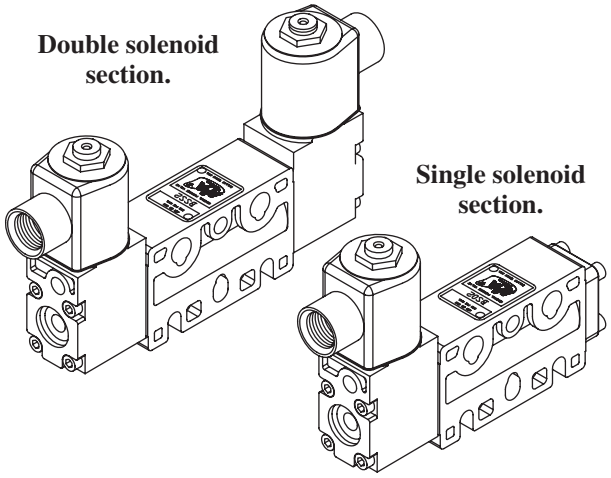
OPTION Z: “EXTERNAL PILOT” OPERATION

A valve may be ordered factory assembled for “External Pilot” operation by adding the suffix “Z” after the regular model number or converted in the field by rotating the entire solenoid assembly 180°. **Manual override will be facing opposite the nameplate.**

To orient the override on the same side as the nameplate and still be externally piloted, you must use kit EPOOK (External Pilot Override Orientation Kit). It takes one kit per solenoid. Models EBSY only one kit is required (Spring centered assembly is rotated instead of the solenoid assembly). This kit will add 1/8" to overall length of valve per solenoid. This kit can be ordered separately and installed in the field or pre-assembled on original factory orders.

"CLASSIC" SOLENOID

SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY 1/4" AND 3/8" SIZES — VACUUM TO 250 PSI

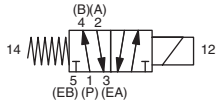
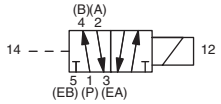
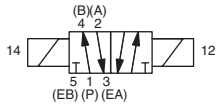
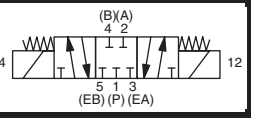


PRESSURE RATING. Standard solenoid sections are assembled for "Internal Pilot" operation using end mount solenoids. Shifting pressure is obtained from the main body through holes drilled from the body into the solenoid base. **Caution!** Inlet pressure on standard solenoid operators must not exceed 160 PSI.

Models EBSR and EBSS (No internal springs) will shift reliably on a minimum line pressure of 25 PSI. Spring return (EBSO) and spring centered (EBSY) should not be operated on a line pressure less than 50 PSI.

Solenoid sections may be used on vacuum or on pressure below the above limits or up to 250 PSI, by ordering them with Option "Z" or converting them in the field to "External Pilot" operation, provided the pilot pressure is in the range of 50 PSI to 160 PSI. The external pilot pressure must be connected to the external pilot port on each solenoid base.

Select basic model (See page 121 for optional spools).

MODEL NUMBER Threaded body 1/4" NPTF	MODEL NUMBER Threaded body 3/8" NPTF	DESCRIPTION	SYMBOL
BSO2	**BSO3**	Single solenoid, 2-position, spring return. Spool returns to original position when solenoid is de-energized.	
BSR2	**BSR3**	Single solenoid, 2-position, pilot pressure returned spool. Pilot pressure from an external 3-way valve returns spool to its original position.	
BSS2	**BSS3**	Double solenoid, 2-position, no springs. Spool shifts and remains shifted when one solenoid or the other is momentarily or continuously energized.	
BSY2	**BSY3**	Double solenoid, 3-position, spring centered, closed center spool. All ports are blocked when both solenoids are de-energized.	

FLOW PATTERN:

When a solenoid is energized, this will cause air to flow from the pressure inlet out the cylinder port which is closest to the solenoid which is energized. The opposite solenoid, if applicable, must be un-energized.

"EXTERNAL PILOT" OPERATION:

To order a standard solenoid section factory assembled for "External Pilot" operation, add suffix "Z" following the regular model number (E.g. BSO2Z 24 vdc).

CONVERSION TO "EXTERNAL PILOT OPERATION:

This valve can be converted to "External Pilot" operation in the field. This operation must be performed on each solenoid operator. Remove the 4 screws holding the solenoid base to the body. Remove the solenoid structure and rotate the gasket 180°, then remount the solenoid structure in the same position as before. This will block the internal pressure passages. Connect the source of pilot pressure to the 1/8" NPTF connection on each solenoid base.

“CLASSIC” SOLENOID OPERATOR FORMS:

“CLASSIC” SOLENOID INFORMATION

The “Classic” coils are a 1/2" Conduit, metal housing style with 1/2" NPT connection, with 18" leads. If no optional solenoid is specified, then the “Classic” coil is used. *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Inrush Current	Holding Current	Resistance
24 volts, 60 Hz	1.72 amps	1.10 amps	5.39 ohms
120 volts, 60 Hz	0.36 amps	0.23 amps	135 ohms
240 volts, 60 Hz	0.18 amps	0.12 amps	546 ohms
6 volts D-C	2.30 amps	2.30 amps	2.4 ohms
12 volts D-C	1.20 amps	1.20 amps	12.8 ohms
24 volts D-C	0.58 amps	0.58 amps	61 ohms

Environmental Ratings: NEMA 1.

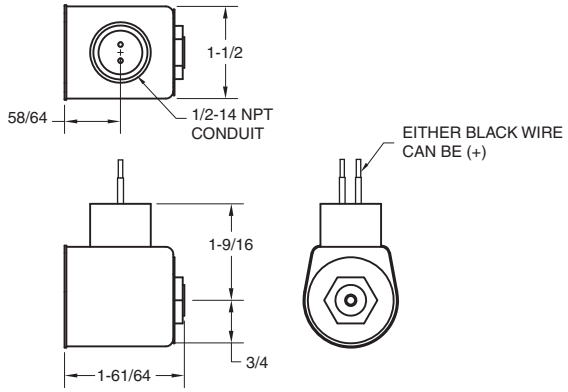
Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Casing: Molded steel canister.

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 160 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 160 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 160 PSIG).



“Classic” Solenoid Operator

Solenoid Seal Material: The internal gasket material is Buna-N, for both the plunger seat and override seal. Consult the factory for seals of other materials.

Mounting Gasket: The gasket that mounts the solenoid stem to the adapter is Buna-N. Additional seals may connect the adapter to the valve body.

Manual Override: Manual overrides must be specified by using the valve options.

Adjacent Mounting Concern: When using this coil on adjacent solenoid valves in a stack arrangement, you must use PS-4 plate between the valves for clearance (See page 120 for information on spacer plates).

OPTION ED: “CLASSIC DIN” SOLENOID COIL

“Classic DIN” coils have same characteristics and performance as the “Classic” coils, but have an ISO 4400 connection interface. To order solenoid valves with this coil type, use the suffix “ED” (E.g. BSO2ED 24 vdc). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Inrush Current	Holding Current	Resistance
120 volts, 60 Hz	0.36 amps	0.23 amps	135 ohms
240 volts, 60 Hz	0.18 amps	0.12 amps	539 ohms
12 volts D-C	1.20 amps	1.20 amps	9.6 ohms
24 volts D-C	0.58 amps	0.58 amps	38.4 ohms

Environmental Ratings: (With proper ISO 4400 DIN connection) NEMA 4 and 4X.

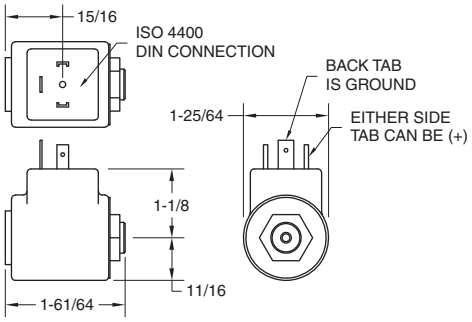
Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 160 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 160 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 160 PSIG).



Classic Style “DIN” Solenoid Operator

Solenoid Seal Material: The internal gasket material is Buna-N, for both the plunger seat and override seal. Consult the factory for seals of other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

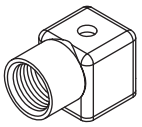
Manual Override: Manual overrides must be specified by using the valve options.

Adjacent Mounting Concern: When using this coil on adjacent solenoid valves in a stack arrangement, you must use PS-4 plate between the valves for clearance (See page 120 for information on spacer plates).

OPTIONAL DIN CAPS FOR "CLASSIC DIN" COILS

DIN caps are not supplied with "Classic DIN" solenoid valves. These caps must be ordered separately. Below are the DIN caps commonly used.

There are several styles of DIN caps. When ordering LED Indicator type, you must specify voltage of solenoid coil (E.g. EDCL-120/60). All caps listed in table are for ISO 4400, consult factory for additional forms available. LED Indicator type caps are equipped with varistor surge protection (Diode surge protection available upon request).



EDC Cap

Environmental Rating: IP 65.

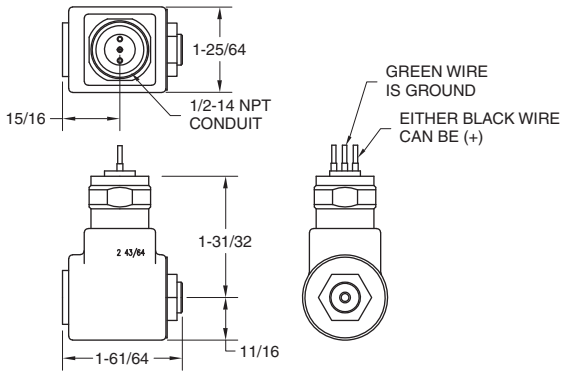
Model No.	Style	LED	Model No.	Style	LED
EDC	1/2" Conduit	no	EDCL	1/2" Conduit	yes

OPTION M: "CLASSIC MOLD-OVER" SOLENOID COIL

"Classic Mold-Over" coils have same characteristics and performance as the "Classic" coils, but have a molded 1/2"-14 NPT connection with 18" leads that are wired through the 1/2"-14 NPT connection. To order solenoid valves with this coil type, use the suffix "M" (E.g. BSO2M 24 vdc). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Inrush Current	Holding Current	Resistance
120 volts, 60 Hz	0.36 amps	0.23 amps	135 ohms
240 volts, 60 Hz	0.18 amps	0.12 amps	539 ohms
12 volts D-C	1.20 amps	1.20 amps	9.6 ohms
24 volts D-C	0.58 amps	0.58 amps	38.4 ohms



Classic Style "Mold-Over" Solenoid Operator

Environmental Ratings: (With proper 1/2" NPT connection) NEMA 4 and 4X.

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Moulding Material: Duroplast/thermoset resin (Duro).

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for "Internal Pilot" operation. They will operate reliably on line pressures from 160 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 160 PSIG, below minimum pressure and for vacuum service, the valve must be configured for "External Pilot" (Between 50 PSIG and 160 PSIG).

Solenoid Seal Material: The internal gasket material is Buna-N, for both the plunger seat and override seal. Consult the factory for seals of other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

Manual Override: Manual overrides must be specified by using the valve options.

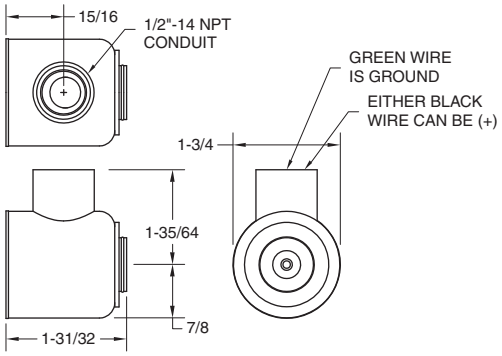
Adjacent Mounting Concern: When using this coil on adjacent solenoid valves in a stack arrangement, you must use PS-4 plate between the valves for clearance (See page 120 for information on spacer plates).

OPTION X: “CLASSIC EXPLOSION PROOF” SOLENOID COIL

All “Classic Explosion Proof” solenoid operators carry the UL label for Class I, Group C and D (Gasoline vapors, etc.), Class II, Groups E, F and G (Coal, coke and grain dusts). The metal housing uses a 1/2"-14 NPT conduit type connection with 18" leads. **Note:** The UL and CSA label on an explosion proof solenoid operator covers only the electrical operator and does not cover the complete valve. To order solenoid valves with “Classic Explosion Proof” operators, add suffix “X” to the basic part number (E.g. BSO2X). *Voltage must be specified when ordering.*

Voltages: This chart shows most common voltages. Consult the AAA factory for other voltages which may be available.

Coil Voltage and Frequency	Inrush Current	Holding Current	Resistance
24 volts, 60 Hz	1.72 amps	1.10 amps	5.5 ohms
120 volts, 60 Hz	0.36 amps	0.23 amps	135 ohms
240 volts, 60 Hz	0.18 amps	0.12 amps	539 ohms
6 volts D-C	2.30 amps	2.30 amps	2.4 ohms
12 volts D-C	1.20 amps	1.20 amps	9.6 ohms
24 volts D-C	0.58 amps	0.58 amps	38.4 ohms



Classic Style “Explosion Proof” Solenoid Operator

Environmental Ratings: UL label for Class I, Group C and D (Gasoline vapors, etc.), Class II, Groups E, F and G (Coal, coke and grain dusts).

Voltage Tolerance: ±10%.

Resistance Tolerance: ±8% @ 20°C.

Operating Temperatures: -4°F to 120°F.

Casing: Steel.

Operating Pressures: 29" Hg vacuum - 250 PSIG. Standard models are assembled for “Internal Pilot” operation. They will operate reliably on line pressures from 160 PSIG down to 25 PSIG minimum for no spring models and down to 50 PSIG on spring return and spring centered models. Above 160 PSIG, below minimum pressure and for vacuum service, the valve must be configured for “External Pilot” (Between 50 PSIG and 160 PSIG).

Solenoid Seal Material: The internal gasket material is Buna-N, for both the plunger seat and override seal. Consult the factory for seals of other materials.

Mounting Gasket: The gasket that mounts the solenoid assembly to the valve is Buna-N.

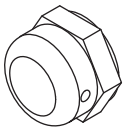
Manual Override: Manual overrides must be specified by using the valve options.

Adjacent Mounting Concern: When using this coil on adjacent “Explosion Proof” solenoid valves in a stack arrangement, you must use XPS-4 plate between the valves for clearance (See page 120 for information on spacer plates).

VALVE OPTIONS:

OPTION L: DUST EXCLUDER NUT

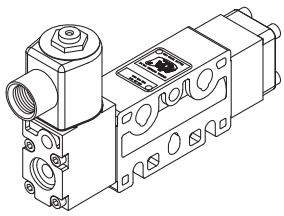
Replaces nut on end of “Classic 1/2 Conduit”, “Classic Din” and “Classic Mold-Over” solenoid coil to reduce entry of dust, water, etc. and reduce sound of exhaust air. Not available on “Classic Explosion Proof” solenoids.



FM-1 Nut

OPTION Q: 2-POSITION SPOOL DETENT

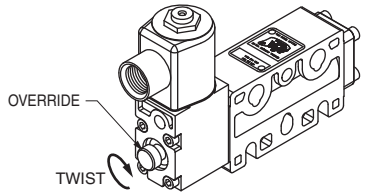
Available only on models BSR and BSS with body styles of 2, 3 and 3P. This option allows the spool to remain in position when shifting pressure is removed. This option is most often used in mobile applications where the vibrations may shift the spool when there is no holding pressure available. Overall length of the valve will increase by 1".



OPTION O: LOCKING MANUAL SOLENOID OVERRIDE TWIST STYLE

Manual override is available on any solenoid operator but is not included unless specified. In case of electrical failure in the control circuit, the valve can be shifted without electricity.

Option “O” designates the standard override as normally used on “Classic” solenoid air valves. A knurled knob, operated by hand, physically lifts the poppet off its seat. The knob can be rotated over center and will remain either in the ON or OFF position.

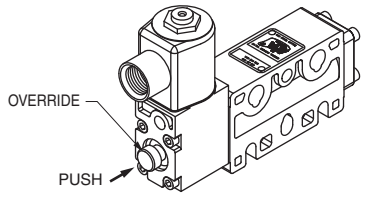


OPTION ON: NON-LOCKING MANUAL SOLENOID OVERRIDE TWIST STYLE

Option “ON” is the same override as “O” except the knob will spring back to the “OFF” position when released.

OPTION OP: NON-LOCKING MANUAL SOLENOID OVERRIDE PUSH STYLE

Option “OP” designates a push style non-locking override. When the knob is pushed in, the poppet is lifted off its seat. This shifts the internal spool and causes a change in air flow through the ports.



OPTION R: SOLENOID ROTATED 180°

The standard assembly of the solenoid block is in the up position so when the cylinder ports are facing down, the solenoid assembly is pointing up. To reverse the solenoid assembly, the valve must be ordered with Option “R”. With this option the solenoid block is assembled in the down position or assembled so the cylinder ports are facing up. Only available on original factory orders and can not be retrofitted in the field.

OPTION T: SOLENOID PIPED EXHAUST

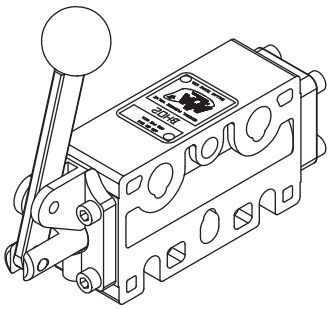
Standard solenoid operators vent pilot exhaust to atmosphere through a small un-threaded hole. A 1/8" NPTF threaded connection can be provided for those applications where the exhaust air or gas must be piped to another area. Sometimes it can be piped into the main exhaust port. To order, add suffix “T” to regular valve model number (E.g. BSO3T 24 vdc).

OPTION Z: “EXTERNAL PILOT” OPERATION

A valve may be ordered factory assembled for “External Pilot” operation by adding the suffix “Z” after the regular model number or converted in the field. To convert in the field, this operation must be performed on each solenoid operator. Remove the 4 screws holding the solenoid base to the body. Remove the solenoid structure and rotate the gasket 180°, then remount the solenoid structure in the same position as before. This will block the internal pressure passages. Connect the source of pilot pressure to the 1/8" NPTF connection on each solenoid base.

MANUAL LEVER CONTROLLED

SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY 1/4" AND 3/8" SIZES — VACUUM TO 250 PSI



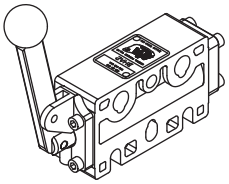
Normal position of handle on spring return model. Manual lever can he installed on opposite end (See page 120 "Cylinder Ports"). Entire stack can be turned with cylinder ports up.

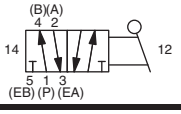
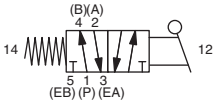
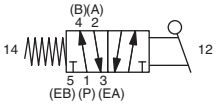
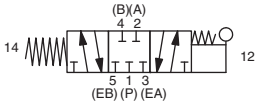
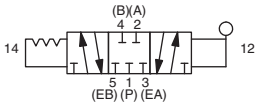
HANDLE POSITION. On 3-position models, handle is vertical in neutral position. On spring return models the handle is normally in position shown at left. On friction positioned models there is no normal position; handle moves 1-1/2" from side to side or 3/4" from center to a side position.

PRESSURE RATING. A manual lever section can be used on any pressure from vacuum to 250 PSI. Can be used as a 3-way valve by plugging the unused cylinder port.

FLOW PATTERN. When lever is pulled outward. Air flows out the cylinder port nearest the handle.

On factory order, 2-position, spring return, model can be furnished with normal handle in position "A", (Order as BHA2 or BHA3).



MODEL NUMBER Threaded body		DESCRIPTION	SYMBOL
1/4" NPTF	3/8" NPTF		
BHE2	**BHE3**	2-position, friction positioned. Spool stays in any position when handle is released.	
BHO2	**BHO3**	2-position, spring return. Handle returns to original position (See left illustration above) when handle is released.	
BHR2	**BHR3**	2-position, pilot return. Handle is returned to original position (See left illustration above) by external 3-way control valve furnished by user (25 PSI minimum).	
BHY2	**BHY3**	3-position, spring centered, closed center spool. All ports blocked when handle is released (See other spools on page 121).	
BHD2†	**BHD3†**	3-position, click detent, closed center spool. Handle stays in any one of three positions (See other spools on page 121).	

†Also available, 3-position manual valve detented in position "C", spring return to center from "A" position.

VALVE OPTIONS:

OPTION C: CURVED HANDLE

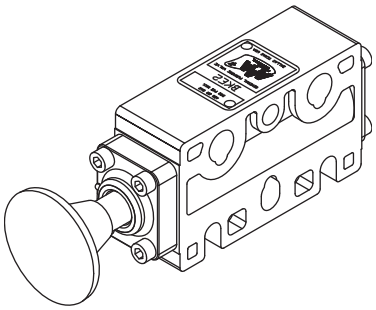
This option has a slightly curved handle to ease operator use when the valve is mounted in awkward locations. Contact the factory for custom handle curves and also unique lever mechanisms. We also have created a valve with a 3-foot long rod that is used in cattle loading and unloading.

OPTION Q: TWO POSITION DETENT

This option is available on BHD models only. Spool stays in position "A" or "C" when lever is released. This is a 2-position version of the model BHD, where there is no center position detent. Additional shifting force is required to initiate spool shifting.

PALM BUTTON CONTROLLED

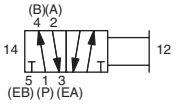
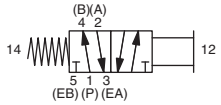
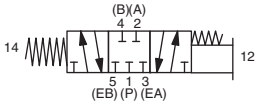
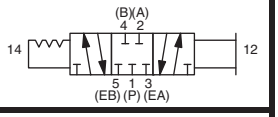
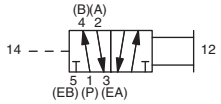
SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY
1/4" AND 3/8" SIZES — VACUUM TO 250 PSI



PALM BUTTON SECTION. Valve is operated with a push-pull motion by a knob attached to the spool. The knob is moved 17/32" to fully shift a 2-position model or 1/4" each side of center on a 3-position model. The actuating force is about 12 lbs on spring loaded models and 5 lbs on no-spring models. Consult factory for mounting palm button valves side by side.

FLOW PATTERN. When the knob is pushed in, air flows out the cylinder port which is nearest the knob.

MOUNTING CONCERN. The knob is larger in diameter than the valve body width. Consult factory when needing to stack palm valves next to each other.

MODEL NUMBER Threaded body		DESCRIPTION	SYMBOL
1/4" NPTF	3/8" NPTF		
BKE2	**BKE3**	Palm button, 2-position, friction positioned. Spool stays in any position when knob is released.	
BKO2	**BKO3**	Palm button, 2-position, spring return. Knob returns to "Out" position (See drawing on page 139) when knob is released.	
BKY2	**BKY3**	Palm button, 3-position, spring centered, closed center spool. All ports blocked when knob is released (See other spools on page 121).	
BKD2	**BKD3**	Palm button, 3-position, click detent, closed center spool. Knob stays in any one of three positions (See other spools on page 121).	
BKR2	**BKR3**	Palm button, 2-position, pilot return. Spool is returned by external 3-way control valve furnished by user (25 PSI minimum).	

VALVE OPTIONS:

OPTION Q: TWO POSTION DETENT

This option is available on BKD models only. Spool stays in position "A" or "C" when palm button is released. This is a 2-position version of the model BKD, where there is no center position detent. Additional shifting force is required to initiate spool shifting.

OPTION R: PANEL MOUNT

Palm button models are available for panel mounting up to 1/4" thick. Use a 7/8" diameter hole in panel for mounting valve. To order, add suffix "R" to regular valve model number for this option (E.g. BKO2R).

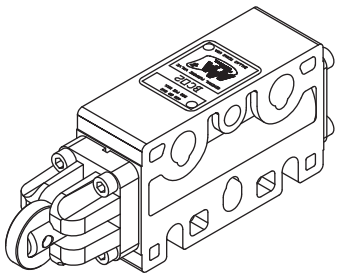
SHIFTING CHARACTERISTICS:

1/4" and 3/8": On BKO models, a minimum force of 12 lbs is required to shift the spool against the spring, with a functional spool travel of 17/32" and with an over-travel of 1/32". On BKY models, a minimum force of 12 lbs is required to shift the spool against the spring in either direction from center. Functional spool travel of 1/4" in either direction from center, with an over-travel of 1/32" on each end. On BKR models a sufficient force is required to opposing force created by the pilot return. Functional spool travel is 17/32" with an over-travel of 1/32". On BKE and BKD models, sufficient force to overcome friction and/or detents is required. Functional spool travel is similar to models described above.

Operating pressure of the valve may affect the shifting force required.

CAM ROLLER CONTROLLED

SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY
1/4" AND 3/8" SIZES — VACUUM TO 250 PSI

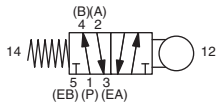
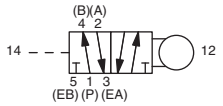


CAM OPERATED SECTION. The hardened steel roller can be actuated either by cross-moving or head-on action of a suitable cam mounted on a machine. Functional spool travel is 17/32" with an over-travel of 1/32" to prevent accidental damage to the valve body in case of incorrect adjustment of the cam. A force of 20 lbs is needed to fully shift the spool on spring return models.

Normal assembly is with the cam roller in a vertical plane as shown in the illustration. Valve may be ordered with roller horizontal or it can be re-positioned in the field.

FLOW PATTERN. When roller is pushed in, air comes out of the cylinder port which is nearest the roller.

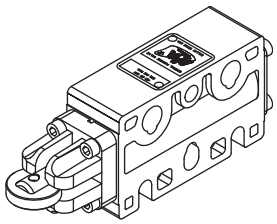
PILOT RETURN MODEL. Model BCR has its spool returned by application of pilot pressure from another valve furnished by the user. This may be a miniature 3-way valve of any type (25 PSI minimum).

MODEL NUMBER Threaded body		DESCRIPTION	SYMBOL
1/4" NPTF	3/8" NPTF		
BCO2	**BCO3**	Cam actuated, 2-position, spring return. Roller returns to position "Out" when released.	
BCR2	**BCR3**	Cam actuated, 2-position, pilot pressure return. Spool is returned by external 3-way control valve furnished by user (25 PSI minimum).	

VALVE OPTIONS:

OPTION R: ROTATED CAM

The standard orientation of the cam on all models is in the vertical direction. To rotate the cam, the cam pin must be removed. With the cam and pin removed, rotate the cam stud and replace the cam and pin to secure the cam in the alternate orientation. On original factory orders specifying this option, the cams will be assembled in the horizontal position.



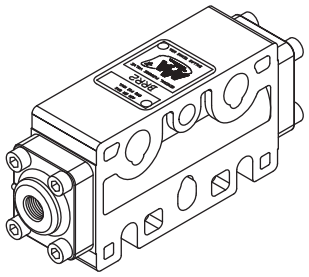
SHIFTING CHARACTERISTICS:

1/4" and 3/8": On BCO models, a minimum force of 20 lbs is required to shift the spool against the spring. On models BCR and BC", sufficient force is required to opposing force created by the pilot return or secondary cam. Functional spool travel is 17/32" with an over-travel of 1/32" to prevent accidental damage to the valve.

Operating pressure of the valve may affect the shifting force required.

REMOTE PILOT CONTROLLED

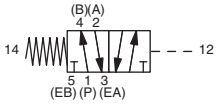
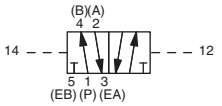
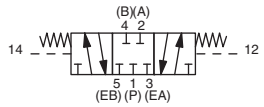
SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY 1/4" AND 3/8" SIZES — VACUUM TO 250 PSI



PILOT OPERATED SECTIONS require a minimum of 25 PSI is required for reliable shifting of no-spring model BRR and 50 PSI for spring loaded models BRO and BRY. Pilot pressure up to 250 PSI is permissible. Pilot ports on one or both end caps are 1/8" NPTF.

FLOW PATTERN. When pilot pressure is applied, flow comes out cylinder port which is nearest the end being piloted.

REMOTE CONTROL. Pilot operated sections must be controlled with an auxiliary remote 3-way valve on each pilot. A remote solenoid or manual valve, with 3-position float center spool, is sometimes used to control both pilots.

MODEL NUMBER Threaded body		DESCRIPTION	SYMBOL
1/4" NPTF	3/8" NPTF	PILOT OPERATED SECTION	
BRO2	**BRO3**	2-position, single pilot, spring return. Spool returns to original position when pilot pressure is released.	
BRR2	**BRR3**	2-position, double pilot, no springs. Spool stays in position to which shifted when pressure on pilot(s) is vented.	
BRY2	**BRY3**	3-position, double pilot, spring centered, closed center spool. All ports are blocked when pressure is released from both pilots (See other spools on page 121).	

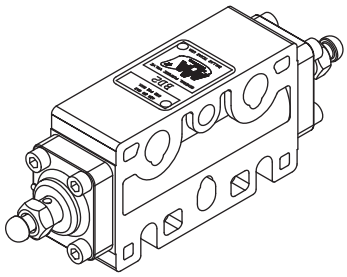
SHIFTING CHARACTERISTICS:

1/4" and 3/8": On BRO and BRY models, a minimum pressure of 50 PSI is required to shift the spool against the spring. On BRR models a minimum pressure of 25 PSI is required to shift the spool. If the return pilot is pressurized then additional pressure will be required overcome the opposing force created by the pilot return.

Operating pressure of the valve may affect the shifting force required.

DIFFERENTIAL PILOT

SECTIONS FOR "B-SERIES" STACK VALVE ASSEMBLIES — 4-WAY 1/4" AND 3/8" SIZES — VACUUM TO 250 PSI

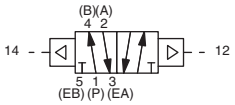
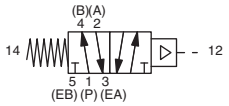
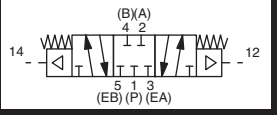


DIFFERENTIAL PILOT SECTIONS will not operate on liquids, vacuum, nor on inlet pressure less than 25 PSI. Two bleed buttons are furnished, screwed into body end caps. In a stack valve, these two buttons are usually removed and connected to body end caps with short lengths of hose for remote operation from a few feet away.

Bleed buttons supplied do not have threaded exhaust ports. For this reason, other types of 2-way N.C. miniature valves must sometimes be substituted for the bleed buttons for remote control (See more information on differential pilot operation on page 104).

FLOW PATTERN. On differential pilot sections, when a bleed button is actuated, air comes out the cylinder port farthest from the button which was actuated.

REMOTE CONTROL. Remote operation by means of bleed buttons should be limited to a distance of less than 10 feet from the valve. At greater distances, spool shifting may be slow or unreliable.

MODEL NUMBER Threaded body		DESCRIPTION	SYMBOL
1/4" NPTF	3/8" NPTF	DIFFERENTIAL PILOT SECTION	
BD2	**BD3**	2-position, differential pilot. Furnished with a button valve on both ends.	
BDO2	**BDO3**	2-position, single differential pilot, spring return. Spool returns to original position when button is pressed.	
BDY2	**BDY3**	3-position, differential pilot, spring centered, closed center spool. Spool returns to center when buttons are released (See other spools on page 121).	

SHIFTING CHARACTERISTICS:

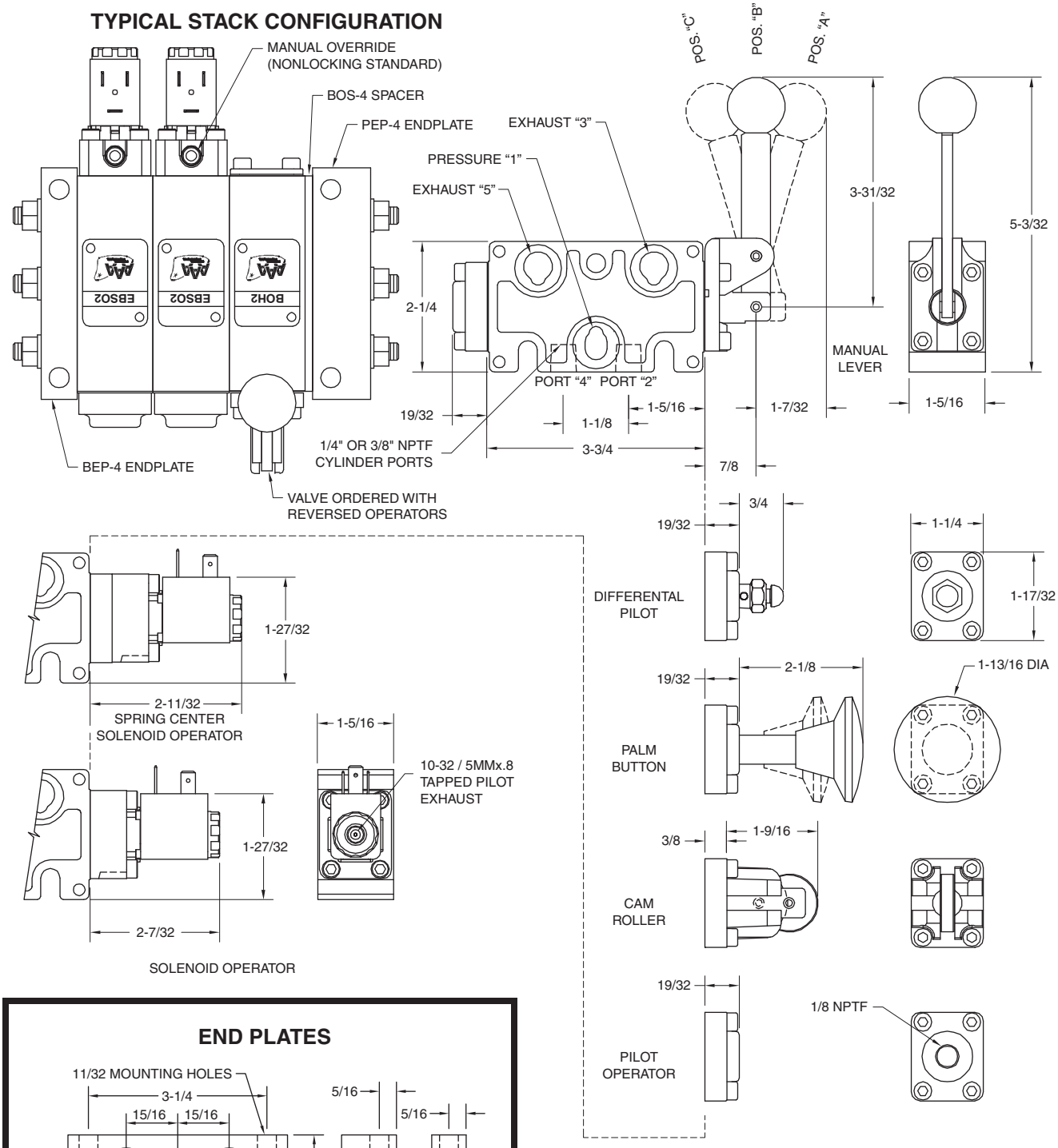
1/4" and 3/8": On BDO and BDY models a minimum pressure of 50 PSI is required to shift the spool against the spring. On BD models a minimum operating pressure is 25 PSI.

Operating pressure of the valve may affect the shifting force required.

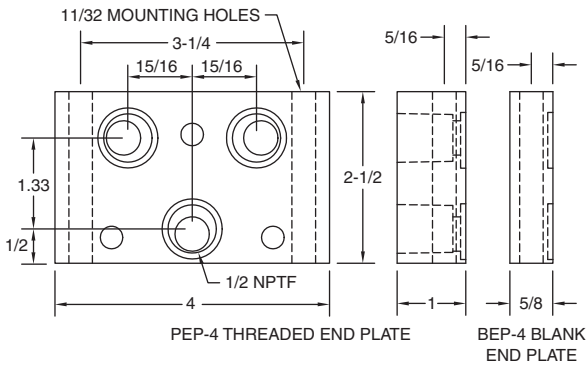
BODY DIMENSIONS - STACK VALVES

Overall dimensions are shown. If additional dimensions or a certified print is required, your distributor will obtain it for you.

TYPICAL STACK CONFIGURATION



END PLATES



MOUNTING DIMENSIONS

Stack assemblies mount with two 5/16" bolts through each end plate to the mounting surface. Mounting bolt pattern is 3-1/4" wide x length of stack. This includes 1-5/16" for each section, plus 5/16" for each end plate, plus 1/8" for BOS-4 spacer (See page 120 for more information).