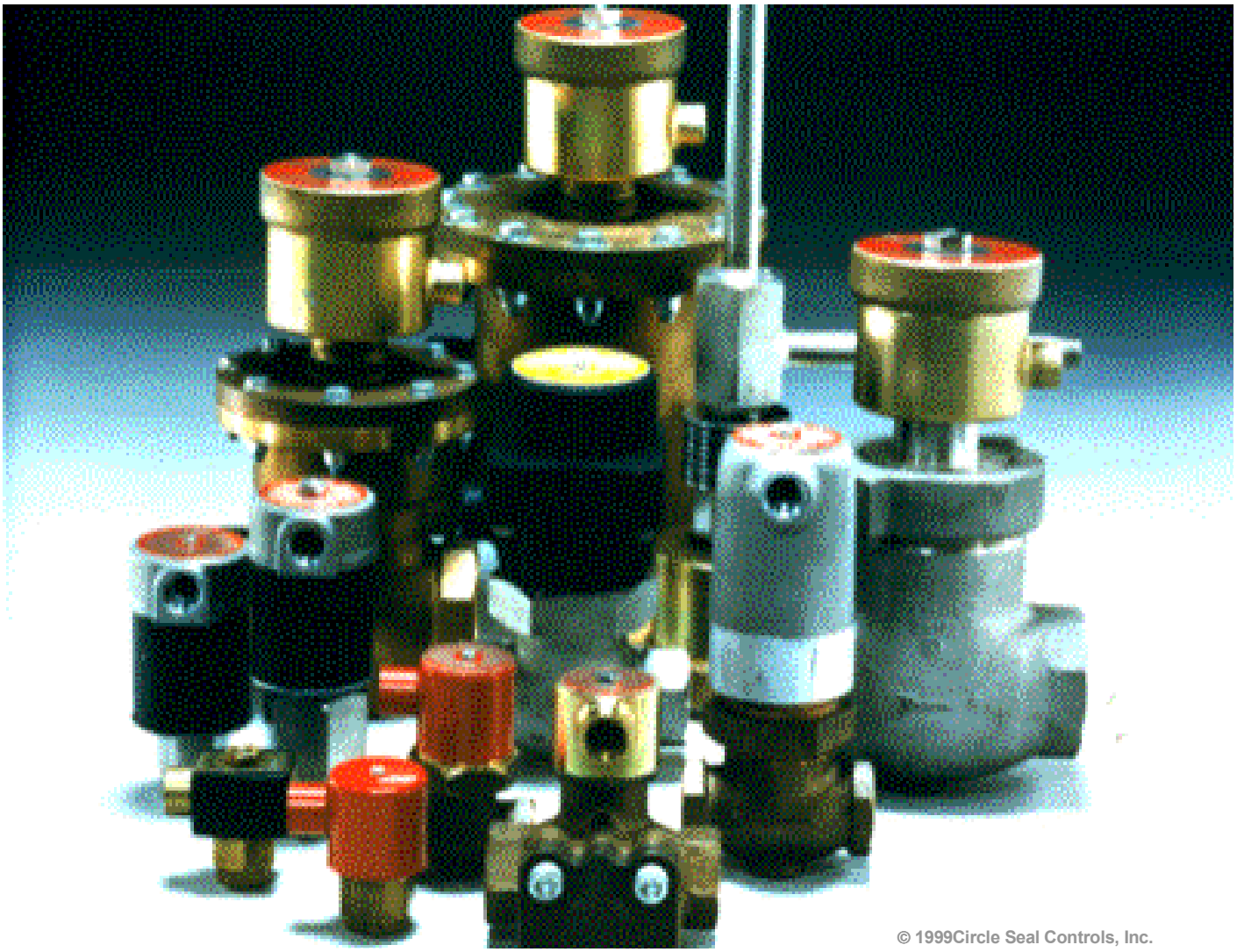
ATKOMATIC

CIRCLE SEAL CONTROLS, INC.
A division of CIRCOR International, Inc.

Products Catalog



ATKOMATIC Products Division of CIRCLE SEAL CONTROLS, INC.
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Catalog Index

TECHNICAL INFORMATION

Overview of Product Line

1. General

- Solenoid valves to meet a wide variety of industrial applications

- 2 position, 2 way valves (one 3-way valve)

- Most are globe style valves with piston poppets (some barstock direct lift)

- Gravity close - with spring and fluid pressure assist

- Most are in-line mounted full ported using pipe threads

- Many are available either normally open or normally closed

- Built to handle all types of clean fluid including air, water, oil, steam, cryogenics, fuels, caustics, refrigerants, and solvents

2. Performance Ranges

- Pressure: vacuum to 10,000 psi

- Fluid temperatures: -423F to + 500F (+750F some models)

- Pipe sizes from 1/8" to 3" (Cv from .02 to 71)

3. Materials of Construction

- 316 Stainless Steel & Naval Bronze or Brass

- Seat material selection: Elastomer: Buna, Viton, EPR
  Plastic: Teflon, Kel-F
  Metal: Stainless, Brass

4. Actuators

- Solenoids rated for continuous duty (operational pressure values for normally open valves are based on intermittent duty only)

- Class H and class B available

- Available with NEMA Type 1 housing - standard
  Type 4 housings - waterproof
  Type 7 and 9 housings – explosion proof for hazardous locations

Valve Ordering Information

Atkomatic valves can be ordered from any of the Circle Seal distributors. A complete list of all authorized stocking distributors in on the Internet at http://www.circle-seal.com.

There are 3 methods of ordering Atkomatic solenoid valves:

1) Specifying the current catalog number

2) Specifying the complete application information

3) For some older valves, referencing a serial number.

Method 1 Specifying the current catalog number

This is the preferred method for ordering solenoid valves.

These catalog numbers are constructed as outlined in the product offering section and more detailed instructions are on pages 7 - 9. Use of these catalog numbers eliminates the need for communicating lengthy text describing all of the application information. Use of these catalog numbers will facilitate order processing in the factory.

Note that the same application information as described in method 2 must be obtained from the customer to create the catalog number.

Method 2 Specifying the complete application information

1. Valve type - normally open or normally closed. This is the position that the valve will return to when electricity is removed.

2. Pilot operated, direct lift of semi-direct lift. This selection can be made by reviewing the customer's application with regard to minimum pressure drop and flow requirements (see pages 12 and 13).

3. Pipe size. If this is not known, it can be determined from the flow, Cv, and/or pressure drop requirement obtained from the customer and/or using the formula from the catalog (see pages 126 and 127).

4. Material of construction - bronze or stainless steel. This selection is made considering compatibility with the fluid and sometimes determined by pressure and size requirements.

5) Fluid - the exact type and state (gas or liquid). The fluid temperature is required if it is elevated or if the fluid is more viscous than 150 SUS at room temperature or if fluid compatibility is an issue.

6) Voltage - both the voltage and frequency (if different from 60 Hz, the assumed default).

7) Maximum operating pressure (maximum differential pressure).

Note that this is not necessarily the maximum pressure at which a particular valve series can perform. More often that not, applications require a specific operational capability that is below the maximum operating pressure of the valve series. Specifying the actual operating pressure requirement allows maximizing the overall performance of the valve by appropriate sizing of the valve's internal orifices. Select the pressure category that matches or most closely exceeds the maximum operational requirement for the application.

8) Ambient temperature if elevated above normal room temperature. 104 F (40 C) is the maximum ambient for continuous coil operation.

9) Options: valve position indicator, manual opening device, or manual throttling device.

Note: If the 4 or 5 digit catalog base number is already known steps 1 through 4 have already been completed.

Method 3 Referencing a serial number

This may apply when an order is placed to duplicate a previously built Atkomatic solenoid valve. The serial number is a 6-digit number that appears on the valve's nameplate at the top of the coil housing. Valves produced after July, 1998 are not serialized and this method of ordering is not applicable to them. The factory maintains files of serialized valves built between July, 1990 and July, 1998 and may be able duplicate these upon order. Due to incomplete records this is not a recommended method of ordering valves.

Without this information it is not possible to select a valve or accept and process an order.

Repair Kits Ordering Information

To order a repair kit for a valve, specify the valve catalog number proceeded by a K\. For instance the repair kit for a 31820-200PMAA1S valve is K\31820-200PMAA1S. Typical contents of repair kits are shown in the section for each valve series in this catalog.

NOTE: All Atkomatic valves are built exclusively for the type of fluid and pressure indicated on the product nameplate. Attempted usage at higher pressures and/or different fluids can result in immediate or delayed valve malfunction (failure to open or close and/or leakage).

Instructions for creating the solenoid valve catalog numbers:

Note: Not all the categories apply to all valve series (see the catalog numbering key for each valve series in the Product Offering section, pages 14 through 101).

1. Match the customer's needs to a catalog base number or valve series using the process outlined in steps 1 through 4 of method 2 (specifying the complete application information) of the previous section.

2. Fill in the first 3 digits after the dash with the appropriate coil voltage code leaving zeros in 2 of the 3 spaces for the unused voltages (see pages 112 – 114 for a summary of available voltages).

   Note: The valves are designed to operate reliably with a voltage within +/- 10% of the nominal catalog voltage for normally closed valves and +10% -0% for normally open valves.

3. Select the coil insulation temperature rating: class H (180 C rise) or class B (155 C rise). Class B coils can be successfully used when fluid temperatures are between 0 and 220 F and the ambient is at room temperature. Class H coils are recommended for other ambient and fluid temperature ranges or where maximum coil life is desired. Usage examples for class H coils include cryogenic fluids, steam, and hot locations such as boiler fuel feed. If in doubt, default to class H which, although slightly more expensive, provides the customer a higher degree of coil burnout protection. Note that class H coils are typically used by default on most stainless steel valves and class B coils or class H coils can be specified on the bronze valves (see page 115).

4. Select the connection type. The default is pipe thread (NPT) which is the preference of the majority of industrial customers. British pipe threads are frequently specified for the Japanese market. AND threads, Aminco threads, flanges, tube stubs, pipe stubs, socket welded connections, butt welded connections, and couplings are options that cause the valve to become a project valve that are numbered differently than catalog valves.

5. Select the operating pressure (for pilot operated and semi-direct lift valves) or orifice size (for direct lift valves)*. This pressure is the actual maximum pressure differential that the valve will be operated at. This can be (and frequently is) less than the maximum possible pressure for a particular valve series (see page 110 for a explanation of operational pressure and the individual valve series pressure capabilities in the Product Offering section, pages 14 through 101).

   a) Direct lift valves

   The diameter of the flow orifice specified determines the flow capacity or Cv of the valve. Note that as larger orifice sizes are selected, the pressure differential that the valve can open against is decreased. Conversely, increasing the differential pressure across the valve requires the use of a smaller flow orifice and therefore results in a lower flow capacity or Cv. This relationship between operational pressure and flow orifice sizing is displayed on charts in the catalog pages for each valve. Note that the viscosity of the fluid has a significant influence on the operational pressures. This a caused by the viscous drag on the plunger as it moves through the fluid during valve opening. This effect is also displayed in the catalog tables which show different operational pressures for three fluids with different viscosity's (representative fluids for these 3 categories are air, water, and hydraulic oil). The pressures given are the maximum operational differential pressures that the valves can operate at reliably with the particular orifice selected.

   * The 50,000 series direct lift valve is an exception to this. The operating pressure range must be known and is specified by the second digit of the catalog number. This is because the construction of the pressure containment changes for pressures above 1500 psi.

b) Pilot operated and direct lift valves

The maximum operational differential pressure the valve is built to operate against is specified here. Note that this is not necessarily the maximum pressure at which a particular valve series can perform. More often that not, applications require a specific operational capability that is below the maximum pressure rating of the valve. Specifying this actual pressure requirement allows maximizing the overall performance of the valve by appropriate sizing of the valve's internal orifices. Select the pressure category that matches or most closely exceeds the maximum operational requirement for the application.

6. Select the main seat and pilot seat material(s)

The following is a set of general rules to guide in the selection of seat materials:

a) Select materials that are chemically compatible with the fluid at operational temperatures. This may at first sound difficult but actually is no different than selecting seal material for any other type of product including other Circle Seal components. There are many sources for chemical compatibility data such as:

1) The technical section of Circle Seal's catalog.
2) Parker's o-ring handbook.
3) Chemical Resistance Guide for Elastomers by Kenneth Pruett
   Compass Publications
   P.O. Box 2276
   La Mesa, CA 91943
   (619) 589-9336

b) **Rubber seats (disk & pilot) cannot be used over 500 psig.** This is the maximum pressure at which these seals will perform reliably. Plastic (Teflon or Kel-F) or metal seats must be used for pressures above 500 psi. In full ported valves, a rubber disc seal can be physically displaced by flow forces if exposed to pressure drops exceeding 500 psig. In direct lift valves pressure drops over 500 psi will deform a rubber seat reducing the orifice size and although the valve may still function, flow will be restricted.

c) Rubber seats (Buna-N, Viton, & EPR) are capable of effecting the most positive seals especially at low pressures. See the factory leakage standards section for the maximum allowable leak rates for production acceptance testing. Typical temperature limitations for rubber seats and seals are:

Buna-N: -65 to +275 F (-54 to +135 C)
Viton: -15 to +400 F (-29 to +204 C)
EPR: -65 to +300 F (-54 to +149 C)

Note that these temperatures are the maximum that the compound can withstand and their suitability with a specific fluid may require more restrictive temperature limitations.

d) Plastic seats (Teflon & Kel-F) can seal reliably with only moderate leakage at low pressure differentials. See the factory leakage standard section (page 128) for the maximum allowable leak rates for production acceptance testing. Typical temperature limitations for plastic seats and seals are:

Kel-F: -400 to +400 F (-240 to +204 C)
Teflon: -450 to +500 F (-268 to +260 C)

Note that these temperatures are the maximum that the compound can withstand and their suitability with a specific fluid may require more restrictive temperature limitations.

e) Metal seats (brass or stainless steel). Metal pilot seats are commonly used in liquid applications where the fluid does not present a hazard from a flammability or toxic aspect. These applications include most water, oil, liquid nitrogen, etc. applications. The purpose of using metal pilot seats is that the life of the product is enhanced as compared to a rubber or plastic pilot seats. Also the operational pressure capability is increased (the valve is able to operate at higher pressures more reliably) with a slightly increased leakage allowance. Metal disc or main valve seats are typically used where temperature limitations require their use.

7. Select the seal material

   Generally, use the same material for the external seals as was used for the valve seats i.e. if Buna-N seats are used, then Buna-N body seals are also used (An exception is Kel-F which is not available in o-rings in the standard catalog product). The valve body seal materials are not subject to the 500 psi limitation that the seats; for instance, Teflon disc seats can be used at high pressure with Viton body seals.

8. Specify the fluid media by type category (see page 110 for assistance in selection the fluid category).

   The categories are:

   a) gas – this includes all types of fluids that remain in the gaseous state
   b) low viscosity liquid – all liquid fluids up to a viscosity of 40 SUS (4.3 Centistokes) such as water, mineral oil, gasoline, JP-4, #2 diesel & fuel oil, and other light oils depending on their temperature
   c) high viscosity liquid – all liquid fluids from a viscosity of 41 SUS to 150 SUS (32 Centistokes) such as light to medium weight oils depending on their temperature (hydraulic fluids such as MIL-5606, #3 & #4 diesel & fuel oil)
   d) steam
   e) cryogenic fluids – includes all fluids that can be in either a liquid or gaseous state such as liquid nitrogen, liquid oxygen, liquid hydrogen, liquid argon, CO2, etc.

      Note: In cases where the fluid can exist at either a liquid or gaseous state, select a cryogenic make-up regardless of the temperatures involves. An example of this would be butane, which can be a gas or liquid depending on pressure at temperatures at or near room temperature.

9. Select the coil housing (see pages 119 through 125 for coil housing information).

   a) Standard NEMA 1
   b) Water proof NEMA 4
   c) Explosion proof NEMA 7
   d) Combination explosion and water proof NEMA 4 & 7

10. Specify options desired (available on selected series, see pages 104 through 106).

    a) valve position indicator
    b) manual opening device
    c) manual metering device

Consult with you local stocking distributor or the Sales department at the factory for assistance in selecting and specifying valve products for specific applications.

Valve Product Matrix

Configurable Valves for General Applications– valves that are built to order

Valve Type	Material	Pressure	Pipe Size	Series	Page
Direct Lift	Bronze	1000	¾ - 1	3000	32
	"	1500	¼ - 1/2	"	"
	Stainless	3000	¼ - 3/8	14,000	61
	"	5000	1/8 – ¼	1,000	24
	"	6000	¼ - 1	16,000	71
	"	10,000	1/8 – ½	2,000	28
Pilot-Piston	Bronze	300	¼ - 1 ½	500	20
	"	500	¼ - 1 ½	4000	37
	"	500	2 – 3	5000	37
	"	1000	¾ - 1 ½	6000	42
	"	1500	¼ - ½	6000	42
	"	3000	3/8 – 1	12,000	53
	Stainless	1500	1 ¼ - 2	8000	49
	"	4000	¼ - 1 ½	8000	49
	"	6000	1/8 – ½	7000	46
Semi-Direct	Bronze	300	¼ - 1 ½	15,400	64
	"	500	2 – 3	30,400	76
	"	1000	¾ - 1 ½	30,400	76
	"	1500	¼ - ½	30,400	76
	Stainless	1500	¼ - 1	15,800	68
	"	3000	¼ - 2	30,800	82

Configurable Valves for Special Applications– valves that are built to order

Valve Type	Material	Pressure	Pipe Size	Series	Page
3-Way Direct Lift	Stainless	2500	¼ - ½	13,000	56
High Temp Direct Lift	Stainless	2500	1/8 - 1	50,000	96
Fast Response Pilot-Piston	Stainless	2000	1 ¼ - 2	35,000	87
	"	1500	½ - 1	35,000	87
High Temp Semi-Direct	Stainless	2500	¼ - 1 ½	40,000	91

Specific Purpose Valves – valves that are pre-built for common applications

Valve Type	Material	Pressure	Pipe Size	Series	Page
Steam Pilot-Piston	Bronze	125	¼ - 1 ½	HS	14
Air Water Oil Pilot-Piston	Bronze	250	¼ - 2	JJ	17
CO2 Pilot-Piston	Stainless	350	½	15-794	101

Explanation of Product Matrix

To facilitate understanding the scope of the Atkomatic product line, the valves can be divided into 3 basic valve design categories as follows:

1) Direct lift valves
2) Pilot operated valves
3) Semi direct lift valves

Each of these basic valve types is appropriate to use in different types of customer's systems. Direct lift valves are applicable where large flow volumes are not required and pressures range from medium to very high. Pilot operated valves are used where a flow producing a minimum pressure drop is always present in a system or in systems where the valves full flow capacity is not required under low flow conditions. Semi-direct lift valves are utilized where it is desired to have the valve function independent of system flow.

Within each of these categories are valves of 2 basic materials of construction: bronze and stainless steel, each serving different fluid media. In addition, the pressure capabilities vary with different valve series within each of the design type categories and material of construction subcategory.

Most of the valves in the product line are configurable, meaning that they can be constructed to meet a variety of application conditions by varying their internal components. The configurable valve series are:

Direct Lift Design

Bronze
- 3000 series, 0 to 1500 psi

Stainless
- 14,000 series, 0 to 3000 psi
- 1000 series, 0 to 5000 psi
- 16,000 series, 0 to 6000 psi
- 2000 series, 0 to 10,000 psi

Pilot-Piston Design

Bronze
- 500 series, 5 to 300 psi
- 4000 series, 5 to 500 psi
- 5000 series, 5 to 500 psi, 2 to 3" sizes
- 6000 series, 5 to 1500 psi
- 12,000 series, 5 to 3000 psi

Stainless
- 8000 series, 5 to 4000 psi
- 7000 series, 5 to 6000 psi

Semi-Direct Lift Design

Bronze
- 15,400 series, 0 to 300 psi
- 30,400 series, 0 to 1500 psi

Stainless
- 15,800 series, 0 to 1500 psi
- 30,800 series, 0 to 3000 psi

There are some valves that do not fit neatly into this progression that address specific marketplace needs. These valves are also configurable and include:

13,000 direct lift 3-way valve, stainless steel, 0 to 2500 psig
35,000 external pilot operated, stainless steel, 0 to 2000 psig, rapid closure
40,000 semi direct lift, stainless steel, 0 to 2500 psig, elevated media temperatures to 750F
50,000 direct lift, stainless steel, 0 to 3000 psig, elevated media temperatures to 750F

A few of the valves are designed to meet specific usage's and are always built with the same configuration of internal parts.

The specific usage valves are currently:

JJ series, general purpose air, water, and oil, 5 to 250 psig
HS series, steam, 5 to 125 psi
15-794 series, liquid CO2, 5 to 350 psi

All of these valves are currently pilot-piston operated. They are designed to cover specific and/or broad ranges of applications such that they can be conveniently stocked by distribution for rapid delivery.

These specific usage valves may be added to or removed as the demand for them changes.

Note: The pressures given above are the maximum for the various valve series, actual operating pressure will vary with coil voltages and fluid media (and in some cases valve size).

Several of the valve series are available in either normally open or normally closed configurations. These are:

Series	Normally Closed Catalog Number Prefix	Normally Open Catalog Number Prefix	Page
500	5X0	5X1	20
3000	3X00 & 3X08	3X01	32
4000	4X00 & 4X08	4X01 & 4X07	37
5000	5X00 & 5X08	5X01 & 5X07	37
6000	6X00	6X01	42
8000	8XX0	8XX1	49
13,000 *	13,1X0	132X0	56
15,400	15,4X0 & 15,4X8	15,4X1 & 15,4X7	64
16,000	16,X00	16,X01	71
30,400	31,4X0	32,4X0	76
30,800	31,8X0 & 31,8X1	32,8X0 & 32,8X1	82
35,800	35,8XX-0	35,8XX-N	87
40,800	41,8X0	42,8X0	91
50,000	50,XX0	50,XX1	96

* The 13,000 series is also available in a distributor version which has a catalog number prefix of 13,3X0 and is described on page 56.

NOTE: Normally open valves are rated for intermittent duty only unless other operational parameters (such as voltage, ambient temperature, fluid temperature, etc.) are at their nominal values.

HS Series Bronze, Pilot Piston, Pilot-Piston, Pressure 5 to 125 psig

Steam or Hot Water valve

Pressures to 125 psig (saturated steam temperature of 352 F)

Pipe sizes from ¼" through 1 1/2" (British BSPT ports available)

Full ported valves – Cv from 1.4 to 21

Pilot operated – require a minimum pressure differential of 5 psig

Bronze valve material (naval M bronze)

Metal to metal pilot seat, Teflon piston seat and Teflon body o-ring seal

No options available

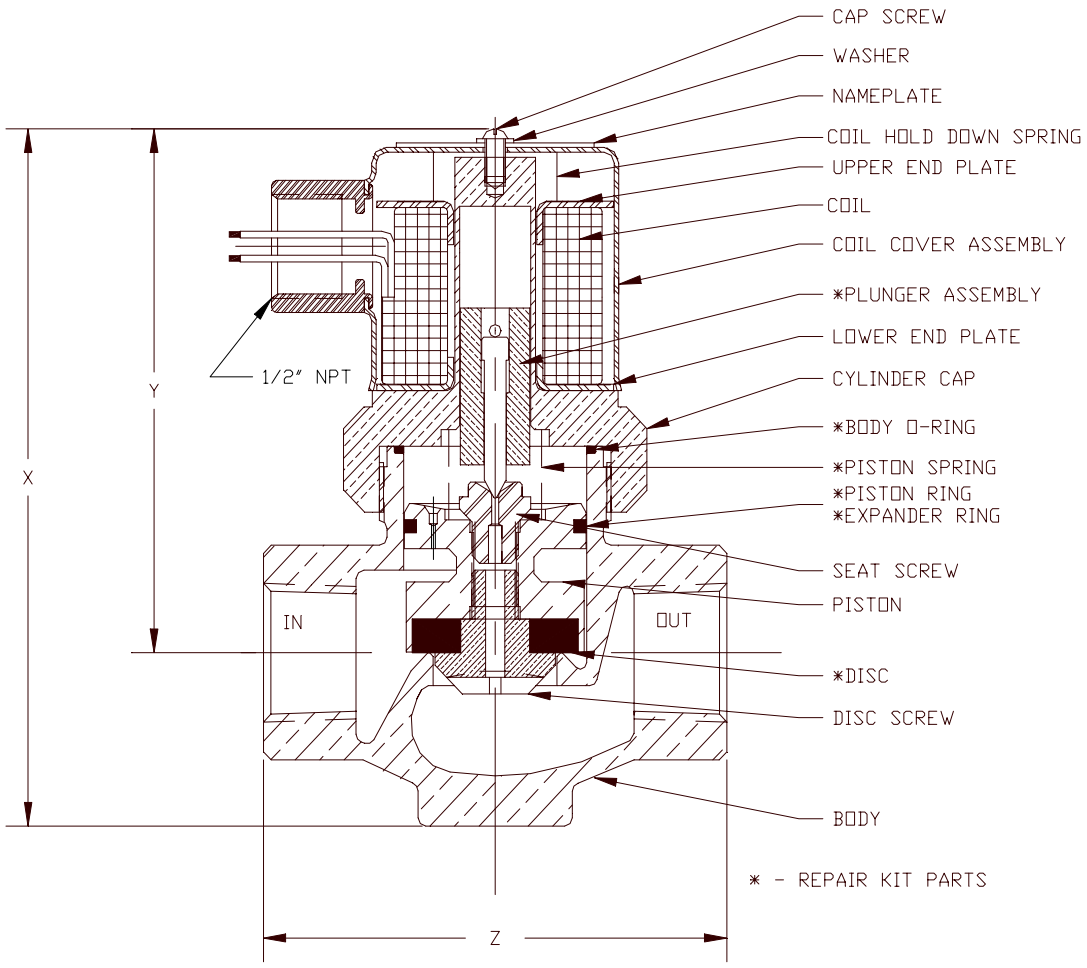
Class H coil is standard

Operational Pressures **All HS series** 5 psid minimum pressure differential

Liquids to 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.
125	125	125	125

Dimensions, Shipping Weights, and Cv Flow Factors

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
HS200	¼"	½"	4 ¾"	3 7/8	2 11/16	3	1.4
HS300	3/8"	½"	4 ¾"	3 7/8"	2 11/16"	3	2.7
HS400	½"	½"	¾"	3 7/8"	3"	4	3.5
HS500	¾"	1"	5 ¼"	4"	3 ¾"	5	7.5
HS600	1"	1"	5 ¼"	4"	3 ¾"	5	9.1
HS700	1 ¼"	1 ½"	7"	5 1/8"	5 1/16"	13	19.5
HS800	1 ½"	1 ½"	7"	5 1/8"	5 1/16"	13	21.0



HS500 ¾" Valve

HS Valve Series catalog number

HSX00-XXX

Connection Type
(P) NPT
(J) British Pipe Thread

Voltage (DC), specify (0) if AC
(0) AC (4) 100
(1) 12 (5) 125
(2) 24 & 32 (6) 250
(3) 48

Voltage (AC), specify (0) if DC
(1) 24-60 (6) 460-60
(2) 100-60 (7) 110-50
(3) 115-60 (8) 220-50
(4) 200-60 (9) 380-50
(5) 230-60

Always 0's- not significant

Designates Pipe Thread Size
(2) ¼" (5) ¾" (8) 1 ½"
(3) 3/8" (6) 1"
(4) ½" (7) 1 ¼"

Designates Valve Series-always HS

JJ Series — Bronze, Pilot-Piston, Pressure 5 to 250 psig

General purpose air, water, and light oil (150 SSU max) valve

Pressures to 250 psig

Fluid temperatures from –65 to +180 F

Pipe sizes from ¼" through 2" (British BSPT ports available)

Full ported valves – Cv from 1.4 to 46

Pilot operated – require a minimum pressure differential of 5 psig

Bronze or brass valve material

Buna-N pilot seat, piston seat, and body o-ring seals

Class B and class H coils are available

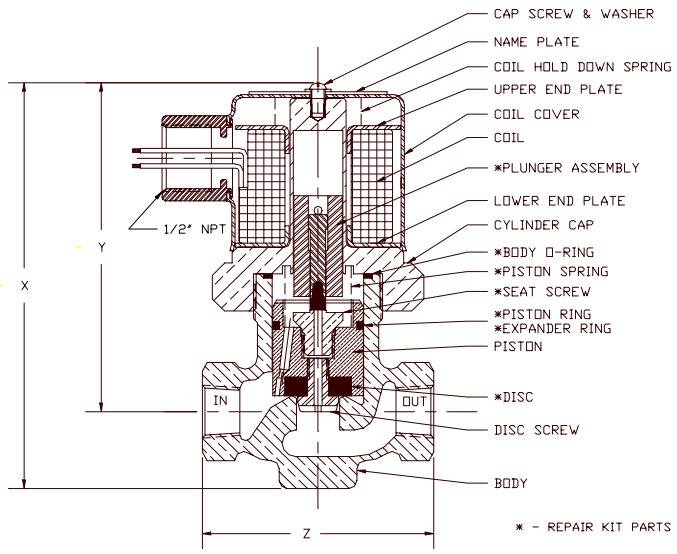
No other options are available

Operational Pressures **All JJ series** 5 psid minimum pressure differential

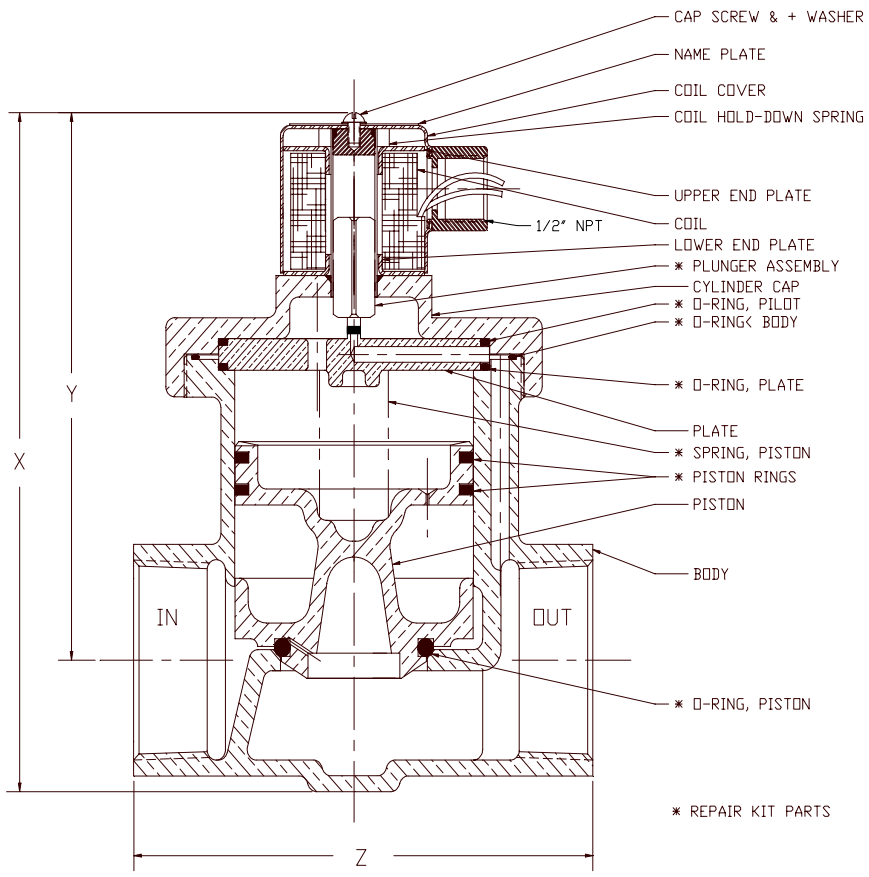
Gases		Liquids to 40 SUS		Liquids over 40 SUS	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
250	150	150	100	75	50

Dimensions, Shipping Weights, and Cv Flow Factors

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
JJ200	¼"	½"	4 ¾"	3 7/8	2 11/16	3	1.4
JJ300	3/8"	½"	4 ¾"	3 7/8"	2 11/16"	3	2.7
JJ400	½"	½"	4 ¾"	3 7/8"	3"	4	3.5
JJ500	¾"	1"	5 ¼"	4"	3 ¾"	5	7.5
JJ600	1"	1"	5 ¼"	4"	3 ¾"	5	9.1
JJ700	1 ¼"	1 ½"	7"	5 1/8"	5 1/16"	13	19.5
JJ800	1 ½"	1 ½"	7"	5 1/8"	5 1/16"	13	21.0
JJ900	2"	2"	8 1/16"	6 ½"	6 ¼"	16	46.0



JJ200 ¼" Valve



JJ900 2” Valve

JJ Valve Series catalog number

JJX00-XXXX

Connection Type
(P) NPT
(J) British Pipe Thread

Coil Insulation Rating
(B) Class B 155°c
(H) Class H 180°c

Voltage (DC), specify (0) if AC
(0) AC (4) 100
(1) 12 (5) 125
(2) 24 & 32 (6) 250
(3) 48

Voltage (AC), specify (0) if DC
(1) 24-60 (6) 460-60
(2) 100-60 (7) 110-50
(3) 115-60 (8) 220-50
(4) 200-60 (9) 380-50
(5) 230-60

Always 0’s- not significant

Designates Pipe Thread Size
(2) ¼" (5) ¾" (8) 1 ½"
(3) 3/8" (6) 1" (9) 2”
(4) ½" (7) 1 ¼"

Designates Valve Series-always JJ

500 Series Bronze, Pilot-Piston, Pressure 5 to 300 psig

Low pressure valve configurable for variety of fluid applications

Pressures to 300 psig.

Fluid temperatures from –100 to +450 F

For use with any gas or liquid (max viscosity of 150 SSU), including steam and cryogenic, that is not harmful to bronze

Pipe sizes from ¼" through 1 1/2" NPT (British BSPT ports available)

Full ported valves – Cv from 1.4 to 21

Pilot operated – requires a minimum pressure differential of 5 psig

Available in normally open and normally closed versions

Optional pilot and piston seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 ss pilot and/or brass piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Bronze valve material (naval M bronze)

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are available as options

Class B coils are available for media temperatures of 0 through 220 F

Class H coils are available – recommended for media temperatures of –100 through +450 F

Operational Pressures 5 psid minimum pressure differential

Normally Closed 500 – 560 ¼ through 1 ½"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
300	300	300	300	300	100	125	125

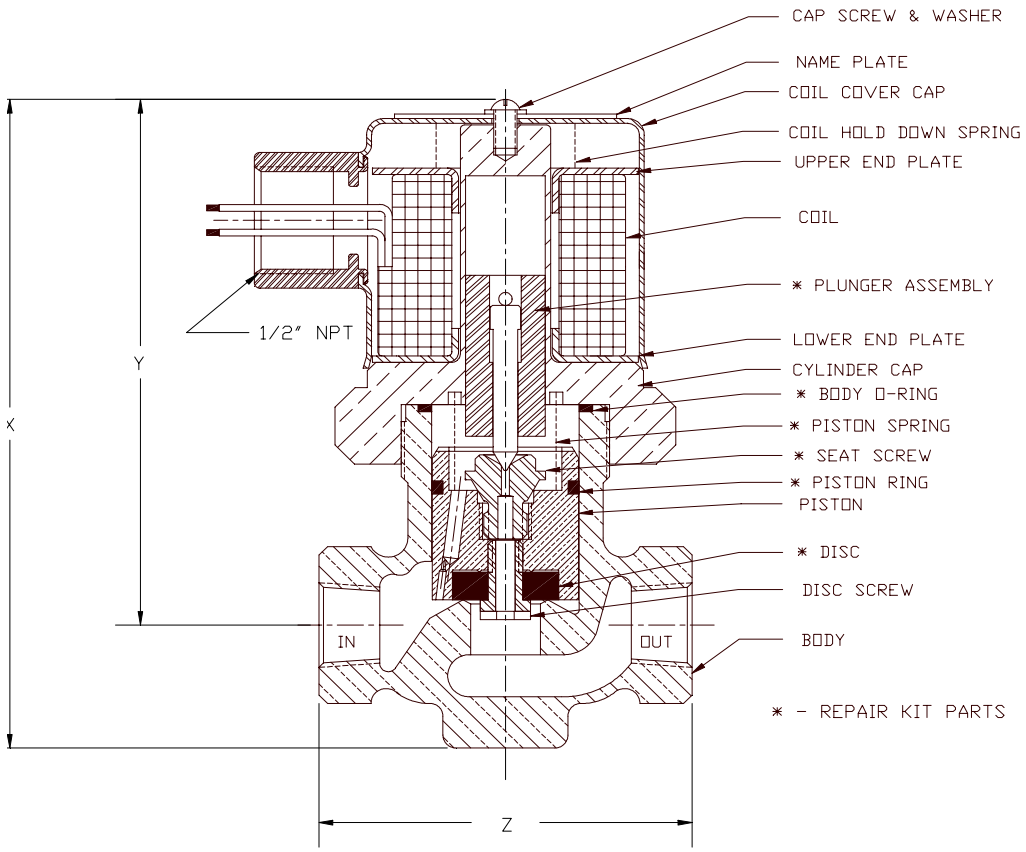
Normally Open 501 – 561 ¼ through 1 ½"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
300	300	200	200	100	100	125	125

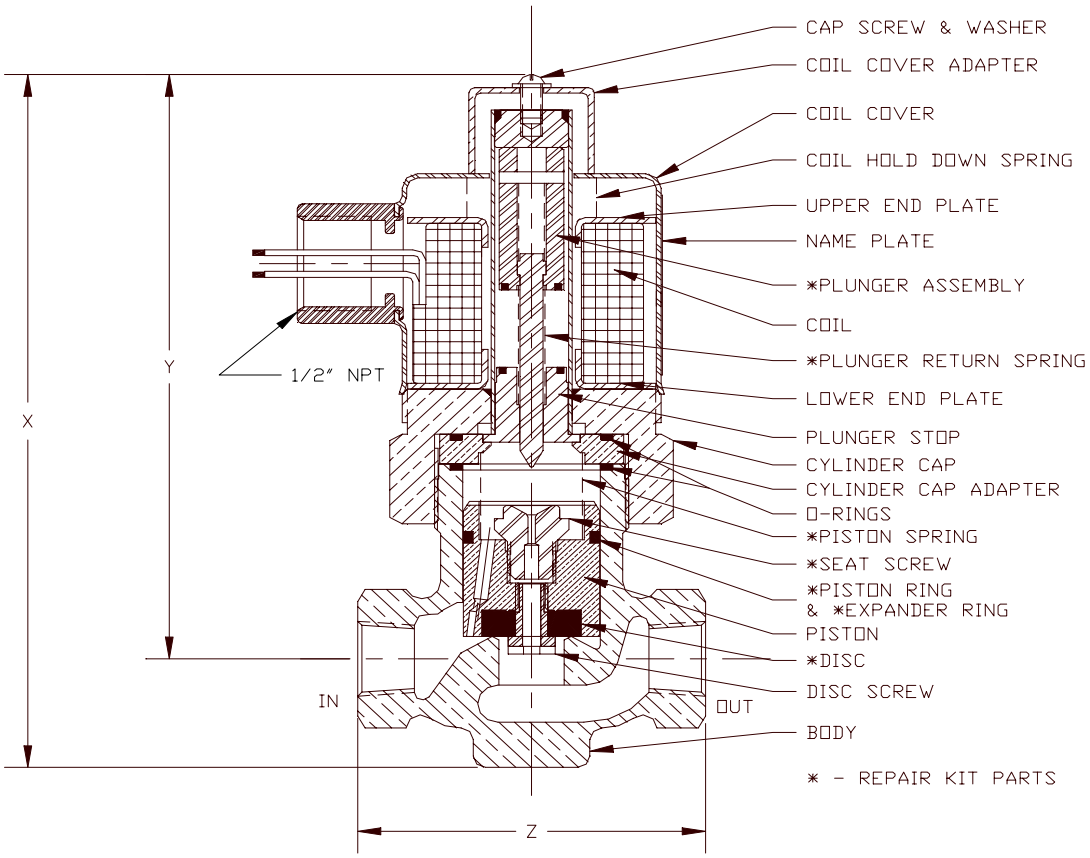
NOTE: Normally open 501series valves are subject to the intermittent operation restrictions described on page 13 and are not recommended for cryogenic service.

Dimensions, Shipping Weights, and Cv Flow Factors

Catalog Number Prefix		Pipe	Main Seat	X		Y			Shipping Weight	
N.C.	N.O.	Size	Orifice	N.C.	N.O.	N.C.	N.O.	Z	(lbs.)	Cv
500	**501**	¼”	½”	4 ¾”	5 ¾”	3 7/8	4 13/16”	2 11/16”	3	1.4
510	**511**	3/8”	½”	4 ¾”	5 ¾”	3 7/8”	4 13/16”	2 11/16”	3	2.7
520	**521**	½”	½”	4 ¾”	5 ¾”	3 7/8”	4 13/16”	3”	4	3.5
530	**531**	¾”	1”	5 ¼”	6 1/8”	4”	4 7/8”	3 ¾”	5	7.5
540	**541**	1”	1”	5 ¼”	6 1/8”	4”	4 7/8”	3 ¾”	5	9.1
550	**551**	1 ¼”	1 ½”	7”	8”	5 1/8”	6”	5 1/16”	13	19.5
560	**561**	1 ½”	1 ½”	7”	8”	5 1/8”	6”	5 1/16”	13	21.0



Normally Closed ¼” 500 Valve – shown with a standard NEMA 1 coil housing and a metal pilot seat



Normally Open ¼" 501 Valve – shown with a standard NEMA 1 coil housing and a metal pilot seat

500 Valve Series catalog number

5XX-XXXXXXXXXX

Options
(M) M: Manual opening device
(T) MT: Manual throttling device

Coil Housing
(E) Explosion Proof (S) Standard
(W) Water Proof (C) H_20 & Explosion Proof

Fluid Media Type
(1) Gas (3) Liquid 41 SUS to 150 SUS
(2) Liquid up to 40 SUS (4) Steam

Seal Material
(A) Teflon (B) Buna-N (C) Viton (D) EPR

Seat/Pilot Material
(A) TFE pilot & TFE disc (F) Metal pilot & Metal disc
(B) Buna pilot & Buna disc (G) Metal pilot & TFE disc
(C) Viton pilot & Viton disc (H) Metal pilot & Buna disc
(D) EPR pilot & EPR disc (I) Metal pilot & Viton disc
(E) Kel-F pilot & Kel disc (J) Metal pilot & EPR disc
(L) Metal pilot & Kel-F disc

Maximum Operating Pressure

(A) 20	(D) 60	(G) 125	(J) 250
(B) 25	(E) 75	(H) 150	(K) 275
(C) 50	(F) 100	(I) 200	(L) 300

Connection Type
(P) NPT
(J) British Pipe Thread

Coil Insulation Rating
(B) Class B
(H) Class H

Voltage DC

(0) AC	(1) 12	(2) 24 & 32	(3) 48
(4) 100	(5) 125	(6) 250	

Voltage AC

(1) 24-60	(2) 100-60	(3) 115-60	(4) 200-60	(5) 230-60
(6) 460-60	(7) 110-50	(8) 220-50	(9) 380-50	

Designates normal (de-energized) position of valve
(0) Normally Closed
(1) Normally Open

Designates pipe connection size

(0)	¼"	(1)	3/8"	(2)	½"	(3)	¾"
(4)	1"	(5)	1 ¼"	(6)	1 ½"		

Designates Valve Series - always 5

1000 Series Stainless Steel, Direct Lift

Medium pressure valve configurable for variety of fluid applications

Direct acting valve

Pressure to 5000 psig depending on fluid and orifice size

Barstock body construction

Compact size

Stainless steel construction on all wetted parts – 316 for pressure containing parts and plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 200 SUS

Fluid temperatures from –423 to +500 F

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenics, and corrosive fluids

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Flow orifice sizes of 1/16, 3/32, 1/8, and 3/16”

Pipe sizes of 1/8” and ¼” NPT

British BSPT ports available

Cv from .093 to .72

Class H coil is standard

Can use a class H double wound coil (requires use with a relay to drop out primary coil winding after valve actuation) depending on pressure

Coils housings is NEMA 1

Operational Pressures No minimum pressure differential

Single wound coils 1000 – 1100 Metal seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1500	1800	1000	1500	500	300	300
3/32	1000	500	800	350	500	170	300	300
1/8	500	200	400	125	250	50	300	125
3/16	175	55	125	35	125	15	125	35

Single wound coils 1002 – 1102 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1275	1500	765	1500	500	300	300
3/32	1000	425	675	300	425	150	300	300
1/8	425	170	350	100	200	40	300	100
3/16	150	40	100	30	100	12	110	30

Double wound coil 1004 – 1104 Metal seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	5000	5000	5000	3500	5000	2500	300	300
3/32	3500	2000	3000	1500	3000	1000	300	300
1/8	2000	800	1500	600	1200	500	300	300

Double wound coil 1009 – 1109 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	5000	4000	4500	3000	4250	2100	300	300
3/32	3000	1700	2600	1300	2250	850	300	300
1/8	1700	680	1275	500	1000	425	300	300

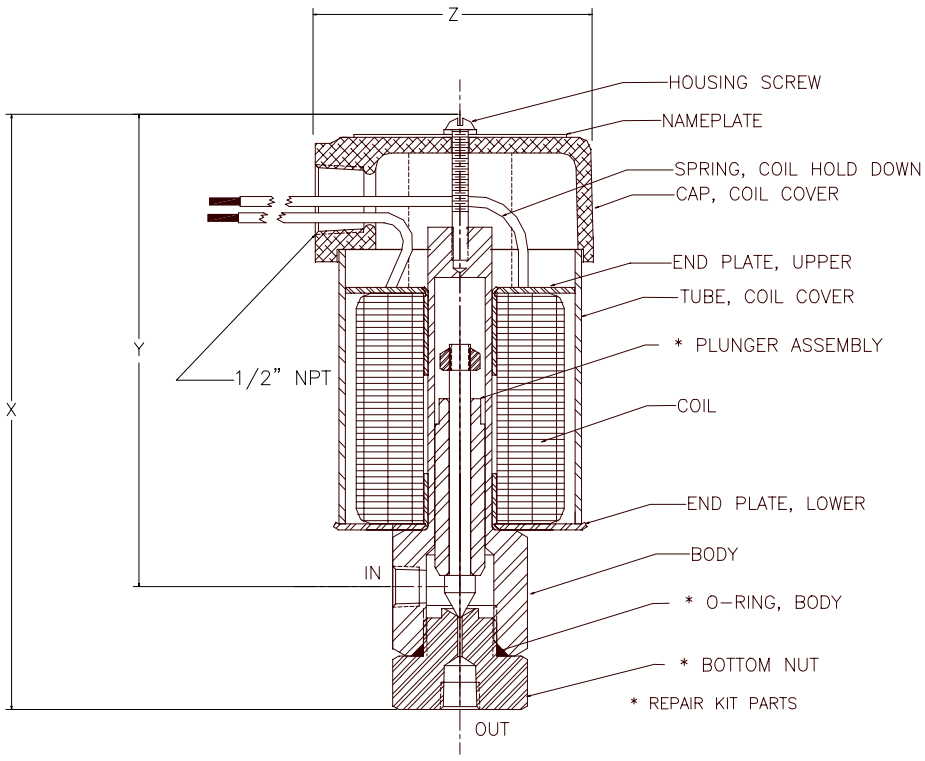
NOTE: Rubber seats are limited to 500 psi

Dimensions and Shipping Weights

Catalog Number Prefix								
Single Wound Coil Metal Seat	Single Wound Coil Soft Seat	Double Wound Coil Metal Seat	Double Wound Coil Soft Seat	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
1000	**1002**	**1004**	**1009**	1/8”	5 ¾”	4 5/8”	2 ¾”	5
1100	**1102**	**1104**	**1109**	1/4”	5 ¾”	4 5/8”	2 ¾”	5

Cv Flow Factors

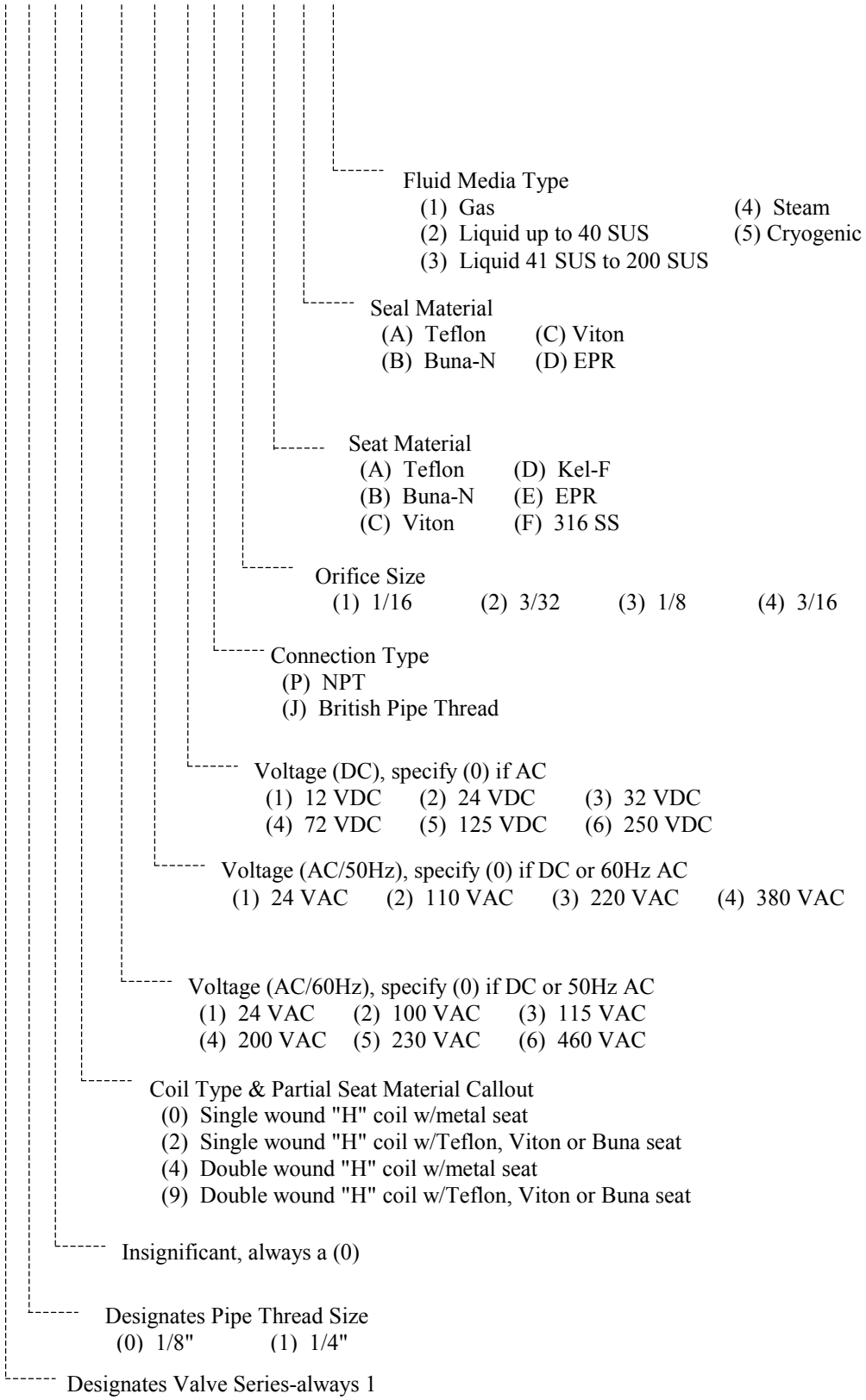
Orifice Size	Cv
1/16”	.093
3/32	.22
1/8”	.44
3/16”	.72



1002 1/8” Valve – shown with a metal seat

1000 Valve Series catalog number

1X0X-XXXXXXXX



2000 series Stainless Steel, Direct Lift

High pressure valve configurable for variety of fluid applications

Direct acting valve

Pressure to 10,000 psig depending on fluid and orifice size

Barstock body construction

Stainless steel construction on all wetted parts – 316 for pressure containing parts and plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 200 SUS

Fluid temperatures from –423 to +500 F

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenics, and corrosive fluids

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure. These are available with 1/16" through 3/16" orifices.

Seat material is Stellite with 1/32 and 3/64" orifices

Body seal materials of Teflon, Viton, Buna-N, or EPR

Flow orifice sizes of 1/32, 3/64, 1/16, 3/32, 1/8, and 3/16"

Pipe sizes of 1/8, ¼, 3/8, and ½" NPT

British BSPT, AND, and AMINCO ports available

Cv from .020 to .72

Can use a class H double wound coil (requires use with a relay to drop out primary coil winding after valve actuation) depending on pressure

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Class H coil is standard

Operational Pressures No minimum pressure differential

Single wound coils 2000 – 2300 Metal (Stellite) seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/32	8000	3000	8000	3000	6000	2000	300	300
3/64	3500	1800	3500	1000	3000	750	300	300

Single wound coils 2000 – 2300 Metal seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1500	1800	1000	1500	500	300	300
3/32	1000	500	800	350	500	170	300	300
1/8	500	200	400	125	250	60	300	125
3/16	175	55	125	35	125	15	125	35

Single wound coils 2000 – 2300 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1275	1500	765	1500	500	300	300
3/32	850	425	675	300	425	150	300	200
1/8	425	170	350	100	200	50	300	100
3/16	150	40	100	30	100	17	110	30

Double wound coils 2004 – 2304 Metal (Stellite) seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/32	10000	10000	10000	10000	10000	6000	300	300
3/64	9000	4000	9000	4000	9000	4000	300	300

Double wound coils 2004 – 2304 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	6000	4000	6000	3500	6000	2500	300	300
3/32	3500	2000	3000	1500	2000	1000	300	300
1/8	1000	800	600	600	500	500	300	300

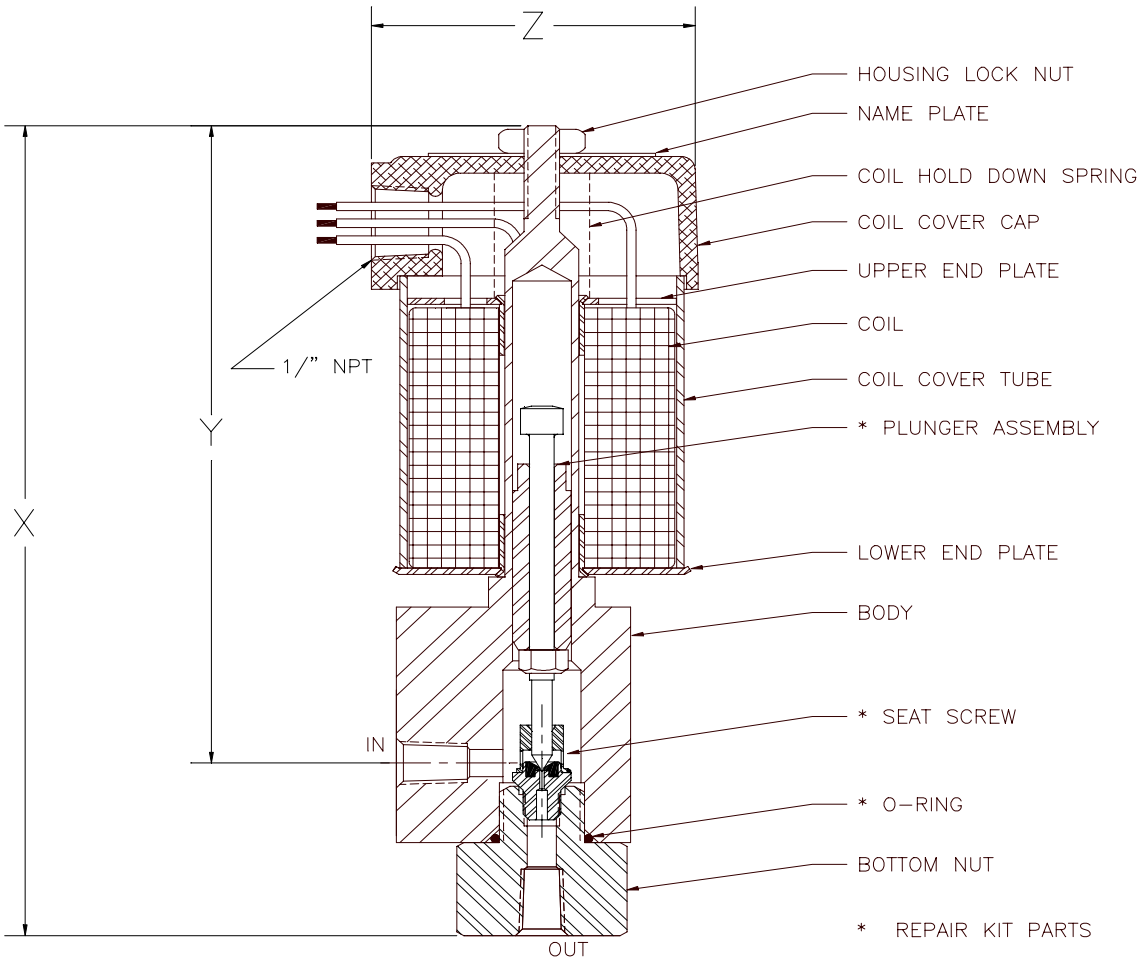
NOTE: Rubber seats are limited to 500 psi

Dimensions and Shipping Weights

Catalog Number Prefix Single Wound Coil	Double Wound Coil	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
2000	**2004**	1/8”	7 9/16”	6”	2 3/4”	7
2100	**2104**	1/4”	7 9/16”	6”	2 3/4”	7
2200	**2204**	3/8”	7 9/16”	6”	2 3/4”	7
2300	**3204**	1/2”	7 9/16”	6”	2 3/4”	7

Cv Flow Factors

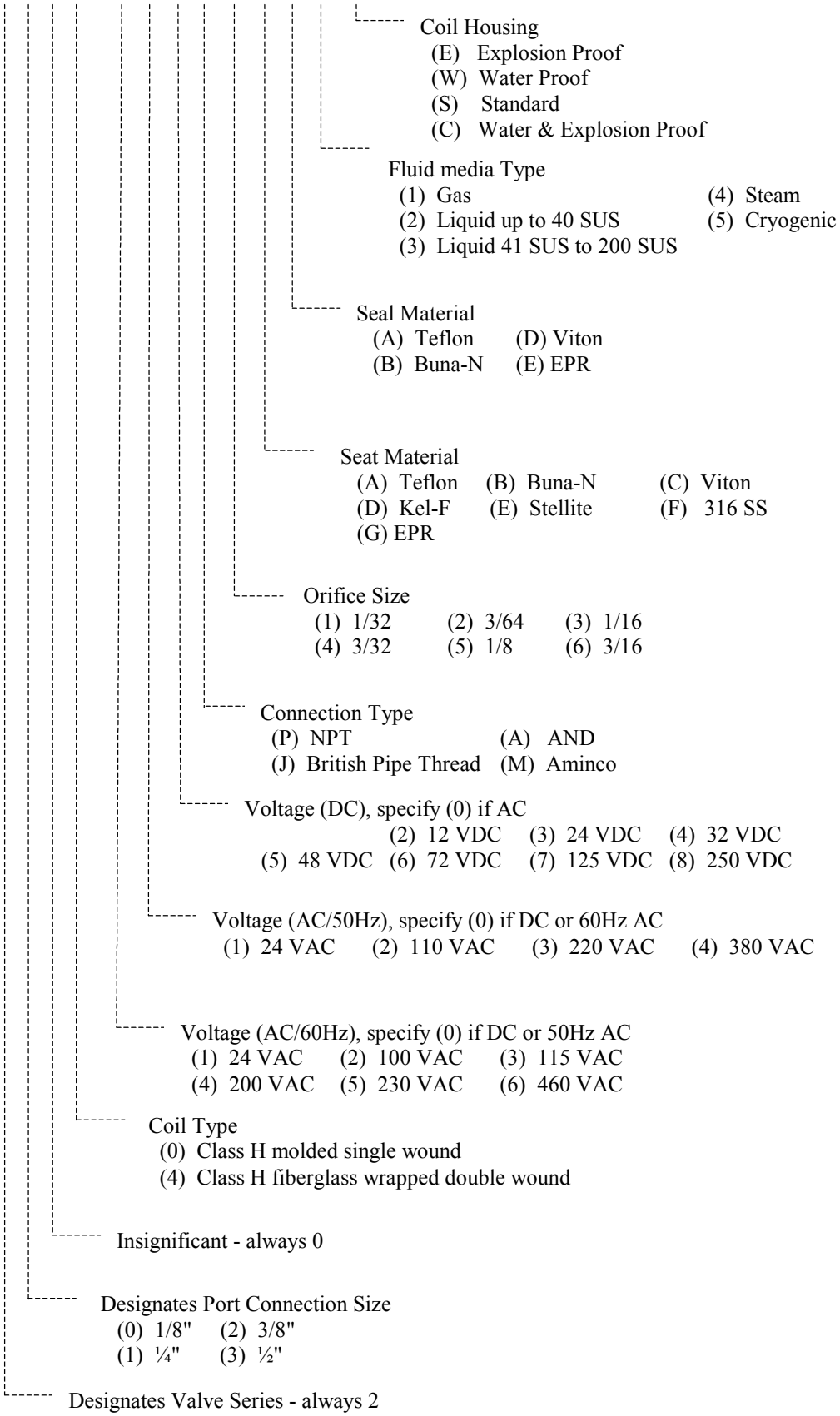
Orifice Size	Cv
1/32”	.020
3/64”	.056
1/16”	.093
3/32	.22
1/8”	.44
3/16”	.72



2004 1/8” Valve – shown with a NEMA 1 coil housing and a soft seat

2000 Valve Series catalog number

2X0X-XXXXXXXXX



3000 series Bronze, Direct Lift

Medium pressure valve configurable for variety of fluid applications

Direct acting valve

Pressure to 1500 psig depending on fluid and orifice size

Available in normally open and normally closed versions

Bronze valve material (naval M bronze)

For use with any gas or liquid (max viscosity of 200 SSU), including steam and cryogenic, that is not harmful to bronze

Fluid temperatures from –423 to +500 F

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe sizes of ¼, 3/8, ½, ¾, and 1" NPT

British BSPT ports available

Flow orifice sizes of 1/6, 3/32, 1/8, & 3/16"

Cv from .093 to 2.3

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Class B coils are available for media temperatures of 0 through 220 F

Class H coils are available – recommended for media temperatures of –423 through +500 F – is standard on normally open version

Operational Pressures No minimum pressure differential

Normally Closed 3000 – 3400 & 3008 – 3408 Metal seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1000*	1000*	1000*	1000	1000*	500	250	250
3/32	1000*	500	800	350	500	150	250	250
1/8	500	200	400	125	250	60	250	125
3/16	175	50	125	35	125	20	165	35

* 1500 psi for ¼, 3/8, and ½" sizes only

Normally Closed 3000 – 3400 & 3008 – 3408 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1000*	1000*	1000*	765	1000*	500	250	250
3/32	1000*	425	675	300	425	170	250	250
1/8	425	170	350	100	200	50	250	100
3/16	150	40	100	30	100	17	140	30

- 1500 psi for ¼, 3/8, and ½" sizes only

Normally Open 3001 – 3401 Metal seats

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1000*	800	1000	350	700	300	250	250
3/32	500	250	300	150	275	90	250	250
1/8	225	100	200	50	125	35	200	150
3/16	65	25	40	15	25	10	50	25

- 1500 psi for ¼, 3/8, and ½" sizes only

Normally Open 3001 – 3401 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1000*	680	1000	300	600	250	250	250
3/32	425	200	250	125	230	75	200	200
1/8	190	85	170	40	100	30	170	125
3/16	65	20	35	12	20	8	40	20

- 1500 psi for ¼, 3/8, and ½" sizes only

NOTE: Normally open 3001 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Rubber seats are limited to 500 psi

Dimensions and Shipping Weights

3000 Series Normally Closed Bronze

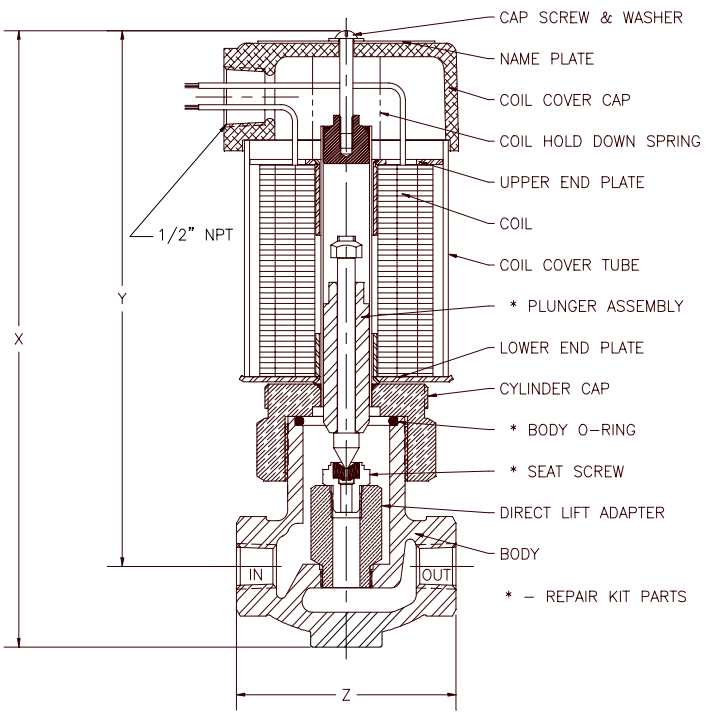
Catalog Number Prefix Class B coil	Class H coil	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
3000	**3008**	¼"	7 5/16"	6 ½"	2 11/16"	5
3100	**3108**	3/8"	7 5/16"	6 ½"	2 11/16"	5
3200	**3208**	½"	7 7/16"	6 ½"	3"	6
3300	**3308**	¾"	7 15/16"	6 5/8"	3 ¾"	7
3400	**3408**	1"	7 15/16"	6 5/8"	3 ¾"	7

3000 Series Normally Open Bronze

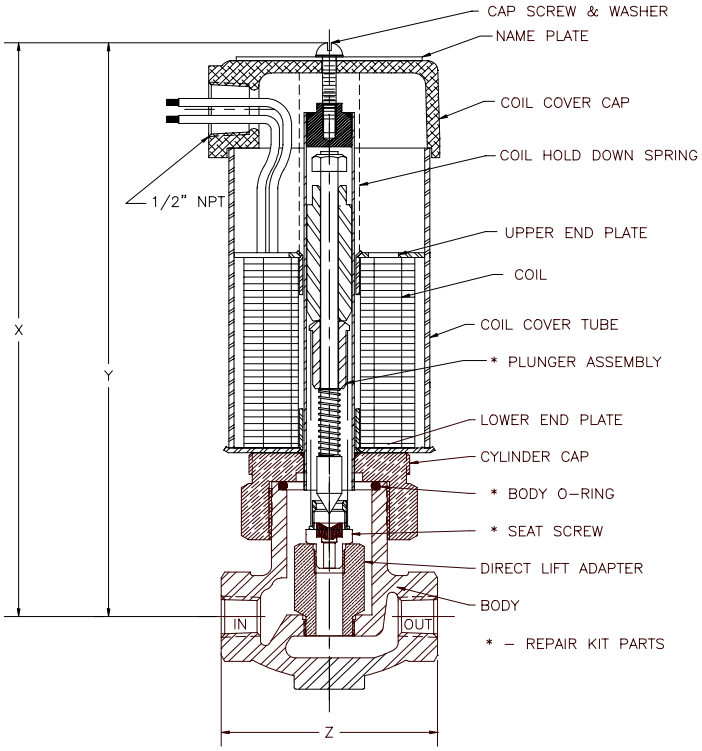
Catalog Number Prefix Class H coil	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
3001	¼"	9 3/32"	8 3/16"	2 11/16"	7
3101	3/8"	9 3/32"	8 3/16"	2 11/16"	7
3201	½"	9 3/16"	8 3/16"	3"	7
3301	¾"	9 ½"	8 ¼"	3 ¾"	8
3401	1"	9 ½"	8 ¼"	3 ¾"	8

Cv Flow Factors

Orifice	Cv
1/16"	.093
3/32"	.22
1/8"	.44
3/16"	.72



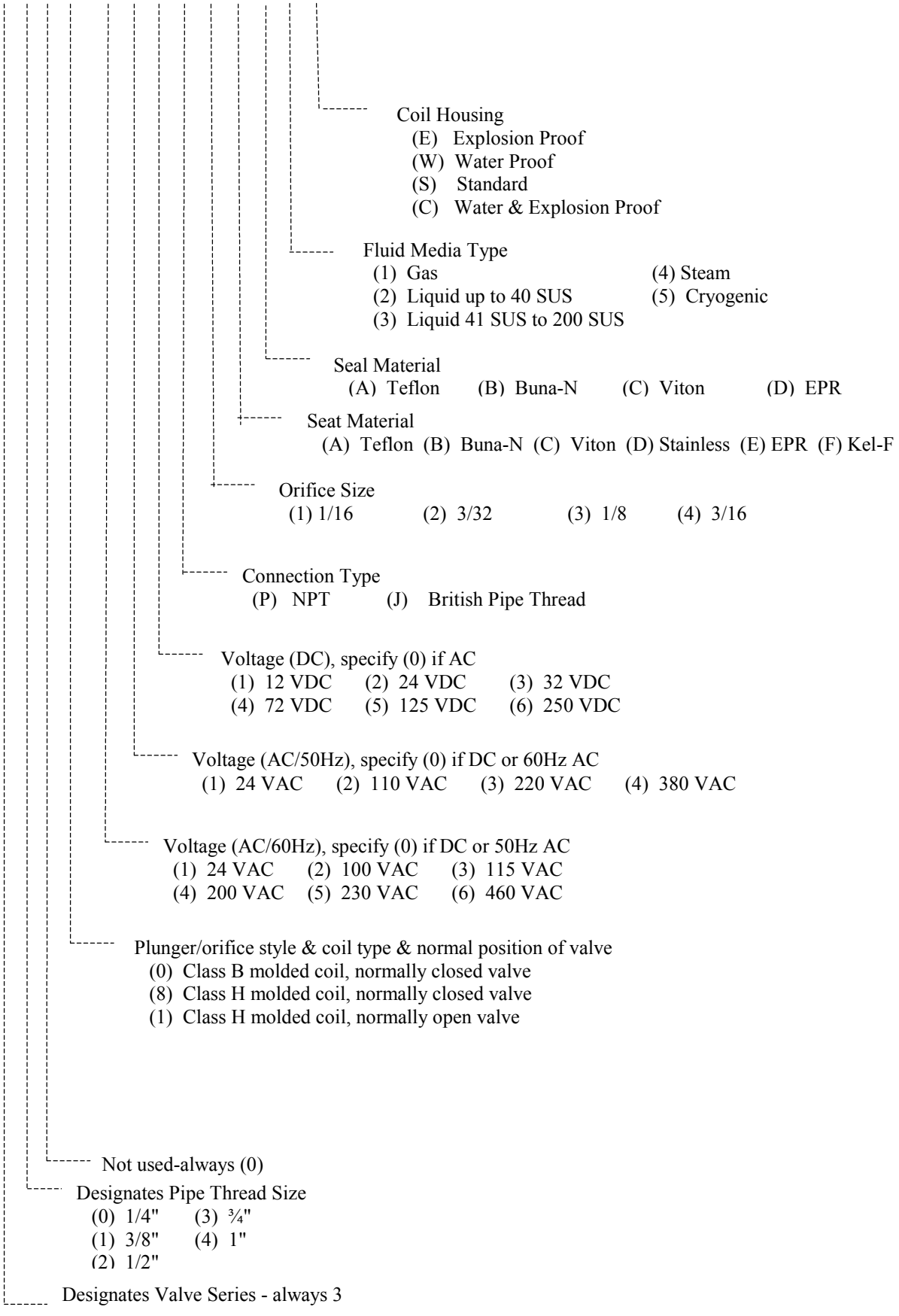
Normally Closed ¼" 3000 Valve – shown with a NEMA 1 coil housing and a soft seat



Normally Open ¼" 3001Valve – shown with a NEMA 1 coil housing and a soft seat

3000 Valve Series catalog number

3X0X-XXXXXXXXX



4000 & 5000 Series Bronze, Pilot-Piston, Pressure 5 to 500 psig

Medium pressure valve configurable for variety of fluid applications

Pressures to 500 psig

Full ported valves

Pilot operated – require a minimum pressure differential of 5 psig

For use with any gas or liquid (max viscosity of 200 SSU), including steam and cryogenic, that is not harmful to bronze

Pipe sizes of ¼ through 1 ½" NPT for 4000 series and 2 through 3" NPT in 5000 series (British BSPT ports available)

Cv from 1.4 to 71

Available in normally open and normally closed versions

Fluid temperatures from –423 to +500 F

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 pilot seat, and/or brass piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Bronze valve material (naval M bronze)

Removable 316 ss body inserts (stainless steel trim) 4000 series only

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are available as options

Class B coils are available for media temperatures of 0 through 220 F – available on both normally closed and normally open valves

Class H coils are available – recommended for media temperatures of –423 through +500 F – available on both normally closed and normally open valves

Operational Pressures **All 4000 & 5000 series** 5 psid minimum pressure differential

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
500	500	500	500	500	300	200	200

NOTE: Normally open 4000 & 5000 series valves are subject to the intermittent operation restrictions described on page 13.

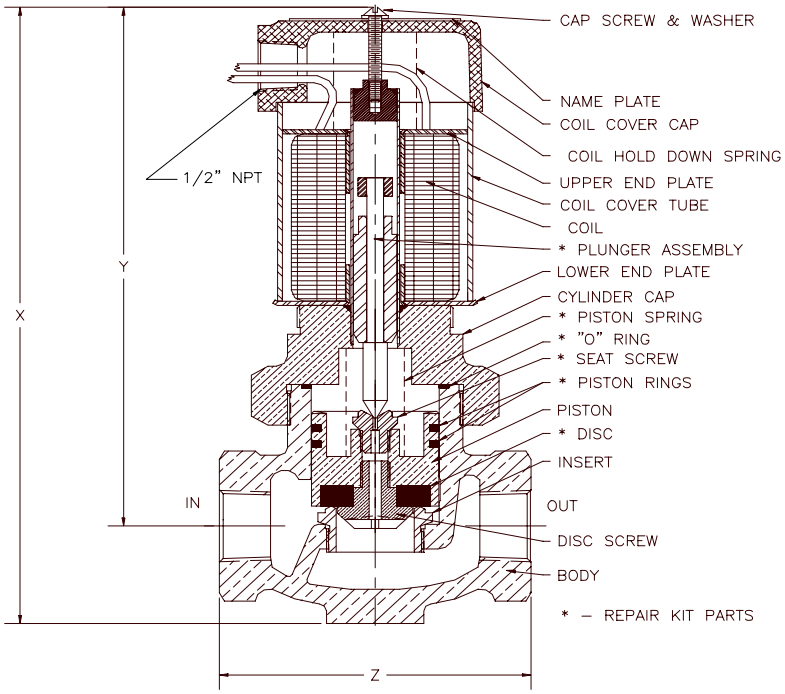
Dimensions, Shipping Weights, and Cv Flow Factors

Normally Closed

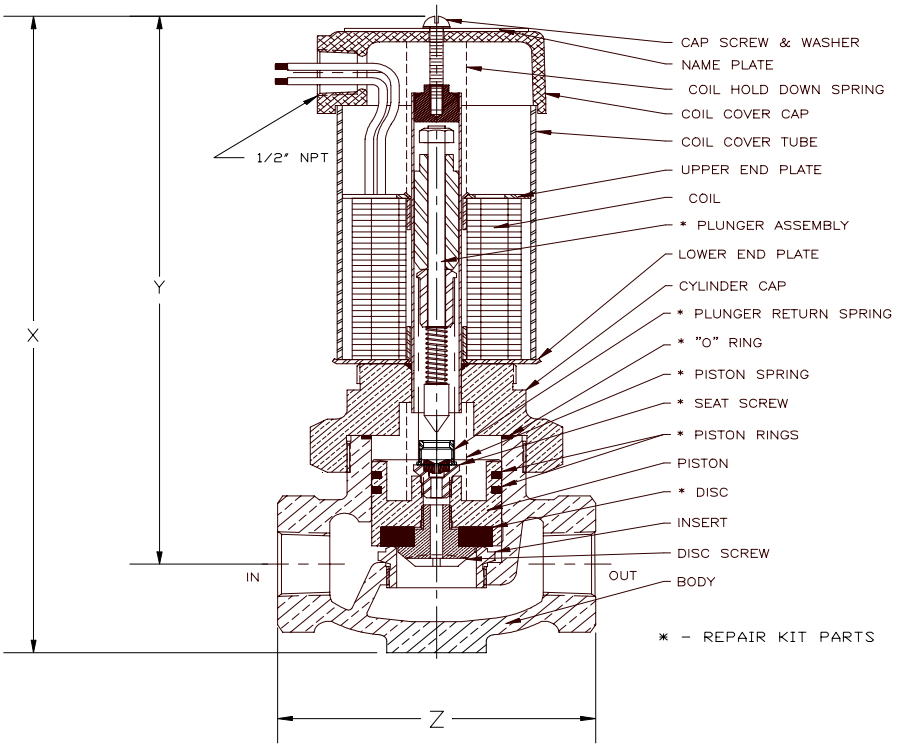
Catalog Number Prefix Class B Coil	Class H Coil	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
4000	**4008**	¼"	3/8"	7 1/8"	6 ¼"	2 11/16"	6	1.4
4100	**4108**	3/8"	3/8"	7 1/8"	6 ¼"	2 11/16"	6	2.7
4200	**4208**	½"	½"	7 1/8"	6 ¼"	3"	8	3.5
4300	**4308**	¾"	1"	8 ¼"	7"	4"	9	8.4
4400	**4408**	1"	1"	8 ¼"	7"	4"	9	9.5
4500	**4508**	1 ¼"	1 ½"	9 13/16"	8"	5 1/16"	15	19.5
4600	**4608**	1 ½"	1 ½"	9 13/16"	8"	5 1/16"	15	21.0
5700	**5708**	2"	2"	12 5/8"	9 3/4"	6 1/8"	35	43.0
5800	**5808**	2 ½"	3"	14 3/8"	10 ½"	8 ½"	75	63.0
5900	**5908**	3'	3"	14 3/8"	10 ½"	8 ½"	75	71.0

Normally Open

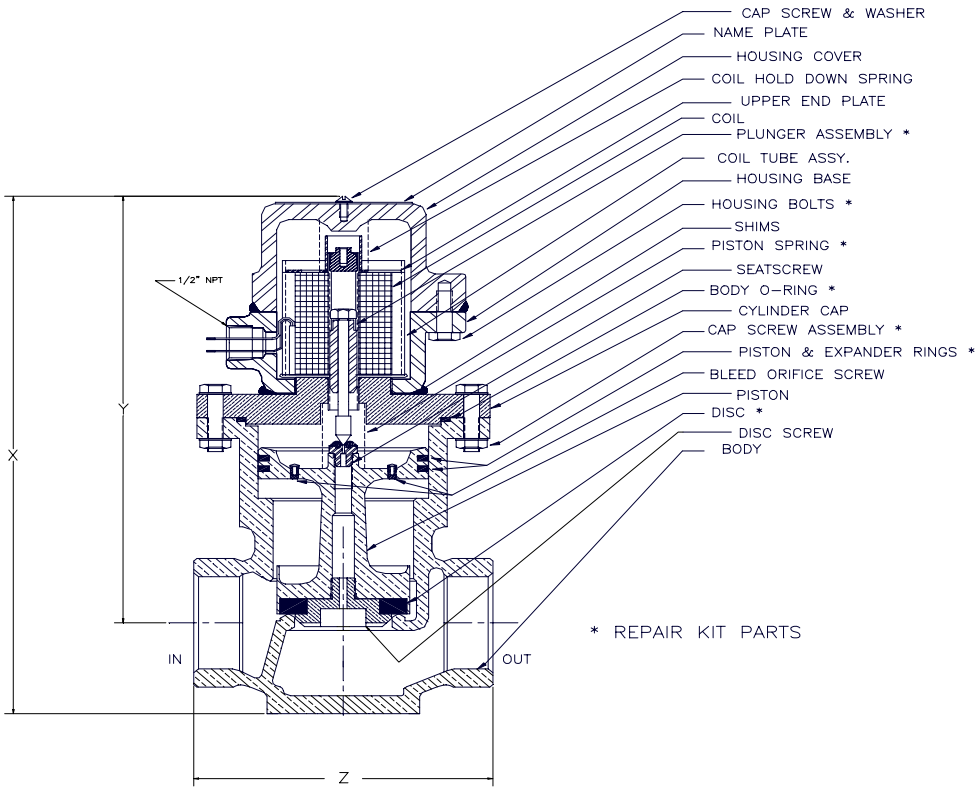
Catalog Number Prefix Class B Coil	Class H Coil	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
4001	**4007**	3/8"	3/8"	8 1/8"	7 ¼"	2 11/16"	6	1.4
4101	**4107**	3/8"	3/8"	8 1/8"	7 ¼"	2 11/16"	6	2.7
4201	**4207**	½"	½"	8 1/8"	7 ¼"	3"	8	3.5
4301	**4307**	¾"	1"	9 7/16"	8 3/16"	4"	9	8.4
4401	**4407**	1"	1"	9 7/16"	8 3/16"	4"	9	9.5
4501	**4507**	1 ¼"	1 ½"	11"	9 3/16"	5 1/16"	15	19.5
4601	**4607**	1 ½"	1 ½"	11"	9 3/16"	5 1/16"	15	21.0
5701	**5707**	2"	2"	13 ¾"	10 7/8"	6 1/8"	35	43.0
5801	**5807**	2 ½"	3"	15 ½"	11 5/8"	8 ½"	75	63.0
5901	**5907**	3"	3"	15 ½"	11 5/8"	8 ½"	75	71.0



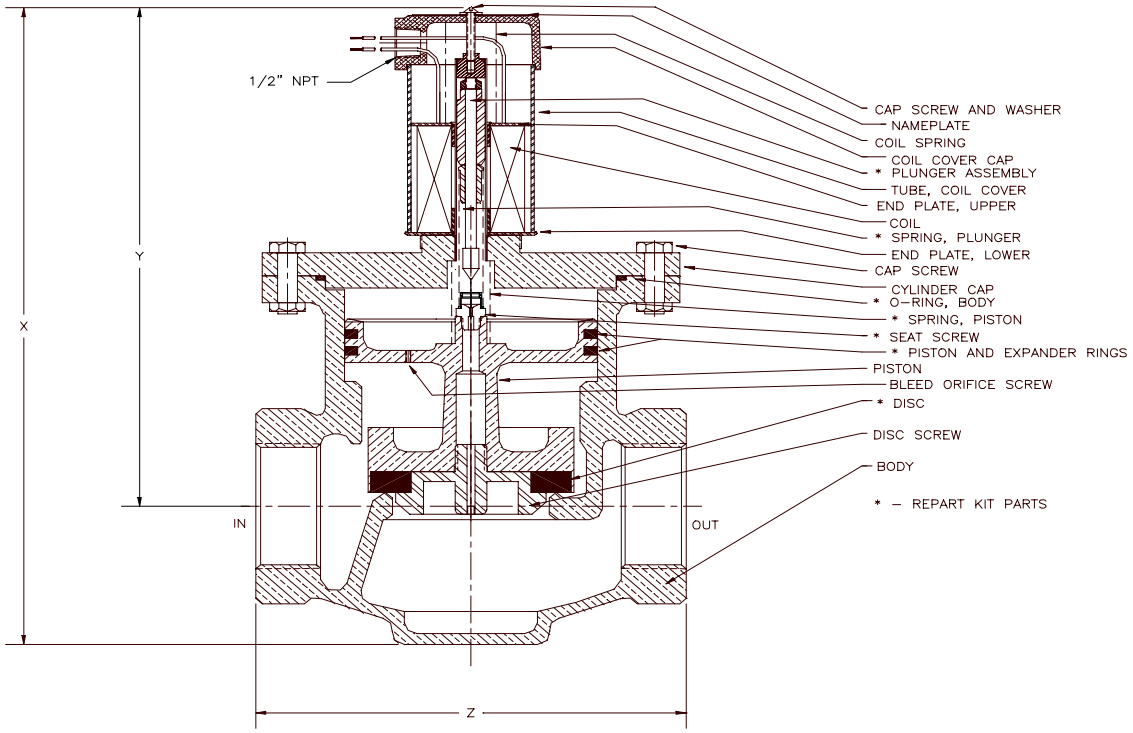
Normally Closed 1” 4408 Valve – shown with a NEMA 1 coil housing and metal pilot seat



Normally Open 1” 4407 Valve – shown with a standard NEMA 1 coil housing and a soft pilot seat

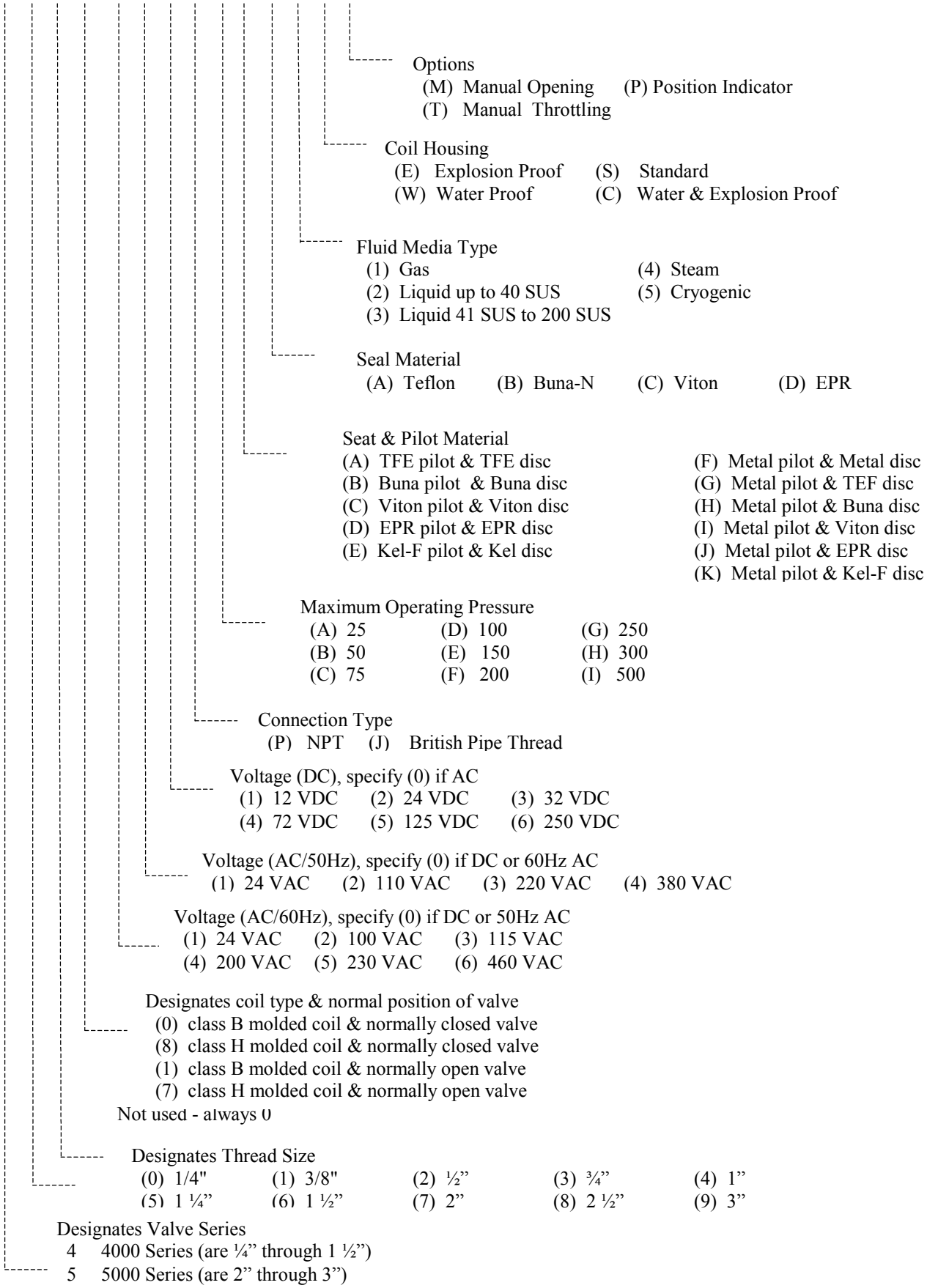


Normally Closed 2” 5700 Valve, shown with a NEMA 7 Explosion Proof Coil Housing and soft pilot seat



Normally Open 2 1/2” 5801 Valve, shown with a NEMA 1 coil housing and metal pilot seat

4000/5000 Valve Series catalog number
XX0X-XXXXXXXXXX



6000 Series Bronze, Pilot-Piston, 0 to 1500 psig

Medium pressure valve configurable for variety of fluid applications

Pressures to 1500 psig

Pilot operated – require a minimum pressure differential of 5 psig

Full ported valves

Fluid temperatures from –423 to +500 F

For use with any gas or liquid (max viscosity of 200 SSU), including steam and cryogenic, that is not harmful to bronze

Pipe sizes of ¼ through 1 ½" (British BSPT ports available)

Cv from 1.4 to 21

Available in normally open and normally closed versions

Optional pilot and piston seat seal materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 ss pilot and/or brass piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Bronze valve material (naval M bronze)

Removable 316 ss body inserts (stainless steel trim)

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are available as options

Class B coils are available for media temperatures of 0 through 220 F – available on both normally closed and normally open valves

Class H coils are available – recommended for media temperatures of –423 through +500 F – available on both normally closed and normally open valves

Operational Pressures 5 psid minimum pressure differential

Normally closed 6000 – 6200 ¼ through ½"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1200	600	200	200

Normally Closed 6300 – 6600 3/4 through 1 1/2"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1000	1000	1000	1000	1000	600	200	200

Normally Open 6001 – 6201 ¼ through ½"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1000	1000	500	1000	350	200	200

Normally open 6301 – 6601 3/4 through 1 1/2"

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1000	1000	1000	500	1000	350	200	200

NOTE: Normally open 6001 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Rubber seats are limited to 500 psi

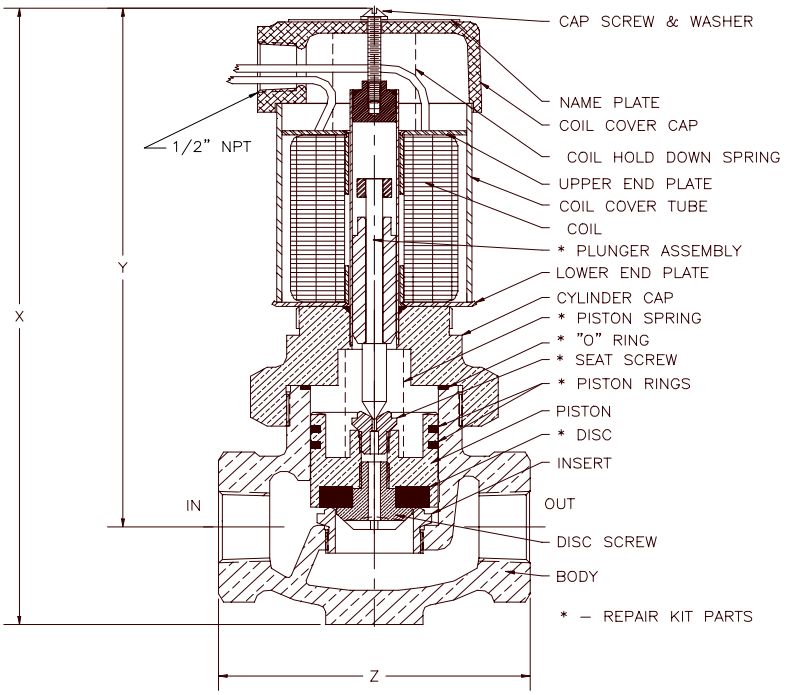
Dimensions, Shipping Weights, and Cv Flow Factors

Normally Closed

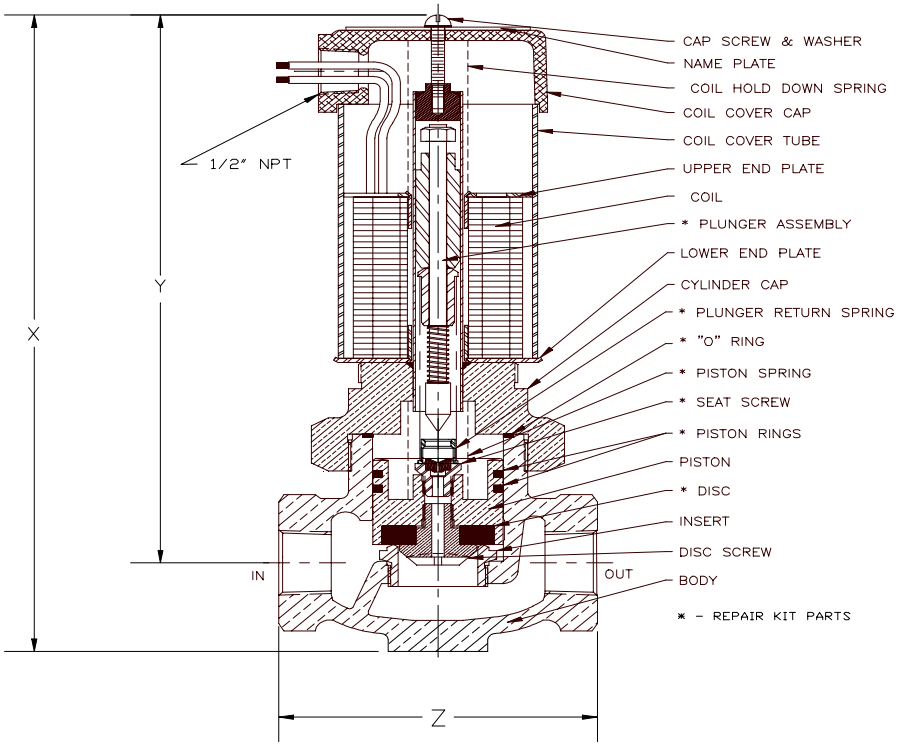
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
6000	¼"	3/8"	7 1/8"	6 ¼"	2 11/16"	6	1.4
6100	3/8"	3/8"	7 1/8"	6 ¼"	2 11/16"	6	2.7
6200	½"	½"	7 1/8"	6 ¼"	3"	8	3.5
6300	¾"	1"	8 ¼"	7"	4"	9	8.4
6400	1"	1"	8 ¼"	7"	4"	9	9.5
6500	1 ¼"	1 ½"	9 13/16"	8"	5 1/16"	15	19.5
6600	1 ½"	1 ½"	9 13/16"	8"	5 1/16"	15	21.0

Normally Open

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
6001	¼"	3/8"	8 1/8"	7 ¼"	2 11/16"	6	1.4
6101	3/8:	3/8"	8 1/8"	7 ¼"	2 11/16"	6	2.7
6201	½"	½"	8 1/8"	7 ¼"	3"	8	3.5
6301	¾"	1"	9 7/16"	8 3/16"	4"	9	8.4
6401	1"	1"	9 7/16"	8 3/16"	4"	9	9.5
6501	1 ¼"	1 ½"	11"	9 3/16"	5 1/16"	15	19.5
6601	1 ½"	1 ½"	11"	9 3/16"	5 1/16"	15	21.0



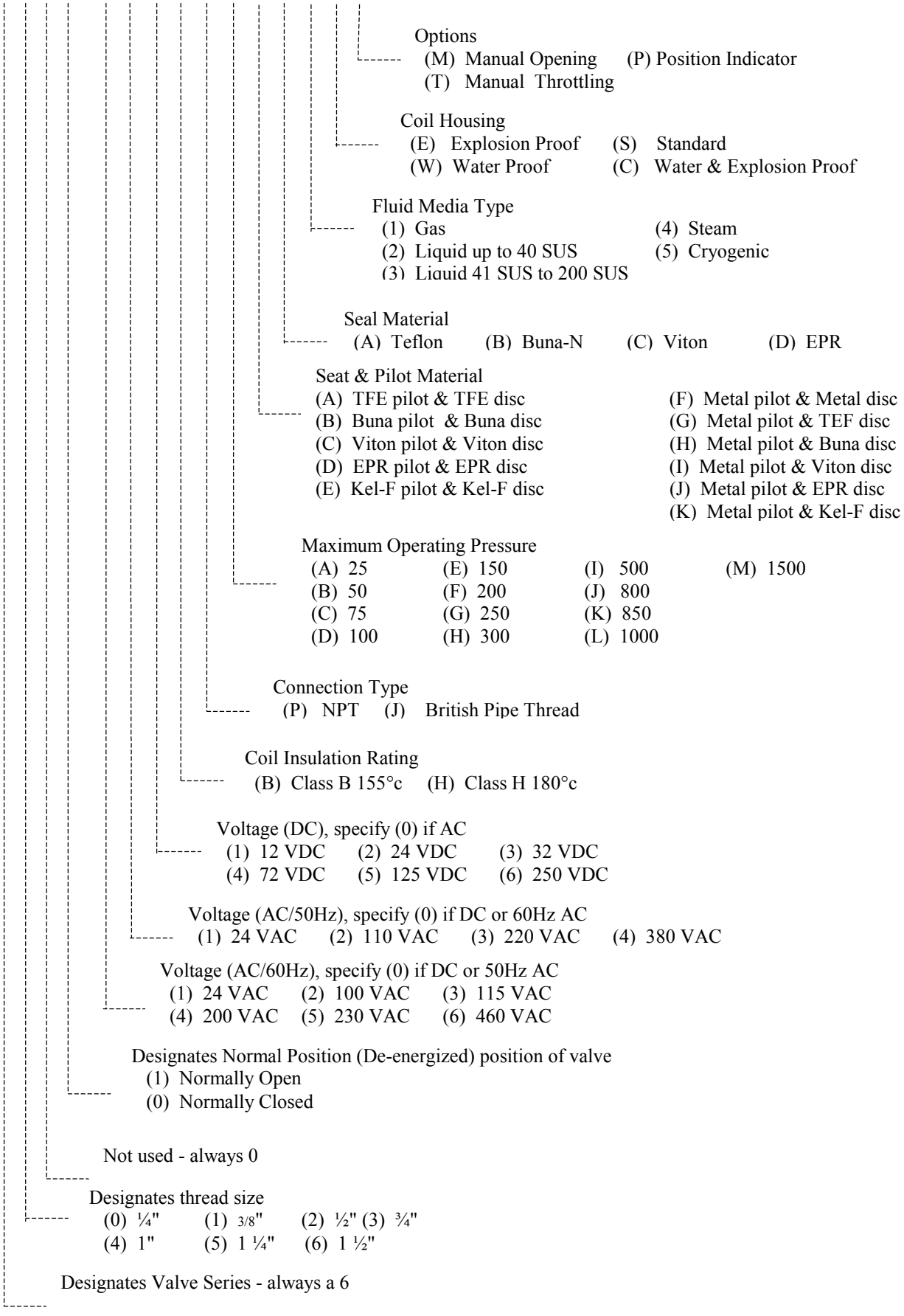
Normally Closed 1” 6400 Valve – shown with a NEMA 1 coil housing and a metal pilot seat



Normally Open 1” 6401 Valve – shown with a NEMA 1 coil housing and a soft pilot seat

6000 Valve Series catalog number

6X0X-XXXXXXXXXXX



7000 Series Stainless Steel, Pilot-Piston, 0 to 6000 psig

High pressure valve configurable for variety of fluid applications

Pressure to 6000 psig

Pilot operated – require a minimum pressure differential of 5 psig

Barstock body configuration

Fluid temperatures of –423 through +500 F (Kel-F piston recommended for –400 through +400 F)

All 316 stainless steel construction on pressure containing parts - plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 200 SUS

Suitable for use with wide variety of fluids including: gasses, liquids, hydraulic fluids, steam, cryogenic fluid, and corrosive fluids

Piston material (same as seat material) of Kel-F or 17-4 stainless steel

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe ports of 1/4, 3/8, or ½" NPT (British BSPT ports available)

Flow orifice of 5/16"

Cv from 1.0 to 2.0

Uses a class H fiberglass wrapped, double wound coil (requires use with a relay to drop out primary coil winding after valve actuation)

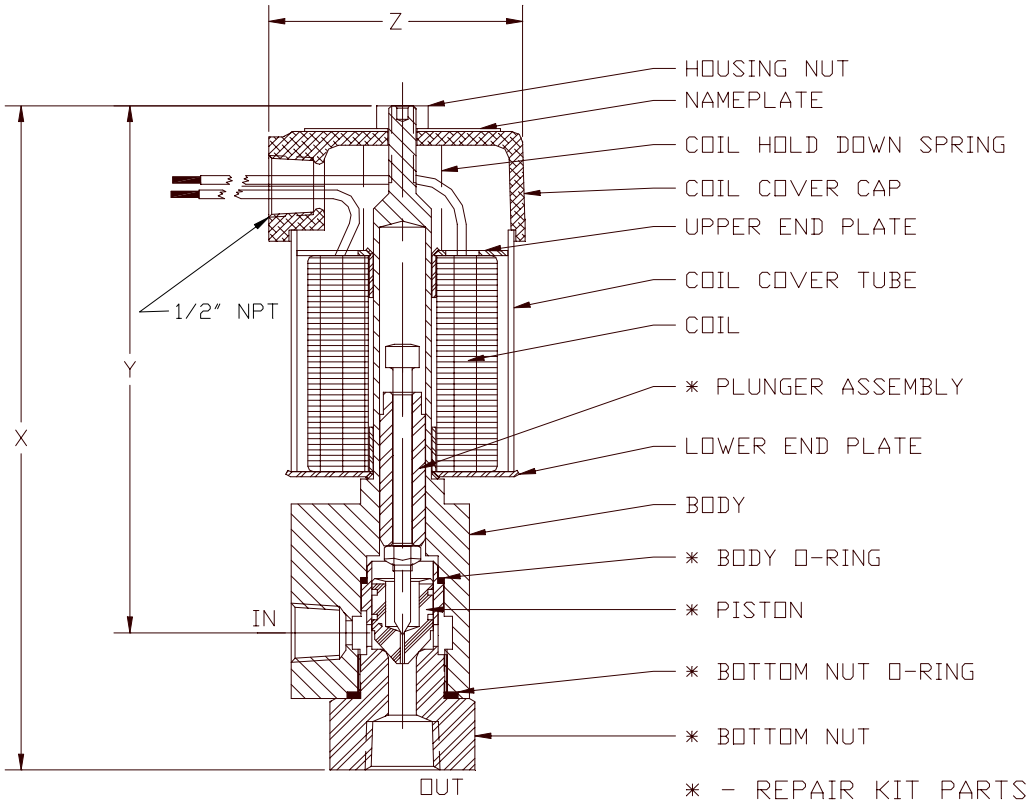
Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Operational Pressures **All 7000 series** 5 psi minimum pressure differential

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
6000	4000	6000	3500	6000	2500	300	300

Dimensions, Shipping Weights, and Cv Flow Factors

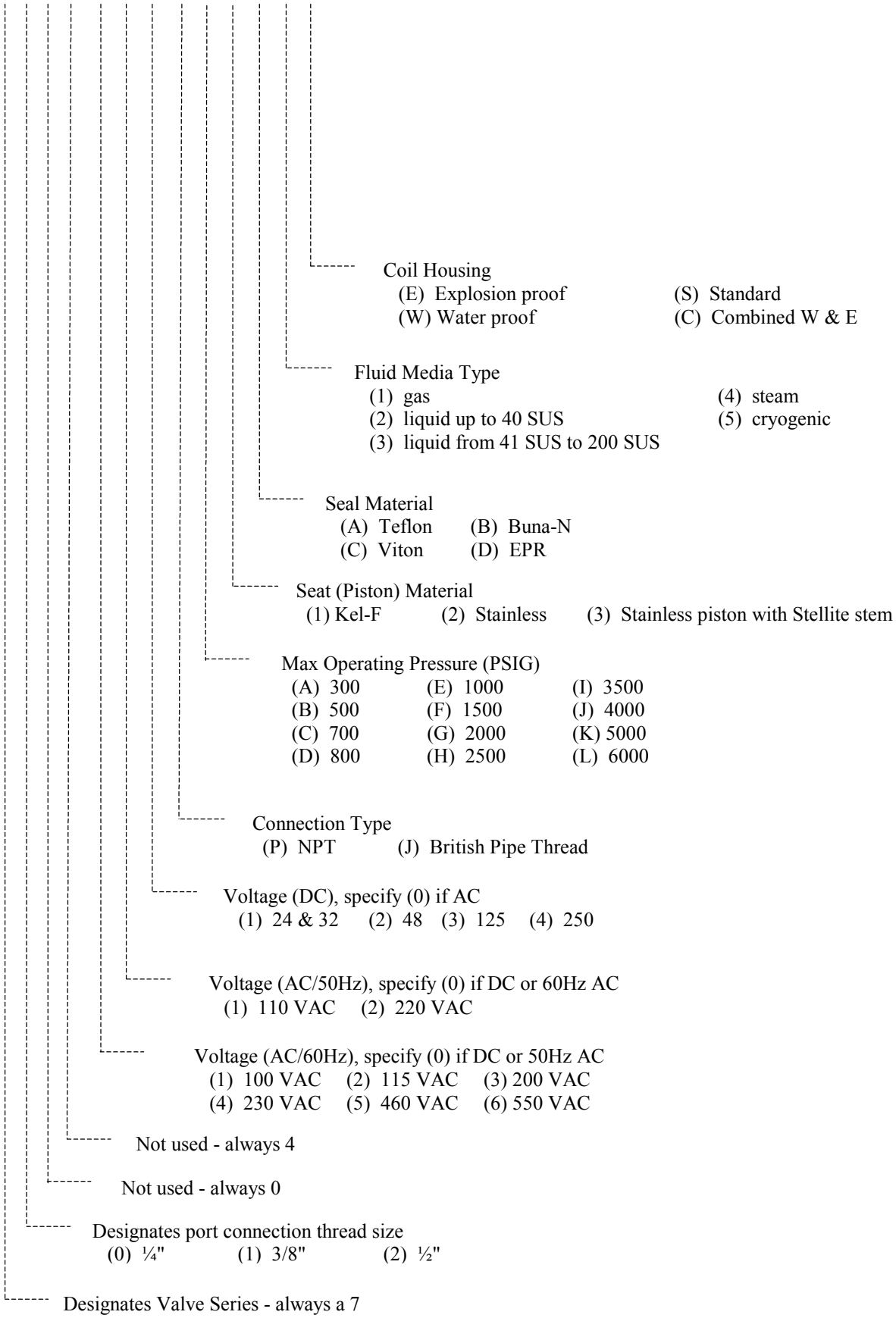
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
7004	¼"	5/16"	7 9/16"	6"	2 ¾"	7	1.0
7104	3/8"	5/16"	7 9/16"	6"	2 ¾"	7	2.0
7204	½"	5/16"	7 9/16"	6"	2 ¾"	7	2.0



7104 3/8" Valve, shown with a NEMA 1 coil housing

7000 Valve Series catalog number

7X04-XXXXXXXXX



8000 Series Stainless Steel, Pilot-Piston, 5 to 4000 psig

High pressure valve configurable for variety of fluid applications

Pressure to 4000 psig depending on fluid and coil type

Pilot operated – require a minimum pressure differential of 5 psig

Full ported valves

Available in normally open and normally closed versions

Fluid temperatures of –423 through +500 F

Stainless steel construction on all wetted parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 200 SUS

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenic fluid, and corrosive fluids

Removable 316 ss body inserts (stainless steel trim)

Optional pilot and piston seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 pilot seat and/or 316 piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe ports of 1/4, through 2" NPT (1 ½" max in 4000 psi version) (British BSPT ports available)

Cv from 1.1 through 45

Class H coils standard

Can use a class H double wound coil (requires use with a relay to drop out primary coil winding after valve actuation) depending on pressure (for operation up to 4000 psi)

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening device is available as an option

Operational Pressures 5 psid minimum pressure differential

Single wound coils **8000 - 8710** **¼" through 2"** **Normally closed**

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1500	500	300	250

Single wound coils **8001 - 8711** **¼" through 2"** **Normally Open**

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	800	1000	350	700	300	250	250

Double wound coils **8004 - 8604** **¼" through 1 ½"** (Normally Closed only)

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
4000	4000	4000	3500	4000	2500	300	300

NOTE: Normally open 8001 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Rubber seats are limited to 500 psi

Dimensions, Shipping Weights, and Cv Flow Factors

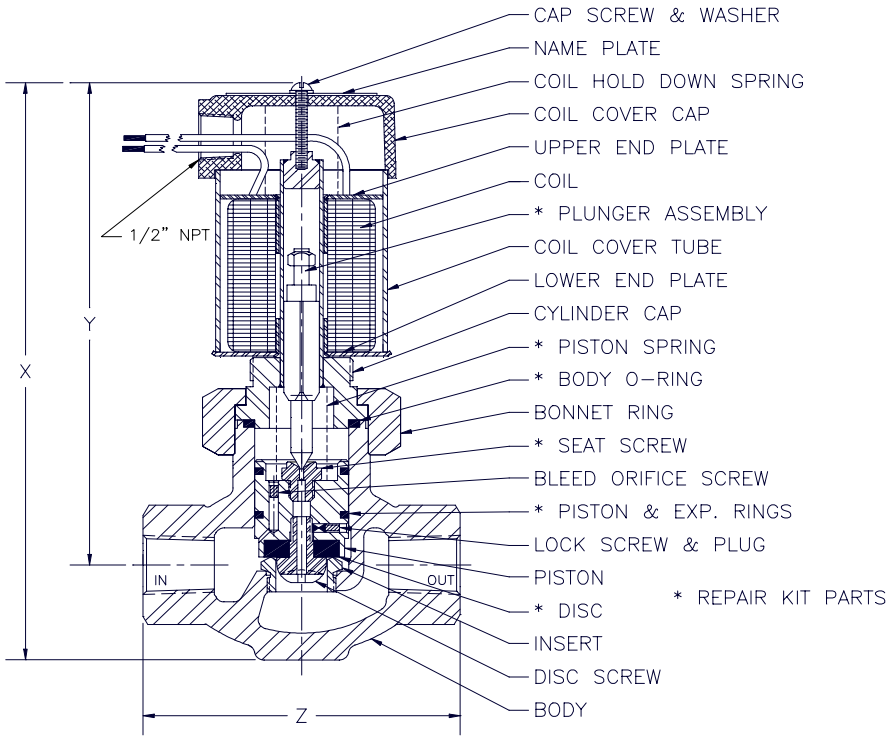
Normally Closed

Catalog Number Prefix Single Wound Coil	Double Wound Coil	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
8000	**8004**	¼"	3/8"	7"	6 1/8"	3"	6	1.1
8100	**8104**	3/8"	3/8"	7"	6 1/8"	3"	6	2.5
8200	**8204**	½"	3/4"	8 ½"	7 3/8"	4 5/8"	9	5.1
8300	**8304**	¾"	¾"	8 ½"	7 3/8"	4 5/8"	9	7.5
8400	**8404**	1"	1"	9 3/16"	7 11/16"	5 ¼"	14	12.5
8510	**8504**	1 ¼"	1 ½"	9 ½"	7 5/8"	5 7/8"	20	19.5
8610	**8604**	1 ½"	1 ½"	9 ½"	7 5/8"	5 7/8"	20	21.0
8710	n/a	2"	2"	11 7/8"	9 ½"	7"	28	45.0

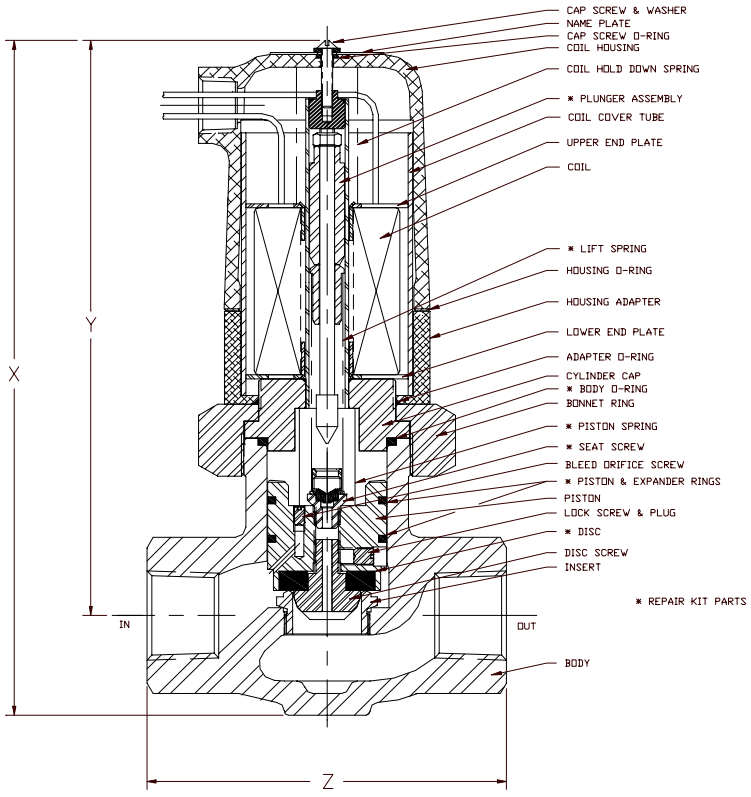
Note: 2" size available in single wound, 1500 psi max only.

Normally Open

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
8001	¼"	3/8"	8 1/8"	7 5/16"	3"	6	1.1
8101	3/8"	3/8"	8 1/8"	7 5/16"	3"	6	2.5
8201	½"	¾"	9 5/8"	8 ½"	4 5/8"	9	5.1
8301	¾"	¾"	9 5/8"	8 ½"	4 5/8"	9	7.5
8401	1"	1"	10 5/16"	8 13/16"	5 ¼"	14	12.5
8511	1 ¼"	1 ½"	10 11/16"	8 13/16"	5 7/8"	20	19.5
8611	1 ½"	1 ½"	10 11/16"	8 13/16"	5 7/8"	20	21.0
8711	2"	2"	13"	10 5/8"	7"	28	45.0



Normally Closed ½" 8200 Valve – shown with a NEMA 1 coil housing and a metal pilot seat



Normally Open 1" 8401 Valve, shown with a NEMA 4 waterproof coil housing and a soft pilot seat

8000 Valve Series catalog number

8XXX-XXXXXXXXXX

Options
(P)Position Indicator, (M) Manual Opening

Coil Housing
(E) Explosion proof (S) Standard
(W) Water proof (C) Combined W & E

Fluid Media Type
(1) gas (4) steam
(2) liquid up to 40 SUS (5) cryogenic
(3) liquid from 41 SUS to 200 SUS

Seal Material
(A) Teflon (B) Buna-N (C) Viton (D) EPR

Seat/Pilot Material
(A) TFE pilot & TFE disc (F) Metal pilot & Metal disc
(B) Buna pilot & Buna disc (G) Metal pilot & TFE disc
(C) Viton pilot & Viton disc (H) Metal pilot & Buna disc
(D) EPR pilot & EPR disc (I) Metal pilot & Viton disc
(E) Kel-F pilot & Kel disc (J) Metal pilot & EPR disc
(K) Metal pilot & Kel-F disc

Max Operating Press (PSIG)
(A) 50 (D) 150 (G) 400 (J) 750 (M) 2000
(B) 75 (E) 200 (H) 500 (K) 1000 (N) 2500
(C) 100 (F) 300 (I) 600 (L) 1500 (O) 3000
(P) 4000

Connection Type
(P) NPT (J) British Pipe Thread

Voltage (DC), specify (0) if AC
(1) 12 VDC (2) 24 VDC (3) 32 VDC
(4) 72 VDC (5) 125 VDC (6) 250 VDC

Voltage (AC/50Hz), specify (0) if DC or 60Hz AC
(1) 24 VAC (2) 110 VAC (3) 220 VAC (4) 380 VAC

Voltage (AC/60Hz), specify (0) if DC or 50Hz AC
(1) 24 VAC (2) 100 VAC (3) 115 VAC
(4) 200 VAC (5) 230 VAC (6) 460 VAC

Designates Normal (De-Energized) Position of Valve & Coil Type
(0) normally closed valve & single wound coil
(1) normally open valve & single wound coil
(4) normally closed valve & double wound coil

Is always 0 when a double wound coil is specified and for ¼, 3/8, ½, ¾ and 1" single wound coils. and 1 for 1 ¼, 1 ½ and 2" single wound coils. This field conveys no meaning and is used only to match historic catalog numbers.

Designates Pipe Thread Size
(0) 1/4" (3) ¾" (6) 1 ½"
(1) 3/8" (4) 1" (7) 2"
(2) 1/2" (5) 1 ¼"

)-6201

Designates Valve Series - always 8

12,000 Series Bronze, Pilot-Piston, 5 to 3000 psig

High pressure valve configurable for variety of fluid applications

Pressures to 3000 psig

Fluid temperatures from –423 to +400 F

For use with any gas or liquid (max viscosity of 150 SSU), including steam and cryogenic, that is not harmful to bronze

Pipe sizes of 3/8 through 1" (British BSPT ports available)

Full ported valve, Cv from 2.8 to 8.9

Pilot operated – require a minimum pressure differential of 5 psig

Optional pilot seat materials of Teflon, Kel-F, or 440 stainless steel

Optional piston seat materials of Teflon, Kel-F, Buna-N, Viton, or EPR depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Bronze valve material (naval M bronze)

Removable 316 ss body inserts (stainless steel trim)

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening device is available as an option (manual throttling device is not available)

Class B coils are available for media temperatures of 0 through 220 F

Class H coils are available – recommended for media temperatures of –423 through +400 F

Can be mounted in any orientation

Compact size & relatively low current draw with AC coils

Operational pressures **All 12000 series** 5 psi minimum pressure differential

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3000	3000	3000	3000	3000	3000	200	200

NOTE: Rubber seats are limited to 500 psi

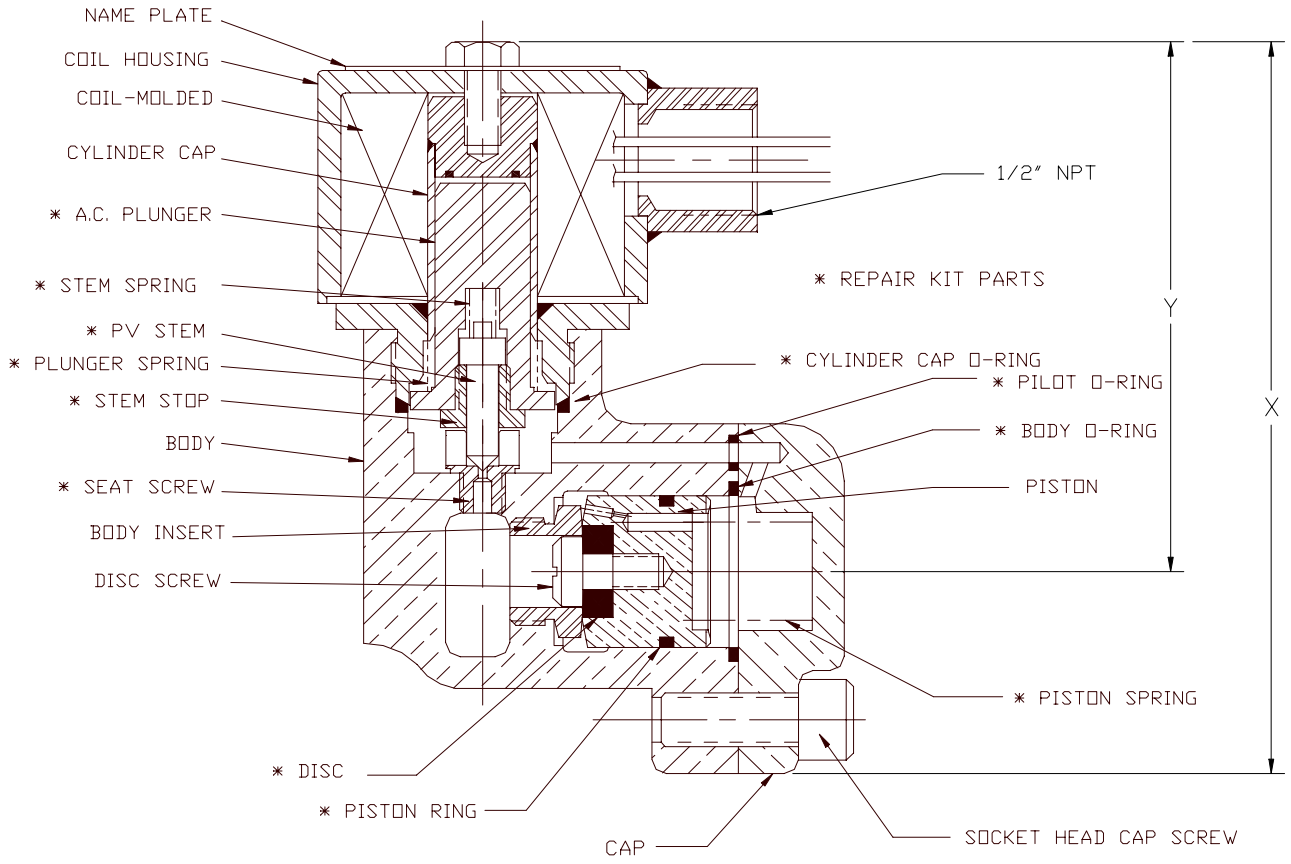
Dimensions, Shipping Weights, and Cv Flow Factors

12,000 Series AC

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
12410	3/8"	½"	3 ¾"	4 ¾"	3 ¼"	6	2.8
12420	½"	½"	3 ¾"	4 ¾"	3 ¼"	6	4.2
12430	¾"	1"	4 1/8"	6"	4 ¾"	11	8.5
12440	1"	1"	4 1/8"	6"	4 ¾"	11	8.9

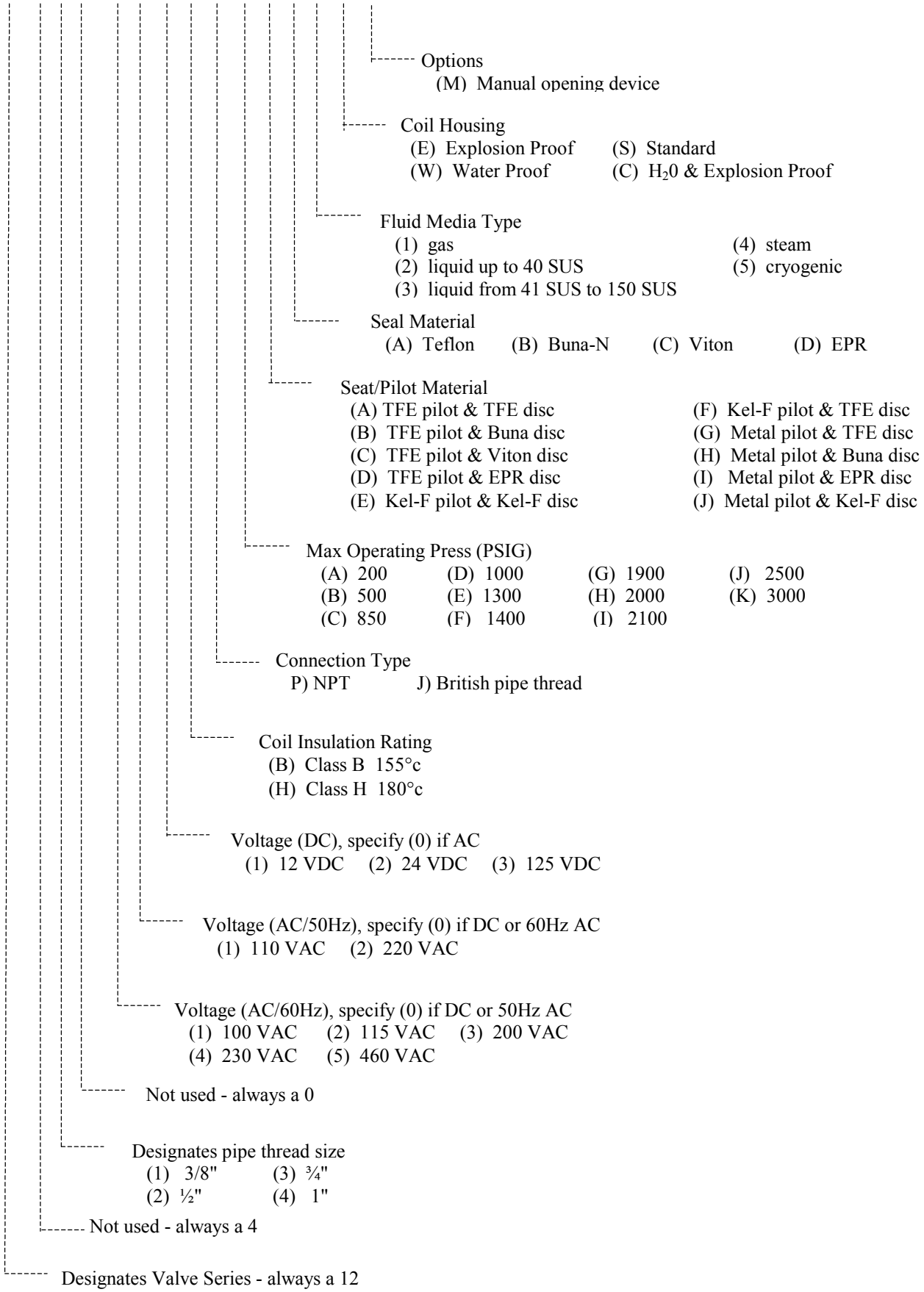
12,000 Series DC

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
12410	3/8"	½"	6"	7"	3 ¼"	8	2.8
12420	½"	½"	6"	7"	3 ¼"	8	4.2
12430	¾"	1"	6 3/8"	8 ¼"	4 ¾"	13	8.5
12440	1"	1"	6 3/8"	8 ¼"	4 ¾"	13	8.9



12410 3/8" Valve – shown with a explosion proof NEMA 7 coil housing and a AC coil

12000 Valve Series catalog number 124X0-XXXXXXXXXXX



13,000 Series Stainless Steel, 3-Way, Direct Lift, 0 to 2500 psig

High pressure valve configurable for variety of fluid applications

3 way valve

Direct acting valve

Barstock construction

Can be installed as normally closed, normally open, or as a directional valve

Can be mounted in any orientation

Pressure to 2500 psig depending on valve type, fluid and orifice size

Media temperatures from –423 F to +500 F

Stellite seats (Cobalt alloy for hardness and corrosion resistance)

Ports sizes of ¼, 3/8, and ½" NPT (British BSPT ports available)

Flow orifices of 3/64, 1/16, 3/32, or 1/8"

Cv from .056 through .40

Stainless steel construction on all wetted parts – 316 for pressure containing parts and plunger material is 416 stainless that is treated for increased corrosion resistance

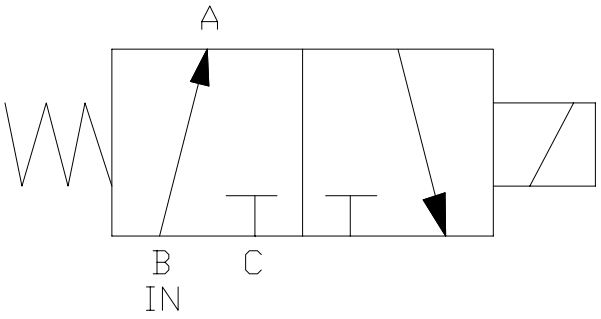
Will handle fluids with viscosity up to 150 SUS

Class H coils standard

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenic fluid, and corrosive fluids

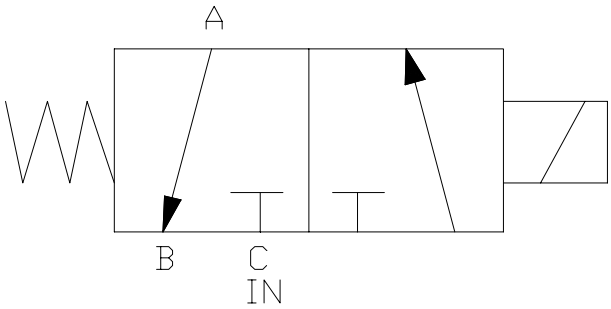
Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

The 13,000 series valve can be built as normally open, normally closed, or a directional valve. The normally open and directional valves are identical and the normally closed is built with a different plunger return spring. For each types of function different ports are used as the inlet and outlet ports. These different types of valve functions are illustrated by the following schematics:



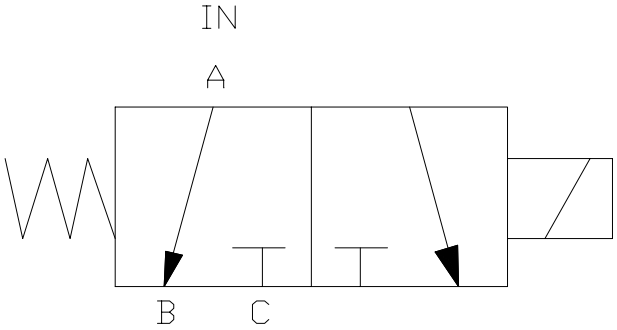
NORMALLY OPEN VALVE

PORT B IS THE INLET



NORMALLY CLOSED VALVE

PORT C IS THE INLET



DIRECTIONAL VALVE

PORT A IS THE INLET

Operational pressures No minimum pressure differential

Normally Open 13110 – 13130 ¼ through ½"

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3/64	2500	2500	2500	2500	2000	2000	300	300
1/16	2300	2300	2300	2300	1400	1400	300	300
3/32	1200	1200	1200	1200	700	700	300	300
1/8	600	600	600	600	300	300	300	300

Directional 13310 – 13330 ¼ through ½"

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3/64	2500	2500	2500	2500	2500	2500	300	300
1/16	2500	2500	2500	2500	1600	1600	300	300
3/32	1200	1200	1200	1200	700	700	300	300
1/8	600	600	600	600	300	300	300	300

Normally Closed 13210 – 13230 ¼ through ½"

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3/64	1300	1300	1300	1300	1200	1200	300	300
1/16	1200	1200	1200	1200	1100	1100	300	300
3/32	600	600	600	600	500	500	300	300
1/8	300	300	300	300	250	250	300	300

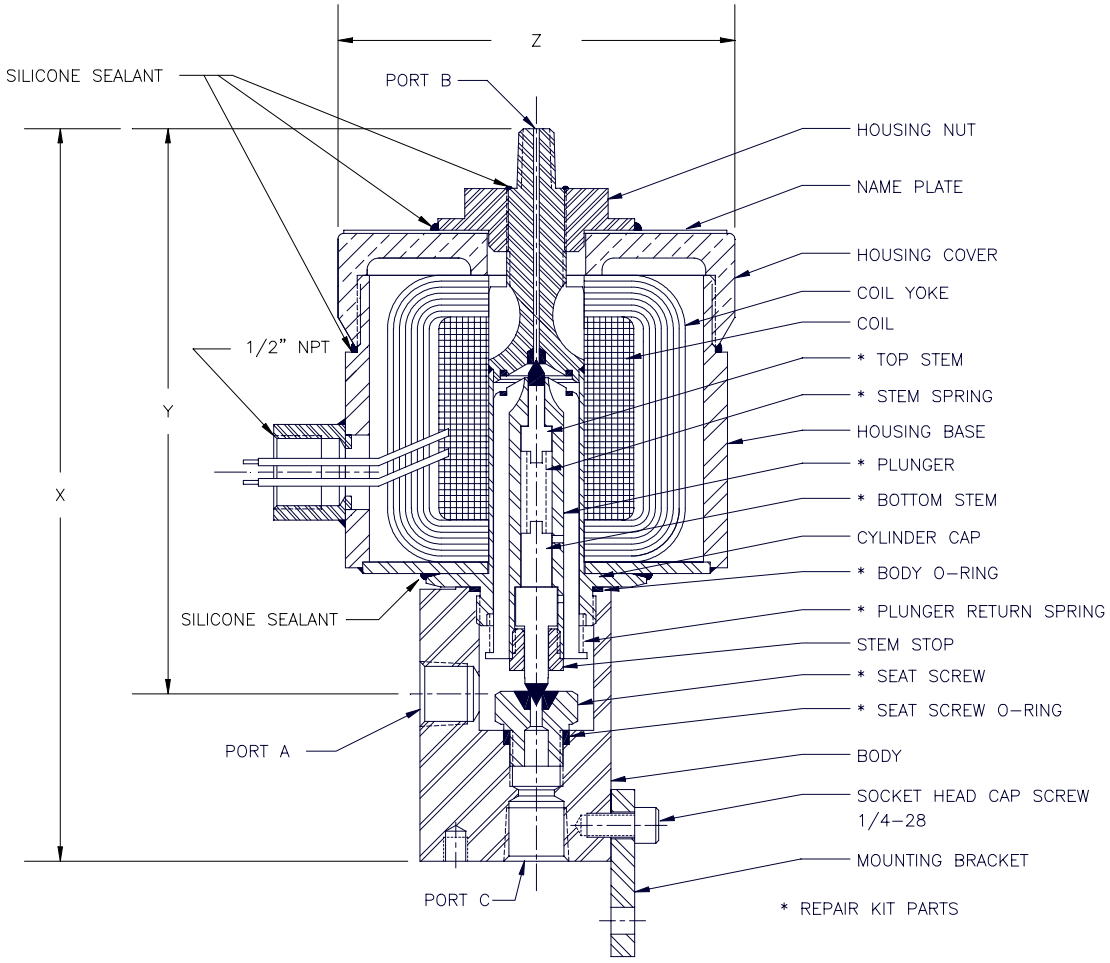
NOTE: Normally open 13000 series valves are NOT subject to intermittent operation restrictions.

Dimensions and Shipping Weights

Catalog Number Prefix N.O. (Inlet B)	N.C. (Inlet C)	Directional (Inlet A)	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
13110	**13210**	**13310**	**¼"**	7 ¼"	5 ½"	4 1/16"	10
13120	**13220**	**13320**	3/8"	7 ¼"	5 ½"	4 1/16"	10
13130	**13230**	**13330**	½"	7 ¼"	5 ½"	4 1/16"	10

Cv Flow Factors

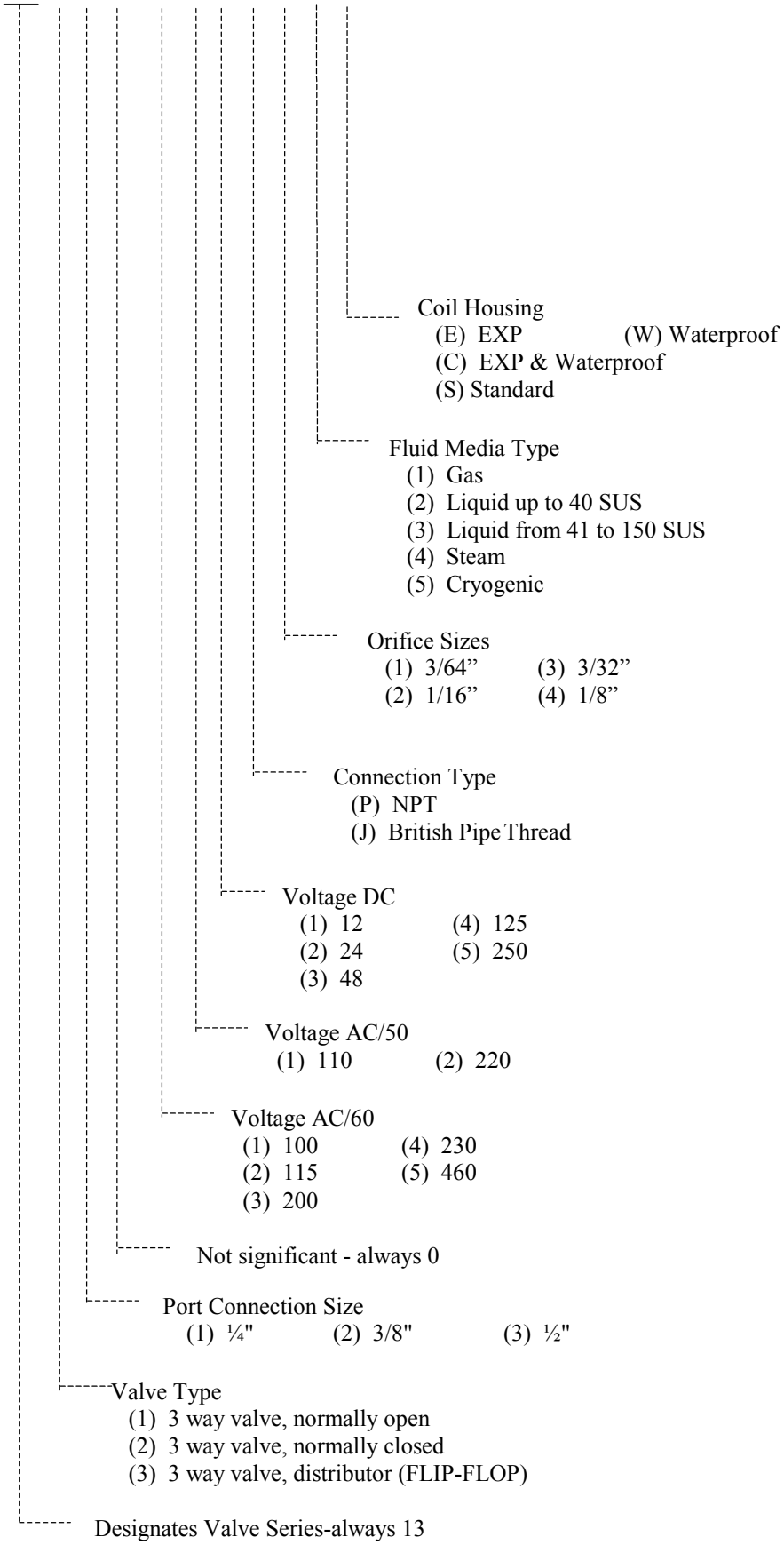
Orifice	Cv
3/64"	.056
1/16"	.093
3/32"	.22
1/8"	.44



13230 1/2" 3-Way Valve, shown with a combination explosion proof NEMA 7 and waterproof NEMA 4 coil housing

13000 Valve Series catalog number

13XX0 -XXXXXXX



14,000 Series Stainless Steel, Direst Lift, 0 to 3000 psig

High pressure valve configurable for variety of fluid applications

Direct acting valve

Pressure to 3000 psig depending on fluid and orifice size

Barstock construction

Can be mounted in any orientation

Stainless steel construction on all wetted parts – 316 for pressure containing parts and plunger material is 416 stainless that is treated for increased corrosion resistance

Optional stem materials of Teflon, Kel-F, or 440 stainless steel

Media temperatures from –423 F to +400 F

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenic fluid, and corrosive fluids

Ports are oriented inline or at 90 degrees (inlet on side and outlet on bottom)

Pipe sizes of ¼" & 3/8" NPT (British BSPT ports available)

Flow orifices of 1/16, 5/64, 3/32, and 1/8"

Cv from .093 to .40

Compact size & relatively low current draw with AC coils

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Class H coils are standard

Operational pressures **All 14800 series** No minimum pressure differential

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	3000	3000	3000	3000	3000	3000	200	200
5/64	2500	2100	2000	1400	1800	1300	200	200
3/32	1900	1100	1400	1100	1000	850	200	200
1/8	450	300	300	225	275	175	200	200

Dimensions and Shipping Weights

AC valve

X	Y	Z	Shipping Weight (lbs.)
4”	3 1/16”	2”	4

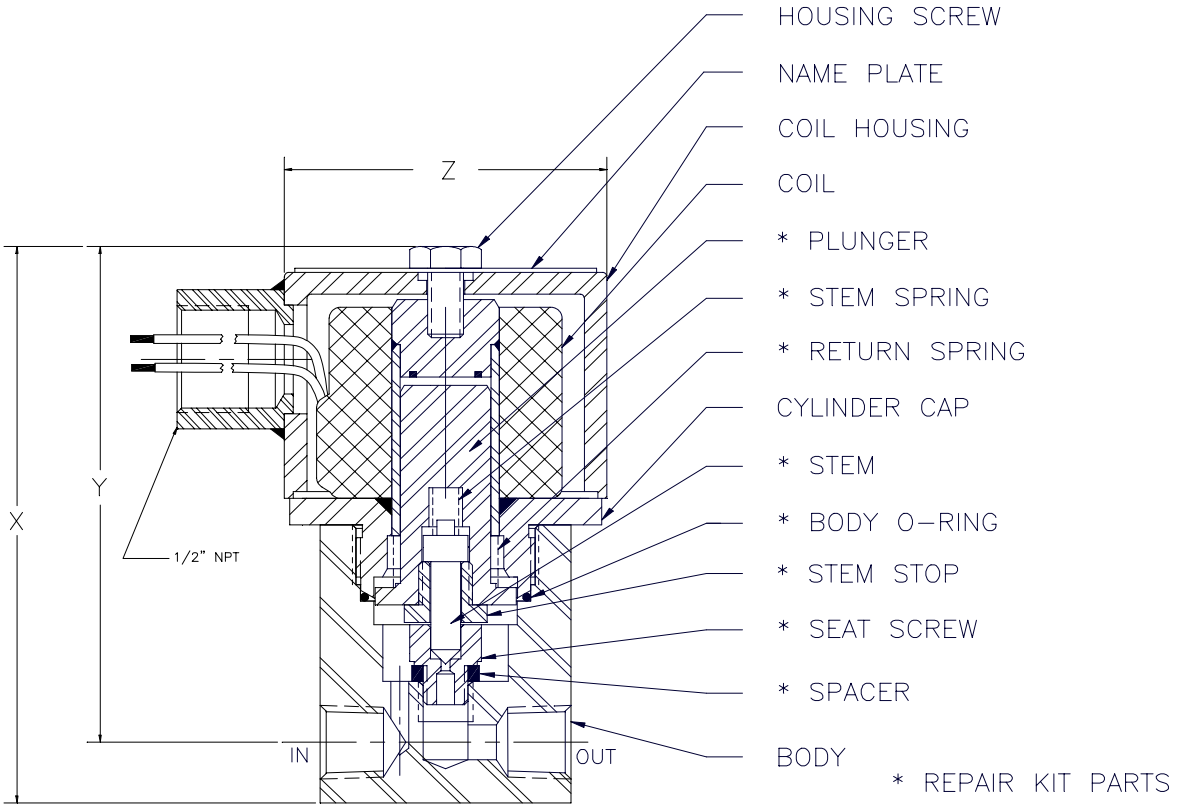
DC valve

X	Y	Z	Shipping Weight (lbs.)
6 9/16”	5 3/8”	2 3/4”	6

Cv Flow Factors

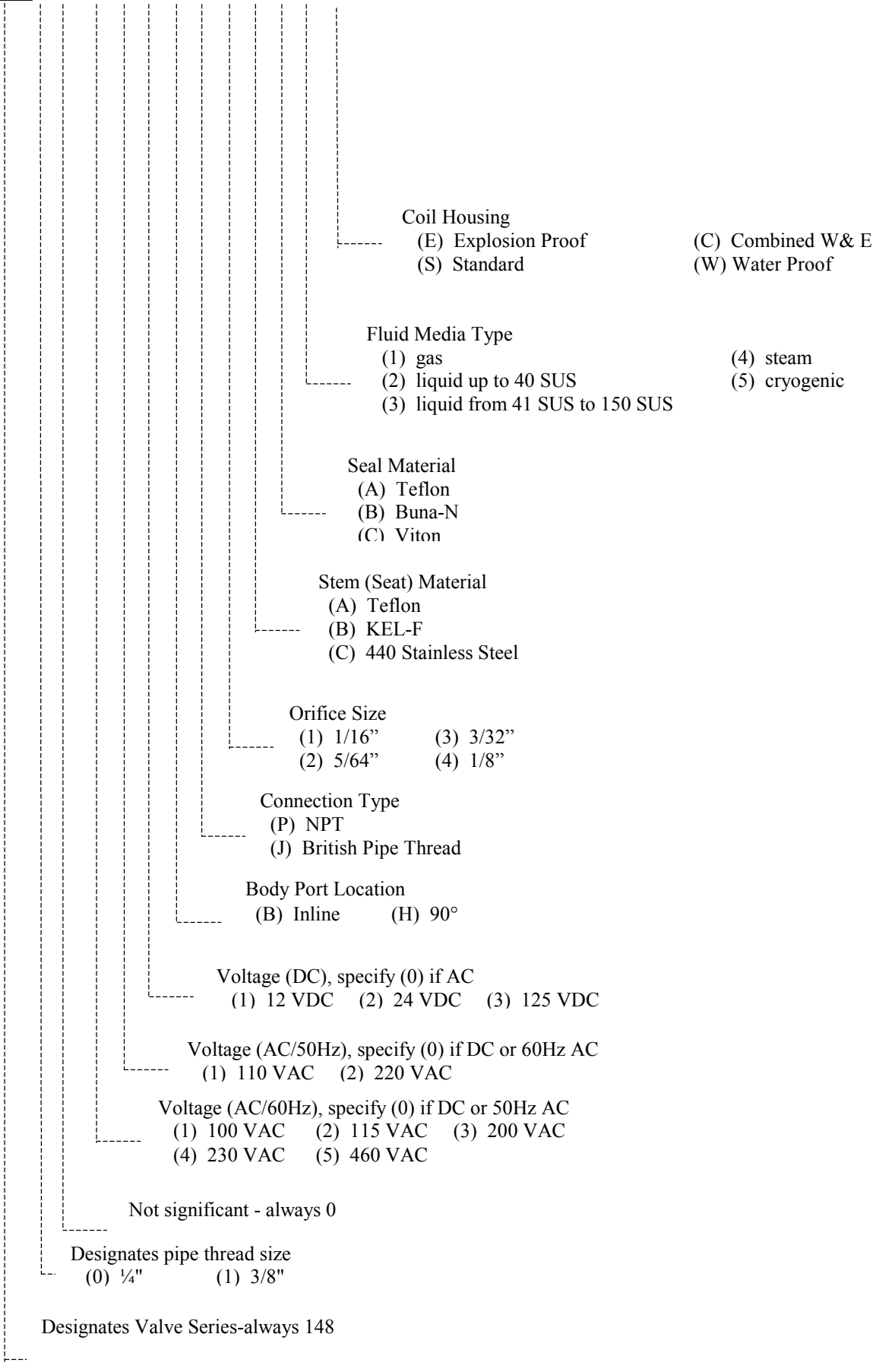
Orifice	Cv
1/16”	.093
5/64”	.15
3/32”	.22
1/8”	.40

Catalog Number Prefix	Pipe Size
14800	¼”
14810	3/8”



14,810 3/8” Valve – shown with a NEMA 7 explosion proof coil housing & AC coil

14000 Valve Series catalog number
148X0-XXXXXXXXXX



15,400 Series Bronze, Semi-Direst Lift, 0 to 300 psig

Low pressure valve configurable for variety of fluid applications

Semi-direct lift action for operation down to zero pressure differential

Operation up to 300 psi

Bronze valve material (naval M bronze)

Available normally closed or normally open

Media temperatures from –423 F to +500 F

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, and cryogenics that are not harmful to bronze

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 pilot seat and/or brass piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe sizes from ¼" through 1 1/2" NPT

British BSPT ports are available

Full ported valves - Cv from 1.1 through 21.5

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are available as options

Valve position indicator option is available

Class B coils are available for media temperatures of 0 through 220 F

Class H coils are available – recommended for media temperatures of –423 through +500 F

Operational pressures **All 15400 series** No minimum pressure differential

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
300	300	300	300	300	300	125	125

NOTE: Normally open 15,400 series valves are subject to the intermittent operation restrictions described on page 13 and are not recommended for cryogenic service above 50 psig.

Dimensions, Shipping Weights, and Cv Flow Factors

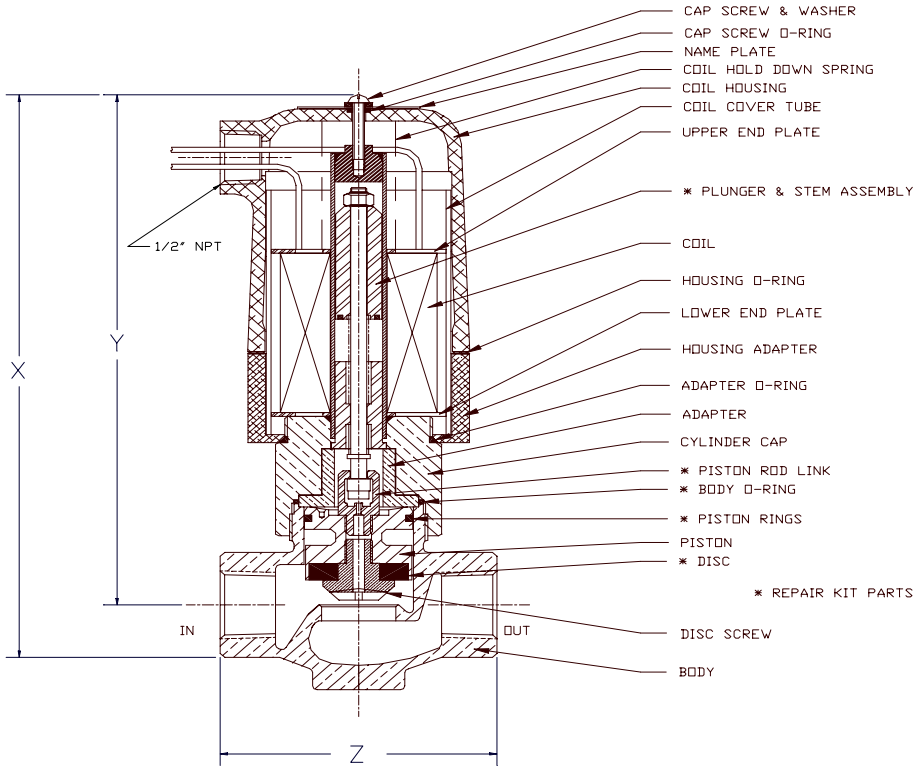
15,400 Series Normally Closed Bronze

Catalog Number Prefix Class B Coil	Class H Coil	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
15400	**15408**	¼"	½"	7 5/16"	6 ½"	2 11/16"	5	1.4
15410	**15418**	3/8"	½"	7 5/16"	6 ½"	2 11/16"	5	2.7
15420	**15428**	½"	½"	7 7/16"	6 ½"	3"	6	3.5
15430	**15438**	¾"	1"	7 15/16"	6 5/8"	3 ¾"	7	7.5
15440	**15448**	1"	1"	7 15/16"	6 5/8"	3 ¾"	7	9.1
n/a	**15458**	1 ¼"	1 1/2"	9 13/16"	8"	5 1/16"	20	19.5
n/a	**15468**	1 ½"	1 ½"	9 13/16"	8"	5 1/16"	20	21.0

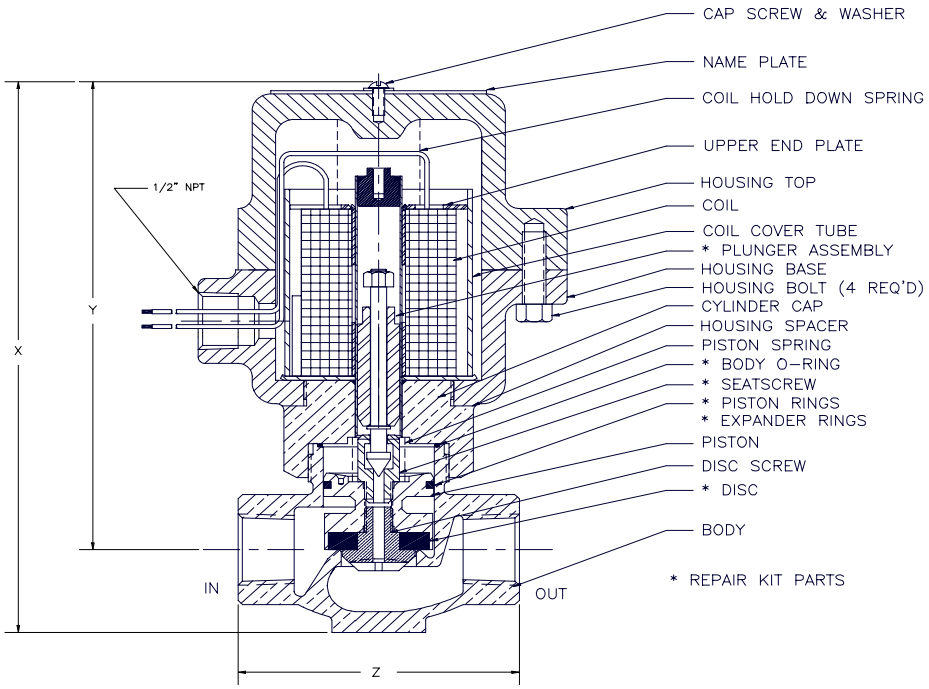
Note: 1 ¼" & 1 ½" valves have aluminum pistons (for reduced weight) and are not suitable for steam, water, and other media harmful to aluminum.

15,400 Series Normally Open Bronze

Catalog Number Prefix Class B Coil	Class H Coil	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
15401	**15407**	¼"	½"	9 3/32"	8 3/16"	2 11/16"	5	1.4
15411	**15417**	3/8"	½"	9 3/32"	8 3/16"	2 11/16"	5	2.7
15421	**15427**	½"	½"	9 3/16"	8 3/16"	3"	6	3.5
15431	**15437**	¾"	1"	9 1/2"	8 1/4"	3 ¾"	7	7.5
15441	**15447**	1"	1"	9 1/2"	8 1/4"	3 ¾"	7	9.1



15447 1" Normally Open Valve – shown with a waterproof NEMA 4 coil housing and a soft pilot seat



15448 1" Normally Closed Valve – shown with a explosion proof NEMA 7 coil housing and a metal pilot seat

15400 Valve Series catalog number

154XX-XXXXXXXXXXX

Options
(P)Position indicator (M) Manual opening
(T) Manual throttling

Coil Housing
(E) Explosion proof (S) Standard
(W) Water proof (C) Combined W & E

Fluid Media Type
(1) gas (4) steam
(2) liquid up to 40 SUS (5) cryogenic
(3) liquid from 41 SUS to 150 SUS

Seal Material
(A) Teflon (B) Buna-N (C) Viton (D) EPR

Seat/Pilot Material
(A) TFE pilot & TFE disc (F) Metal pilot & Metal disc
(B) Buna pilot & Buna disc (G) Metal pilot & TFE disc
(C) Viton pilot & Viton disc (H) Metal pilot & Buna disc
(D) EPR pilot & EPR disc (I) Metal pilot & Viton disc
(E) Kel-F pilot & Kel disc (J) Metal pilot & EPR disc
(L) Metal pilot & Kel-F disc

Max Oper. Press (PSIG)
(A) 100 (D) 200 (M) 50
(B) 125 (E) 250
(C) 150 (F) 300

Connection Type
(P) NPT (J) British Pipe Thread

Coil Insulation Rating
(B) Class B (155°c) (H) Class H (180°c)

Voltage (DC), specify (0) if AC
(1) 12 VDC (2) 24 VDC (3) 32 VDC
(4) 72 VDC (5) 125 VDC (6) 250 VDC

Voltage (AC/50Hz), specify (0) if DC or 60Hz AC
(1) 24 VAC (2) 110 VAC (3) 220 VAC (4) 380 VAC

Voltage (AC/60Hz), specify (0) if DC or 50Hz AC
(1) 24 VAC (2) 100 VAC (3) 115 VAC
(4) 200 VAC (5) 230 VAC (6) 460 VAC

Valve Normal Position
(0) Normally closed & class B coil (8) Normally closed & class H coil
(1) Normally open & class B coil (7) Normally open & class H coil

Designates Connection Size
(0) ¼" Pipe (1) 3/8" Pipe (2) ½" Pipe (3) ¾" Pipe
(4) 1" Pipe (5) 1 ¼" Pipe (6) 1 ½" Pipe

Valve Material
Always (4) Bronze

Designates Valve Series - always 15

15,800 Series Stainless Steel, Semi-Direct Lift, 0 1500 psig

Medium pressure valve configurable for variety of fluid applications

Stainless steel construction on all wetted parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Semi-direct lift action for operation down to zero pressure differential

Normally closed operation

Operation up to 1500 psi

Media temperatures from –423 F to +500 F

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenics, and corrosive fluids

Optional pilot and piston seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe sizes from ¼" through 1" NPT

British BSPT ports are available

Full ported valves - Cv from 1.1 through 12.5

Removable 316 ss body inserts (stainless steel trim)

Class H coils standard

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening device is available as an options

Valve position indicator option is available

Operational pressures **All 15800 series** No minimum pressure differential

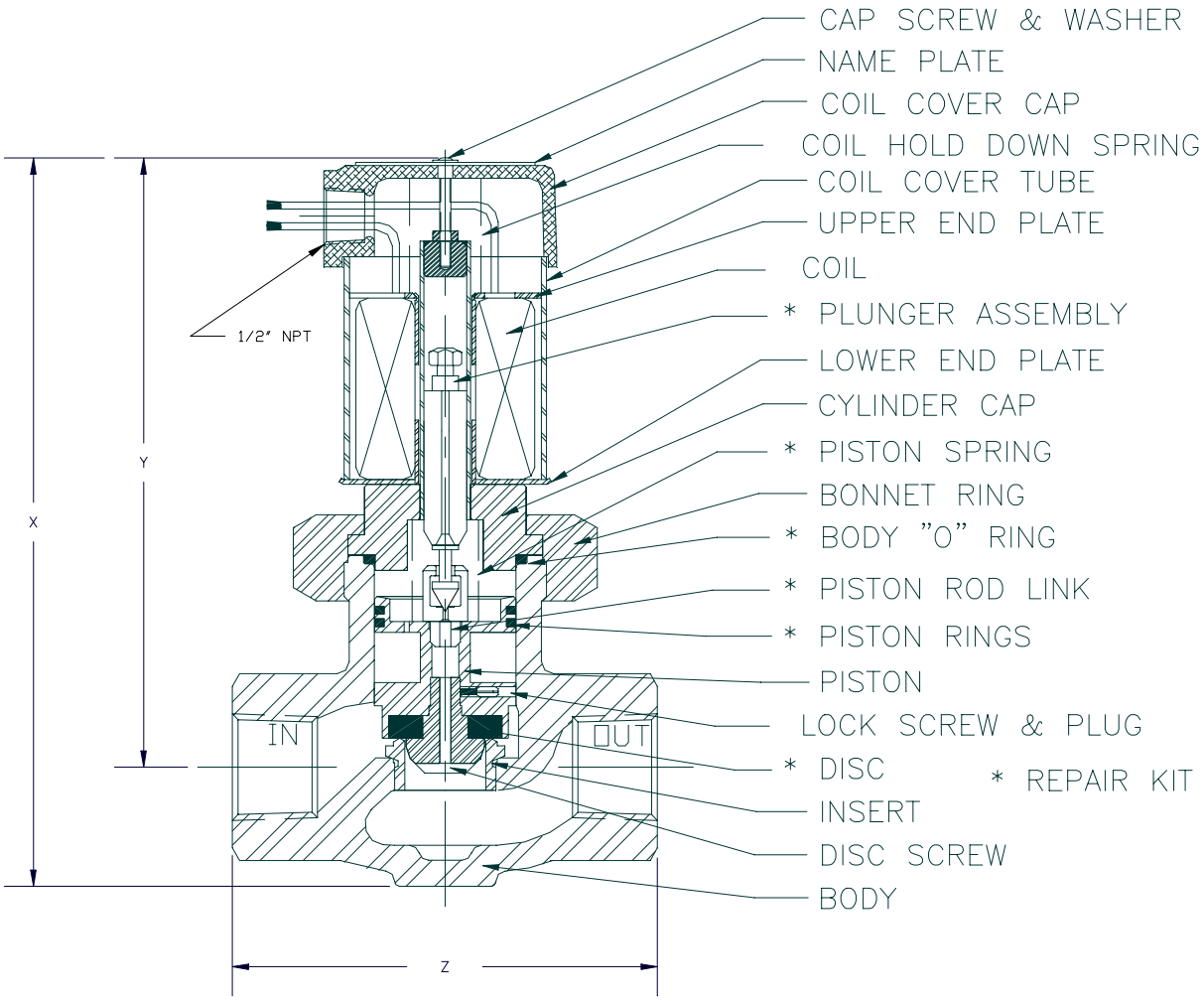
Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1500	1000	200	200

NOTE: Rubber seats are limited to 500 psi

Dimensions, Shipping Weights, and Cv Flow Factors

15,800 Series Normally Closed Stainless Steel

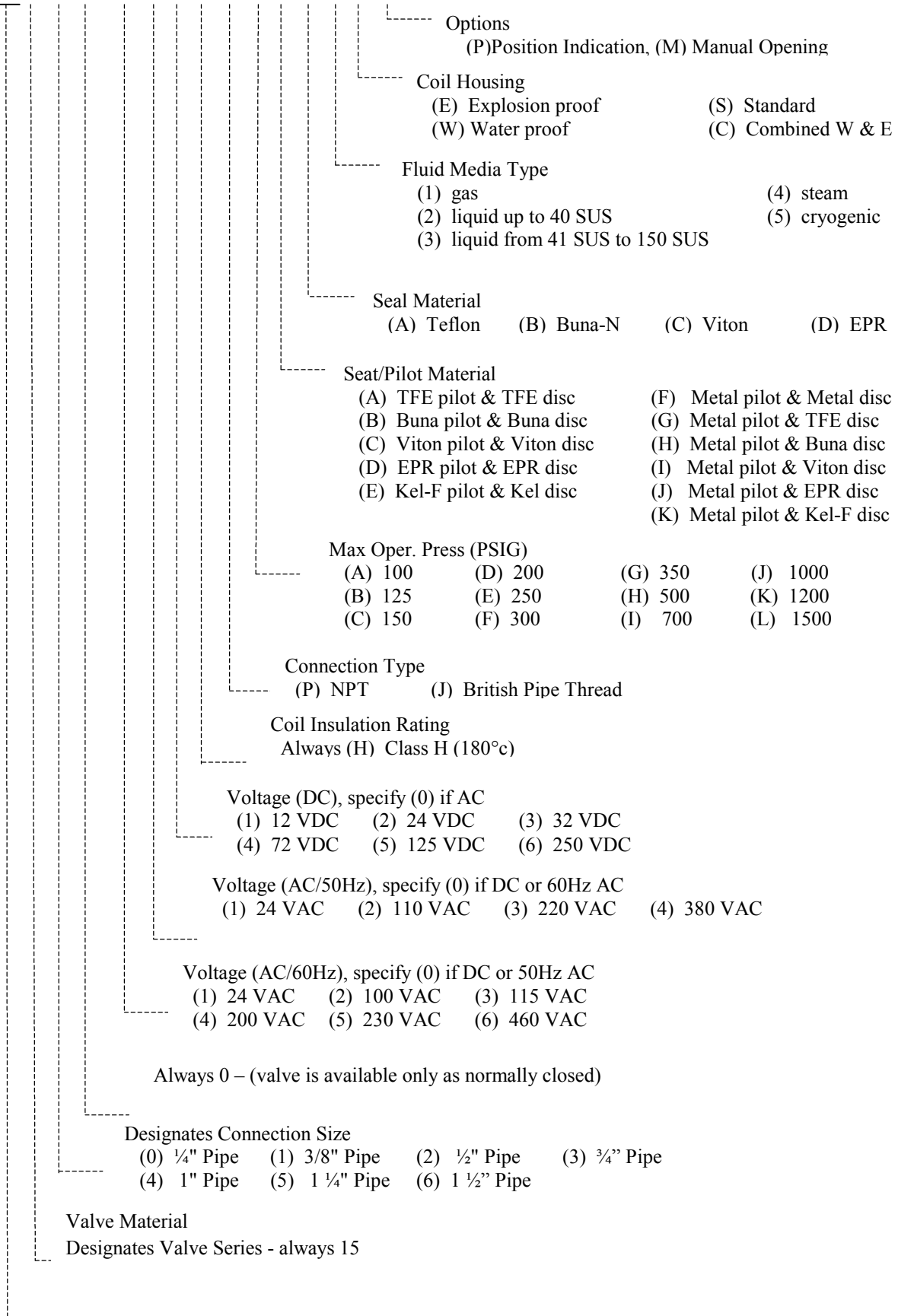
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
15800	¼"	3/8"	7 3/8"	6 ½"	3"	7	1.1
15810	3/8"	3/8"	7 3/8"	6 ½"	3"	7	2.5
15820	½"	¾"	8 ¼"	7 1/8"	4 5/8"	9	5.1
15830	¾"	¾"	8 ¼"	7 1/8"	4 5/8"	9	7.5
15840	1"	1"	9 3/16"	7 11/16"	5 ¼"	15	12.5



15840 1" Valve – shown with a NEMA 1 coil housing and a metal pilot seat

15800 Valve Series catalog number

158X0-XXXXXXXXXXX



16,000 Series Stainless Steel, Direct Lift, 0 to 6000 psig

High pressure valve configurable for variety of fluid applications

Direct acting valve

Pressure to 6000 psig depending on coil type, fluid and orifice size

Available in normally open and normally closed versions

Stainless steel construction on all wetted parts – 316 for machined parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 200 SUS

Media temperature from –423 to +500 F

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenics, and corrosive fluids

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Pipe sizes from ¼ through 1" NPT (British BSPT ports available)

Flow orifices of 1/16, 3/32, 1/8, or 3/16"

Cv from .093 to .72

Class H coils standard

Can use a class H double wound coil (requires use with a relay to drop out primary coil winding after valve actuation) depending on pressure

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Operational pressures No minimum pressure differential

Single wound coils **16000 - 16400** **Metal seats** **Normally Closed**

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1500	1800	1000	1500	500	300	300
3/32	1000	500	800	350	500	170	300	300
1/8	500	200	400	125	250	60	300	125
3/16	175	55	125	35	125	17	125	35

Single wound coils 16000–16400 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F) Normally Closed

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	1275	1500	850	1500	425	300	300
3/32	1000	425	675	300	425	150	300	300
1/8	425	170	350	100	210	50	300	100
3/16	150	40	100	30	100	15	100	30

Double wound coil 16004 –16404 Metal seats (always normally closed)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	6000	4000	6000	3500	5000	2500	300	300
3/32	3500	2000	3000	1500	3000	1000	300	300
1/8	2000	800	1500	600	1200	400	300	300
3/16	700	250	600	200	500	175	300	200

Double wound coil 16004 – 16404 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F)

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	6000	4000	5500	3000	4250	2100	300	300
3/32	3000	1700	2600	1300	2250	850	300	300
1/8	1700	680	1275	500	1000	425	300	300
3/16	600	200	500	170	425	150	300	170

Single wound coils 16001 – 16401 Metal seats Normally Open

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1800	800	1000	350	700	300	300	300
3/32	500	250	300	150	275	90	300	150
1/8	250	100	200	50	125	35	200	50
3/16	65	25	40	15	25	10	40	15

Single wound coils 16000–16401 Soft seats (Buna-N, Viton, EPR, Teflon, & Kel-F) Normally Open

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	1500	680	850	300	600	250	300	300
3/32	425	200	250	130	230	75	300	130
1/8	200	85	170	40	100	30	170	40
3/16	55	20	85	12	20	8	85	12

NOTE: Normally open 16,000 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Rubber seats are limited to 500 psi

Dimensions and Shipping Weights

16,000 Series Normally Closed, single and double wound coils

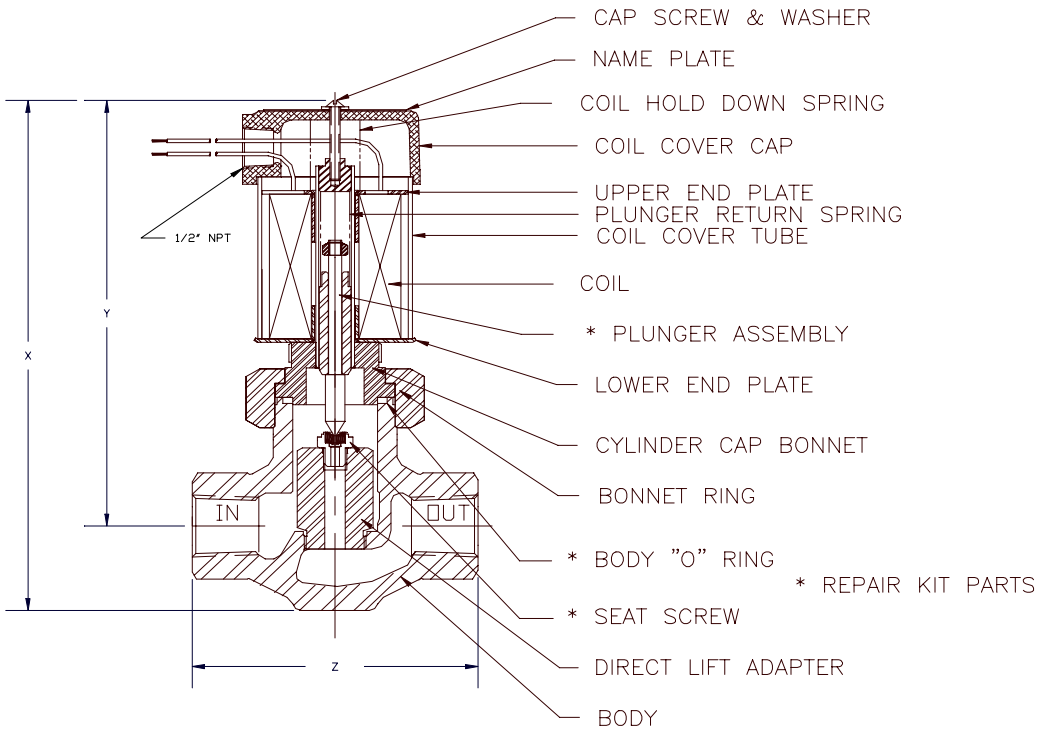
Catalog Number Prefix						
Single Wound Coil	Double Wound Coil	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
16000	**16004**	¼”	7”	6 1/8”	3”	6
16100	**16104**	3/8”	7”	6 1/8”	3”	6
16200	**16204**	½”	8 ½”	7 3/8”	4 5/8”	9
16300	**16304**	¾”	8 ½”	7 3/8”	4 5/8”	9
16400	**16404**	1”	9 3/16”	7 11/16”	5 ¼”	14

16,000 Series Normally Open, single wound coils only

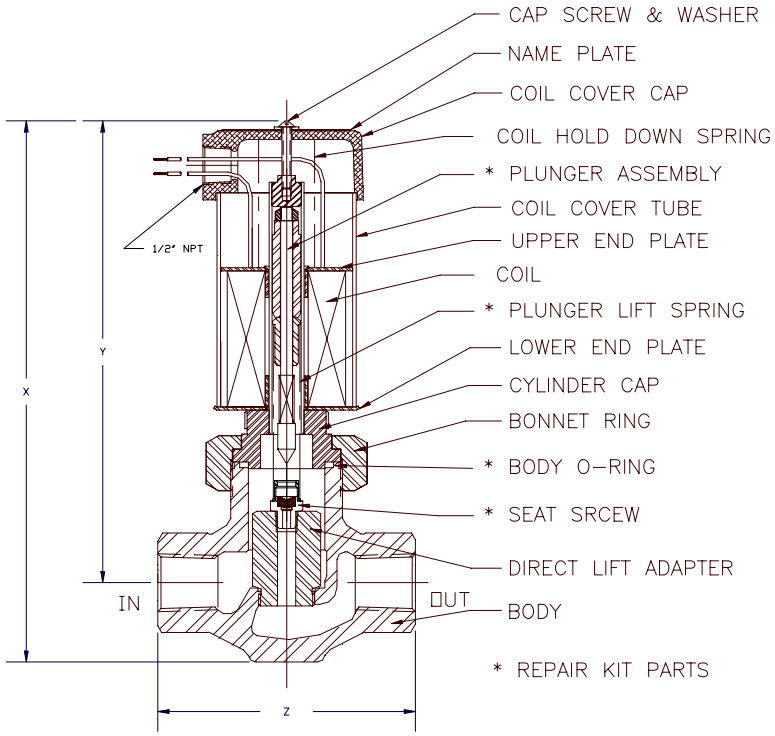
Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
16001	¼”	8 1/8”	7 5/16”	3”	6
16101	3/8”	8 1/8”	7 5/16”	3”	6
16201	½”	9 5/8”	8 ½”	4 5/8”	9
16301	¾”	9 5/8”	8 ½”	4 5/8”	9
16401	1”	10 5/16”	8 13/16”	5 ¼”	14

Cv Flow Factors

Orifice	Cv
1/16”	.093
3/32”	.22
1/8”	.44
3/16”	.72

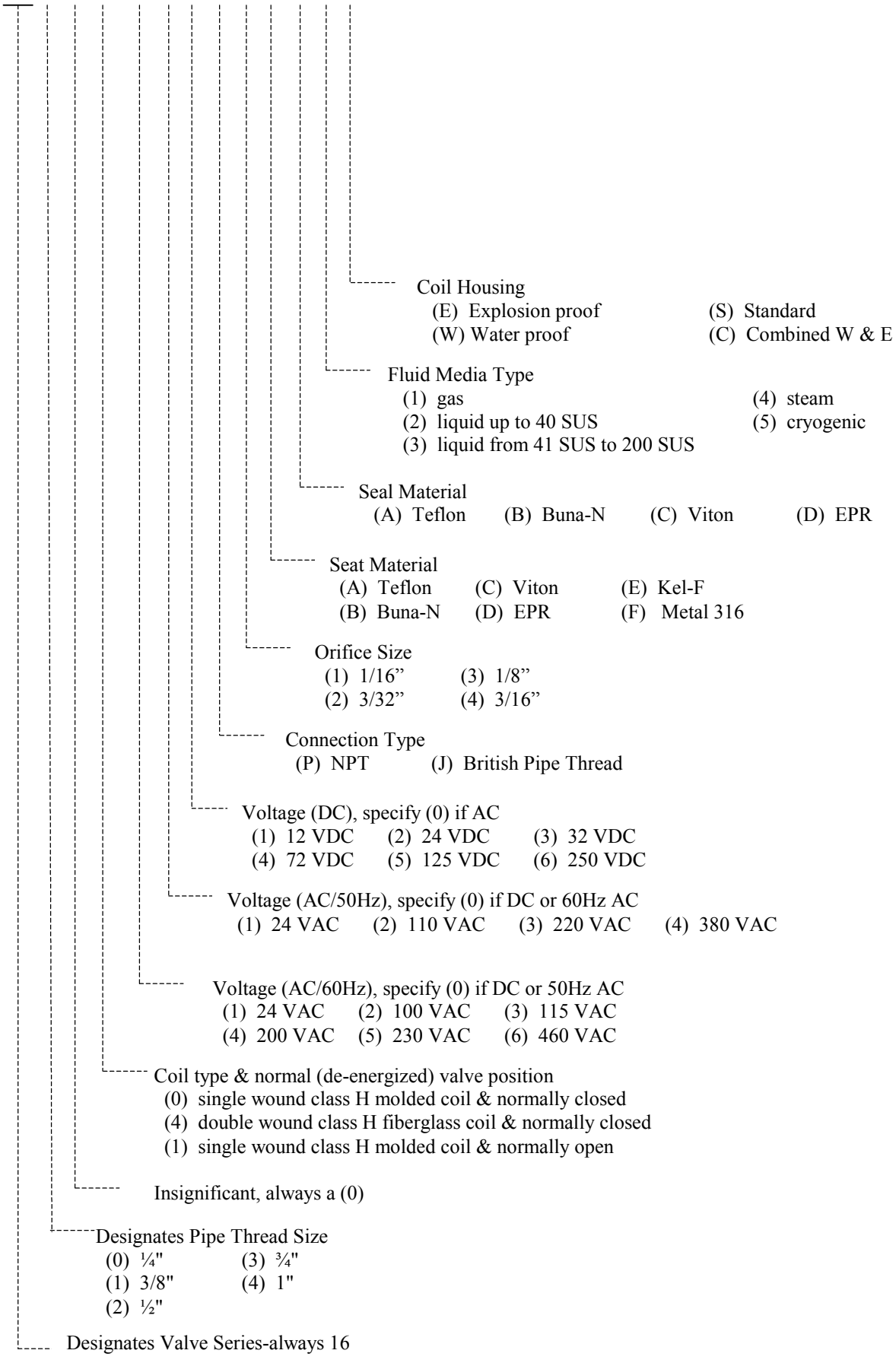


Normally Closed 16200 1/2" Valve – shown with a NEMA 1 coil housing and a soft seat



Normally Open 16201 1/2" Valve – shown with a NEMA 1 coil housing and a soft seat

16000 Valve Series catalog number
16XOX-XXXXXXXXX



30,400 Series Bronze, Semi-Direct Lift, 0 to 1500 psig

Medium pressure valve configurable for variety of fluid applications

Semi-direct lift action for operation down to zero pressure differential

Operation up to 1500 psig

Media temperatures from –423 F to +500 F

Will handle fluids with viscosity up to 150 SUS

Bronze valve material (naval M bronze)

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, and cryogenics that are not harmful to bronze

Heaviest duty and most rugged construction

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, 316 pilot seat, or piston seat (metal piston seat up to 1 ½") depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Removable 316 ss body inserts (stainless steel trim)

Available in normally closed configuration from ¼ to 3" NPT ports

Available in normally open configuration from 1/4 to 1 ½" NPT ports

British BSPT ports available

Full ported valves

Normally closed Cv from 2.7 to 71

Normally open Cv from 2.7 to 21

Class H coils are standard

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are available options (requires aluminum piston in 2 ½" & 3")

Valve position indicator option is available

Operational Pressures No minimum pressure differential

Normally Closed ¼ through ½" 31400 - 31420

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1500	1000	200	200

Normally Closed 3/4 through 1 ½" 31430 - 31460

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1000	1000	1000	1000	1000	1000	200	200

Normally Closed 2 through 3" 31570 - 31590

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
500	500	500	350	500	350	200	100

Normally Open ¼ through ½" 32400 - 32420

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1500	1500	1250	200	200

Normally Open 3/4 through 1 ½" 32430 - 32460

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1000	1000	1000	1000	1000	1000	200	200

NOTE: Normally open 32,400 series valves are subject to the intermittent operation restrictions described on page 13 and are not recommended for cryogenic service above 50 psig.

NOTE: Rubber seats are limited to 500 psi

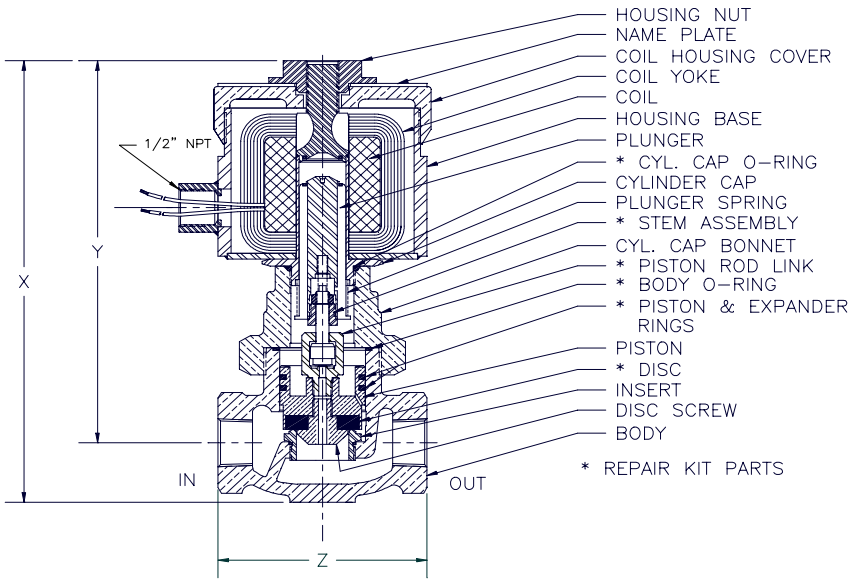
Dimensions, Shipping Weights, and Cv Flow Factors

30,400 Series Normally Closed Bronze

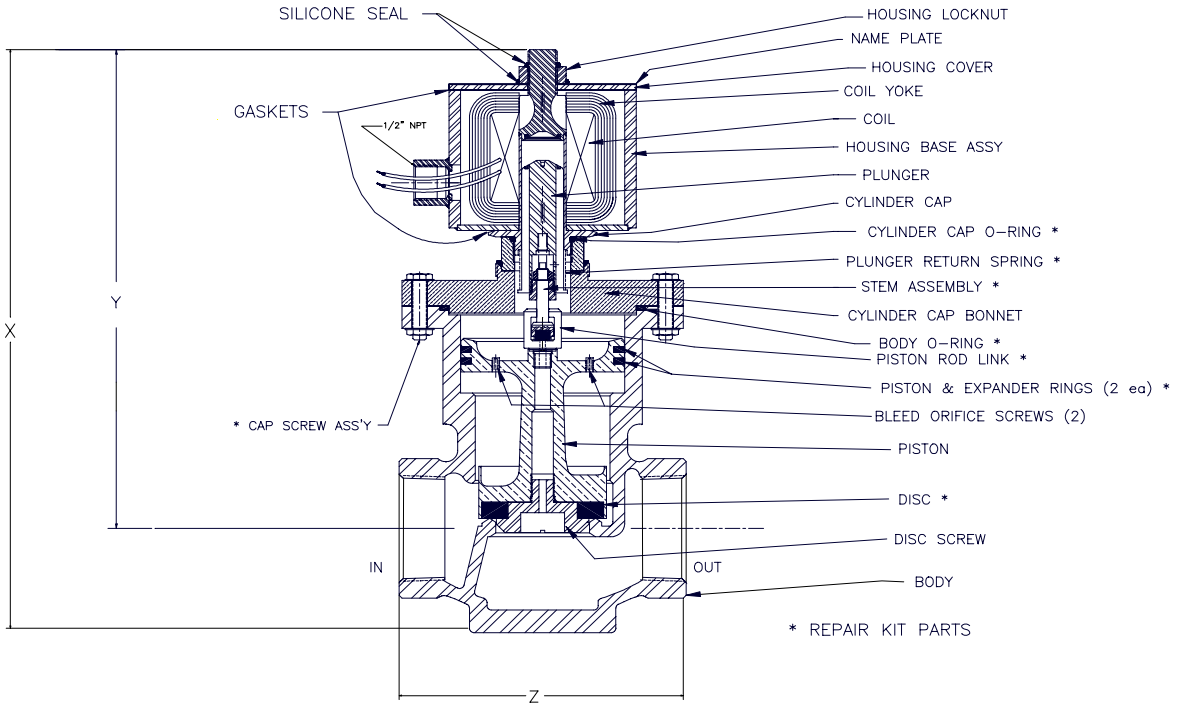
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
31400	¼"	3/8"	7 7/8"	7"	2 11/16"	10	1.4
31410	3/8"	3/8"	7 7/8"	7"	2 11/16"	10	2.7
31420	½"	½"	8"	7 1/16"	3"	10	3.5
31430	¾"	1"	8 5/8"	7 3/8"	4"	12	8.4
31440	1"	1"	8 5/8"	7 3/8"	4"	12	9.5
31450	1 ¼"	1 ½"	10 1/8"	8 ¼"	5 1/16"	26	19.5
31460	1 ½"	1 ½"	10 1/8"	8 ¼"	5 1/16"	26	21.0
31570	2"	2"	13 3/16"	10 5/16"	6 1/8"	38	43.0
31580	2 ½"	3"	14 ¼"	10 3/8"	8 ½"	76	63.0
31590	3"	3"	14 ¼"	10 3/8"	8 ½"	76	71.0

30,400 Series Normally Open Bronze

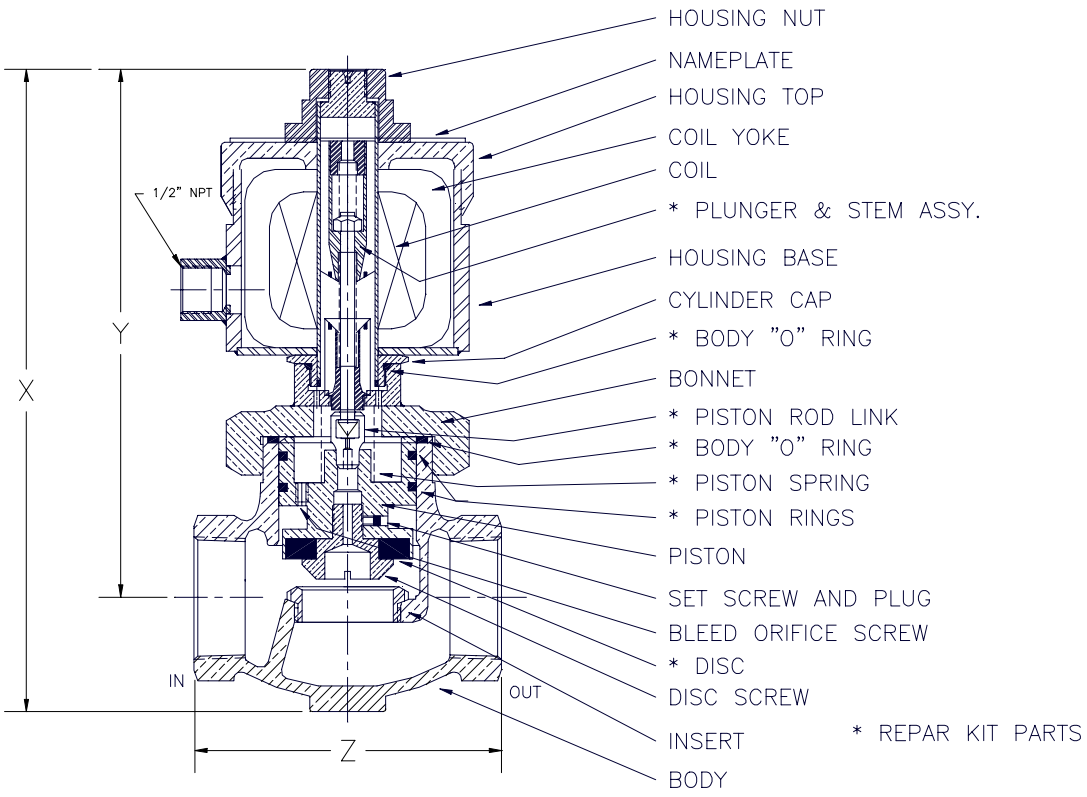
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
32400	¼"	3/8"	8 5/8"	7 ¾"	2 11/16"	10	1.4
32410	3/8"	3/8"	8 5/8"	7 ¾"	2 11/16"	10	2.7
32420	½"	½"	8 ¾"	7 13/16"	3"	10	3.5
32430	¾"	1"	9 3/8"	8 1/16"	4"	12	8.4
32440	1"	1"	9 3/8"	8 1/16"	4"	12	9.5
32450	1 ¼"	1 ½"	10 ½"	8 7/8"	5 1/16"	26	19.5
32460	1 ½"	1 ½"	10 ½"	8 7/8"	5 1/16"	26	21.0



Normally Closed 1” 31440 Valve – shown with explosion proof NEMA 7 Coil Housing, an AC coil, and soft pilot seat

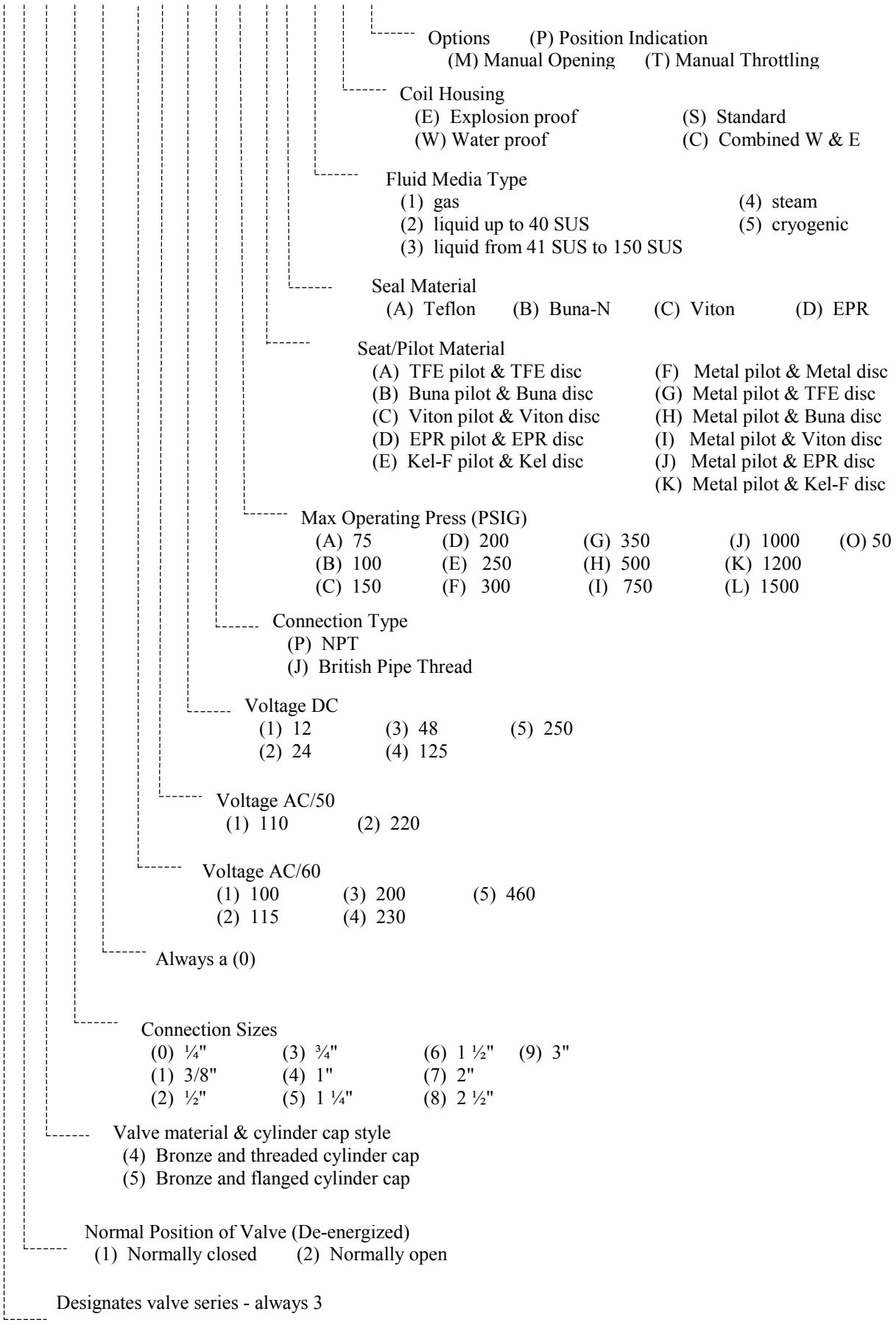


Normally Closed 2” 31570 Valve – shown with NEMA 4 Coil Housing, an AC coil, and a soft pilot seat



Normally Open 1 ½" 32460 Valve – shown with explosion proof NEMA 7 coil Housing, an AC coil, and a metal pilot seat

30400 Valve Series catalog number 3XXX0-XXXXXXXXXX



30,800 Series Stainless Steel, Semi-Direct Lift, 0 to 3000 psig

High pressure valve configurable for variety of fluid applications

Stainless steel construction on all wetted parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Semi-direct lift action for operation down to zero pressure differential

Operation up to 3000 psig

Media temperatures from –423 F to +500 F

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluids including: air, gasses, liquids, hydraulic fluids, steam, cryogenicss, and corrosive fluids

Optional seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or metal (316 pilot seat and/or 316 piston seat) depending on fluid type and pressure

Body seal materials of Teflon, Viton, Buna-N, or EPR

Heaviest duty and most rugged construction

Removable 316 ss body inserts (stainless steel trim)

Available in normally closed configuration from 1/4 to 2” ports

Available in normally open configuration from ¼ to 1 ½” ports

British BSPT ports are available

Full ported valves

Cv from 2.5 to 45 in normally closed valves

Cv from 2.5 to 21.5 in normally open valves

Class H coils are standard

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening device is available as an options

Valve position indicator option is available

Operational Pressures No minimum pressure differential

Normally Closed ¼ through 1 ½" 31800 - 31860

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3000	1500	3000	1000	3000	1000	300	300

Normally Closed 1 1/4 through 2" 31851-31871 with threaded cylinder cap

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1500	1000	300	300

Normally Open ¼ through 1 " 32800 - 32860

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
3000	2000	3000	1500	3000	1250	300	300

Normally Open 1 1/4 through 1 1/2" 32851-32871 with threaded cylinder cap

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1000	1500	1000	300	300

NOTE: Normally open 32,800 series valves are subject to the intermittent operation restrictions described on page 13 and are not recommended for cryogenic service above 50 psig.

NOTE: Normally open 32,800 series valves are not available with 50 Hz coils for operational pressures above 1500 psi.

NOTE: Rubber seats are limited to 500 psi

Dimensions, Shipping Weights, and Cv Flow Factors

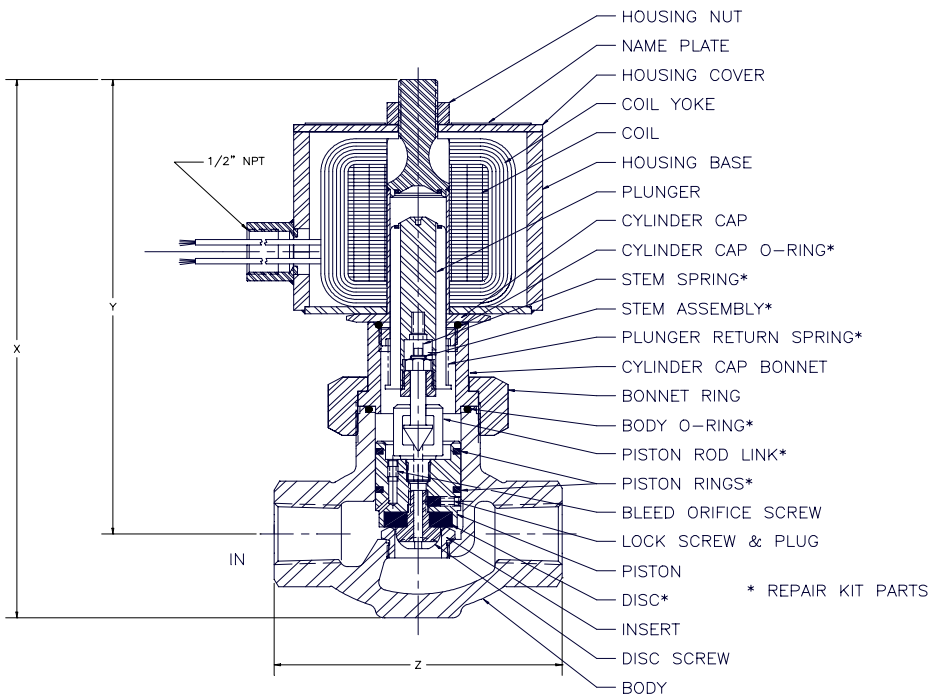
30,800 Series Normally Closed Stainless Steel

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
31800	¼"	3/8"	8 1/16"	7 1/16"	3"	10	1.1
31810	3/8"	3/8"	8 1/16"	7 1/16"	3"	10	2.5
31820	½"	3/4"	8 11/16"	7 9/16"	4 5/8"	13	5.1
31830	¾"	3/4"	8 11/16"	7 9/16"	4 5/8"	13	7.5
31840	1"	1"	9 ½"	8 1/16"	5 ¼"	19	12.5
31850	1 ¼"	1 ½"	10 ½"	8 3/8"	7 5/8	50	21.0
31860	1 ½"	1 ½"	10 ½"	8 3/8"	7 5/8"	50	21.5
31851	1 ¼"	1 ½"	10 3/16"	8 3/8"	5 7/8"	22	21.0
31861	1 ½"	1 ½"	10 3/16"	8 3/8"	5 7/8"	22	21.5
31871	2"	2"	12 3/8"	9 13/16"	7"	32	45.0

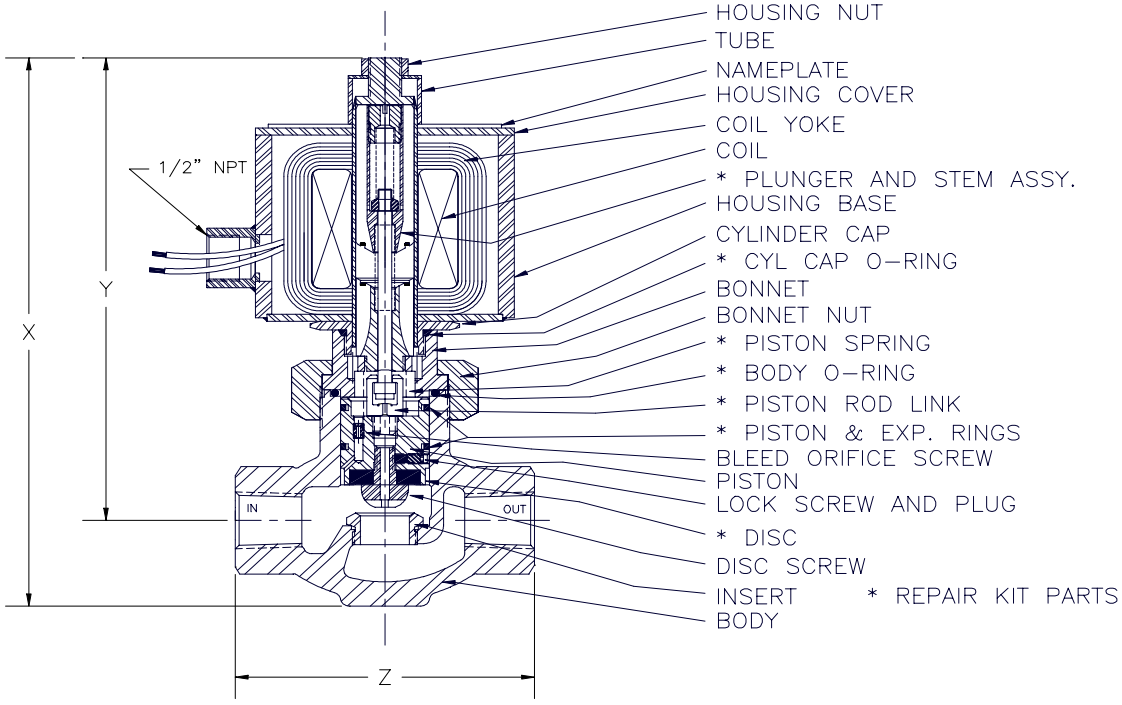
Note: 1 ¼" & 1 ½" valves model 31850 and 31860 are rated for 3000 psig and constructed with a flanged body & cylinder cap connection. Models 31851, 31861, and 31871 are constructed with a threaded cylinder cap & body connection and are rated for 1500 psig

30,800 Series Normally Open Stainless Steel

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
32800	¼"	3/8"	8 5/8"	7 5/8"	3"	10	1.1
32810	3/8"	3/8"	8 5/8"	7 5/8"	3"	10	2.5
32820	½"	¾"	9 ½"	8"	4 5/8"	13	5.1
32830	¾"	¾"	9 ½"	8"	4 5/8"	13	7.3
32840	1"	1"	10 1/16"	8 9/16"	5 ¼"	19	12.5
32851	1 ¼"	1 ½"	10 ½"	8 ½"	5 7/8"	22	21.0
32861	1 ½"	1 ½"	10 ½"	8 ½"	5 7/8"	22	21.5

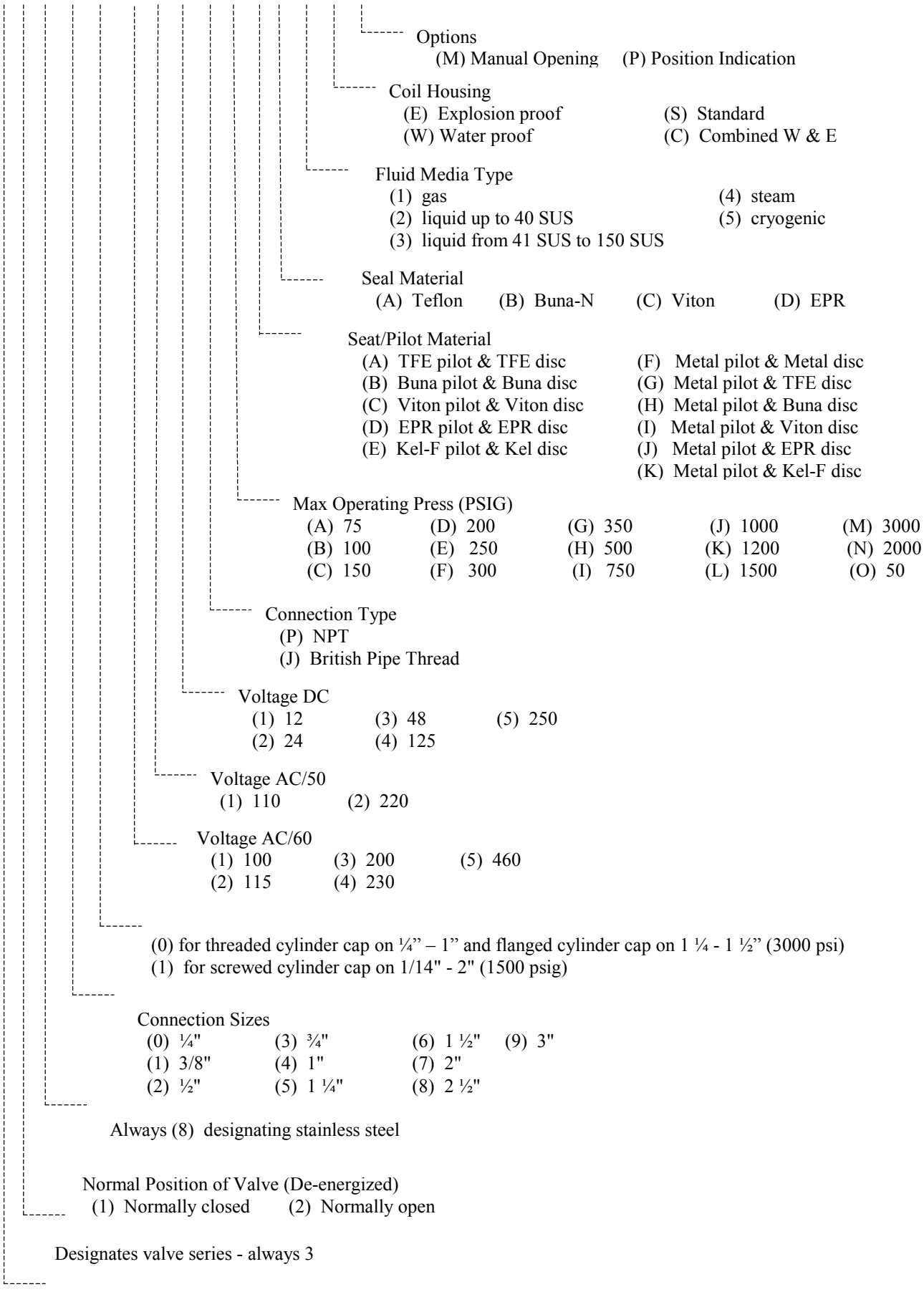


Normally Closed ¾" 31830 Valve – shown with NEMA 1 coil housing, an AC coil, and a metal pilot seat



Normally Open ¾" 32830 Valve – shown with NEMA 1 coil housing, an AC coil, and a soft pilot seat

30800 Valve Series catalog number 3X8XX-XXXXXXXXXX



35,800 Series Stainless Steel, Pilot-Piston, 35 to 2000 psig

High pressure valve configurable for variety of fluid applications

Rapid response time – achieved by use of an external pilot source

Pilot operated valve

Operation up to 2000 psig

Available in normally open and normally closed versions

Stainless steel construction on all wetted parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Available in ½ through 2" NPT pipe size

Full ported valves

Heavy duty, rugged construction

CV from 5.1 to 45

British BSPT ports available

Media temperatures from –15 F to +400 F

Body seal materials of Teflon, Viton, Buna-N, or EPR

Piston lip seals are Viton

Stellite pilot seats (Cobalt alloy for wear and corrosion resistance)

Optional piston seat materials of Teflon, Kel-F, Buna-N, Viton, EPR, or 316 stainless steel depending on fluid type and pressure

Removable 316 ss body inserts (stainless steel trim)

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluid including both gasses and liquids

Class H coils are standard

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Manual opening and throttling devices are not available as options

Valve position indicator option is not available

Operational Pressures 35 psid minimum pressure differential

1/2 through 1" Normally Open and Closed 35820 - 35840

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
2000	2000	2000	2000	2000	2000	300	300

1 1/4 through 2" Normally Open and Closed 35851 - 35871

Gases		Liquids to 40 SUS		Liquids over 40 SUS		Steam	
A. C.	D. C.	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1500	1500	1500	1500	1500	1500	300	300

NOTE: Rubber seats are limited to 500 psi

Dimensions, Shipping Weights, and Cv Flow Factors

35,800 Series Normally Closed or Normally Open Stainless Steel

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
35820	½"	¾"	11 11/16"	10 ¼"	4 5/8"	15	5.1
35830	¾"	¾"	11 11/16"	10 ¼"	4 5/8"	15	7.5
35840	1"	1"	12 1/8"	10 15/16"	5 ¼"	21	12.5
35851	1 ¼"	1 ½"	12 9/16"	10 5/16"	5 7/8"	25	21.0
35861	1 ½"	1 ½"	12 9/16"	10 5/16"	5 7/8"	25	21.5
35871	2"	2"	14 7/8"	12 3/8"	7"	34	45.0

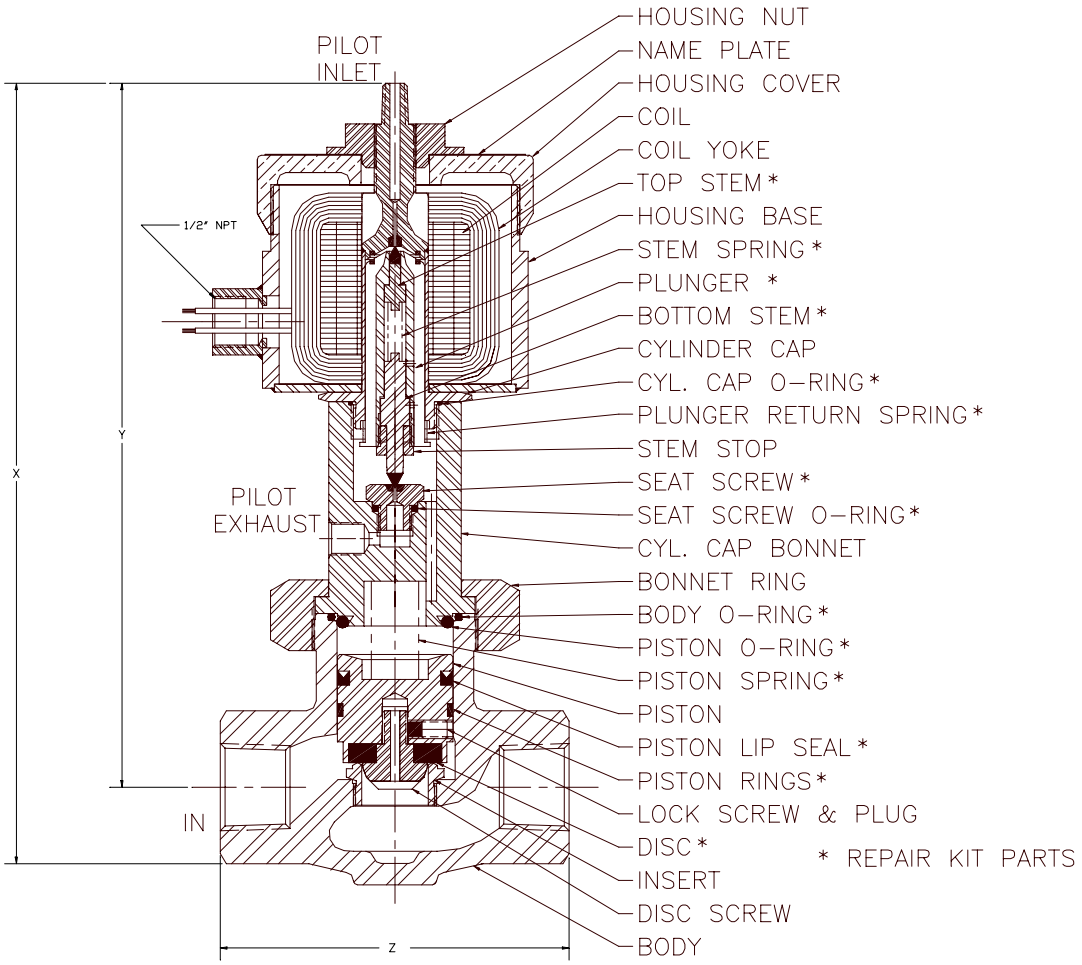
NOTE: Restrictions that apply to other normally open valves do not affect the 35000 series normally open valves.

In most systems pilot pressure is tapped off of the valve's inlet line and pilot exhaust is routed to atmosphere or a low pressure receptacle. Independent sources for pilot pressure are also commonly used and occasionally the valve's outlet pipe is used for pilot exhaust. For valve operation the following minimum conditions must be met:

For opening, pilot exhaust pressure must be at least 35 psi less than the valve's inlet pressure.

For closing, pilot pressure must be at least equal to the valve's inlet pressure and at least 35 psi greater than the valve's outlet pressure.

The fastest operational speeds are obtained at maximum pressure differentials.

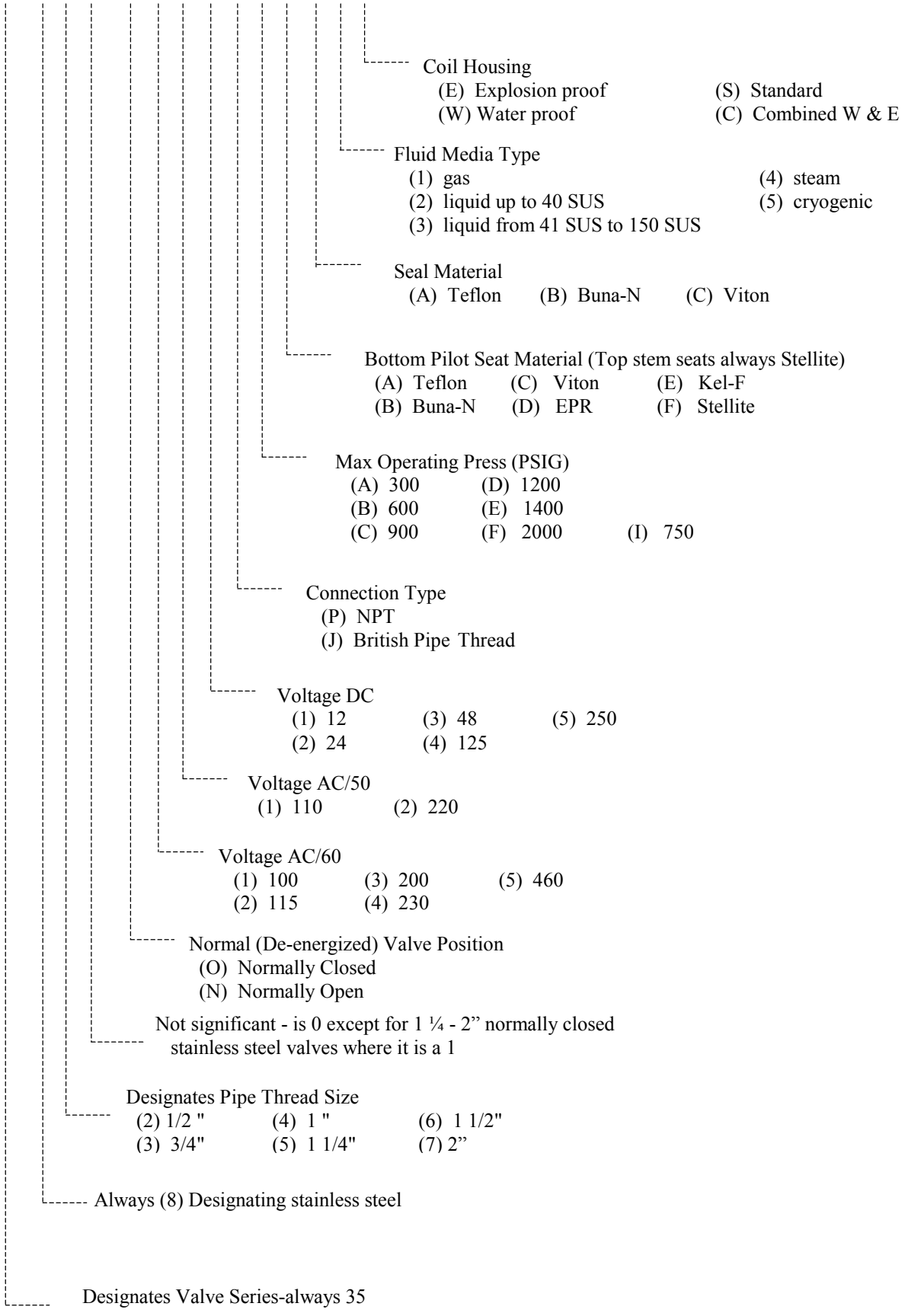


35840 1" Valve - shown as a normally closed valve, with a NEMA 7 coil housing, and a AC coil.

Note: Both the pilot inlet and pilot exhaust ports are ¼" NPT male and female respectively.

Note: On normally open valves the position of the pilot inlet and exhaust are reversed.

35000 Valve Series catalog number 35XXX-XXXXXXXXXX



40,000 Series Stainless Steel, Semi-Direct Lift, 0 to 2500 psig

High temperature, high pressure valve configurable for variety of fluid applications

Designed for high temperature fluids – up to 750 F

Operational pressure up to 2500 psi.

Extended neck to locate the solenoid at a distance from the hot fluid flow

Carbon graphite piston rings

Metal (316 stainless steel) body o-rings

Pilot seats are made of Stellite (a cobalt alloy) for temperature and wear resistance

Piston is made of 17-4 stainless steel and the piston seat is Stellite

Available in normally open and normally closed versions

Mounted with the coil oriented down to minimize convection heating of coil from the hot media

Stainless steel construction on all pressure containing parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Semi-direct lift action for operation down to zero pressure differential

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluid including: air, gasses, liquids, hydraulic fluids, steam, and corrosive fluids

Heaviest duty and most rugged construction

Removable 316 ss body inserts (stainless steel trim)

Full ported valves

Available in normally closed configuration from 1/4 to 1 1/2” ports

Cv from 1.1 to 21.5 in normally closed version

Available in normally open configuration from ¼ to 1 ” ports

Cv from 1.1 to 12.5 in normally open version

British BSPT ports are available

Class H coils are standard

Coils housings available in NEMA 1 (standard), NEMA 4 (waterproof), NEMA 7 (explosion proof for hazardous locations), and combination NEMA 4 and 7

Operational Pressures No minimum pressure differential

Normally Closed **¼ through 1 ½" 42800 - 41861**

All Gases		All Liquids	
A. C.	D. C.	A. C.	D. C.
2500	1500	2500	1000

Normally Open **¼ through 1" 42800 - 42840**

All Gases		All Liquids	
A. C.	D. C.	A .C.	D. C.
2500	2000	2500	1500

NOTE: The operational pressure is limited to a maximum of 1500 psi when the fluid temperature is between 650 F and 750 F.

The operational pressure is limited to a maximum of 2000 psi when the fluid temperature is between 550 F and 650 F.

For fluid temperatures below 550 F the operational pressure is 2500 psi maximum.

NOTE: Normally open 40,000 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Normally open 40000 series valves are not available with 50 Hz coils for operational pressures above 1500 psi.

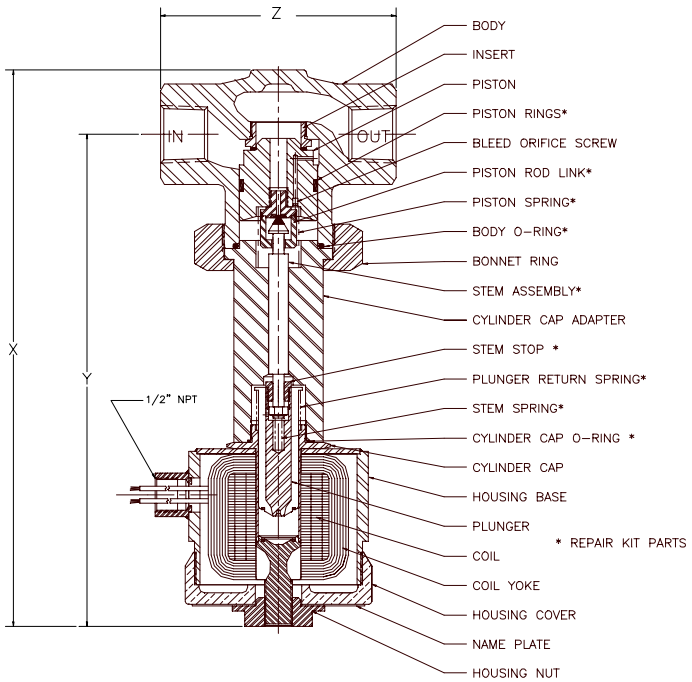
Dimensions, Shipping Weights, and Cv Flow Factors

40,000 Series Normally Closed

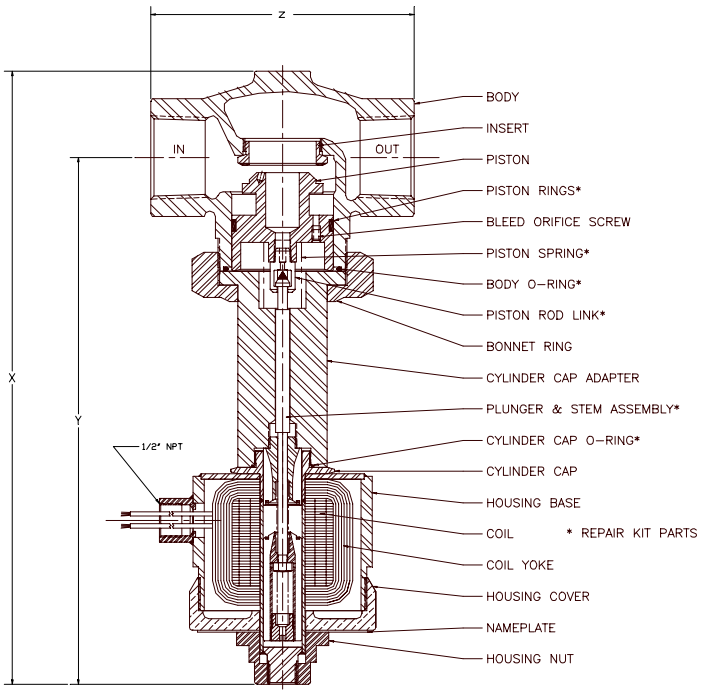
Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
41800	¼"	3/8"	11 3/8"	10 7/16"	3"	14	1.1
41810	3/8"	3/8"	11 3/8"	10 7/16"	3"	14	2.5
41820	½"	3/4"	12 5/16"	10 7/8"	4 5/8"	17	5.1
41830	¾"	¾"	12 5/16"	10 7/8"	4 5/8"	17	7.5
41840	1"	1"	12 11/16"	11 1/4"	5 ¼"	23	12.5
41851	1 ¼"	1 ½"	13 5/16"	13 11/16"	5 7/8"	22	21.0
41861	1 ½"	1 ½"	13 5/16"	13 11/16"	5 7/8"	22	21.5

40,000 Series Normally Open

Catalog Number Prefix	Pipe Size	Main Seat Orifice Dia	X	Y	Z	Shipping Weight (lbs.)	Cv
42800	¼"	3/8"	11 1/2"	10 9/16"	3"	14	1.1
42810	3/8"	3/8"	11 1/2"	10 9/16"	3"	14	2.5
42820	½"	¾"	12 9/16"	11 1/8"	4 5/8"	17	5.1
42830	¾"	¾"	12 9/16"	11 1/8"	4 5/8"	17	7.3
42840	1"	1"	13 1/16"	11 9/16"	5 ¼"	23	12.5



Normally Closed 1” 41840 Valve – shown with a NEMA 7 explosion proof coil housing and a AC coil



Normally Open 1 1/2” 42861 Valve – shown with a NEMA 7 explosion proof coil housing and a AC coil

40000 Valve Series catalog number

4X8XX-XXXXXXX

Coil Housing
(E) Explosion proof (S) Standard
(W) Water proof (C) Combined W & E

Fluid Media Type
(1) gas (4) steam
(2) liquid up to 40 SUS (5) cryogenic
(3) liquid from 41 SUS to 150 SUS

Max Operating Press (PSIG)
(A) 75 (D) 250 (G) 1000 (J) 2000
(B) 100 (E) 350 (H) 1200 (K) 2500
(C) 200 (F) 750 (I) 1500

Connection Type
(P) NPT
(J) British Pipe Thread

Voltage DC
(1) 12 (3) 48 (5) 250
(2) 24 (4) 125

Voltage AC/50
(1) 110 (2) 220

Voltage AC/60
(1) 100 (3) 200 (5) 460
(2) 115 (4) 230

Usually a (0) except is a (1) for 1 ¼ - 2" size with threaded cylinder cap (1500 PSIG max.) This field conveys no meaning and is used only to match historic catalog numbers.

Pipe Thread Sizes
(0) ¼" (3) ¾" (6) 1 ½"
(1) 3/8" (4) 1"
(2) ½" (5) 1 ¼"

Insignificant, always an (8)

Normal Position of Valve (De-energize)
(1) Normally closed
(2) Normally open

Designates Valve Series -always 4

50,000 Series Stainless Steel, Direct Lift, 0 to 3000 psig

High temperature, high pressure valve configurable for variety of fluid applications

Designed for high temperature fluids – up to 750 F

Direct lift valve

Barstock construction

Mounted with the coil oriented down to minimize convection heating of coil from the hot media

Flow orifices of 1/16, 3/32, 1/8, and 3/16”

Cv from .093 to .72

Normally closed and normally open versions available

Available in pipe size from 1/8 through 1” NPT & BSPT or 1/8 through 1” tube stubs

Pressures up to 3000 psig

Stainless steel construction on all pressure containing parts – 316 for barstock parts and CF8M for cast parts. Plunger material is 416 stainless that is treated for increased corrosion resistance

Will handle fluids with viscosity up to 150 SUS

Suitable for use with wide variety of fluid including: air, gasses, liquids, hydraulic fluids, steam, cryogenic fluids, and corrosive fluids

Stellite seat (Cobalt alloy for wear and corrosion resistance)

Extended stem to reduce heat transfer from fluid to coil (two lengths available depending on fluid temperature)

Class H coils are standard

Operational pressures No minimum pressure differential

Normally Closed Extended stem 1/8 through 1" 50800 - 50850

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	2500	2500	2500	2500	2500
3/32	2500	2500	2000	2000	2000	2000
1/8	1200	1200	900	900	900	900
3/16	500	500	350	350	350	350

Normally Closed Short stem 1/8 through 1" 50900 - 50950

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	3000	3000	3000	3000	3000	3000
3/32	3000	3000	2500	2500	2500	2500
1/8	1200	1200	1000	1000	1000	1000
3/16	600	600	450	450	450	450

Normally Open Extended stem 1/8 through 1" 50801 - 50851

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	2500	2500	2000	2000	2000	2000
3/32	1200	1200	1000	1000	1000	1000
1/8	400	400	350	350	350	350
3/16	250	250	150	150	150	150

Normally Open Short stem 1/8 through 1" 50901 - 50951

Orifice	Gases		Liquids to 40 SUS		Liquids over 40 SUS	
Size	A. C.	D. C.	A. C.	D. C.	A. C.	D. C.
1/16	3000	3000	3000	3000	3000	3000
3/32	1600	1600	1200	1200	1200	1200
1/8	400	400	350	350	350	350
3/16	250	250	150	150	150	150

NOTE: Normally open 50,000 series valves are subject to the intermittent operation restrictions described on page 13.

NOTE: Normally open 50000 series valves are not available with 50 Hz coils for operational pressures above 1500 psi.

Cv Flow Factors

Orifice	Cv
1/16”	.093
3/32”	.22
1/8”	.44
3/16”	.72

Dimensions and Shipping Weights

50,800 Series Normally Closed (extended stem for fluid temperatures of 500 to 750 F)

Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
50800	1/8”	10”	8 1/8”	4 1/16”	14
50810	¼”	“	“	“	“
50820	3/8”	“	“	“	“
50830	½”	“	“	“	“
50840	¾”	“	“	“	“
50850	1”	“	“	“	“

50,900 Series Normally Closed (standard stem for fluid temperatures up to 500 F)

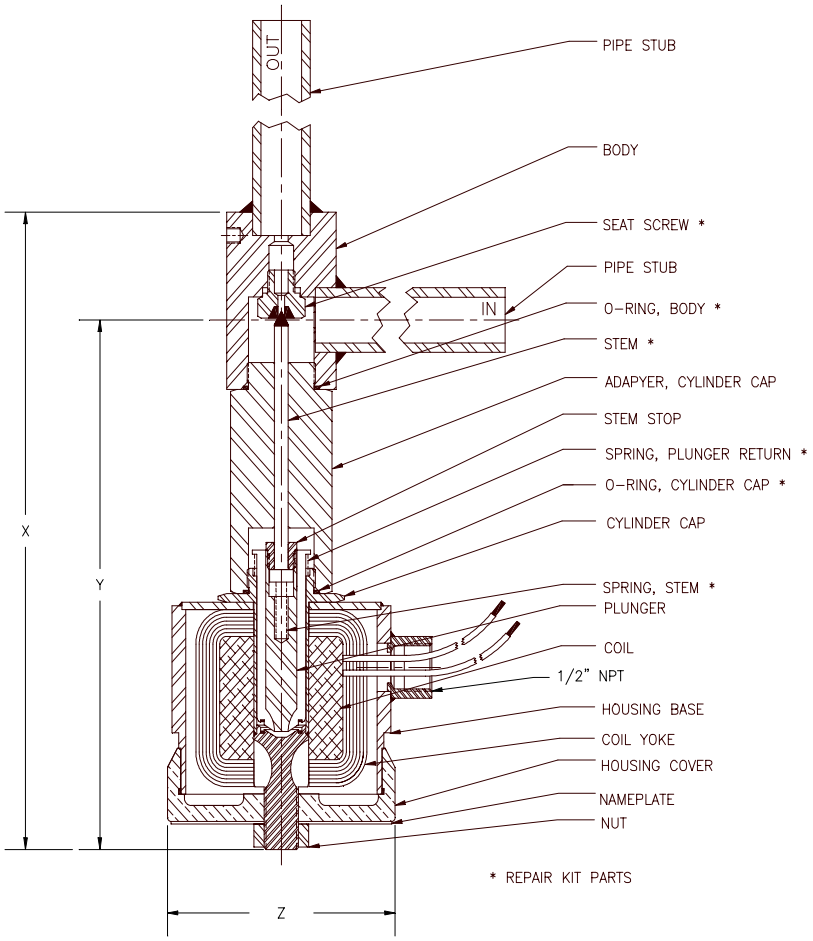
Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
50900	1/8”	7 1/2”	5 3/4”	4 1/16”	10
50910	¼”	“	“	“	“
50920	3/8”	“	“	“	“
50930	½”	“	“	“	“
50940	¾”	“	“	“	“
50950	1”	“	“	“	“

50,801 Series Normally Open (extended stem for fluid temperatures of 500 to 750 F)

Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
50801	1/8”	11 1/8”	9 1/4”	4 1/16”	16
50811	¼”	“	“	“	“
50821	3/8”	“	“	“	“
50831	½”	“	“	“	“
50841	¾”	“	“	“	“
50851	1”	“	“	“	“

50,901 Series Normally Open (standard stem for fluid temperatures up to 500 F)

Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)
50901	1/8”	8 5/8”	6 7/8”	4 1/16”	12
50911	¼”	“	“	“	“
50921	3/8	“	“	“	“
50931	½”	“	“	“	“
50941	¾”	“	“	“	“
50951	1”	“	“	“	“



50840 1” Valve - shown with optional 3/4” tube stubs, a NEMA 7 explosion proof coil housing, and a AC coil

50000 Valve Series catalog number (Formally 13,800 & 13,900 Series)

5XXXX-XXXXXXX

Coil Housing
(E) Explosion proof (S) Standard
(W) Water proof (C) Combined W & E

Fluid Media Type
(1) Gas (2) Liquid up to 40 SUS (3) Liquid from 41 to 150 SUS
(4) Steam (5) Cryogenic

Orifice Size
(1) 1/16” (3) 1/8”
(2) 3/32” (4) 3/16”

Connection Type
(A) 6” Stubs (J) British Pipe Thread
(P) NPT

Voltage DC
(1) 12 (3) 48 (5) 250
(2) 24 (4) 125

Voltage AC/50
(1) 110 (2) 220

Voltage AC/60
(1) 100 (3) 200 (5) 460
(2) 115 (4) 230

(0) Normally Closed
(1) Normally Open

Connection Size
(0) 1/8 (2) 3/8 (4) ¾
(1) ¼ (3) ½ (5) 1

Stem Type
(8) Extended Length (9) Standard Length

Designates valve series and pressure range – 50 for 0 - 1500 psi or 51 for 1501 - 3000 psi

15-794 Series Stainless Steel, Pilot-Piston, 5 to 350 psig

Liquid CO2 valve

Designed specifically for liquid CO2

Pilot operated valve

Pressure to 350 psig

½" NPT or BSPT ports

Cv of 3.0

Stainless steel construction

Teflon piston (seat material)

Teflon body seal

Coil housing is waterproof and nickel plated

Class H and class B coils are available

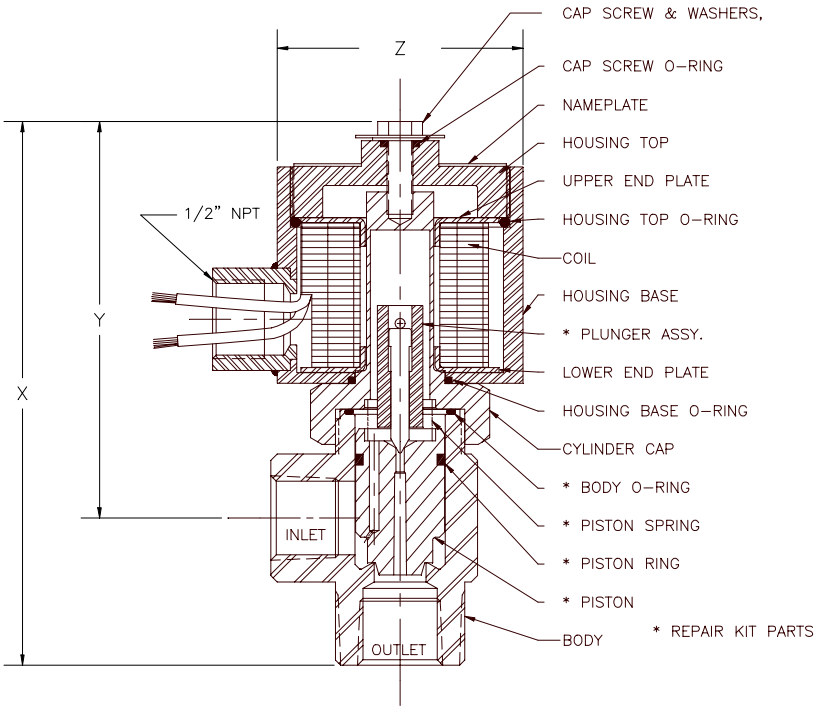
No other options available

Operational Pressures 5 psid minimum pressure differential

Liquid carbon dioxide	
A. C.	D. C.
350	350

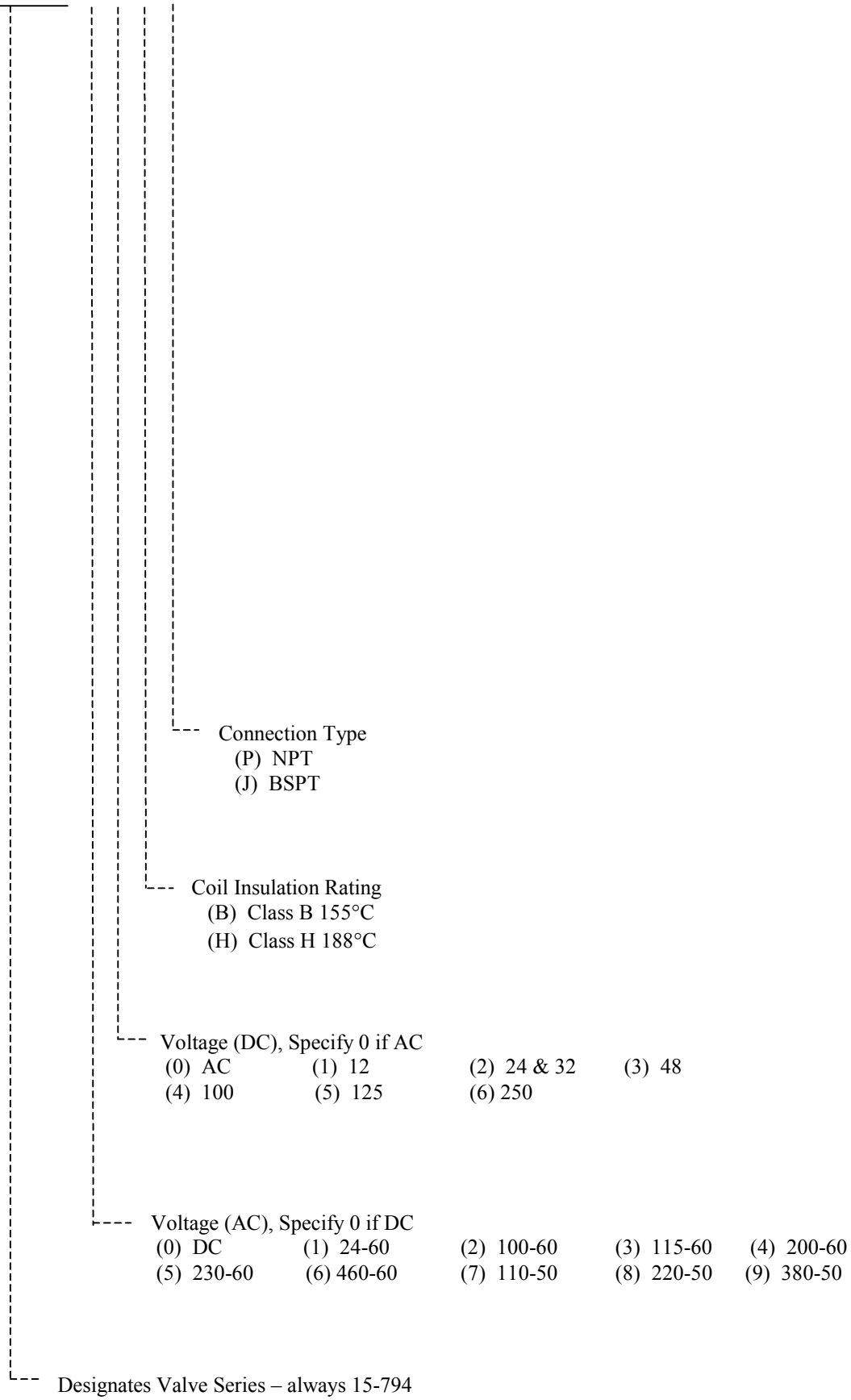
Dimensions, Shipping Weights, and Cv Flow Factors

Catalog Number Prefix	Pipe Size	X	Y	Z	Shipping Weight (lbs.)	Cv
15-794	½"	5 ¼"	3 7/8"	2 3/8"	4	3


CAP SCREW & WASHERS,
Z
CAP SCREW O-RING
NAMEPLATE
HOUSING TOP
UPPER END PLATE
1/2" NPT
HOUSING TOP O-RING
COIL
HOUSING BASE
Y
* PLUNGER ASSY.
LOWER END PLATE
X
HOUSING BASE O-RING
CYLINDER CAP
* BODY O-RING
* PISTON SPRING
INLET
* PISTON RING
* PISTON
BODY
* REPAIR KIT PARTS
OUTLET

15-794 Valve

15-794-XXXX Catalog number



Options Available

Catalog Options

- Valve position indicator switches

  This consists of a pair of reed switches that are mounted adjacent to a tube on the bottom of the valve. Inside of this tube is a magnet, which is physically attached to the piston so that it travels up and down with the piston motion. The reed switches are positioned such that when the valve is closed one switch is actuated closed by the magnet and the other switch is open. When the valve is fully open the other switch is actuated closed. It is not unusual for these switches to require some adjustments in position after final valve installation. There are set screws (one per switch) in the mounting block that can be loosened to adjust the switches position. The reed switches are a single pole, single throw configuration. Their maximum switching current is 0.7 amp for DC and 1.0 amp for AC. The maximum switching voltage is 150 volts on AC and 200 volts on DC. The switch contact rating is 70 watts on AC service and 50 watts on DC. The range of allowable fluid temperatures is reduced to a range from –320 to + 450 F when the VPI option is installed on a valve. Typically position indicator switches are only ordered on semi-direct lift valves. It is possible to place them on pilot operated valves, but this is not generally recommended. This is because the piston position is dependent on the flowrate through the pilot operated valve. Since the magnet that actuates the switches is connected to the piston, variations in flowrate will cause the position switches to open or close. Additionally, final setting of the switches (which typically must be done after installation in the field) requires either full system flow through the valve or disassembly of the pilot operated valve and manual movement of the piston. The position indicator switch option is not available on direct lift valves.

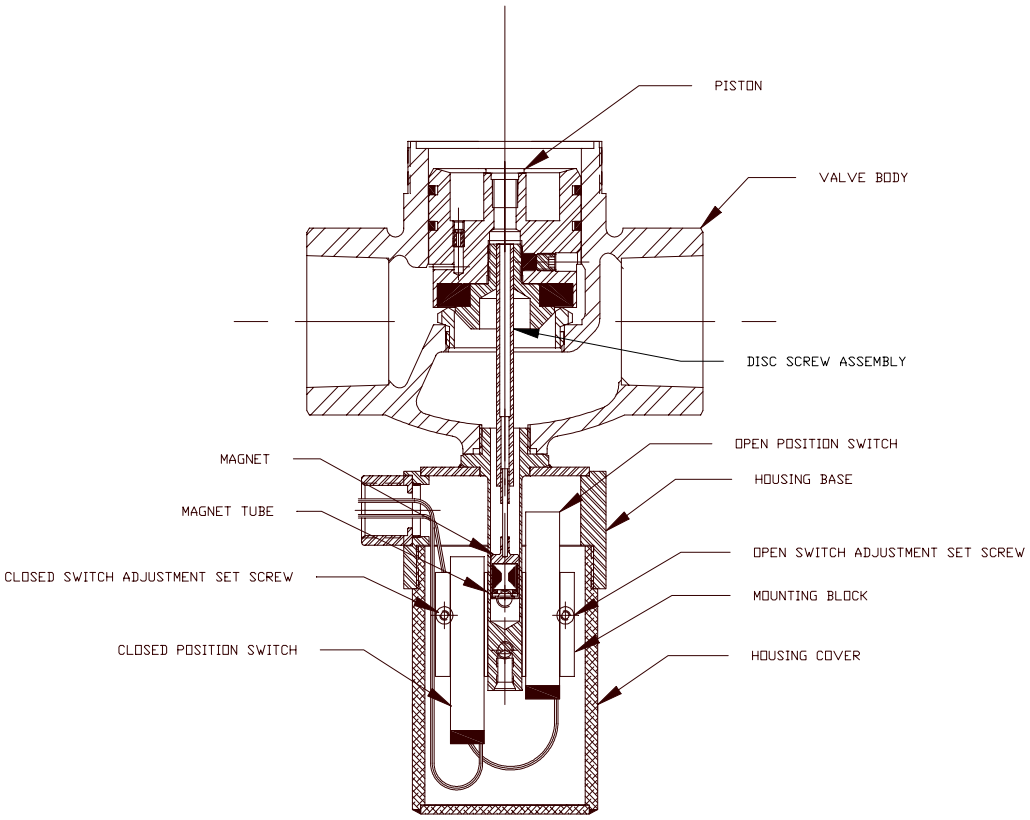
- Manual opening device

  This provides a method for manually opening the valve typically for use when power failures occur. It consists of a handwheel and rising stem attached to the bottom of the valve body. Turning the handwheel causes the stem to mechanically push the piston open. This option requires the use of a anodized aluminum piston on models 31580 & 31590 which will affect compatibility with some fluids.

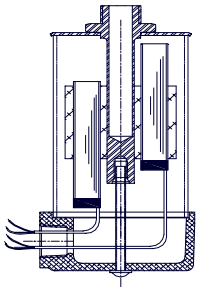
- Manual throttling device

  This provides a method of restricting the flow through a valve by reducing the area of the main valve orifice. It is physically similar to the manual opening device except instead of pushing the piston open , the stem pushes a baffle toward the main flow orifice under the piston. Quantitative metering of the flow is not a feature unless a separate instrument is used to measure the flowrate. This option requires the use of a anodized aluminum piston on models 31580 & 31590 which will affect compatibility with some fluids.

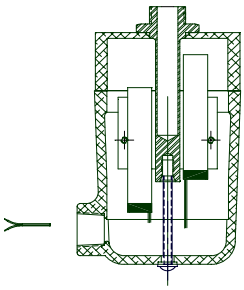
These options are coded into the standard catalog model number.



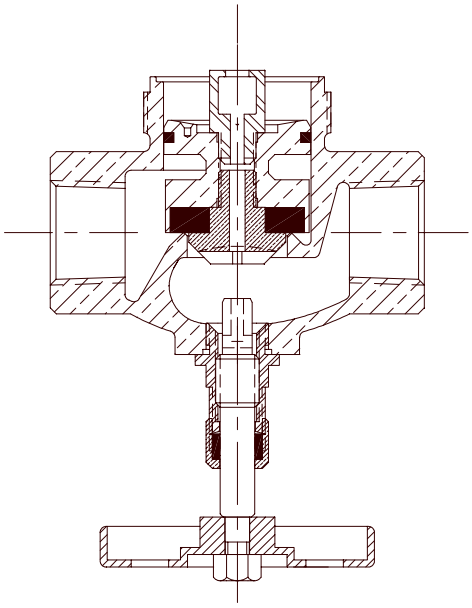
Valve Position Indicator Option – shown with NEMA 7 explosion proof housing



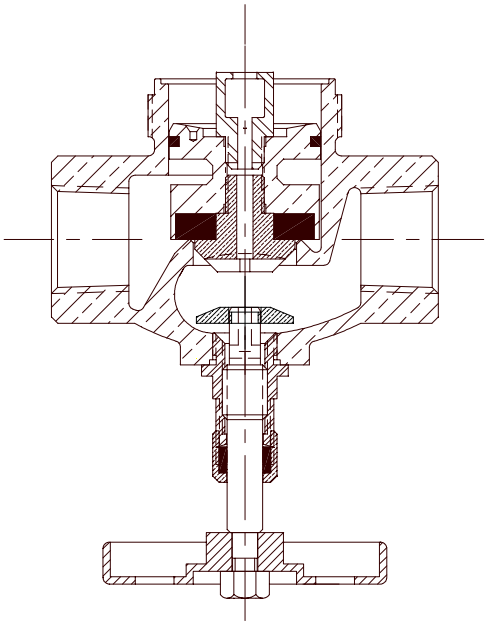
Valve Position Indicator Option – shown with NEMA 1 standard housing



Valve Position Indicator Option – shown with NEMA 4 waterproof housing



Manual Opening Device Option



Manual Throttling Device Option

Project Valve (Special – non-catalog) Options

This list of options includes some of the more commonly requested modifications to the standard catalog valves. Custom designs for specific applications are available for all the valve series. These can be requested from Circle Seal Distributors or the Sales Department at Circle Seal. A complete list of stocking distributors for Atkomatic and other Circle Seal products is on the Internet at http://www.circle-seal.com.

- Flanges, pipe stubs, couplings, etc - These are available in a variety of pressure ratings (Class 150, 300, 600, etc.) materials (stainless, carbon steel, etc.), and joining methods (butt welds, screwed and seal welded, socket welded, etc.). Special connections and installation of customer-furnished fittings is also available. Flange types available include raised face, flat face, slip-on, socket weld, weld neck, etc.

- Clad plunger for use with extremely corrosive fluids - A clad plunger consists of a slug of core iron which is encased in 316 stainless steel such that the magnetic material is separated from, and only the 316 stainless is in contact with, the fluid media. This option reduces operating pressure by 50% and is available on the 1000, 2000, 8000, 15800, and 16000 series.

- Special sealing materials such as Kalrez ®

- Special pressure containing materials such as Inconel, Monel, and Hastelloy

- Stainless steel housings. These can meet NEMA 4X and Class I div I Group B requirements

- Check valve feature in piston assembly which allows full flow in the reverse direction – This consists of a small check valve mounted in the piston under the pilot orifice. There is no effect on normal valve operation, but the check valve closes off the pilot orifice when the valve is exposed to a reverse pressure differential. When this occurs the cavity above the piston is prevented from being pressurized by the downstream fluid. This allows the piston to be pushed fully open allowing free flow in the reverse direction. This option is not necessary on direct lift valves (they flow freely in the reverse direction) and is available on the following fully ported valve series: 500, 4000, 5000, 6000, 8000, 15,400, 15,800, 30,400, 30,800, and 40,000. See the section on directional flow in the Installation and General Information section on page 111.

- Fatigue resistant plunger assembly for high cycle applications - This consists of a sleeve that is brazed to the stem assembly replacing the threaded stem/nut connection.

- Specialty stainless plunger and magnetic stop alloys for chemical compatibility with corrosive media

- Nickel plating internal and/or external parts on bronze valves

- Epoxy potted coil housings for under water installation

- Carbon piston rings and/or metal o-rings where Teflon material is not suitable (some radioactive environments)

- Extra length coil leads

- Ground wires for coil housings

- Spring loading for operation in any orientation. This option should be used as a last resort only when it is not possible to mount the valves in their normal positions. Normal warranties do not apply to spring loaded valves as premature wear is a side effect as is increased internal leakage and reduction in service life of the coils. On some valves this option reduces operating pressure by 50% and increases the minimum operational pressure. On other valve series it does not affect the maximum operational pressures since the plunger is already spring loaded, however it does affect operation at low pressures. These differences are outlined below. The option is not available on all valve series due to available force margins. Standard leakage rates do not apply to spring loaded valves.

  The following semi-direct lift valve series can be spring loaded with no effect on the operational pressure:

  30,400 normally open and closed ¼" – 1" sizes only
  30,800 " " " " "

  The following valve series cannot be spring loaded:

  JJ, HS, 500, 7004,15,400 (normally open and closed),
  15,800, 15-794, and 35,000

  The following pilot operated valve series can be spring loaded with operational pressures reduced by 50% and a increased pressure differential required for piston operation:

  4000 normally open and closed
  5000 " " "
  6000 " " "
  8000 " " "

  The following direct lift valve series can be spring loaded with the operational pressure reduced by 50%:

  1000, 2000, 3000, and 16,000

  The following valve series can be mounted in any orientation without modification:

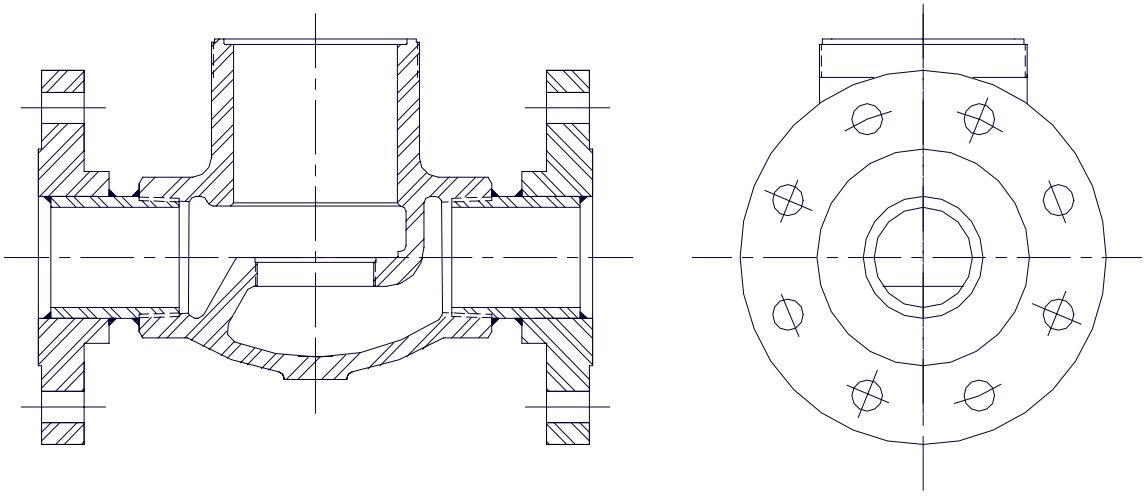
  12,000, 13,000, and 14,000

  1000, 2000, 3000, and 16,000 series spring loaded valves can be mounted in any direction.

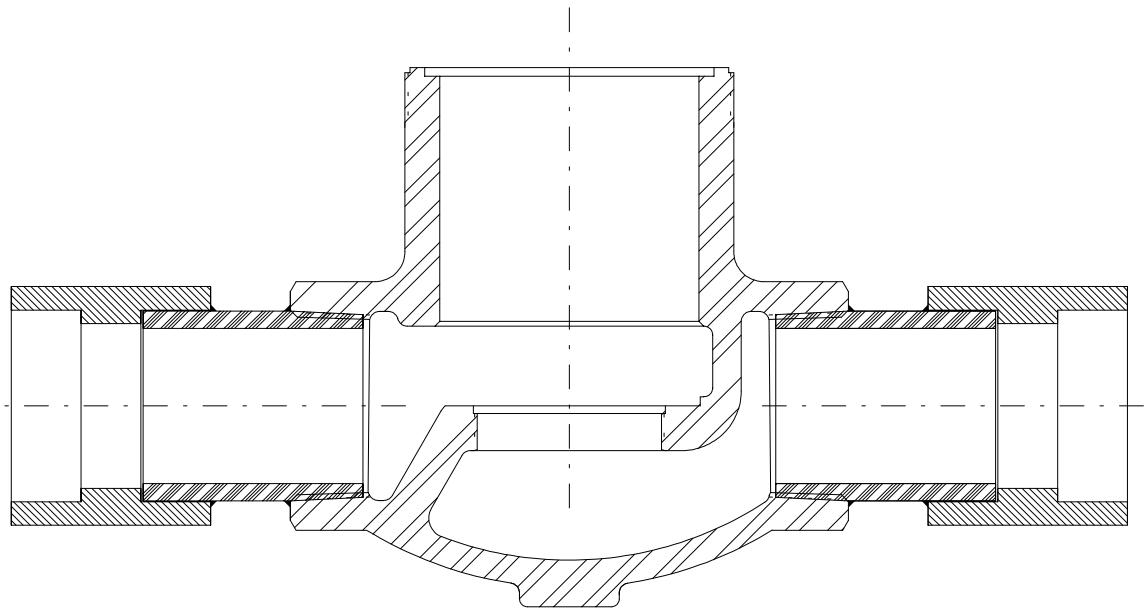
  4000, 5000, 6000, and 8000 series spring loaded valves can be constructed to function either horizontally or in any orientation as specified.

  30,400 and 30,800 series valves can be spring loaded for horizontal mounting only.

These and other non-catalog options cannot be coded into standard catalog model numbers. A project valve number is assigned by the Circle Seal factory to each valve having these or other special options. These project numbers consist of the catalog valve number prefix followed by a sequentially assigned dash number. An example project number is 31840-1529 which is a 1" stainless steel 31840 valve that has been modified to meet a specific customer requirement. The factory maintains a database of all previously built project or special valves produced. Consult the Sales Department at the factory for application information, numbering, pricing, and deliveries of all new and existing Atkomatic project valves.



Example of Flange Connection Option – raised face slip on flanges shown



Example of Coupling Connection Option

Technical Information

Operational pressures for Atkomatic valves

Operational pressures are sometimes referred to as differential pressures, maximum differential pressure, or maximum operational pressure differential (MOPD). All of these terms can be used interchangeably on the Atkomatic product line. Operational pressures are given for several categories of fluids. These are divided up by viscosity as follows:

f) Gas – this includes all types of fluids that remain in the gaseous state during flow through the valve. Typical examples include air, nitrogen, natural gas, helium, argon, hydrogen, helium, etc.

g) Low viscosity liquid – all liquid fluids up to a viscosity of 40 SUS (4.3 Centistokes) such as water, mineral oil, gasoline, kerosene, Diesel and fuel oil #2, JP-4 and other light oils depending on their temperature

h) High viscosity liquid – all liquid fluids from a viscosity of 41 SUS to 150 SUS (32 Centistokes) [200 SUS for some valves (42 Centistokes)] such as light to medium weight oils depending on their temperature (hydraulic fluids such as MIL-5606, Diesel and fuel oil #3, 4, & 5, S.A.E #10 weight oil).

i) Steam. These are broken out separately due to the temperature limitations of the valves rather than their ability to open against a particular pressure.

j) Cryogenic fluids – includes all fluids that can be in either a liquid or gaseous state such as liquid nitrogen, liquid oxygen, liquid hydrogen, liquid argon, CO2, etc. When looking up a pull-off value for a cryogenic fluid, use the value given for a liquid up to 40 SUS.

   Note: In cases where the fluid can exist at either a liquid or gaseous state, select a cryogenic make-up regardless of the temperatures involves. An example of this would be butane, which can be a gas or liquid depending on pressure at temperatures at or near room temperature.

All of the operational pressures for normally closed valves given are for valves that have been energized continuously, i.e., have coils which have stabilized at a high (above ambient) temperature. Since the resistance of the copper windings increase with temperature, the current is less at elevated temperatures and the strength of the magnetic field is less resulting in lower operational pressures. This effect is especially pronounced in many of the DC coils. The result of this method of rating the valves operational pressures is that the values are conservative for applications where the coils are only intermittently energized and all other operating conditions are nominal.

These pressure rating do not consider factors such as variations of the voltage applied to the coil or ambient temperatures. The limits of application conditions given in the literature should not be construed to imply that the valves would function under all combinations of adverse conditions. For instance, if after the coil energized continuously, the ambient temperature is at 100F, and the voltage is dropped to 90% of nominal the valve may not function at is maximum rated pressure. Other combinations of adverse conditions may cause similar effects.

Fluid Filtration Requirements

Contamination in fluid systems is the largest single cause of operational problems. Frequently contamination is present in new systems from sources such as pipe sealant, pipe scale, weld slag, and metallic particles from the assembly of pipe fittings. Flushing of new systems is important to reduce the occurrence of problems, however often even through flushing will not eliminate all contaminants that will break loose during the initial operation of a new system. Filters are an essential component in many systems to prevent valve problems. It is important to locate filters immediately upstream of the valves and to size the filter rating correctly. A maximum micron rating to provide adequate protection is 40 microns. Note that strainers or screens are generally not capable of providing this degree of filtration and a filter with a depth type of element is necessary.

Ambient Air Temperature Requirements

All the Atkomatic valve series (with one exception, the 50,000 series) are designed to operate with ambient temperatures up to 40 degrees C (104 F) with class H coils. Ambient temperatures above 40C will adversely affect coil life. Note that for this ambient temperature to be maintained around the coils, it may be necessary to provide air motion to prevent the valve bodies and associated piping from heating the air surrounding the coil above the 40 C limit when fluid temperatures are elevated. This heating effect in more pronounced in larger valves. Class B coils are not recommended for applications where the ambient air will be above 25 C (77 F). The 50000 series (50800 and 50900) is designed to function with ambient air up to 150 F (66 C).

None of the solenoid valves are designed to operate with an external vacuum. The coils rely on convection for cooling and this cooling effect is not present in a vacuum.

Installation and General Information

Most Atkomatic valves are designed to be mounted in a horizontal stationary line with the coil on top (within +/- 10 degrees). The exceptions are: 12,000, 13,000, and 14,000, series which may be mounted in any orientation and the 40,000 and 50,000 series valve which are designed to be installed in a horizontal stationary line with the coil on the bottom (within +/- 10 degrees).

All Atkomatic valves are designed to hold pressure in one direction only. Under a reverse delta pressure all valves will exhibit reverse flow. With pilot operated and semi-direct lift valves, a reverse pressure will push the pilot valve open and pressurize the cavity above the piston. This will prevent the piston from opening and the valve from flowing freely in the reverse direction. Reverse pilot flow will always be present and the volume of flow will depend on the reverse pressure and the diameter of the pilot orifice. It is possible to modify the valve such that full flow is allowed in the reverse direction (see the Cv feature option on page 107). A direct lift valve will always produce a back flow under a negative or reverse delta pressure condition. It is not possible to prevent all reverse flow without the installation of a check valve in the line.

All direct acting and semi-direct lift valves are suitable for vacuum service. The valves will function normally with any level of vacuum at the outlet port. However, globe style valves, cast components, brass material, and some elastomers are often not appropriate for use with extremely low vacuums.

Atkomatic valves must be mounted with the valve in the line such that the arrow cast into the valve body is in the direction of flow (or with the ports connected as marked for barstock body valves).

To prevent system instability, do not locate valves immediately downstream of pressure or flow control components such as regulators.

For more detailed instructions see the Installation, operating, & troubleshooting instructions for the specific valve series. These are available from the factory, authorized distributors, and on the Internet at http://www.circle-seal.com/Atkomatic.html.

COILS

Standard Available Coil Voltages

Class B coils for JJ, TT, 15-794, and 500 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
24 VAC 60 Hz	62197	6.51 Ohms	2.11	0.99	51
110 VAC 50 Hz	62191	232.5	0.35	0.17	39
115 VAC 60 Hz	62209	156.4	0.43	0.21	49
220 VAC 50 Hz	62193	955.2	0.17	0.084	37
230 VAC 60 Hz	62199	639.2	0.21	0.10	48
460 VAC 60 Hz	62201	2517	0.108	0.050	50
12 VDC	62203	9.63		1.26	15
24 VDC	62205	39.67		0.60	15
100 VDC	62199	639.2		0.20	20

Class H coils for JJ, HS, TT, 15-794, and 500 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
24 VAC 60 Hz	62198	6.48	2.10	0.96	50
100 VAC 60 Hz	63599	101.4	0.68	0.35	68
110 VAC 50 Hz	62190	187.6	0.39	0.17	43
115 VAC 60 Hz	62210	140.1	0.52	0.25	60
200 VAC 60 Hz	63600	408.4	0.34	0.17	68
220 VAC 50 Hz	62194	903.0	0.18	0.085	40
230 VAC 60 Hz	62200	498.3	0.31	0.10	71
380 VAC 50 Hz	62202	1980	0.16	0.075	74
460 VAC 60 Hz	62202	980	0.16	0.075	74
12 VDC	62206	10.17		1.13	14
24 VDC	62186	40.82		0.58	14
32 VDC	62186	40.82		0.74	24
48 VDC	62210	140.1		0.40	19
100 VDC	62200	498.3		0.20	20
125 VDC	62188	706.0		0.17	21
250 VDC	62192	2986		0.08	20

Class H coils for 12,000 and 14,000 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
100 VAC 60 Hz	63635	34.5	0.92	0.52	92
110 VAC 50 Hz	62186	40.82	0.98	0.52	108
115 VAC 60 Hz	62186	40.82	0.85	0.34	98
200 VAC 60 Hz	63636	99.3	0.61	0.37	122
220 VAC 50 Hz	62190	187.6	0.36	0.17	79
230 VAC 60 Hz	62210	140.1	0.48	0.24	110
460 VAC 60 Hz	62200	498.3	0.32	0.16	147
12 VDC	62174	4.17		2.7	32
24 VDC	62176	15.92		1.4	34
125 VDC	62178	485.9		0.26	33

Class B coils for 12,000 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
110 VAC 50 Hz	62205	39.67	0.98	0.52	108
115 VAC 60 Hz	62205	39.67	0.85	0.34	98
230 VAC 60 Hz	62191	156.4	0.48	0.24	110
460 VAC 60 Hz	62193	639.2	0.32	0.16	147

Class B coils for 3000, 4000, 5000, 6000, and 15,000 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
110 VAC 50 Hz	62170	32.25	1.0	0.52	110
115 VAC 60 Hz	62211	23.24	1.14	0.58	131
220 VAC 50 Hz	62181	126.1	0.50	0.26	110
230 VAC 60 Hz	62173	92.9	0.53	0.28	122
380 VAC 50 Hz	62179	381.5	0.28	0.15	129
460 VAC 60 Hz	62179	381.5	0.28	0.15	129

Note: There are no class B coils available in DC voltages for these valve series.

Class H coils for 1000, 2000, 3000, 4000, 5000, 6000, 8000, 15,000, and 16,000 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
24 VAC 50 Hz	62175	1.25	4.80	2.5	115
24 VAC 60 Hz	62182	0.97	5.73	3.21	138
100 VAC 60 Hz	62171	18.72	1.25	0.60	125
110 VAC 50 Hz	62185	32.33	1.00	0.52	110
115 VAC 60 Hz	62212	23.07	1.14	0.58	131
200 VAC 60 Hz	62172	75.37	0.64	0.31	128
220 VAC 50 Hz	62189	126.4	0.50	0.27	110
230 VAC 60 Hz	62187	92.04	0.54	0.28	131
380 VAC 50 Hz	62177	379.3	0.27	0.14	124
460 VAC 60 Hz	62177	379.3	0.27	0.14	124
12 VDC	62174	4.17	2.94	2.11	35
24 VDC	62176	15.92	1.52	1.07	36
32 VDC	62185	32.33	0.98		31
72 VDC	62189	126.4	0.55		40
125 VDC	62178	485.9	0.24		30
250 VDC	62180	2212	0.11		28

For AC valves the maximum possible wattage or power consumption is the volt-amp figure given in the tables. This is the "inrush" condition or the high momentary amperage surge occurring when the coil is energized. After the valve actuates, the current is reduced to a steady state referred to as "holding" current. The maximum possible holding power consumption is the holding volt-amps. This can be calculated by multiplying the voltage times the holding current given in the tables as follows:

Holding volt-amps = Voltage x Holding Current
and
Inrush volt-amps = Voltage x Inrush Current

DC coils do not produce a inrush current higher than the holding current, i.e. the holding current and inrush current are the same. Power consumption or wattage for DC coils can be calculated as follows:

Watts = Voltage x Current

Double Wound Class H coils for 1004, 2004, 7004, 8004, and 16,004 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
100 VAC 60 Hz	63603	2.32 p 46.13 s	25.0	0.37	2500
110 VAC 50 Hz	62163	3.52 p 82.39 s	21.5	0.30	2365
115 VAC 60 Hz	62161	3.32 p 65.41 s	19.0	0.30	2185
200 VAC 60 Hz	63596	10.23 p 173.9 s	11.05	0.19	2210
220 VAC 50 Hz	62162	13.39 p 403.0 s	10.0	0.17	2200
230 VAC 60 Hz	62160	12.82 p 387.6 s	10.1	0.17	2323
460 VAC 60 Hz	62168	68.8 p 2710 s	3.7	0.058	1702
24 VDC	62164	2.23 p 46.92 s	6.8	0.54	163
32 VDC	62164	2.23 p 46.92 s	6.8	0.54	163
48 VDC	62161	3.32 p 65.41 s	10.0	0.70	480
125 VDC	62166	8.65 p 461.7 s	14.0	0.24	1750
250 VDC	62168	68.8 p 2710 s	3.1	0.90	775

Class H coils for 13,000, 30,000, 40,000, and 50,000 Series Valves

Voltage	Part Number	Resistance +/-10%	Inrush Amps	Holding Amps	Volt-Amps
100 VAC 60 Hz	62213-10	7.36	4.3	0.75	430
110 VAC 50 Hz	62213-11	9.91	3.6	0.65	396
115 VAC 60 Hz	62213-1	9.17	3.7	0.66	426
200 VAC 60 Hz	62213-9	28.43	2.5	0.42	500
220 VAC 50 Hz	62213-12	41.50	1.5	0.26	330
230 VAC 60 Hz	62213-5	27.00	2.2	0.38	506
460 VAC 60 Hz	62213-7	111.4	1.05	0.20	483
12 VDC	62216-1	3.10		4.0	48
24 VDC	62216-2	11.53		2.0	48
48 VDC	62216-6	47.82		1.1	53
125 VDC	62216-8	238.4		0.5	63
250 VDC	62216-10	961.8		0.25	63

NOTE: 50 HZ coils are not available on the 30000, 40000, and 50000 series valves above 1500 psig

NOTE: At a particular voltage 60 HZ coils can only be used on 60 HZ and 50 HZ only on 50 HZ.

Note that the 12,000/14,000 series valves use some of the same class H coils as the HS/JJ/500 series. Since the magnetic circuits external to the coil are substantially different between these two groups of valves the coil performance also differs. This means that those coils which are common to both groups of valves will operate at different voltages in each valve group. For instance, a coil that is used as a 230/60 hz coil in the HS/JJ/500 valve group is used as a 460/60 hz coil in the 12,000/14,000 valve group and a coil that is used at 24 VDC in the HS/JJ/500 group is used at 115/60 hz in the 12,000/14,000 group. The DC coils used in the 12,000/14,000 group are the same as those used in the 1000/2000/3000/4000/5000/15000/16000 group and operate at the same voltages.

When voltage is removed from a coil the magnetic field collapses rapidly and its energy is converted into a voltage surge (sometimes referred to a back EMF). This surge travels back up the power lines and can have peak voltages of several thousand volts. Usually it is dissipated harmlessly in the form of a spark across switch contacts. Some types of electrical systems, particularly computer components and some instruments, can be adversely affected. In these types of systems surge suppression or isolation using relays is recommended.

Types of Insulation

The coils used in the Atkomatic line are of 2 types of construction:

1) A molded construction. These coils are wound on a Nylon bobbin and encapsulated with a polyester plastic. These types of coils are hermetically sealed and suitable for use over a wide temperature range and in humid conditions. The leads are 18 gage stranded wire and are 24 inches in length. They are available in 2 temperature classifications, class H and B. The B class is used extensively in the lower cost bronze valves mainly for competitive purposes and the H class in the more expensive stainless steel valves and where elevated temperatures are involved. All molded coils are Underwriters Laboratories recognized components.

2) A fiberglass wrapped construction. These coils are wound and then wrapped with strips of fiberglass cloth and dipped in a resin to bind the assembly. The leads are 18 gage stranded wire and are 18 inches in length. This style coil is used only in double wound coils and all of these are class H. Its usage in all other style valves has been replaced with the molded coils.

Class H coils only are recommended for use in the cast iron NEMA 7 coil housings used on the 2000, 3000, 4000, 5000, 6000, 8000, and 15,000 series valves.

Insulation for coils is rated by the capability to withstand elevated temperatures. Categories common in the electrical industry include:

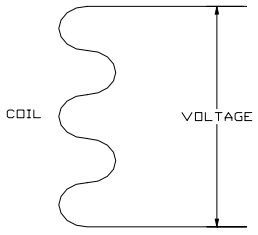
Class A insulation: 105 C temperature rise above an ambient of 25 C
Class B insulation: 130 C " " " "
Class F insulation: 155 C " " " "
Class H insulation: 180 C " " " "

These classes indicate a temperature that the insulation is capable of surviving for a specified time. This specified life is not set by any generally recognized standard but is determined by individual manufactures. A typical value used in the industry today is 30,000 hours with all operating parameters at their nominal conditions (voltage at nominal, ambient and fluid at room temperature, etc.). Refer to the section on each valve and the section on creating the catalog number (page 7) for insulation class selection guidelines.

These temperatures are for the coil insulation and windings, not the temperature of the fluid media flowing through the valve. There are several factors, which govern the temperature of a coil in service including the fluid temperature, ambient temperature, duty cycle, coil housing, as well as the coil design itself.

All normally closed valves are designed to function with a voltage applied that is within +/- 10% of the nominal value. Normally open valves require a minimum of the voltage for proper operation and can withstand an overvoltage of +10% without damage to the coil (although intermittent operation is required to maintain cool coil temperatures for operation).

All single wound coils have the following wiring diagram:



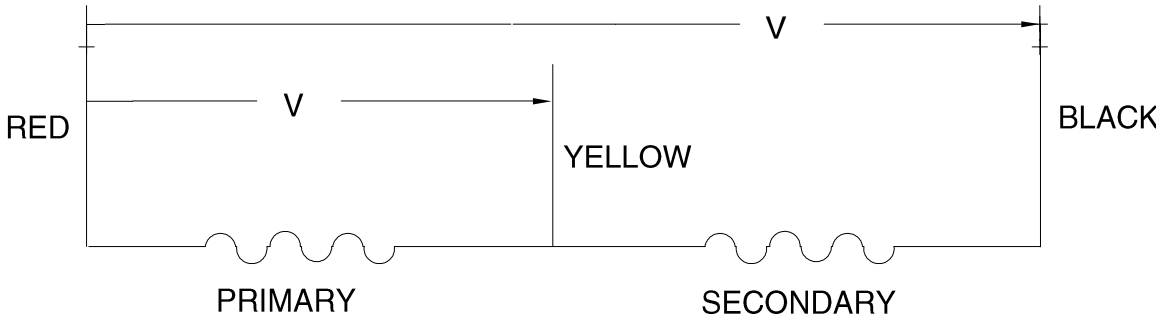
FOR PROPER VALVE OPERATION POWER TO THE COIL SHOULD BE CONTROLLED WITH A DOUBLE POLE SWITCH

POWER SUPPLY CIRCUITS THAT CONTAIN DIODES OR CAPACATORS CAN DELAY VALVE CLOSURE

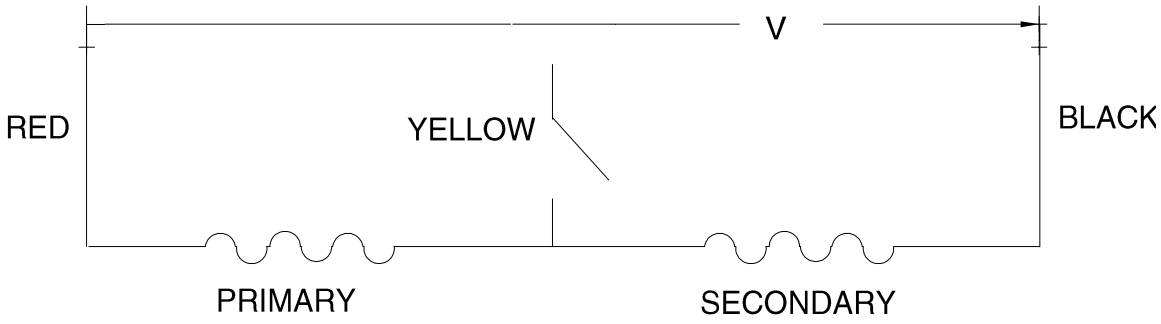
There is no polarity; i.e. either wire can be positive or negative.

Double Wound Coils

The double wound coils consist if two coil windings within the same encapsulation. The windings are the primary, which consists of a heavy wire coil with relatively few turns and a low resistance and a secondary coil winding of many turns of fine wire with a high resistance. To open the valve, power is initially applied across the primary winding (red to yellow) and the combination of primary and secondary circuits in series (red to black) as shown schematically:



The high current through the primary circuit generates a strong magnetic field that actuates the valve. This current is sufficiently high that the coil would overheat if the current were allowed to continue for more than a few minutes. After a fraction of a second, (the delay is caused by the dropout time of the relay) the yellow lead is disconnected and the voltage remains applied only across the combination of the primary and secondary windings in series. The low current through both windings produces a lower strength magnetic field that is sufficient to hold the valve open. The low current produces only modest heating of the coil allowing the valve to remain actuated open continuously. This steady state condition is shown schematically:



Current production of these coils utilizes a fiberglass wrapping that is dipped in a resin to affect a seal. This insulation is rated class H that means that it can withstand a 180C temperature rise continuously.

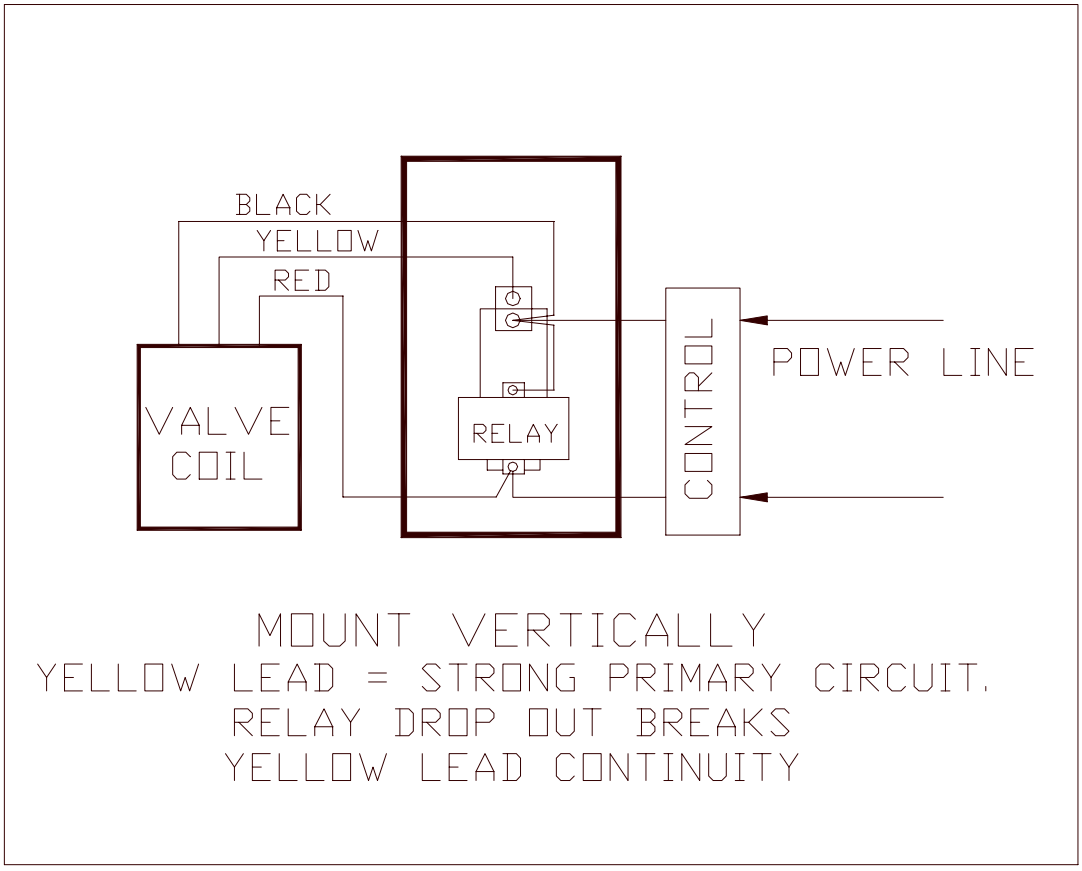
The double wound coils require the use of a time delay relay to disconnect the primary coil winding after the valve has actuated. This delay is on the order of ½ second. In some cases the customer supplies this timing device and Circle Seal does offer a normally closed relay for this purpose. It is ordered as a separate line item as follows:

R-XXX

The voltage is coded in the same manner as the valve catalog number that the relays are used with. The following voltages are available:
100 VAC 60 Hz, 110 VAC 50 Hz, 115 VAC 60 Hz, 200 VAC 60 Hz, 220 VAC 50 Hz, 230 VAC 60 Hz, 460 VAC 60 Hz, 24 VDC, 32 VDC, 48 VDC, 125 VDC, and 250 VDC.

The relays are an encapsulated mercury tube design and are supplied mounted in a NEMA 1 electrical enclosure.

Wiring Diagram for the Relay



Note: The maximum cycle rate for double wound coils is 10 cycles per minute.

Double wound coils are used in the following valve series (also included for comparison are performances with both single and double wound coils):

1000 Series Direct Lift Normally closed only

1000 1/8" & 1002 1/8"	Single wound coil
1100 ¼" & 1102 ¼"	0 – 2500 psi, depending on orifice size, fluid, and voltage
1004 1/8" & 1009 1/8"	Double wound coil
1104 ¼" & 1109 1/8"	0 – 5000 psi, depending on orifice size, fluid, and voltage

2000 Series Direct Lift Normally closed only

2000 1/8" to	Single wound coil
2300 ½"	0 – 2500 psi, depending on orifice size, fluid, and voltage
2004 1/8"	Double wound coil
2304 ½"	0 – 10000 psi depending on orifice size, fluid, and voltage

7000 Series Pilot Operated Normally closed only

7004 ¼"	
7104 3/8"	Double wound coil
7204 ½"	0 – 6000 psi depending on fluid and voltage

8000 Series Pilot Operated

Normally closed

8000 ¼" to	Single wound coil
8710 2"	0 – 1500 psi depending on fluid and coil voltage (AC or DC)
8004 ¼"	Double wound coil
8604 1 ¼"	0 – 4000 psi depending on fluid and coil voltage (AC or DC)

Normally open

8001 ¼"	Single wound coil
8711 2"	0 – 1500 psi depending on fluid and coil voltage (AC or DC)

16000 Series Direct Lift

Normally closed

16000 ¼"	Single wound coil
16400 1"	0 – 2500 psi depending on orifice size, fluid
16004 ¼"	Double wound coil
16404 1"	0 – 6000 psi depending on orifice size, fluid, and voltage

Normally open

16001 ¼"	Single wound coil
16401 1"	0 – 1500 psi depending on orifice size, fluid, and voltage

COIL HOUSINGS

The National Electrical Equipment Manufacturers Association defines the various types of electrical enclosures used as follows:

NEMA 1 enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment in locations where unusual service conditions do not exist. They provide a degree of protection against limited amounts of falling dirt but will not prevent the entry of dust or liquids. They prevent the insertion of a straight rod of a specified diameter into the equipment cavity of the enclosure.

NEMA 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water.

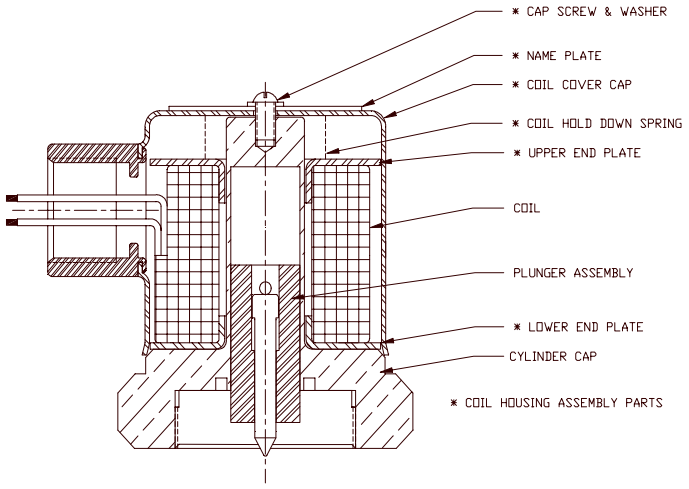
NEMA 7 enclosures are used in hazardous locations and are designed to contain an internal explosion without causing an external hazard. Type 7 enclosures are intended for indoor use and are capable of withstanding the pressures resulting from an internal explosion of specified gasses and contain such an explosion sufficiently that an explosive gas-air mixture existing in the atmosphere surrounding the enclosure will not be ignited. In operation, external surfaces do not reach temperatures capable of igniting explosive gas-air mixtures in the surrounding atmosphere.

NEMA 9 enclosures prevent the entrance of dust and external surfaces do not reach temperatures capable of igniting explosive dust-air mixtures in the surrounding atmosphere. Type 9 enclosures are intended for indoor usage.

In the Atkomatic line, combination NEMA 7 or 9 and 4 enclosures combine the features of waterproof and explosion proof housings and are intended for either indoor or outdoor usage. Additionally, the NEMA 4 housings meet the requirements of NEMA 2 and 3 that provide lesser degrees of protection from water.

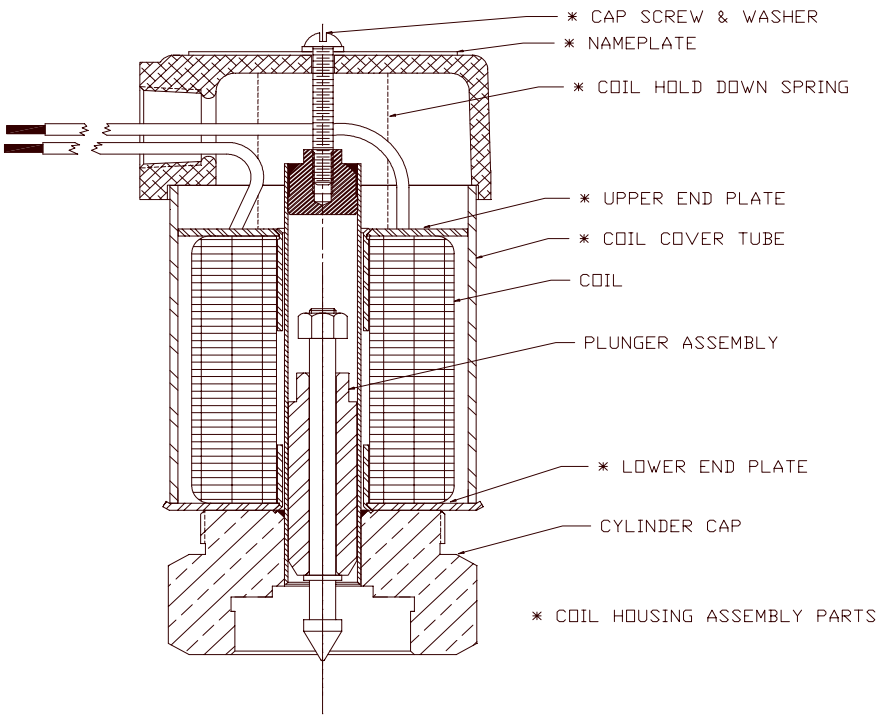
All electrical connections are ½" NPT

Note: Plungers, coils, and cylinder caps are not considered to be part of coil housing subassemblies, but are shown in some of the following cross sections.

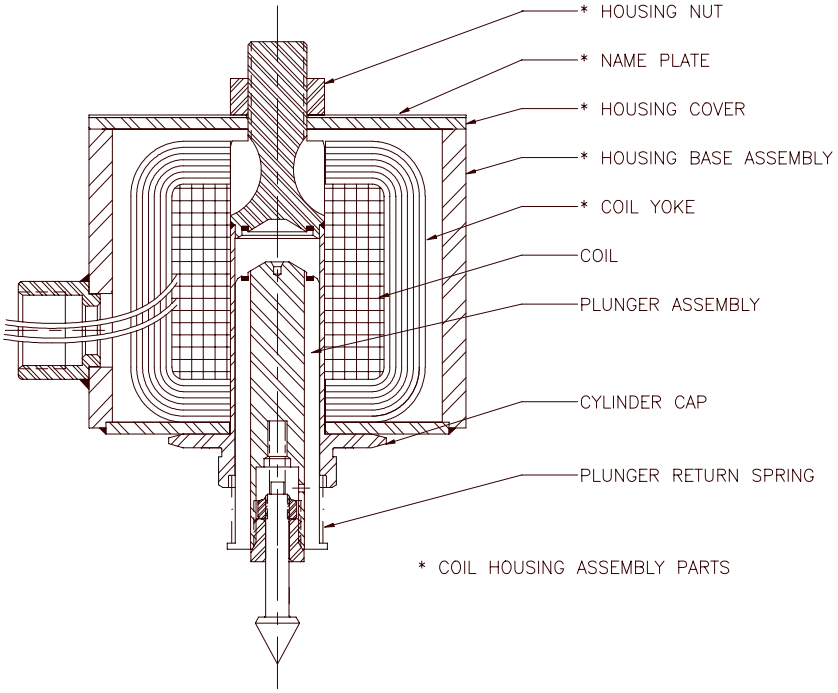


Standard NEMA 1 coil housing option for the following valve series:
JJ, HS, and 500

(See page 22 for a cross section of the NEMA 1 housing used on normally open 500 series valves)

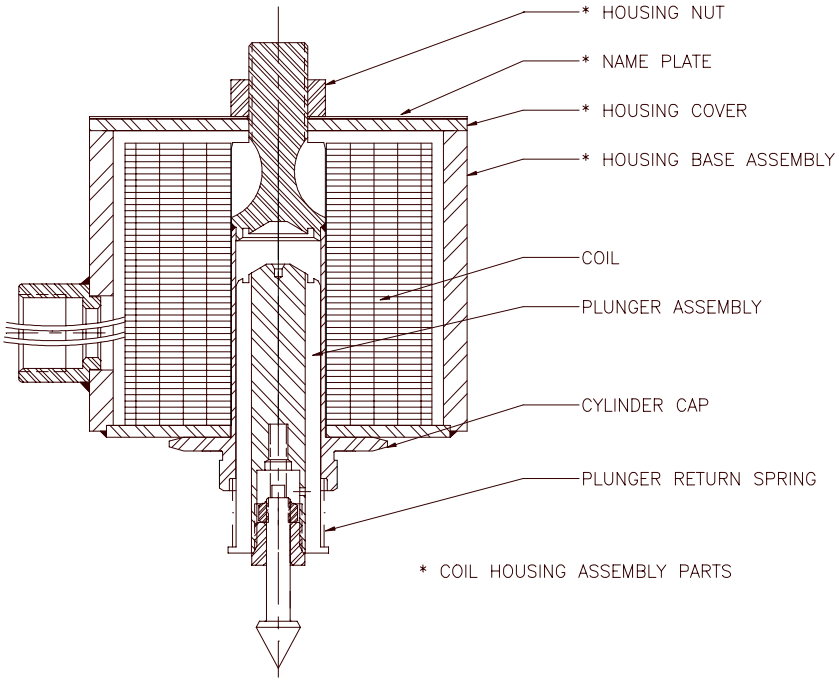


Standard NEMA 1 coil housing option for the following valve series:
2000, 3000, 4000, 5000, 6000, 7000, 8000, 15,400, 15,800, 16,000



Shown with a AC coil
Standard NEMA 1 coil housing option for the following valve series:

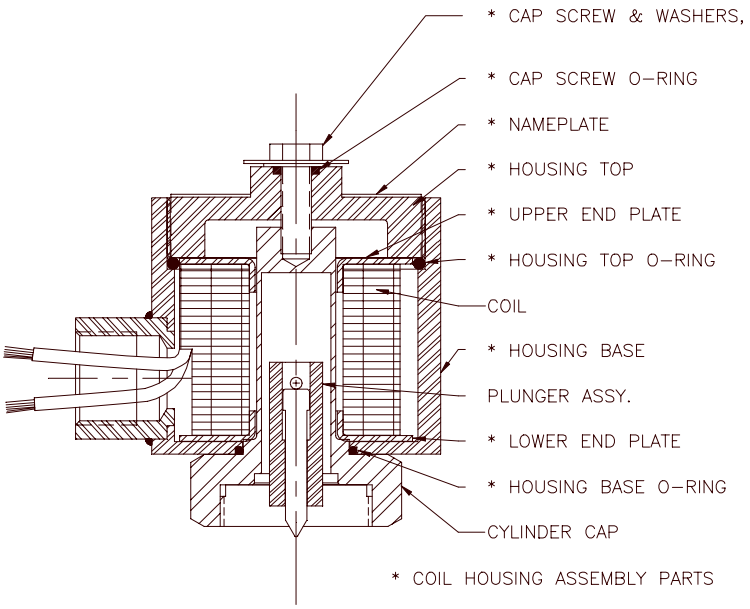
13,000, 30,400, 30,800, 35,000, 40,000, and 50,000



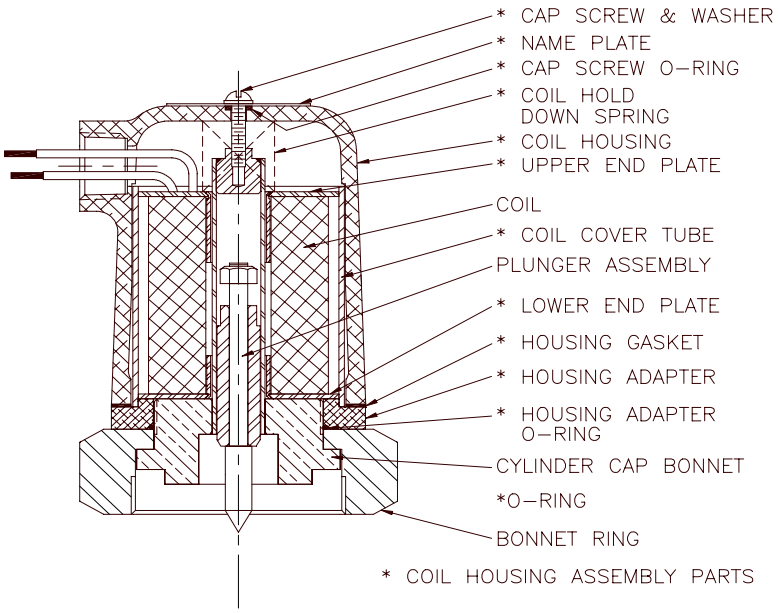
Shown with a DC coil

Standard NEMA 1 coil housing option for the following valve series:

13,000, 30,400, 30,800, 35,000, 40,000, and 50,000

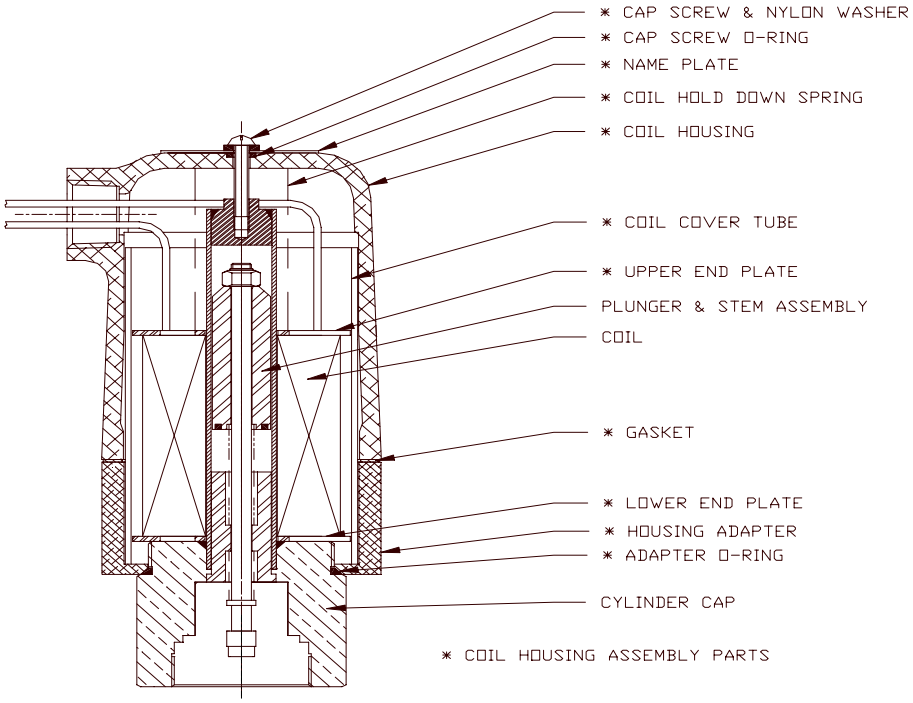


Waterproof NEMA 4 coil housing option for the 500 valve series (is standard on the 15-794 valve).



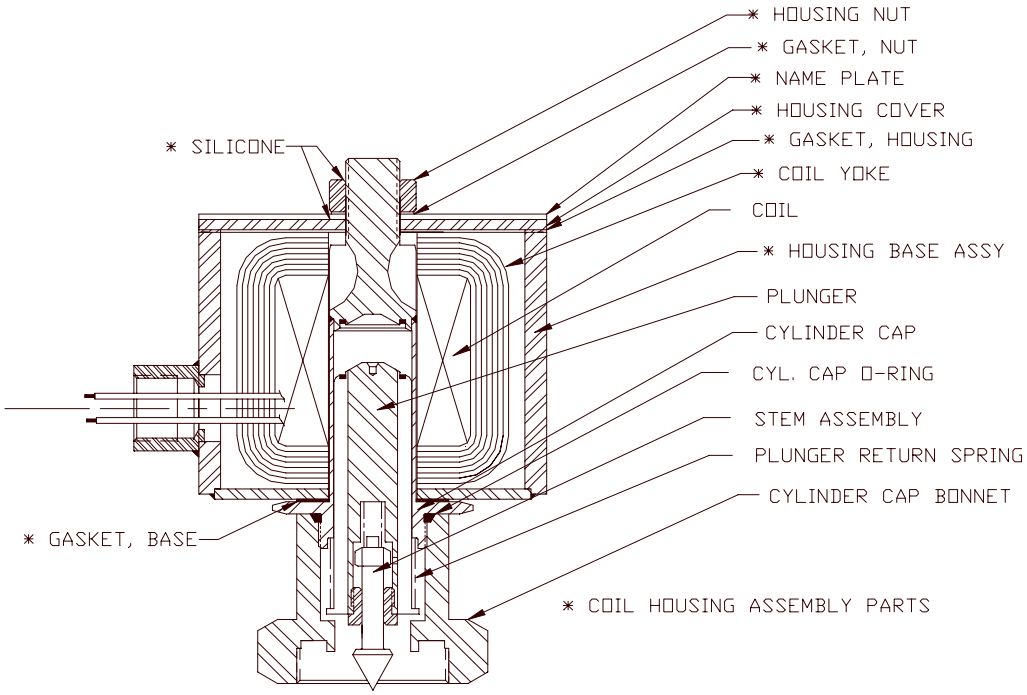
Waterproof NEMA 4 coil housing option for the following normally closed valve series:
2000, 3000, 4000, 5000, 6000, 7000, 8000, 15,400, 15,800, 16,000

Note that there are some minor differences among housings used on these valves



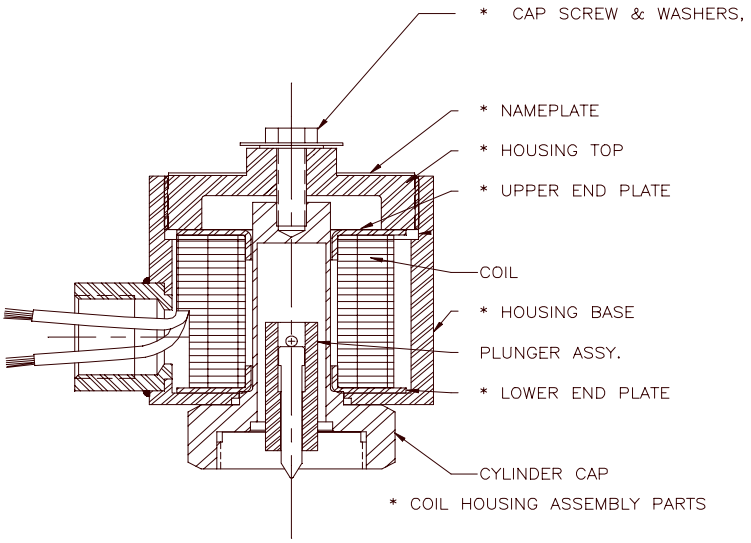
Waterproof NEMA 4 coil housing option for the following normally open valve series:
3001, 4001, 5001, 6001, 8001, 15,401, 15,801, 16,001

Note that there are some minor differences among housings used on these valves

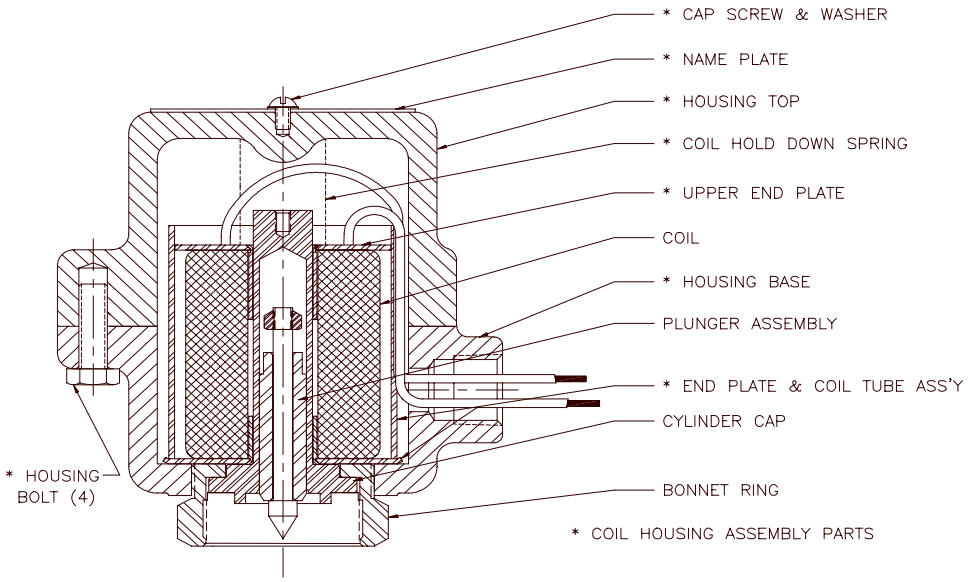


Waterproof NEMA 4 coil housing option for the following valve series:

13,000, 30,400, 30,800, 35,000, 40,000, and 50,000

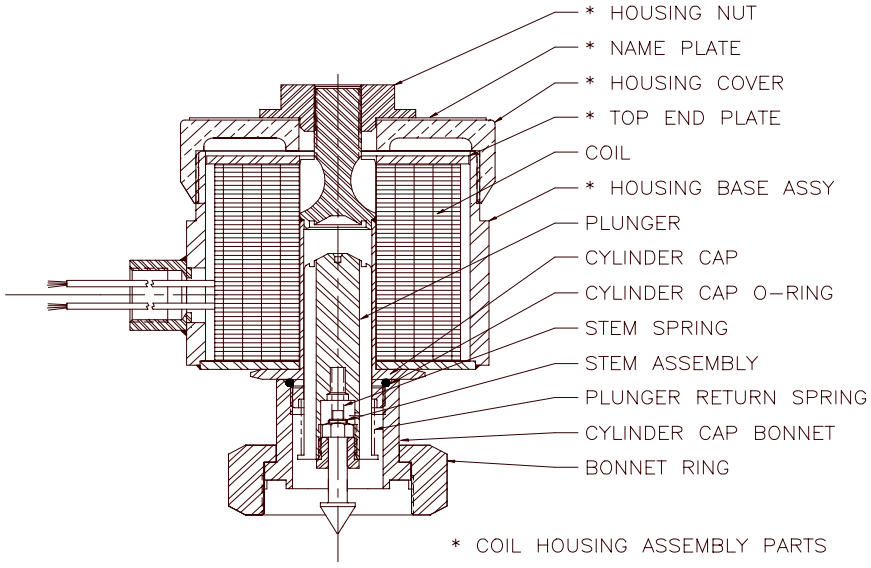


Explosion proof NEMA 7 & 9 coil housing option for 500 valve series.



Explosion proof NEMA 7 & 9 coil housing option for the following valve series: 2000, 3000, 4000, 5000, 6000, 7000, 8000, 15,400, 15,800, 16,000

There are some differences among housings used on these valves. For instance, the 2000 series housings do not use the 4 housing bolts and the housing top is threaded to the top of the cylinder cap. The cap screw & washer is also replaced with a nut that is threaded to the cylinder cap.



Explosion proof NEMA 7 & 9 coil housing option (Shown with a DC coil) for the following valve series: 13,000, 30,400, 30,800, 35,000, 40,000, and 50,000

Note: These NEMA 7 housings are made into combination waterproof & explosion proof NEMA 4 & 7 housings by the application of silicone sealant to the outside of the joints.

Coil Housings for Hazardous Locations

Explosion proof coil housing on Atkomatic valves are NEMA 7 & 9 enclosures and meet the requirements for Division I, Class I, groups C & D.

The National Electrical Code defines various types of hazardous areas and classifies them by class, group, and division. The Code is maintained by the National Fire Protection Association and is recognized as the standard for electrical installations in the United States. Basically, class defines a distinction between types of explosive hazards in the atmosphere. Class I atmospheres contain hazardous vapors of volatile chemicals and class II atmospheres contain hazardous concentrations of dust or particulate that are potentially explosive. Each of these class designations is subdivided into groups that identify specific types of hazardous materials present. These are:

Class I group classifications:

Group A. Atmospheres containing acetylene

Group B. Atmospheres containing hydrogen or vapors of equivalent hazard such as butadiene, ethylene oxide, propylene oxide, and acrolein.

Group C. Atmospheres such as ethyl ether and ethylene.

Group D. Atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naptha, and propane.

Class II group classifications:

Group E. Atmospheres containing combustible metal dusts including aluminum, magnesium, and their alloys.

Group F. Atmospheres containing combustible carbonaceous dusts including carbon black, charcoal, and coal.

Group G. Atmospheres containing other combustible dusts including flour, grain, wood, or plastics.

Industrial facilities are divided into two Divisions as follows:

Division I. These are areas where any of the hazardous atmospheres as defined above are present in the normal operation. For solenoid enclosures, this requires a housing that meets the requirements of NEMA 7 or 9.

Division II. These are areas where either:

1) Where volatile and flammable liquids or gases are handled and processed but where the vapors are confined within closed containers or systems from which they can only escape in case of accidental rupture or breakdown.
2) Where ignitable concentrations of vapors are prevented by mechanical ventilation.

For solenoids, explosion proof NEMA 7 or 9 enclosures are not required by the National Electric Code for these Division II locations.

The National Electrical Manufactures Association (NEMA) defines physical requirements of solenoid enclosures for use in hazardous locations in NEMA standard # 250 (some of the requirements are in referenced Underwriters Laboratories standards ANSI/UL 698 or 1002).

Cv Flow Coefficients & Valve Sizing

The flow coefficient, Cv, is the volume (in gallons) of water at 60F that will flow per minute through a valve with a pressure drop of 1 psi across the valve. Numerically this definition can be expressed as:

$$Cv = F/\sqrt{\Delta P}$$

The use of the flow coefficient offers a standard method of comparing valve capacities and sizing valves for specific applications that is widely accepted by industry. The general definition of the flow coefficient can be expanded into equations modeling the flow of liquids, gases and steam as follows:

Liquid flow

$F = Cv \sqrt{(\Delta P / S)}$ $Cv = F / \sqrt{(\Delta P / S)}$ $\Delta P = S (F / Cv)^2$

Gas flow

When the downstream pressure (P2) is greater than 53% of the inlet pressure (P1), the following formulae apply:

$F = 1391 Cv \sqrt{(P2 \Delta P / S T)}$ $Cv = F / 1391 \sqrt{(P2 \Delta P / S T)}$ $\Delta P = ST (F / 1391 Cv)^2 / P2$

When the downstream pressure is equal to or less than *53% of the inlet pressure (P1), the following formulae apply:

$F = 695.4 Cv P1 / \sqrt{(S T)}$ $Cv = F \sqrt{(S T)} / 695.4 P1$ $P1 = F \sqrt{(S T)} / 695.4 Cv$

Steam flow

When the downstream pressure (P2) is greater that 57% of the inlet pressure (P1), the following formulae apply:

$F = 3 Cv \sqrt{(P2 \Delta P / X)}$ $Cv = F / 3 \sqrt{(P2 \Delta P / X)}$ $\Delta P = X (F / 3 Cv)^2 / P2$

When the downstream pressure (P2) is equal or less than 57% of the inlet pressure (P1), the following formulae apply:

$F = 3 Cv P1 / 2 \sqrt{(X)}$ $Cv = 2 F \sqrt{(X)}/ 3 P1$ $P1 = 2 F \sqrt{(X)} / 3 Cv$

Note: Equations are for saturated steam

Definitions

Cv = Flow coefficient or flow capacity rating of valve
F = Rate of flow in USGPH for liquids, SCFH for gases, and LBS/hr for steam.
T = Absolute temperature in degrees Rankine (460 + degrees Fahrenheit)
S = Specific gravity (relative to air or water)
P1 = Inlet pressure, PSIA
P2 = Downstream pressure, PSIA

ΔP = Pressure drop across the valve, PSI
X = Quality of steam in decimal form. i.e. 80% quality = 0.80
USGPM = U.S. gallons per minute
SCFH = Standard cubic feet per hour
PSI = Pounds per square inch
PSIA = Pounds per square inch absolute (PSIA = PSI + 14.7)

***** The 53% is accurate for air, nitrogen, hydrogen, and oxygen. The values for other fluids will vary slightly. For instance: helium and argon 49%, methane and carbon dioxide 55%.

Cv Flow Coefficient Chart for Atkomatic Valves

	Angle Type Valve – Barstock Body			Globe Type Valve – Cast Body					
Valve Orifice Size	1000 2000 50000	7004	14000	JJ HS 500 15400	4000 5000 6000 30400	3000	12000	8000 15800 30800	16000
1/32”	.020	-	-	-	-	-	-	-	-
3/64’	.056	-	-	-	-	-	-	-	-
1/16”	.093	-	.093	-	-	.093	-	-	.093
3/32”	.22	-	.22	-	-	.22	-	-	.22
1/8”	.44	-	.40	-	-	.44	-	-	.44
5/32”	-	-	-	-	-	-	-	-	-
3/16”	.72	-	-	-	-	.72	-	-	.72
7/32”	-	-	-	-	-	-	-	-	-
¼”	-	1.0	-	1.4	1.4	-	-	1.1	-
3/8”	-	2.0	-	2.7	2.7	-	2.8	2.5	-
½”	-	2.0	-	3.5	3.5	-	4.2	5.1	-
¾”	-	-	-	7.5	8.4	-	8.5	7.5	-
1”	-	-	-	9.1	9.5	-	8.9	12.5	-
1 ¼”	-	-	-	19.5	19.5	-	-	21.0	-
1 ½”	-	-	-	21.0	21.0	-	-	21.5	-
2”	-	-	-	46.0	43.0	-	-	45	-
2 ½”	-	-	-	-	63.0	-	-	-	-
3”	-	-	-	-	71.0	-	-	-	-

Factory Leakage Standards

GAS INTERNAL LEAKAGE STANDARD

SEAT MATERIAL	TEST PRESSURE, PSIG					
	1 - 25	26 - 100	101 - 500	501 - 1500	1501 - 3000	OVER 3000
Pilot Operated & Semi-Direct Lift Valves						
Rubber Pilot & Disc	B. T.	B. T.	B. T.	B. T.	B. T.	B. T.
For 500 and 15400 valve series both N.O and N.C.						
Teflon pilot & Teflon Disc	500 sccm	100 sccm	B. T.	B. T.	B. T.	B. T.
For 4000, 5000, 6000, 7000, 8000, 12000, 15800, and 30000 valve series both N.O. and N.C.						
Teflon Pilot & Teflon Disc	100 sccm	10 sccm	B. T.	B. T.	B. T.	B. T.
Metal Pilot & Teflon/KEL-F/Rubber Disc	1500 sccm	1500 sccm	1000 sccm	500 sccm	500 sccm	500 sccm
Metal Pilot & Metal Disc	2000 sccm	2000 sccm	3000 sccm	3000 sccm	3000 sccm	3000 sccm
KEL-F Pilot & KEL-F Disc	500 sccm	250 sccm	100 sccm	10 sccm	B. T.	B. T.
Direct Lift Valves						
Rubber Seat	B.T.	B.T.	B.T.	B.T.	B.T.	B.T.
Plastic Seat	50 sccm	5 sccm	B.T.	B.T.	B.T.	B.T.
Metal Seat	1000 sccm	1000 sccm	1500 sccm	1500 sccm	1500 sccm	1500 sccm

DEFINITIONS: Rubber: Elastomer (Buna, Viton, EPR, etc.)

B. T.: Bubble tight (less than 10 cc/hr leakage)

SCCM: Standard cubic centimeters per minute

Note: Leakage values with Teflon and Kel-F seats are after applicable after the valve has been cycled in production acceptance testing. Typically on clean fluid applications with Teflon or Kel-F seats leakage decreases with number of cycles.

LIQUID INTERNAL LEAKAGE STANDARD

SEAT MATERIAL	TEST PRESSURE, PSIG					
	1 - 25	26 - 100	101 - 500	501 - 1500	1501 - 3000	OVER 3000
Pilot Operated & Semi-Direct Lift Valves						
Rubber Pilot & Disc	0	0	0	0	0	0
Teflon Pilot & Teflon Disc	5 cc/m	*	0	0	0	0
Metal Pilot & Teflon/KEL-F/Rubber Disc	5 cc/m	5 cc/m	5 cc/m	5 cc/m	5 cc/m	5 cc/m
Metal Pilot & Metal Disc	10 cc/m	10 cc/m	10 cc/m	10 c/m	10 cc/m	10 cc/m
KEL-F Pilot & KEL-F Disc	5 cc/m	5 cc/m	0	0	0	0
Direct Lift Valves						
Rubber Seat	0	0	0	0	0	0
Plastic Seat	2 1/2 cc/m	*	0	0	0	0
Metal Seat	5 cc/m	5 cc/m	5 cc/m	5 cc/m	5 cc/m	5 cc/m

* 5 cc/m to 75 psig
0 75 to 100 psig

DEFINITIONS: Rubber: Elastomer (Buna, Viton, EPR, etc.)

0: No leakage visible to the naked eye

cc/m: Cubic centimeters per minute

Note: Leakage values with Teflon and Kel-F seats are after applicable after the valve has been cycled in production acceptance testing. Typically on clean fluid applications with Teflon or Kel-F seats leakage decreases with number of cycles.

Response Times

Solenoid valves are relatively quick operating when compared to other types of valves against which they compete. Most open and close operations occur in fractions of a second. This compares to seconds that valves such as motor operated ball valves require. Generally speaking, solenoid valves will respond much more rapidly on a gas, particularly a low molecular weight gas, than a liquid. Liquids, due to their resistance to compression, much completely displace around a plunger or piston that is traveling through the media. In a solenoid valve this frequently means that as a piston strokes, the volume of fluid that it displaces must pass through the pilot orifice or through the sum of the bleed orifice and piston ring gap(s). This takes a relatively long length of time particularly at low pressure drops. Liquids of high viscosity such as hydraulic oils will damp motions of parts in valves and result in slowed opening and closing times that valves used on lower viscosity fluid such as gasoline or liquid nitrogen.

When a solenoid is first energized there is a time delay caused by inductance which opposes the immediate build-up of current and delays the formation of the magnetic field This time delay is small compared to the motions of the valve components. Motions of components in a solenoid valve can be divided into two distinct categories: 1) the motion of the plunger or plunger/stem assembly (in a direct lift valve this is the only valve unit motion), and 2) motion of the piston as it strokes through it's travel. The plunger motion is relatively quick, typically occurring in a matter of tens of milliseconds. The motion of the piston is relatively much slower for the reasons given in the proceeding paragraph. Times for the piston motion can range in the low hundreds of milliseconds for opening depending on valve size, fluid pressure, and viscosity. Times for closing can range from a few hundred milliseconds on up depending on valve size, pressure drop across the valve caused by fluid flow, and fluid viscosity. For large valves in the 2 to 3" range on liquids at low flowrates, closing times can be several seconds.

The 35,000 series valve was designed for rapid closing and has been tested for opening and closing times with several sizes on both air and water. It utilizes an external pilot, which produces a faster closing response than internally piloted valves. Opening times of 150 milliseconds and closing times of 100 milliseconds have been measured with several sizes on applications with gaseous media and pressure drops of 500 to 1000 psid across the valves.

Quantitative response time data has not been generated for most of the Atkomatic valve line – consult the Sales Department at the factory for the availability of testing.

Life Cycle Capability

Atkomatic valves are a rugged and robust product that are designed to serve a wide variety of demanding applications in markets including turbine manufacturing, chemical process, electric and gas utilities, industrial gasses, metal fabrication, food processing, oil refining, cryogenic transfer, and heating and air conditioning. Within these applications these is a vast diversity of fluid types, concentrations, degree of contamination, operating pressures, fluid and ambient temperatures, coil voltages, electrical enclosure types, and cycle rates as well as valve type and size. This makes it impractical to establish any meaningful estimates of product lifetime or number of cycles that can be generally expected. This also causes the results of any testing conducted to be applicable to one specific or a very limited number of applications. Due to the limited usefulness of such testing and the expense associated with running life cycle testing over a long period of time the factory has not conducted testing to determine life cycle capability for particular applications. Additionally it has never been economically attractive for a customer to fund such a program. In all cases where life cycle capability has been a question trials in the field using the product in the application has been the preferred method of determining product duration.

In some applications, such as oil at ambient temperature, modest pressures, and low cycle rates, valves have lasted for millions of cycles and for dozens of years without difficulty. In other applications with dry gasses and high cycle rates, valves can wear after a matter of days and thousands or hundreds of thousands of cycles. Generally, liquids providing lubrication and damping of motion will allow more extended cycle life than a dry gas. Corrosive fluids and higher temperatures both act to reduce cycle life. Certain types of applications that are known to be extremely severe, such as continuous and very rapid cycle rates with non-lubricated air, will result in very limited valve life expectancy.

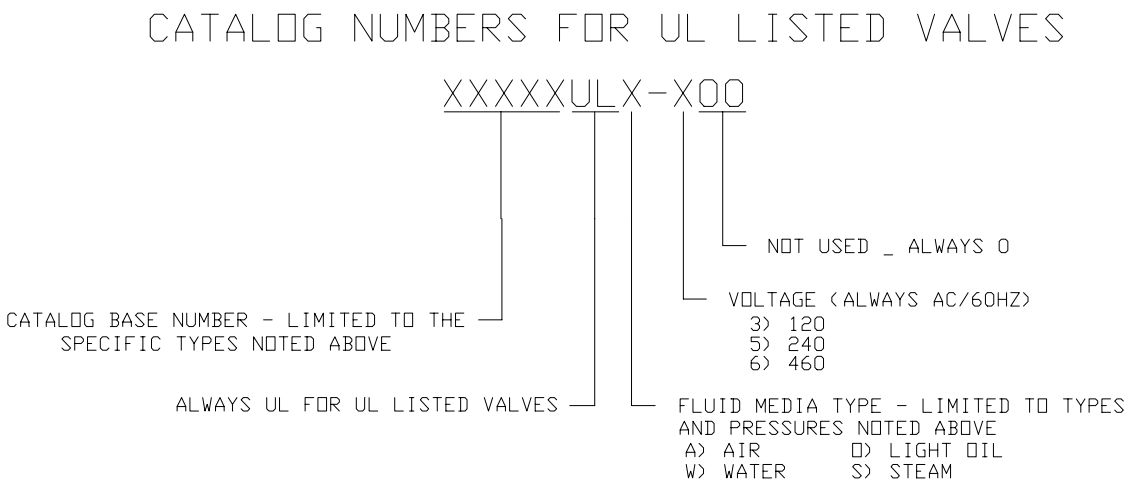
Many demanding applications are handled satisfactorily with periodic maintenance involving inspection and/or replacement of internal parts. Appropriate maintenance intervals are determined by field experience on an individual application basis. Standard repair kits that contain all parts subject to wear are available for all the valve series (see page 6). For the most demanding applications, high cycle plunger assemblies are also available for most valve series (see page 107).

UL & CSA Listings and Approvals

Underwriters Laboratories

General Purpose Catalog Valves

File Number	Catalog base no.	Size	Fluid, Pressure, Voltage (same for all of group)
		4000 & 5000 series Group	
MH11913	4008	¼" NPT	
"	4108	3/8" NP	Air, Water, Oil: 5 to 500 psig Fluid Temp to 66 C (5 to 300 psig for 5708)
"	4208	½" NPT	Saturated Steam 5 to 200 psig
"	4308	¾" NPT	Voltages: 120 vac, 60 Hz
"	4408	1" NPT	240 vac, 60 Hz
"	4508	1 ¼" NPT	480 vac, 60 Hz
"	4608	1 ½" NPT	Ambient temperature: 25 C
"	5708	2" NPT	
		15000 series	
"	15408	¼" NPT	Air, Water, Oil: 0 to 300 psig Fluid Temp to 66 C
"	15418	3/8" NPT	Saturated Steam 0 to 125 psig
"	15428	½" NPT	Voltages: 120 vac, 60 Hz
"	15438	¾" NPT	240 vac, 60 Hz
"	15448	1" NPT	480 vac, 60 Hz
			Ambient temperature: 25 C



Underwriters Laboratories

Specific Usage Project Valve

File Number	Project Valve Model Number	Fluid, Pressure, Voltage (same for all of group)
E104727	31820-436	Class I, Group B hazardous locations, General Purpose Liquid hydrogen: 0 to 250 psig Fluid Temp: -252 C Voltage: 115 vac, 60 Hz Ambient temperature: -40 to +40 C

Canadian Standards Association

Report Number	Project Valve Model Number	Fluid, Pressure, Voltage (same for all of group)
LR80415-3	35871-691	Natural gas, 2" flanges, 400 to 600 psig, 24 VDC, 40 C ambient
"	31830-706	Oil, ¾" NPT, 0 to 100 psig, 24 VDC, 40 C ambient
"	31861-697	Oil,1 ½" NPT, 0 to 1000 psig, 24 VDC, 40 C ambient
"	32820-714	Natural gas, ½" NPT, 0 to 1500 psig, 24 VDC, 40 C ambient
"	2100-707	Natural gas, ¼" NPT, 0 to 1000 psig, 24 VDC, 40 C ambient
"	35840-937	#2 Diesel, 1" Flanges, 0 to 950 psig, 24 VDC, 60 C ambient
		All are class 3228 01 for Hazardous Locations Class I, Group D, General Purpose Valves

In addition to these CSA approvals on specific valves, Special Acceptances from CSA are available on the explosion proof coil housing assemblies using 24 VDC coils only on the following series of valves:

13,000 ¼" through ½", distributor, normally open, and normally closed, stainless
30,400 ¼" through 3" N.C. and ¼ " through 1 1/2" N.O., bronze
30,800 ¼" through 2" N.C. and ¼" through 1 ½ " N.O., stainless
35,800 ¾" through 3", normally open and closed, stainless
40,800 ¼" through 1 ½", normally open and closed, stainless
50,000 1/8" through 1", normally open and closed (formally 13800 & 13900), stainless

VPI Switch Adjustment

1. Explosion proof NEMA 7 housings:
   Unscrew the housing cover from the base and valve body assembly by using a strap wrench on the aluminum housing cover. The 2 switches and mounting block are now exposed.

   Waterproof NEMA 4 and standard NEMA 1 housings:

   Unscrew the housing screw at the center of the housing bottom and remove the housing. . The 2 switches and mounting block are now exposed.

   WARNING: Do not allow the weight of the housing cover to pull on the switch leads. This can permanently damage the switches.

   Note: It is recommended that the following steps be performed with an ohmmeter connected directly to the lead wires of the position switches and the coil and cylinder cap removed so that the piston can be manually moved.

2. With the valve in the closed position, loosen the Closed Switch Adjustment Set Screw and gently slide the Closed Position Switch either up or down in the mounting block until the switch closes.

3. Move the piston up from the closed position and verify that the switch opens before the piston reaches the full open position.

4. Adjust the position of the switch as required until the conditions of steps 3 and 4 are met.

   Note: The position of the switches will vary from valve to valve as the exact position of the reed switch within the switch tube is subject to variation.

   Note: The switches can also be rotated in the mounting block. This can affect their sensitivity and in some cases aid in setting of the switches. Again, this is because there is variation in the position of the reed switch within the tube.

5. Tighten the Closed Switch Adjustment Set Screw.

6. With the valve in the open position, loosen the Open Switch Adjustment Set Screw and gently slide the Open Position Switch either up or down in the mounting block until the switch closes.

7. Move the piston down from the open position and verify that the switch opens before the piston reaches the fully closed position.

8. Adjust the position of the switch as required until the conditions of steps 6 and 7 are met.

9. Tighten the Open Switch Adjustment Set Screw.

10. Repeat the test of the switches with the valve assembled, the valves position controlled by energizing the coil, and with full system pressure. Repeat the above steps as required.

    Note: There are 2 set screws in the center of the plastic mounting block that hold the block to the magnet tube. Generally it is not necessary to loosen these set screws and adjust the position of the block relative to the magnet tube. If necessary to achieve switch positioning this can be done.

11. Replace the housing cover.

See page 105 for a drawing of the position indicator switch assembly.

Aligning Coil Housings

Some valves use cast iron explosion proof housings that are threaded directly to the valve body bonnets. This means that the angular position of the conduit fitting will be random when the housing is tightened down. These NEMA 7 housings are used on the following valve series:

2000, 3000, 4000, 5000, 6000, 7000, 8000, 12,000 (DC only),
14,000 (DC only), 15000, and 16000

When an explosion proof housing is ordered on any of these valves a set of 4 shims is included with the valve. The part number for this shim kit is 61427 (Atko p/n 229). If the angular alignment of the coil housing is not important the installation of the shims is not required.

Instructions for Installing Shims

1. Unscrew the cast iron coil housing assembly from the valves bonnet or cylinder cap.

   Note: If holding the valve in a vise, clamp on it either end to end or on the hex portion. Do NOT clamp across the width of the valve body. This can distort the valve body and prevent proper piston motion.

2. Place the shims over the cylinder cap tube so that they rest on the cylinder cap or bonnet.

3. Screw the cast iron coil housing back onto the bonnet or cylinder cap.

   Note: There are 4 shims with thickness of .005, .010, .015, and .020. Use any combination of these that allow the coil housing thread to bottom out such that the conduit fitting is oriented in the desired direction.

4. Repeat steps 2 and 3 as required.

   Note: Do not use more than .050 if shims (all those provided) or the explosion proof feature of the housing will be compromised.

All other valves with any type of coil housing can be aligned by loosening the screw or nut at the top of the coil housing, rotating the housing, then re-tightening the screw.

Field Modifications

Coil Replacement

All Atkomatic valves are designed for easy coil replacement without removing the valve from the line. This involves removal of 1 to 4 fastener(s) and does not break into fluid containment

AC to DC conversion

This can be accomplished on most valves in the field. The following valves require the installation Of an endplate with the DC coil when converting from AC operation: 13,000, 30,400, 30800, 35,000, 40,000, and 50,000 series.

The 12,000 and 14,000 series valves require the replacement of the complete coil housing assembly and the cylinder cap to switch from AC to DC or DC to AC operation. This conversion is not recommended for the field.

NOTE: Converting from AC to DC operation will usually result in lower operational pressures.

DC to AC conversion

This can be accomplished on some valves in the field. The following valves can be converted by just changing coils: HS, JJ, 1000, 2000, 7000, 15800, and 15-794. The following valves can be converted only in their normally closed configurations: 500, 3000, 4000, 5000, 6000, 8000, 15,400, and 16,000 series.

The following valves require shading rings for AC service which can only be installed at the factory and cannot be converted to AC service in the field:

- 12,000 & 14,000 series
- Normally open & closed 30,400, 30,800, 35,800, 40,800, and 50,000 series
- All versions of the 13,000 series
- Normally open 501, 3001, 4001, 5001, 6001, 8001, 15401, and 16,001 series.

For more detailed instructions on coil replacement see the Installation, operating, & troubleshooting instructions for the specific valve series. These are available from the factory, authorized distributors, and on the Internet at http://www.circle-seal.com/Atkomatic.html.

Converting from normally closed to normally open & visa versa

This conversion is not recommended for the field. It is possible to do at the factory, however it is usually more economical to procure a new valve.

Converting valves to operate at a higher operational pressure

This conversion is not recommended for the field. It is possible to do at the factory.

Converting valve to operate on a different fluid

This conversion is not recommended for the field. It is possible to do at the factory.

NOTE: All Atkomatic valves are built exclusively for the type of fluid and pressure indicated on the product nameplate. Attempted usage at higher pressures and/or different fluids can result in immediate or delayed valve malfunction (failure to open or close and/or leakage).

Valve Operation

Normally closed valves remain in the closed position when the coil is not energized or return to the closed position upon removal of voltage from the coil.

Normally open valves remain in the open position when the coil is de-energized or return to the open position upon removal of voltage from the coil.

1. Direct Lift Normally Closed

Opening

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw or bottom nut orifice thus initiating flow through the valve.

Closing

When voltage is removed from the coil leads, the magnetic field collapses. Gravity pulls both the plunger and stem down until the stem point seals off the orifice stopping flow through the valve.

2. Direct Lift Normally Open

Closing

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop, compressing the plunger return spring as it travels. The plunger assembly continues to move until the stem shuts off the valve orifice stopping flow through the valve.

Opening

When voltage is removed from the coil leads, the magnetic field collapses. The force exerted by the compressed plunger return spring then pushes the plunger up from its position at the center of the coil or adjacent to the magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw or bottom nut orifice thus initiating flow through the valve.

3. Pilot Operated Normally Closed

Opening

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw pilot orifice. Fluid from the cavity above the piston flows through the pilot orifice in the seat screw and through the drilled hole in the center of the piston to the downstream side of the valve. Pressure above the piston decreases since the pilot orifice is larger in diameter that the bleed orifice. Inlet pressure acting around the annular area outside of the main valve seat at the bottom of the piston then pushes the piston up, thus initiating flow through the valve.

Note that flow through the valve creating a pressure drop across the valve is required to hold the piston open. If flow is diminished the piston will move toward the closed position. To maintain the valve fully open a pressure drop of 3 to 5 psid across the valve is required.

Closing

When voltage is removed from the coil leads, the magnetic field collapses. Gravity pulls both the plunger and stem down until the stem point seals off the pilot orifice. Fluid flow from the valve's inlet side through the bleed orifice in the piston charges the cavity above the piston to a pressure equal to the valve's inlet pressure. Since downstream pressure is acting against the center portion of the bottom of the piston, the pressure forces acting on the piston are unbalanced and act to push the piston to the closed position (gravity and, with some valves, a piston spring assists in the closing).

It is characteristic for pilot operated valves to briefly open if subjected to a shock or sudden surge of inlet pressure. This is caused by the elevated inlet pressure pushing the piston open before the pressure above the piston can build via flow through the small bleed orifice. Once the pressure above the piston equalizes with the inlet pressure the valve closes.

4. Pilot Operated Normally Open

Closing

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop, compressing the plunger return spring as it travels. The plunger assembly continues to move until the stem shuts off the pilot orifice in the seat screw. Fluid flow from the valve's inlet side through the bleed orifice in the piston charges the cavity above the piston to a pressure equal to the valve's inlet pressure. Since downstream pressure is acting against the center portion of the bottom of the piston, the pressure forces acting on the piston are unbalanced and act to push the piston to the closed position (gravity assists in the closing).

Opening

When voltage is removed from the coil leads, the magnetic field collapses. The force exerted by the compressed plunger return spring then pushes the plunger up from its position at the center of the coil or adjacent to the magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the pilot orifice in the seat screw, thus initiating flow through the pilot orifice in the seat screw. Fluid from the cavity above the piston flows through the pilot orifice in the seat screw and through the hole in the center of the piston to the downstream side of the valve. Pressure above the piston decreases since the pilot orifice is larger in diameter that the bleed orifice. Inlet pressure acting around the annular area outside of the main valve seat at the bottom of the piston then pushes the piston up, thus initiating flow through the valve.

Note that flow through the valve creating a pressure drop across the valve is required to hold the piston open. If flow is diminished the piston will move toward the closed position. To maintain the valve fully open a pressure drop of 3 to 5 psid across the valve is required.

5. Semi Direct Lift Normally Closed

Opening

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw orifice (This much of the action is identical to the pilot operated valves). The stem – plunger assembly continues its motion until the shoulder on the stem contacts the piston rod link. The piston rod link is attached to the piston, so as the stem – plunger assembly completes its motion, the piston is pulled from the main valve seat effecting the full opening of the valve. In actuality, the fluid force affect the motion of the piston at pressures above approximately 5 psig and the magnetic force on the plunger (through the mechanical connection of the stem to the plunger via the piston rod link) is sufficient to lift the piston at lower pressures.

Closing

When voltage is removed from the coil leads, the magnetic field collapses. Gravity pulls both the plunger and stem down until the stem point seals off the orifice in the piston rod link. Fluid flow from the valve's inlet side through the bleed orifice in the piston charges the cavity above the piston to a pressure equal to the valve's inlet pressure. Since downstream pressure is acting against the center portion of the bottom of the piston, the pressure forces acting on the piston are unbalanced and act to push the piston to the closed position (gravity and, in some valves, a piston spring assists in the closing).

Note: In this type of valve the piston opens and closes fully independent of line pressure or system flow.

It is characteristic for semi-direct lift valves to briefly open if subjected to a shock or sudden surge of inlet pressure. This is caused by the elevated inlet pressure pushing the piston open before the pressure above the piston can build via flow through the small bleed orifice. Once the pressure above the piston equalizes with the inlet pressure the valve closes.

6. Semi Direct Lift Normally Open

Opening

When voltage is removed from the coil leads, the magnetic field collapses. The force exerted by the compressed plunger return spring then pushes the plunger up from its position at the center of the coil or adjacent to the magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw orifice (This much of the action is identical to the pilot operated valves). The stem – plunger assembly continues its motion until the shoulder on the stem contacts the piston rod link. The piston rod link is attached to the piston, so as the stem – plunger assembly completes its motion, the piston is pulled from the main valve seat effecting the full opening of the valve. In actuality, the fluid force effect the motion of the piston at pressures above approximately 5 psig and the magnetic force on the plunger (through the mechanical connection of the stem to the plunger via the piston rod link) is sufficient to lift the piston at lower pressures.

Closing

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the center of the coil or magnetic stop, compressing the plunger return spring as it travels. The plunger assembly continues to move until the stem shuts off the pilot orifice in the seat screw. Fluid flow from the valve's inlet side through the bleed orifice in the piston charges the cavity above the piston to a pressure equal to the valve's inlet pressure. Since downstream pressure is acting against the center portion of the bottom of the piston, the pressure forces acting on the piston are unbalanced and act to push the piston to the closed position (gravity assists in the closing).

Note: In this type of valve the piston opens and closes fully independent of line pressure or system flow.

7. 13,000 3 – Way Direct Lift

Normally Closed Valves

The inlet is the FNPT port on the bottom of the valve body. The normally closed port is on the side of the valve body. When the coil is energized flow is from the port on the bottom of the valve body to the port on the side of the valve body and the port at the top of the valve is closed off. When the coil is not energized there is no flow and the port on top of the valve is open to the port on the side of the valve body.

Normally Open Valves

The inlet is the ¼" MNPT port at the top of the valve (in the center of the nameplate). The normally open port is in the side of the valve body. When the coil is not energized, there is flow from the port on top of the valve to the port on the side of the valve body. When the coil is energized, the inlet port on top of the valve is closed off and the port on the side of the valve body is open to the port on the bottom of the valve.

Directional Flow Valves

The inlet is the FNPT port on the side of the valve body. When the coil is not energized, the inlet port is open to the port on top of the valve and the port at the bottom of the valve body is shut off. When the coil is energized the port at the top of the valve is shut off and the inlet port is open to the port at the bottom of the valve body.

The opening and closing operation is the same for each of the above three types of valves.

Opening

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw orifice. Plunger assembly motion continues until the top stem seals off the orifice at the top of the cylinder cap thus shutting it off.

Closing

When voltage is removed from the coil leads, the magnetic field collapses. Gravity and the plunger return spring pulls both the plunger and stem assembly down until the top stem opens the orifice at the top of the cylinder cap and the bottom stem seals off the orifice in the seat screw.

8. **35,000 Series Externally Piloted**

These valves can be either normally open or normally closed depending on how the pilot is plumbed. There are also internal differences between normally open and normally closed valves.

The normally closed valve has the pilot inlet attached to the ¼" MNPT port at the top of the valve (in the center of the nameplate). The pilot exhaust port is the ¼" FNPT port in the side of the bonnet (the cylinder between the valve body and coil housing).

The normally open valve has the pilot inlet plumbed to the ¼" FNPT port in the side of the bonnet (the cylinder between the valve body and coil housing). The pilot exhaust is the ¼" MNPT port at the top of the valve (in the center of the nameplate).

Opening

When voltage is applied across the coil leads a current is produced in the coil windings which generates a magnetic field. The magnetic field attracts the plunger and causes it to move toward the magnetic stop. Initially the plunger slides freely on the stem until it impacts the nut or shoulder at the end of the stem. The plunger's momentum is then transferred to the stem and the stem is lifted off the seat screw orifice. Plunger assembly motion continues until the top stem seals off the orifice at the top of the cylinder cap thus shutting off pilot flow. Pressure above the piston is bled off through drilled passageway in the bonnet and the seat screw to the pilot exhaust port. Inlet pressure acting around the annular area outside of the main valve seat at the bottom of the piston then pushes the piston up, thus initiating flow through the valve.

Closing

When voltage is removed from the coil leads, the magnetic field collapses. Gravity and the plunger return spring pulls both the plunger and stem assembly down until the top stem opens the orifice at the top of the cylinder cap and the bottom stem seals off the orifice in the stationary seat screw. Fluid flow from the pilot supply then flows directly into the cavity above the piston and charges this volume to a pressure equal to the valve's inlet pressure (assuming that the inlet pressure is being used as the pilot supply). Since the pilot pressure acts over the entire area of the piston and the downstream pressure is acting only against the center portion of the bottom of the piston, the pressure forces acting on the piston are unbalanced and act to push the piston to the closed position (gravity assists in the closing).

Note that the time to charge the volume above the piston and thus affect valve closure is considerably less than with flow through a bleed orifice in the piston as in other pilot operated valves.

With upstream line pressure used as source for pilot pressure the fastest closing times will be achieved when the maximum pressure drop is present across the valve. See page 88 for pilot plumbing and pressure requirements.