

Item #1      Aurora Booster Pump  
                  Model #421  
                  HP-100 TYPE 421 – Stage – 2  
                  Voltage- 460 – Amperage – Phase 3  
                  RPM – 1750  
                  Size. 4 X 5 X 15  
                  Impeller diameter – 14.5”

Item #2      Cla-Val Pump Control Valve  
                  Model 60-39  
                  -   Combination pressure regulating, Pressure sustaining, pump control

Item #3      Myers Submersible Sump Pump  
                  -   ½ HP  
                  -   250 VAC – 1d

Item #4      Warranty

Item #1      Aurora Booster Pump & Motor

Model #421

HP-100 TYPE 421 – Stage – 2

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RPM – 1750

Size. 4 X 5 X 15

Impeller diameter – 14.5”

INSTRUCTION AND REPAIR MANUAL

# HORIZONTAL AND VERTICAL TWO-STAGE PUMPS

Models  
421, 485, 422  
AND 423

ENGLISH: PAGES 2-16

## **INSTRUCTION AND REPAIR MANUAL**

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.



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## CALIFORNIA PROPOSITION 65 WARNING:

**⚠ WARNING** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

### NOTE

This repair manual is applicable to pump Models 421 & 485, 422, 423. All photos illustrate Model 422 except where noted.

### SERVICE

Your Aurora pump requires no maintenance other than periodic inspection, lubrication and occasional cleaning. The intent of inspection is to prevent breakdown, thus obtaining optimum service life.

### LUBRICATION (BALL BEARINGS)

Regreasable bearings will require periodic lubrication and this can be accomplished by using the zerk or lubrication fitting at each bearing. Lubricate the bearings at regular intervals using high quality grease. The initial bearing lubrication at Aurora is Chevron SRI Grease NLGI 2 (polyurea thickener) (Pentair Part Number 384-0002-639). Before lubricating the bearings, thoroughly flushing the old grease with the new grease is required. We recommend Chevron SRI Grease NLGI 2 (polyurea thickener) for follow-up relubrication after the flushing. Most major brands of Grade No. 2 ball bearing grease are satisfactory for pump operation in both wet and dry applications.

### CAUTION

Be aware that mixing of different brands or blends of grease should be avoided due to possible incompatibilities that could damage the bearings. A thorough flushing of the old grease with the new grease is required to minimize this potential incompatibility. Avoid using the following: (1) grease of vegetable or animal base that can develop acids or (2) grease containing rosin, graphite, talc or other impurities. Under no circumstances should grease be reused.

### CAUTION

Over lubrication should be avoided as it may result in overheating and possible bearing failure. Under normal application, adequate lubrication is assured if the amount of grease is maintained at 1/3 to 1/2 the capacity of the bearing and adjacent space surrounding the bearing.

In dry locations, each bearing will need lubrication at least every 4,000 hours of running time or every 6 to 12 months, whichever is more frequent. In wet locations the bearings will need lubrication at least after every 2,000 hours of running time or every 4 to 6 months, whichever is more frequent. A unit is considered to be installed in a wet location if the pump and motor are exposed to dripping water, to the weather, or to heavy condensation such as found in unheated and poorly ventilated underground locations.

At times it may be necessary to clean the bearings due to accumulated dirt or deteriorated lubricants. This can be accomplished by flushing the bearing with a light oil heated to 180 to 200°F. while rotating it on a spindle. Wipe the bearing housing with a clean rag soaked in a cleaning solvent, and flush all surfaces.

Dry bearing thoroughly before relubricating. Compressed air can be used to speed drying, but care should be taken not to let bearings rotate while being dried.

### CAUTION

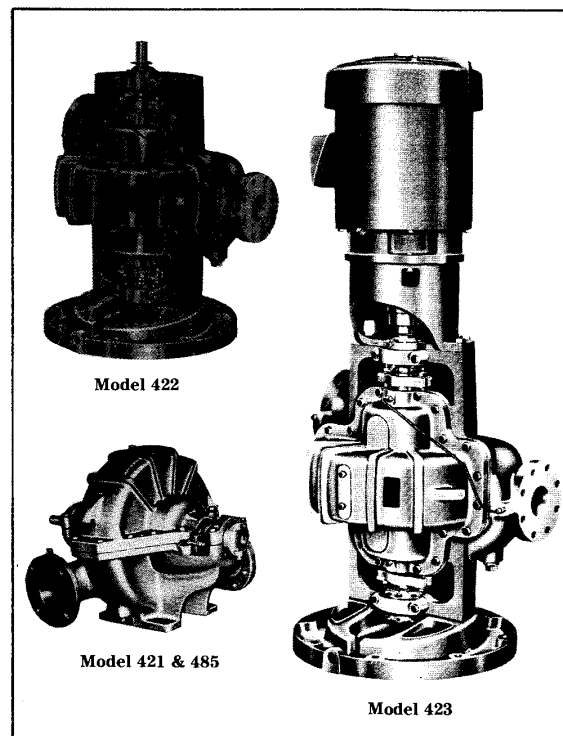
Use normal fire caution procedures when using any petroleum cleaner.

Model 421 pumps are available with two options for lubricating the shaft bearings. They are:

1. Regreasable (standard)
2. Oil Lubrication

Oil lubricated bearings are optional on Model 421 pumps. A fixed oil level is maintained within the bearing cartridge by an oiler which allows visual indications of reserve oil.

At initial installation and before starting a unit that has been shut down for repairs or for any extended length of time, run enough 10W-30 weight motor oil through the oiler to maintain a constant oil level to insure that the bearing will never be without an oil supply. Oil will have to be added at intervals to maintain a constant level in the oiler. This interval can only be determined by experience.



A. Complete pump assemblies.

Under working conditions, oil will breakdown and need to be replaced at regular intervals. The length of these intervals will depend on many factors. Under normal operation, in clean and dry locations, the oil should be changed about once a year. However, when the pump is exposed to dirt contamination, high temperatures (200°F. or above) or a wet location, the oil may have to be changed every 2 or 3 months.

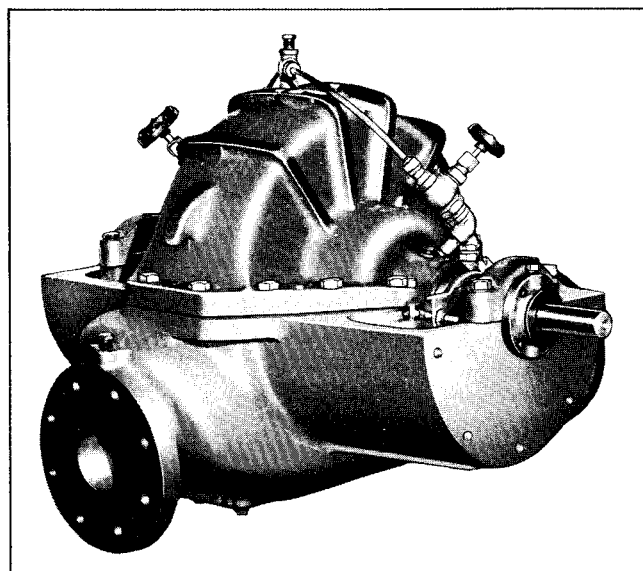
The motor which drives your Aurora pump may or may not require lubrication. Consult the manufacturer's recommendations for proper maintenance instructions.

**REPAIRS**

The pump may be disassembled using the illustrations and text provided. Although complete disassembly is covered, it will seldom be necessary to completely disassemble your Aurora pump.

The illustrations accompanying the disassembly instructions show the pump at various stages of disassembly. The illustrations are intended to aid in the correct identification of the parts mentioned in the text.

Inspect removed parts at disassembly to determine their reusability. Cracked castings should never be reused. All packing and gaskets should be replaced with new ones at reassembly simply as a matter of economy; they are much less expensive to replace routinely than to replace as the need occurs. In general it is economical to return to the manufacturer for repair only the motor and motor controller.



B. Pump positioned horizontally for disassembly. Pump base removed. Model 422 or 423 Illustrated.

**DISASSEMBLY OF THE PUMP.**

Disassemble only what is needed to make repairs or accomplish inspection. Proceed to disassemble the pump as follows: (See Figure 4 for Model 421 & 485, Figure 5 for Model 422 and Figure 6 for Model 423.)

1. Break electrical connection to motor or take similar steps to make certain that drive unit will not be unintentionally energized during disassembly.

2. Close such valves or flow-control devices necessary to make certain that flow of liquid will not take place during disassembly.

**NOTE**

Discharge and suction piping need not be disturbed unless complete pump assembly is to be removed.

3. Drain liquid from pump by removing plugs (1 and 2). Disconnect by-pass lines if applicable.

4. Loosen and remove capscrews (6) securing casing half (8) to remainder of pump assembly.

**NOTE**

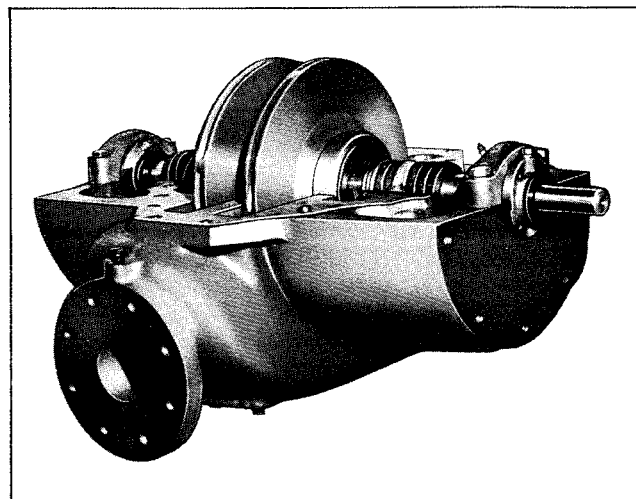
If pump being disassembled is 3 x 4 x 14A or larger, remove capscrews (7) before attempting to separate the casing halves.

5. Make certain that all securing capscrews are removed, then carefully remove casing half (8) using hoist or crane with sling attached to cast hooks.



Use extreme care when casing comes loose that it does not drop out of sling as this would cause extensive damage to other components of pump.

6. Remove gasket (9) and scrape mating surfaces of casing halves to remove pieces of gasket which may have adhered in separation. Take care not to scratch or mar mating surfaces.



C. Upper casing, bearing caps and packing removed. Model 421 or 485 Illustrated.

7. For Model 421 & 485 and 423 pumps, loosen setscrews in flexible coupling and slide halves apart. For Model 422 remove flexible shafting from pump.

8. Remove capscrews (25) securing bearing caps (26). Lift off bearing caps (26) and pins (27). Mark caps to insure correct replacement and orientation on the respective bearing arms.

9. Loosen and remove nuts (18), washers (19), and

clamps (20), securing split halves of packing glands (21). Remove swing bolts (22).

10. Assuming that further work is required on shaft and impeller assembly, use properly secured rope slings and hoist or crane as required to lift it from casing half (74) and place it on suitable bench or work surface.

**CAUTION**

Take care not to dent or damage impeller and/or other parts. Use of a supporting cradle or work stand is recommended.

**NOTE**

Disassembly procedure from this point covers pumps having standard packing. If pump has mechanical seals, refer to Specific Instructions.

11. Remove and discard rings of packing (23), since replacement with new packing is recommended whenever pump is disassembled.

12. Slide pump half of flexible coupling off shaft (71) and remove key (24). Pry up on end of key so as not to damage shaft. If preferred, key may be removed by carefully tapping from outer end with a brass drift or similar non-marring tool, using a small hammer.

13. Remove casing wearing rings (28).

14. If pump is grease lubricated remove zerks (10) and pipe plugs (12) from cartridge caps (32 and 42). If pump has oil lubrication option, Model 421 only, remove breather cap from top of cartridge caps and remove close nipples from bottom of cartridge caps. The remaining oil cup, street elbows, and nipples are loose at this point and can be removed as an assembly.

15. For Model 422 and 423 pumps, loosen and remove capscrews (31) from cartridge cap (32). Outboard shaft end protector (29) may be removed from its recess in the outboard cartridge cap at this time if necessary. Remove retainer (35) with truarc pliers. Remove gasket (34).

**NOTE**

For Model 421 pumps, if unit has tandem shaft, protector (29) is not used. Remove slinger and capscrews (31). Slide cartridge cap (32) and grease seal off shaft. Press grease seal out of cartridge cap if it is necessary to replace this seal. Remove retainer ring (35) with truarc pliers. Remove gasket (34).

16. Outboard bearing (38) is press fitted onto shaft (71). To remove it, place a puller on bearing cartridge (36) and pull cartridge, grease seal (37), and bearing from shaft.

The grease seal can be pressed from the bearing cartridge if it needs replacing. Slide slinger (39), lantern ring (52), and bushing (56) off shaft (71).

17. Removal of the inboard bearing is basically the same as the outboard bearing. Remove capscrews (41) and slide slingers (40), cartridge cap (42), grease seal (43), and gasket (44) off shaft.

18. Pull or press off bearing cartridge (45), grease seal (46), and bearing (47). Remove slinger (48), lantern ring (52), and bushing (56) from shaft.

19. If unit has right hand rotation, unscrew and remove outboard sleeve (57) first. Remove O-ring (58). If unit has left hand rotation, unscrew and remove inboard sleeve (65). Remove O-ring (66).

20. On right hand unit, balance of the parts will be removed as follows: Pull or tap impeller (59) off shaft (71) using care not to damage impeller. Remove gasket (60). Slide casing bushing (61) off separator sleeve (62). Pull separator sleeve, gasket (64), and impeller (67) off shaft. Remove gasket (66) and key (68). Unscrew and remove shaft sleeve (65).

Left hand unit disassembly will begin with impeller (67) and end with sleeve (58).

21. Disassemble wearing ring(s) (70) (optional) from impeller(s) (59) and (67) only if necessary. For pumps on power frame 5, remove setscrews (83). Apply a puller and gradually withdraw wearing rings (70) from impellers (59 and 67). Wearing rings may have to be cut or trimmed off the impeller. If a lathe is used to trim rings off, use care not to clamp impeller too tight and cause distortion. Also use care not to remove any metal from impeller.

22. Remove locking and locating pins (63, 69, 72, and 73) from lower casing half (74) only if replacement is necessary.

23. Nameplate (76) and its securing screws (75) should only be removed if replacement is necessary.

24. On Model 423 pumps unscrew capscrews (79) to remove motor and motor bracket (80) from casing half (74). It is best to leave motor bracket on motor as it helps protect motor shaft from possible damage. Remove nuts (77) from capscrews (78) which allows motor to be separated from motor bracket.

**Disassembly of Pumps with Mechanical Seals.**

1. Perform disassembly procedures as previously given through step 8.

2. Loosen and remove nuts (18), and washers (19), thus freeing swing bolts (22) to allow shaft and impeller assembly to be lifted from casing half (74) with sling and hoist or crane as described in paragraph 10 above.

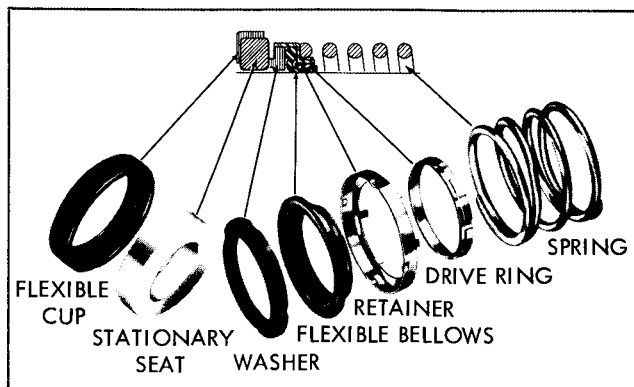


Figure 1. Mechanical Seal

**CAUTION**

Use extreme care in moving assembly. Ceramic seats can be cracked by just sliding loose on shaft. To prevent this, wrap seal securely in a shop cloth or other protective covering.

3. With shaft and impeller assembly on a suitable bench, cradle, or work stand, loosen and remove pipe plug (12) from inboard cartridge cap (42). Remove grease zerk (10) and capscrews (41) and slide the cartridge cap with grease seal (43) off end of shaft (71). Remove gasket (44).

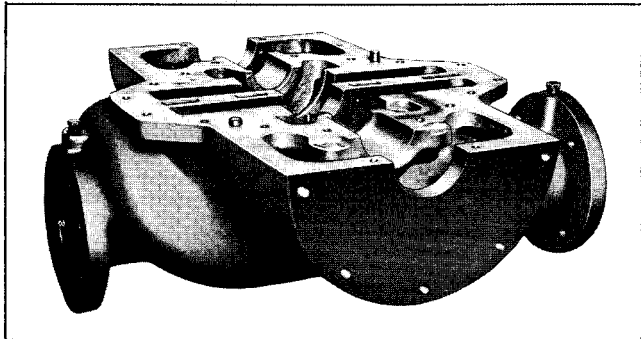
4. Pull or press bearing cartridge (45), grease seal (46), and bearing (47) off shaft. Remove slinger (48).

5. One piece gland (49) used with mechanical seal assembly can now be removed from shaft. "O" ring (50) can be removed from seal gland if desired.

**CAUTION**

Exercise great care in removing seal assembly (53) to keep from marring or otherwise damaging precision ground mating surfaces.

6. Scribe a mark on shaft sleeves for relocating seal collar on reassembly. Loosen setscrews (55), securing seal collars (54) to shaft sleeves and slide them off.



D. Rotating element removed from lower casing.

7. Proceed with further disassembly of outboard ball bearing and seal assembly using same basic procedure.

8. After removal of mechanical seals proceed with balance of disassembly in same manner of described for packing design.

**REASSEMBLY**

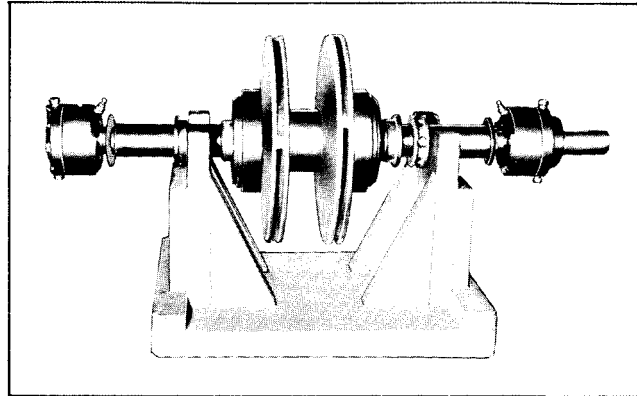
Reassembly will generally be in reverse order of disassembly. If disassembly was not complete, use only those steps related to your particular repair program.

1. Position locating pins (72) in casing half (74), adding swing bolt pins (73) if used on your pump. Install wearing ring pins (69) and casing bushing pins (63). Tap pins gently to seat them in place. Place O-ring (66) in shaft sleeve (65).

If nameplate (76) was removed, install it with screws (75).

2. On right hand unit, thread inboard sleeve (65) onto shaft (71) distance "A" (refer to Figure 2). On left hand unit,

thread outboard sleeve (57) onto shaft distance "A" (refer to Figure 3). When sleeve is in position, its keyway should align



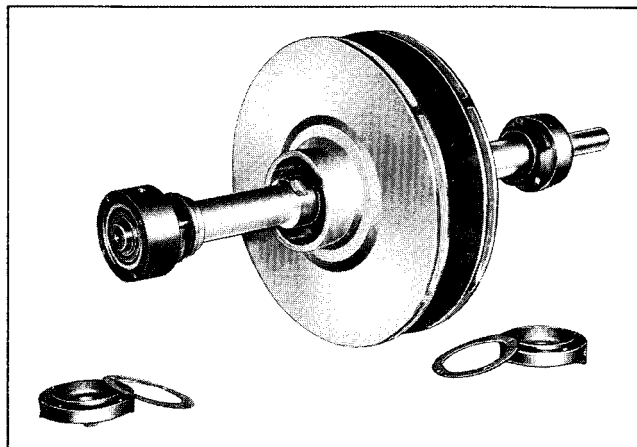
E. Rotating element placed in a protective cradle for further disassembly.

with keyway on shaft. Coat key and keyway with loctite sealant grade 242. Insert key (68) into keyways of shaft and sleeve. Tap key firmly in place.

3. Coat inside diameter of impeller wearing rings (70) (optional) with Loctite sealant Grade 271 and press them over hubs of impeller(s) (59) and (67). Do not attempt to hammer impeller wear rings into position, since they are a press fit. Use of an arbor press is preferred. However, placing a block of wood over the impeller wearing ring and pressing it in will work satisfactorily. For pumps on power frame 5 only, four setscrews (83) will be installed by drilling into wearing rings and impeller. The opposite surface of the impeller should be protected from damage throughout the procedures by resting it against soft wood on the surface of work bench.

**CAUTION**

Impeller wearing rings must be given special care because they are press fit. Be sure rings are



F. Bearing cartridge cap and gasket removed from shaft.

positioned squarely over hubs of impeller. A soft headed hammer may be used to gently tap impeller wearing rings into correct alignment before they are pressed into place.



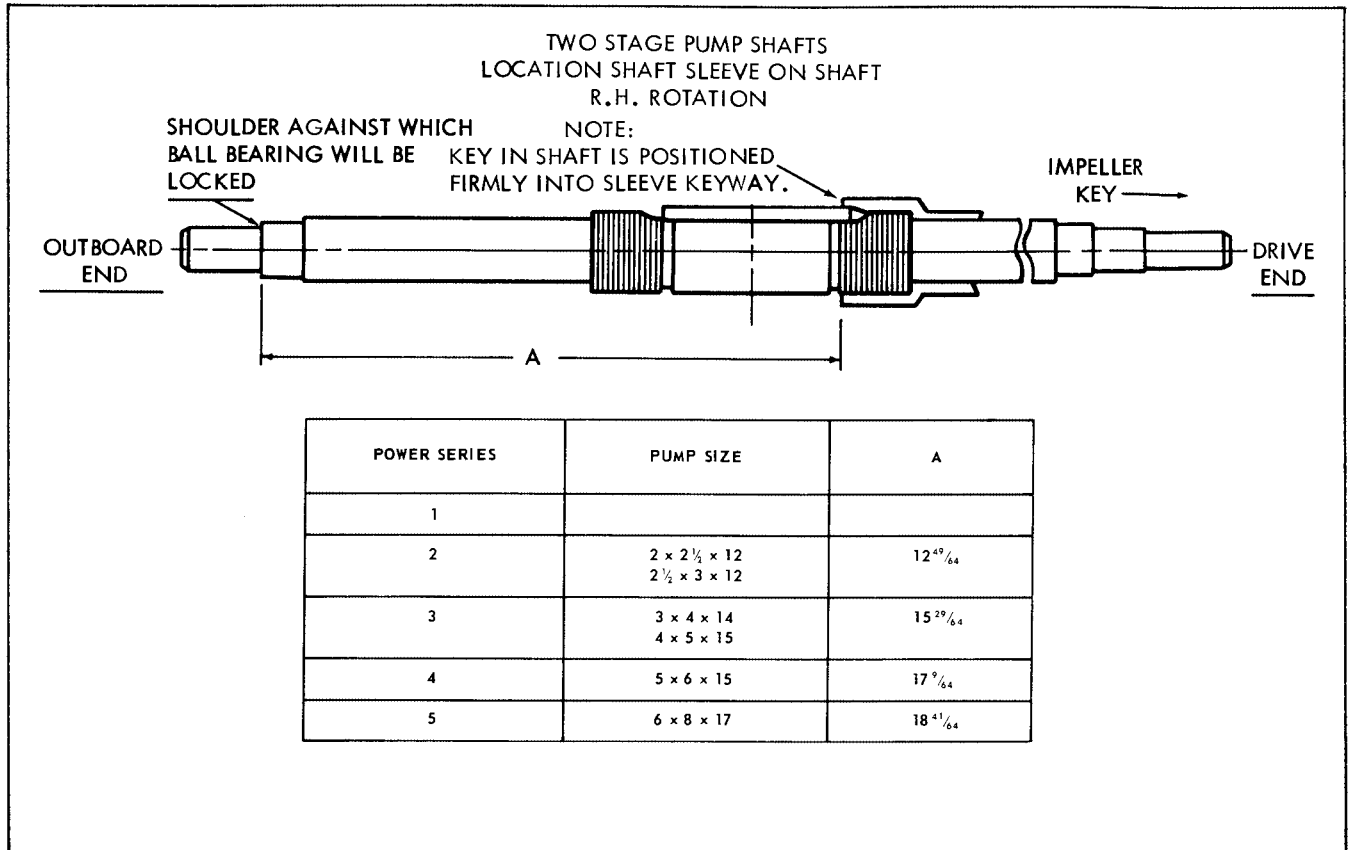


Figure 2

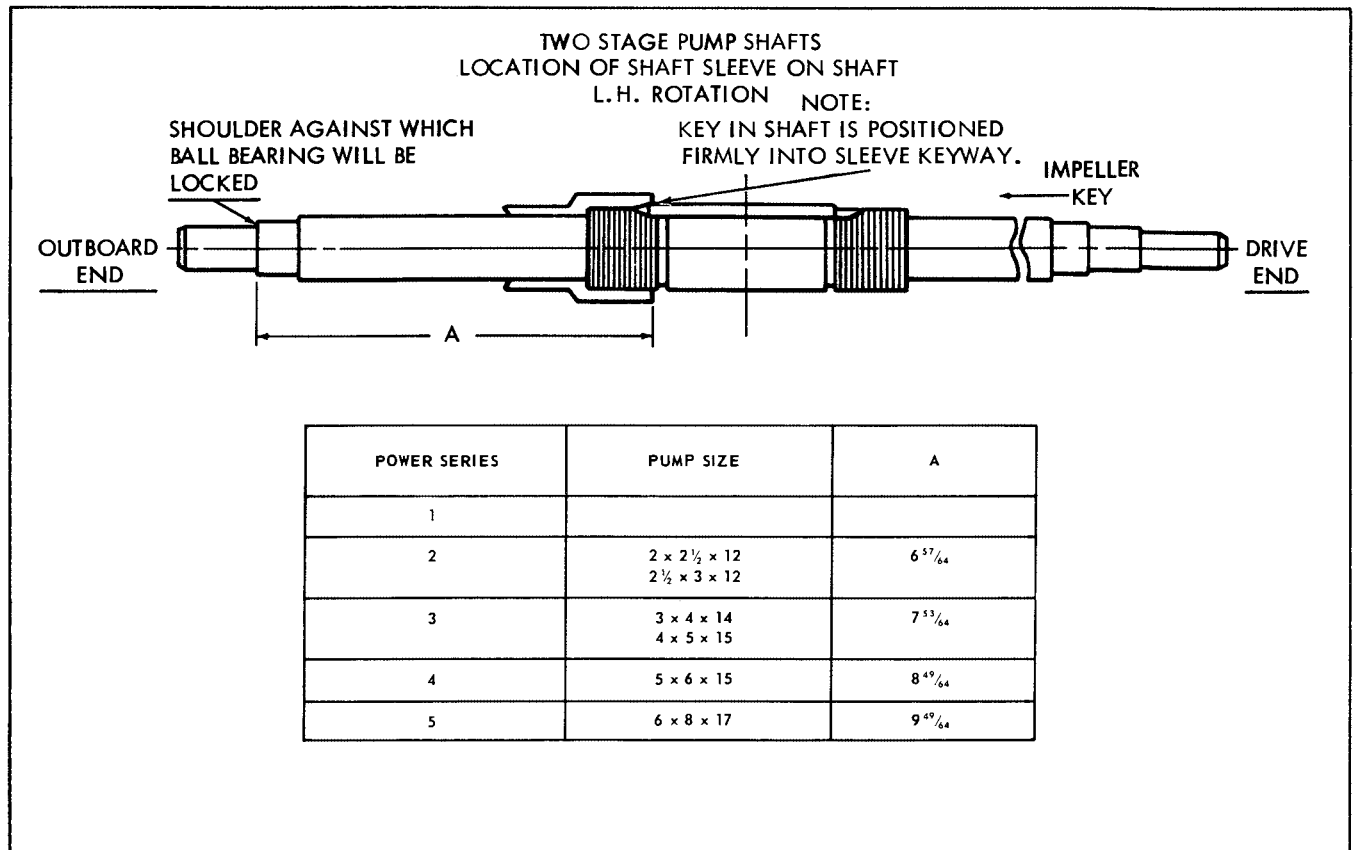


Figure 3

4. On right hand unit proceed to assemble the rotating element as follows:

Coat impeller (59) keyway with loctite sealant grade 242, slide impeller (67) onto shaft (71).

Place gasket (64) on shaft and slide separate sleeve (62) against it. Place casing bushings (61) over separator sleeve. Place gasket (60) on shaft, coat impeller (59) keyway with loctite sealant grade 242 and slide impeller (59) in place. Key (68) should not protrude beyond impeller (59) hub after impeller has been positioned. Place O-ring (58) in shaft sleeve (57), then thread shaft sleeve tight onto shaft (71).

On left hand unit use same procedure only starting with impeller (59).

**NOTE**

When assembling rotating element of a 420 Series Pump it is important that the curve of impeller blades is in agreement with pump rotation. (See insert in Figures 4, 5, or 6).



Carefully check to see that the proper shaft sleeve has been keyed into place for rotation of pump. If the correct shaft sleeve is not keyed onto shaft, it can spin loose during operation of pump and cause extensive damage.

5. Install packing or mechanical seals and secure according to the following specific instructions:

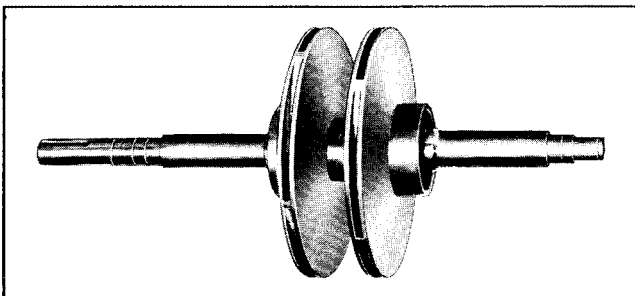
**STANDARD PACKING**

- a. Slide bushings (56) onto each end of shaft. The raised shoulder on bushings must face away from impeller.
- b. Seven pieces of packing (23) are placed on outboard end of shaft (71) over shaft sleeve. Two pieces of packing, a lantern ring (52), and three more pieces of packing are placed on inboard shaft sleeve.

Stagger breaks in packing rings so that pump will not leak excessively.

**MECHANICAL SEAL**

- a. Single seal and balanced single seals.



G. Inboard and outboard bearings and bearing cartridges removed.

- I. Slide one seal lock collar (54) with setscrews (55) facing the impeller onto each end of the shaft. Position on scribe mark made during disassembly and lock in place.
- II. Put a light coat of liquid dishwashing detergent on shaft sleeve. Check rotating parts of seal to make sure they are clean. Spread a light coat of liquid detergent on inside diameters of flexible bellows and washer.
- III. Place the seal's spring, drive ring, retainer, flexible bellows, and washer on shaft sleeve in respective order. (Refer to Figure 1.)
- IV. Thoroughly inspect cavity of seal gland (49) for burrs or nicks which could damage the seat of seal. Apply a film of liquid detergent to seal seat and install it in the seal gland cavity, taking care to seat it evenly and squarely.

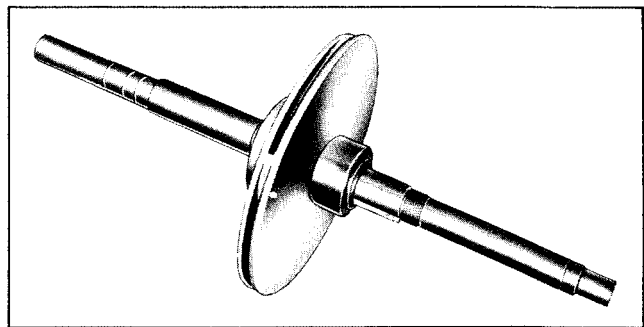
**NOTE**

If it is not possible to insert seat with fingers, place a cardboard protecting ring furnished with seal over the lapped face of seat and press into place with a piece of tubing having end cut square. Tubing should be slightly larger than the diameter of shaft. Remove cardboard after seat is firmly in place.



Never place a mechanical seal into service after it has been used without replacing or relapping stationary seat and washer faces.

- V. Place "O" rings (50) around seal glands and slide seal glands onto ends of shaft.
- b. Double Seal
  - I. Place one seal seat in collar (54). The other fits into seal gland (49). These parts are set into their cavities in the same manner as they are with a single seal.



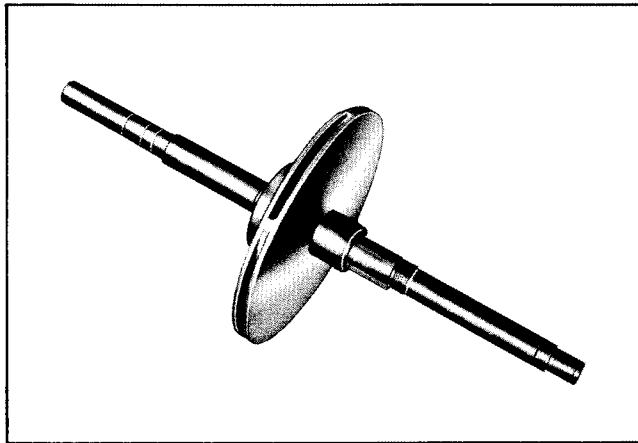
H. Shaft sleeve and outboard impeller removed from shaft.

- II. Place "O" rings (51) around collars (54) and put the collars with stationary seats facing away from impeller on ends of shaft. Slide flexible bellows, washers, and springs on shaft in the order shown in Figure 1, for each half of double seal assembly (53).

III. Place "O" rings (50) around the seal glands (49) and slide seal glands onto ends of the shaft with stationary seats facing impeller.

6. Place slinger (39) onto outboard end of shaft (71).

7. Press grease seal (37) into bearing cartridge (36). Place outboard double row ball bearing (38) in bearing cartridge and press parts onto outboard end shaft. Snap retainer ring (35) in place to secure outboard bearing. Place gasket (34) and cartridge cap (32) in position and secure it with capscrews (31).



I. Casing bushing removed from impeller separator sleeve.

**NOTE**

Both grease zerk holes in bearing cartridges and pipe plug holes in cartridge caps must be facing in opposite directions when assembled.

8. Protector (29) can be placed in cartridge cap or if unit has tandem shaft press a grease seal into cartridge cap and slide a slinger onto shaft.

9. Place slinger (48) in inboard end of shaft.

10. Press grease seal (46) into bearing cartridge (45). Place inboard ball bearing (47) in bearing cartridge and press this assembly onto inboard end of shaft.

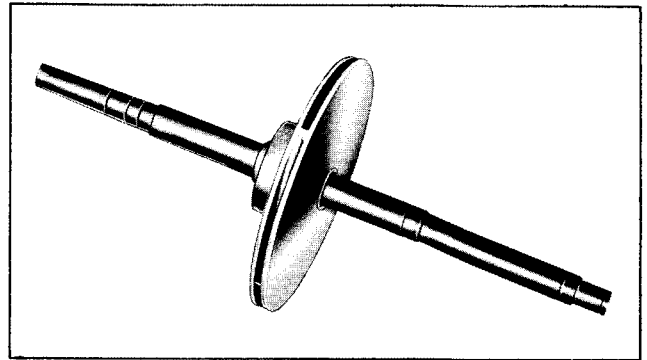
11. Press grease seal (43) into cartridge cap (42). Position gasket (44) and cartridge cap against bearing cartridge and secure it in place with capscrews (41). Be sure to align grease zerk holes and pipe plug hole on opposite sides.

12. Place slinger (40) onto shaft. Place grease zerks (10) in bearing cartridges and pipe plugs (12) in bearing caps. If pump is oil lubricated, Model 421 only, breather tubes are placed in each bearing cartridge. Oilers with nipples and elbows are placed in cartridge caps.

13. Slide casing wearing rings (28) over impeller hub or optional wearing rings (70) and set rotating element into casing half (74). Make certain that drill holes in bottom surface of casing wearing rings are located over pins (69). The drill hole in casing bushing (61) is over pin (63) previously set in casing half (74).

**NOTE**

Grease zerks or breather tubes should face up.



J. Impeller separator sleeve removed from shaft.

14. Install key (24) in motor end of shaft (71). Check positioning and alignment of packing rings or seal components, install swing bolts (22) and split gland halves (21) if pump has packing. Position clamps (20), washers (19), and nuts (18), securing loosely in place. Swing bolts (22) are set over pins (73) on 3 x 4 x 14A or smaller units. On larger units, swing bolts are held in place by capscrews (7) after casing half (8) is in position.

15. Place pins (27) into bearing cartridges. Place bearing caps (26) in position and secure with capscrews (25).

16. Position new casing gaskets (9) on casing half (74). Set casing half (8) in place. Secure it to casing half (74) with capscrews (6). Pins (72) are used as a means of locating the position of casing halves.

17. On pumps larger than 3 x 4 x 14A thread in capscrews (7) making sure they are placed through eye of swing bolts (22).

18. Place drain plugs (1) and (2) back in casing halves.

19. On Model 423 pumps, set the motor on motor bracket (80) and fasten them together with capscrews (78) and nuts (77). Slide flexible coupling halve onto pump and motor shafts. Attach motor bracket to casing half (74) with capscrews (79). Connect flexible coupling halves.

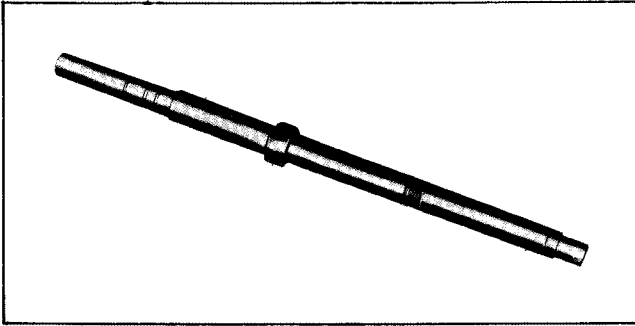
20. If the casing half (74) was removed from base, see section on installation for proper methods of realigning pump to motor and piping. On Model 422 pumps see this section for realigning pump to flexible shafting. Attach flexible shafting to pump. Ideal joint operating angle is 1° to 5°.

21. Replace any flushing or cooling lines that were removed. Connect electricity back to motor.

Starting Pump After Reassembly. Do not start pump until all air and vapor have been bled. Make sure that there is liquid in the pump to provide necessary lubrication.

**NOTE**

Do not over tighten standard packing assembly before returning unit to operation.



K. Inboard impeller removed. Shaft sleeve in place.

**CAUTION**

Read operating instructions carefully before starting pump. Jog pump to check for proper rotation. Allow it to run a short time. Gradually tighten nuts (18) until dripping has been reduced to its normal level.

Over tightening the packing will cause stuffing box to over heat. The shaft sleeve will also receive excessive wear.

**NOTE**

**WHEN ORDERING SPARE PARTS ALWAYS INCLUDE THE PUMP TYPE, SIZE, SERIAL NUMBER, AND THE PIECE NUMBER FROM THE EXPLODED VIEW IN THIS MANUAL.**

**ORDER ALL PARTS FROM YOUR LOCAL AUTHORIZED DISTRIBUTOR, FACTORY BRANCH SALES OFFICE OR THE FACTORY AT NO. AURORA, ILLINOIS.**

MODELS 421 & 485-422-423

MODEL 421 & 485 LIST OF PARTS (SEE FIGURE 4)

1. Plug	27. Pin	46. Grease Seal	63. Pin
2. Plug	28. Case Ring	47. Bearing	64. Gasket
6. Capscrew	29. Protector	48. Slinger	65. Sleeve
7. Capscrew	31. Capscrew	49. Gland	66. O-Ring
8. Casing	32. Cartridge Cap	50. "O" Ring	67. Impeller
9. Gasket	34. Gasket	51. "O" Ring	68. Key
10. Grease Fitting	35. Retaining Ring	52. Lantern Ring	69. Pin
12. Plug	36. Cartridge	53. Seal	70. Wearing Ring
18. Nut	37. Grease Seal	54. Collar	71. Shaft
19. Washer	38. Bearing	55. Setscrew	72. Pin
20. Clamp	39. Slinger	56. Bushing	73. Pin
21. Gland Half	40. Slinger	57. Sleeve	74. Casing
22. Swing Bolt	41. Capscrew	58. O-Ring	75. Drive Screw
23. Packing	42. Cartridge Cap	59. Impeller	76. Nameplate
24. Key	43. Grease Seal	60. Gasket	83. Setscrew
25. Capscrew	44. Gasket	61. Bushing	
26. Bearing Cap	45. Cartridge	62. Sleeve	

MODEL 422 LIST OF PARTS (SEE FIGURE 5)

1. Plug	27. Pin	46. Grease Seal	63. Pin
2. Plug	28. Case Ring	47. Bearing	64. Gasket
6. Capscrew	29. Protector	48. Slinger	65. Sleeve
7. Capscrew	31. Capscrew	49. Gland	66. Gasket
8. Casing	32. Cartridge Cap	50. "O" Ring	67. Impeller
9. Gasket	34. Gasket	51. "O" Ring	68. Key
10. Grease Fitting	35. Retaining Ring	52. Lantern Ring	69. Pin
12. Plug	36. Cartridge	53. Seal	70. Wearing Ring
18. Nut	37. Grease Seal	54. Collar	71. Shaft
19. Washer	38. Bearing	55. Setscrew	72. Pin
20. Clamp	39. Slinger	56. Bushing	73. Pin
21. Gland Half	40. Slinger	57. Sleeve	74. Casing
22. Swing Bolt	41. Capscrew	58. Gasket	75. Drive Screw
23. Packing	42. Cartridge Cap	59. Impeller	76. Nameplate
24. Key	43. Grease Seal	60. Gasket	81. Capscrew
25. Capscrew	44. Gasket	61. Bushing	82. Base
26. Bearing Cap	45. Cartridge	62. Sleeve	

MODEL 423 LIST OF PARTS (SEE FIGURE 6)

1. Plug	28. Case Ring	48. Slinger	66. Gasket
2. Plug	29. Protector	49. Gland	67. Impeller
6. Capscrew	31. Capscrew	50. "O" Ring	68. Key
7. Capscrew	32. Cartridge Cap	51. "O" Ring	69. Pin
8. Casing	34. Gasket	52. Lantern Ring	70. Wearing Ring
9. Gasket	35. Retaining Ring	53. Seal	71. Shaft
10. Grease Fitting	36. Cartridge	54. Collar	72. Pin
12. Plug	37. Grease Seal	55. Setscrew	73. Pin
18. Nut	38. Bearing	56. Bushing	74. Casing
19. Washer	39. Slinger	57. Sleeve	75. Drive Screw
20. Clamp	40. Slinger	58. Gasket	76. Nameplate
21. Gland Half	41. Capscrew	59. Impeller	77. Nut
22. Swing Bolt	42. Cartridge Cap	60. Gasket	78. Capscrew
23. Packing	43. Grease Seal	61. Bushing	79. Capscrew
24. Key	44. Gasket	62. Sleeve	80. Bracket
25. Capscrew	45. Cartridge	63. Pin	81. Capscrew
26. Bearing Cap	46. Grease Seal	64. Gasket	82. Base
27. Pin	47. Bearing	65. Sleeve	

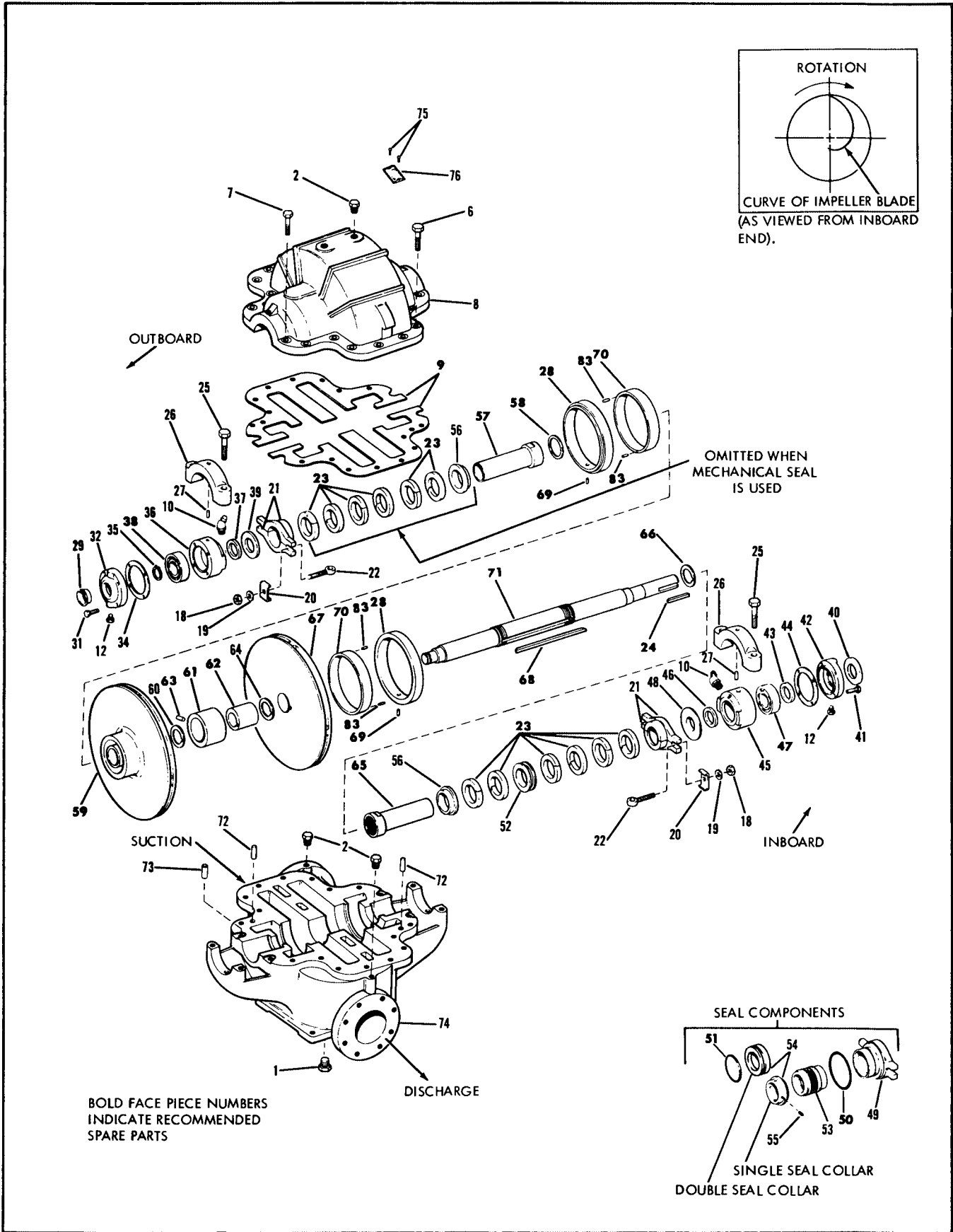


Figure 4. 421 & 485 Pump Exploded View

NOTE: MODEL 485 AVAILABLE WITH PACKING ONLY.

# NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



**DATE:** 8/17/2022

**P.O. NO.:** 100HP-RFQ  
**Order/Line NO.:** 1605087 IN 100

**TO:** Aurora Pump  
Pentair Water Aurora Pump  
1101 Myers Parkway  
Ashland, OH, 44805

**ATTN:** CUSTOMER

**Model Number:** NA  
**Catalog Number:** D100V2BS-P  
Horiz. ODP VFD Duty Config.  
CONF,MOTOR,HORIZ. ODP VFD DUTY

**REVISIONS:**

**ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.  
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.**

**Accessories:**

Clockwise Rotation FODE  
AEGIS Grounding Ring (SGR)  
Insulated Bearing - Short End  
115 Volt Space Heaters  
Special Balance  
Thermostats - Normally Closed

**USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT**

<b>Horsepower</b>	100
<b>Pole(s)</b>	04
<b>Voltage(s)</b>	460-230
<b>Frame Size</b>	404TS
<b>Shaft U Diameter</b>	2.125
<b>Outlet Box AF</b>	4.72
<b>Outlet Box AA</b>	3.00

39-1  
40  
24  
—  
65

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**NIDEC MOTOR CORPORATION**

8050 WEST FLOISSANT AVE.  
ST. LOUIS, MO 63136

*Engineer Requested  
this motor information  
during Submittal Review*



**DATE:** 8/17/2022

**P.O. NO.:** 100HP-RFQ  
**Order/Line NO.:** 1605067 IN 100

**TO:** Aurora Pump  
Pentair Water Aurora Pump  
1101 Myers Parkway  
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CONF,MOTOR,HORIZ. ODP VFD DUTY

**REVISIONS:**

**ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.  
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.**

**Features:**

Temporary - DO NOT COPY  
Horsepower ..... 00100.00 ~ KW: 74.6  
Enclosure ..... ODP  
Poles ..... 04 ~ RPM: 1800  
Frame Size ..... 404~TS  
Phase/Frequency/Voltage.. 3~060~230/460  
Winding Type ..... Random Wound  
Service Factor ..... 1.15  
Insulation Class ..... Class "F" ~ Insulife 2000  
Altitude In Feet (Max) .. 3300 Ft.(1000 M)  
Ambient In Degree C (Max) +40 C  
Assembly Position ..... "F-1" Assembly Position  
Efficiency Class ..... Premium Efficient  
Application ..... Centrifugal Pump  
Inverter Duty NEMA MG1 Part 31  
Customer Part Number ....  
Inverter Duty Rating Details:  
Load Type (Base Hz & Below) .. Variable Torque  
Speed Range (Base Hz & Below). 10:1  
VFD Service Factor 1.00  
"AK" Dimension (Inches).. NA  
Temperature Rise (Sine Wave): "F" Rise @ SF (Resist)  
Design Letter ..... B  
Starting Method ..... Direct-On-Line Start  
Duty Cycle ..... Continuous Duty  
Efficiency Value ..... 95.4 % ~ Typical  
Load Inertia: NEMA ~ Standard Inertia: 441 LB-FT<sup>2</sup>  
Number Of Starts Per Hour: NEMA  
Motor Type Code ..... RI  
Rotor Inertia (LB-FT<sup>2</sup>) ..... 18.3 LB-FT<sup>2</sup>  
Qty. of Bearings PE (Shaft) ..... 1  
Qty. of Bearings SE (OPP) ..... 1  
Bearing Number PE (Shaft) ..... 6215-2Z-J  
Bearing Number SE (OPP) ..... 6212-2Z-J

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# NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



**DATE:** 8/17/2022

**P.O. NO.:** 100HP-RFQ  
**Order/Line NO.:** 1605087 IN 100

**TO:** Aurora Pump  
Pentair Water Aurora Pump  
1101 Myers Parkway  
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**ATTN:** CUSTOMER

**Model Number:** NA  
**Catalog Number:** D100V2BS-P  
Horiz. ODP VFD Duty Config.  
CONF,MOTOR,HORIZ. ODP VFD DUTY

**REVISIONS:**

**ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION  
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.**

**Accessories:**

Direct Connected To Load  
Clockwise Rotation FODE  
AEGIS Grounding Ring (SGR)  
Insulated Bearing - Short End  
115 Volt Space Heaters  
Special Balance  
Thermostats - Normally Closed

**USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT**

<b>Horsepower</b>	100
<b>Pole(s)</b>	04
<b>Voltage(s)</b>	460-230
<b>Frame Size</b>	404TS
<b>Shaft U Diameter</b>	2.125
<b>Outlet Box AF</b>	4.72
<b>Outlet Box AA</b>	3.00

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# NAMEPLATE DATA

CATALOG NUMBER: <input style="width: 150px;" type="text" value="D100V2BS-P"/>	NAMEPLATE PART #: <input style="width: 150px;" type="text" value="422699-007"/>
MODEL <input style="width: 100px;" type="text" value="FR"/> <input style="width: 100px;" type="text" value="404TS"/>	TYPE <input style="width: 100px;" type="text" value="RI"/> ENCL <input style="width: 100px;" type="text" value="ODP"/>
SHAFT END BRG <input style="width: 150px;" type="text" value="6215-2Z-J - QTY 1"/>	OPP END BRG <input style="width: 150px;" type="text" value="6215 2Z J QTY 1"/>
PH <input style="width: 50px;" type="text" value="3"/> MAX AMB <input style="width: 80px;" type="text" value="40 C"/>	ID# <input style="width: 200px;" type="text" value="(ref: Order#: 1605087, Type: IN, Line#: 100)"/>
INSUL CLASS <input style="width: 50px;" type="text" value="F"/> Asm. Pos. <input style="width: 150px;" type="text" value="F1"/>	DUTY <input style="width: 150px;" type="text" value="CONT"/>
HP <input style="width: 50px;" type="text" value="100"/> RPM <input style="width: 80px;" type="text" value="1785"/>	HP <input style="width: 50px;" type="text"/> RPM <input style="width: 80px;" type="text"/>
VOLTS <input style="width: 50px;" type="text" value="460"/> <input style="width: 50px;" type="text" value="230"/>	VOLTS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
FL AMPS <input style="width: 50px;" type="text" value="112.0"/> <input style="width: 50px;" type="text" value="225.0"/>	FL AMPS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
SF AMPS <input style="width: 50px;" type="text" value="130.0"/> <input style="width: 50px;" type="text" value="260.0"/>	SF AMPS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
SF <input style="width: 50px;" type="text" value="1.15"/> DESIGN <input style="width: 50px;" type="text" value="B"/> CODE <input style="width: 50px;" type="text" value="F"/>	SF <input style="width: 50px;" type="text"/> DESIGN <input style="width: 50px;" type="text"/> CODE <input style="width: 50px;" type="text"/>
NEMA NOM EFFICIENCY <input style="width: 50px;" type="text" value="95.4"/> NOM PF <input style="width: 50px;" type="text" value="87.4"/> KiloWatt <input style="width: 50px;" type="text" value="74.60"/>	NEMA NOM EFFICIENCY <input style="width: 50px;" type="text"/> NOM PF <input style="width: 50px;" type="text"/>
GUARANTEED EFFICIENCY <input style="width: 50px;" type="text" value="94.5"/> MAX KVAR <input style="width: 50px;" type="text"/> HZ <input style="width: 50px;" type="text" value="60"/>	GUARANTEED EFFICIENCY <input style="width: 50px;" type="text"/> MAX KVAR <input style="width: 50px;" type="text"/> HZ <input style="width: 50px;" type="text"/>

**HAZARDOUS LOCATION DATA (IF APPLICABLE):**

DIVISION <input style="width: 100px;" type="text"/>	CLASS I <input style="width: 100px;" type="text"/>	GROUP I <input style="width: 100px;" type="text"/>
TEMP CODE <input style="width: 100px;" type="text"/>	CLASS II <input style="width: 100px;" type="text"/>	GROUP II <input style="width: 100px;" type="text"/>



**VFD DATA (IF APPLICABLE):**

VOLTS <input style="width: 80px;" type="text" value="460"/> <input style="width: 80px;" type="text" value="230"/>	AMPS <input style="width: 80px;" type="text" value="117.6"/> <input style="width: 80px;" type="text" value="236.3"/>
TORQUE 1 <input style="width: 150px;" type="text" value="294.50LB-FT"/>	TORQUE 2 <input style="width: 150px;" type="text"/>
VFD LOAD TYPE 1 <input style="width: 150px;" type="text" value="VT/PWM"/>	VFD LOAD TYPE 2 <input style="width: 150px;" type="text"/>
VFD HERTZ RANGE 1 <input style="width: 100px;" type="text" value="6-60"/>	VFD HERTZ RANGE 2 <input style="width: 100px;" type="text"/>
VFD SPEED RANGE 1 <input style="width: 100px;" type="text" value="180-1800"/>	VFD SPEED RANGE 2 <input style="width: 100px;" type="text"/>
SERVICE FACTOR <input style="width: 80px;" type="text" value="1.00"/>	FL SLIP <input style="width: 100px;" type="text"/>
NO. POLES <input style="width: 50px;" type="text"/>	MAGNETIZING AMPS <input style="width: 100px;" type="text"/>
VECTOR MAX RPM <input style="width: 100px;" type="text"/>	Encoder PPR <input style="width: 100px;" type="text"/>
Radians / Seconds <input style="width: 100px;" type="text"/>	Encoder Volts <input style="width: 100px;" type="text"/>

**TEAO DATA (IF APPLICABLE):**

HP (AIR OVER) <input style="width: 100px;" type="text"/>	HP (AIR OVER M/S) <input style="width: 100px;" type="text"/>	RPM (AIR OVER) <input style="width: 100px;" type="text"/>	RPM (AIR OVER M/S) <input style="width: 100px;" type="text"/>
FPM AIR VELOCITY <input style="width: 100px;" type="text"/>	FPM AIR VELOCITY M/S <input style="width: 100px;" type="text"/>	FPM AIR VELOCITY SEC <input style="width: 100px;" type="text"/>	

**ADDITIONAL NAMEPLATE DATA:**

Decal / Plate	WD=109145	Customer PN	
Notes		Non Rev Ratchet	
Max Temp Rise		OPP/Upper Oil Cap	GREASE
Thermal (WDG)	OVER TEMP PROT 2	SHAFT/Lower Oil Cap	GREASE
Altitude		Usable At	
Regulatory Notes		Regulatory Compliance	CC 030A
COS		Marine Duty	
Balance	0.08 IN/SEC	Arctic Duty	
3/4 Load Eff.	96.1	Inrush Limit	
Motor Weight (LBS)	750	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)		Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps		SH Max. Temp.	
190V 50 hz Max Amps		SH Voltage	SH VOLTS=115V
380V 50 Hz Max Amps		SH Watts	SH WATTS=144W
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	
Heater in C/B Voltage		Heater in C/B Watts	
Zone 2 Group		Division 2 Service Factor	
Note 1		Note 2	
Note 3		Note 4	
Note 5		Note 6	
Note 7		Note 8	
Note 9		Note 10	
Note 11		Note 12	
Note 13		Note 14	
Note 15		Note 16	
Note 17		Note 18	
Note 19		Note 20	
Note 21		Note 22	

**NIDEC MOTOR CORPORATION  
ST. LOUIS, MO**

TYPICAL NAMEPLATE DATA  
ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY  
SOME FIELDS MAY BE OMITTED



Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

## MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME
NA	D100V2BS-P	3	RI	404TS
<b>ORDER NO.</b>		1605087	<b>LINE NO.</b>	
			100	
MPI:			131651	131652
HP:			100	100
POLES:			4	4
VOLTS:			460	230
HZ:			60	60
SERVICE FACTOR:			1.15	1.15
EFFICIENCY (%):				
S.F.			95.1	95.1
FULL			95.4	95.4
3/4			96.1	96.1
1/2			96	96
1/4			94.2	94.2
POWER FACTOR (%):				
S.F.			87.1	87.1
FULL			87.4	87.4
3/4			86.5	86.5
1/2			82	82
1/4			65.2	65.2
NO LOAD			4.4	4.4
LOCKED ROTOR			33	33
AMPS:				
S.F.			130	260
FULL			112	225
3/4			84	169
1/2			59	119
1/4			38	76
NO LOAD			27.1	54.2
LOCKED ROTOR			687.5	1376
NEMA CODE LETTER			F	F
NEMA DESIGN LETTER			B	B
FULL LOAD RPM			1785	1785
NEMA NOMINAL / EFFICIENCY (%)			95.4	95.4
GUARANTEED EFFICIENCY (%)			94.5	94.5
MAX KVAR			18.4	18.4
AMBIENT (°C)			40	40
ALTITUDE (FASL)			3300	3300
SAFE STALL TIME-HOT (SEC)			30	30
SOUND PRESSURE (DBA @ 1M)			68	68
TORQUES:				
BREAKDOWN{% F.L.}			214	214
LOCKED ROTOR{% F.L.}			175	175
FULL LOAD{LB-FT}			294.5	294.5

NEMA Nominal and Guaranteed Efficiencies are up to 3,300 feet above sea level and 25 ° C ambient

The Above Data Is Typical. Sinewave Power Unless Noted Otherwise

**NIDEC MOTOR CORPORATION**  
ST. LOUIS, MO

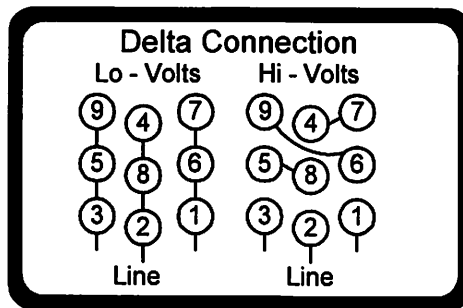
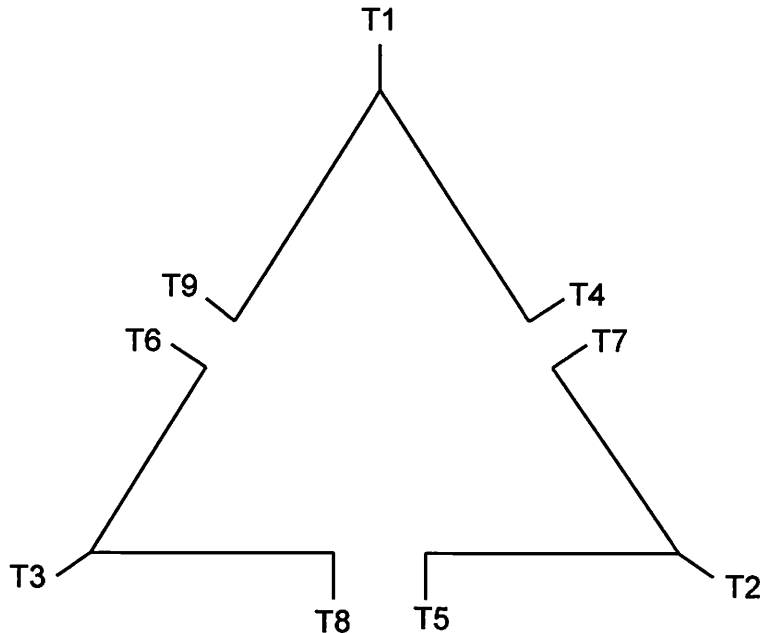


Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.



A109145

### Motor Wiring Diagram 9 Lead, Dual Voltage (DELTA Conn.)



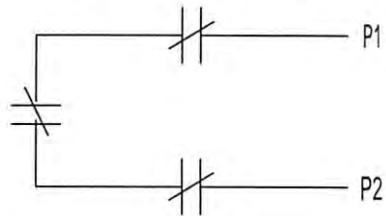
To reverse direction of rotation interchange connections L1 and L2.

Each lead may have one or more cables comprising that lead.  
In such case each cable will be marked with the appropriate lead number.

THERMOSTATS

1. MOTOR IS EQUIPPED WITH QTY-3 (1 PER PHASE) NORMALLY CLOSED THERMOSTATS. THERMOSTATS ARE SET TO OPEN AT HIGH TEMPERATURE.
2. CONTACT RATINGS FOR THERMOSTATS: 120-600 VAC, 720 VA

N. C. THERMOSTATS



NOTE: THERMOSTATS LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX OR IF SO EQUIPPED, AN AUXILIARY BOX.

ACCESSORY LISTING
QTY-3 N.C. THERMOSTATS

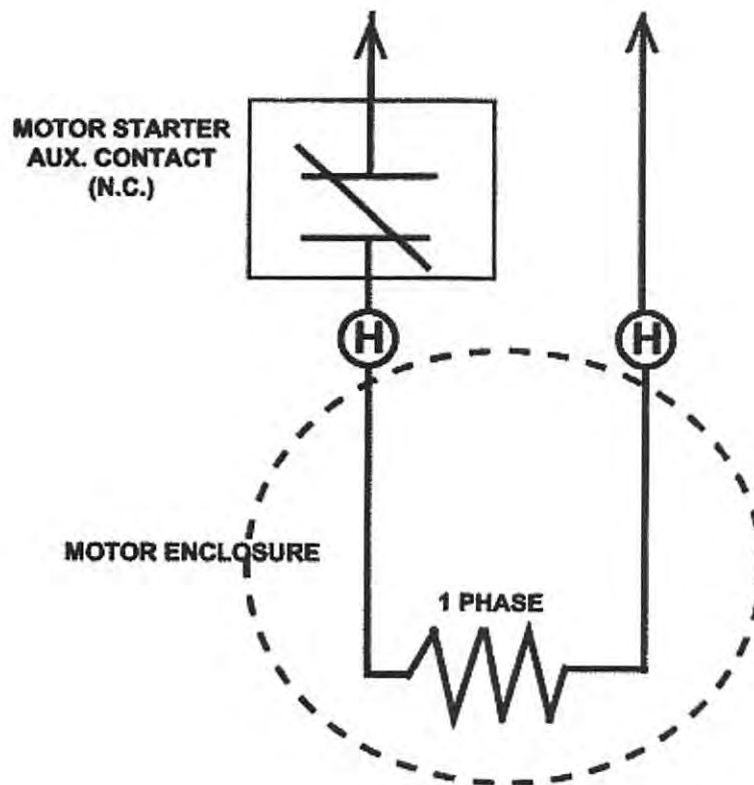
REVISION DESCRIPTION FOR: MISC	SCALE	UNITS	TITLE	NIDEC MOTOR CORPORATION	
STL0211 - UPDATED FORMAT	NONE	IN	CUSTOMER CONNECTION DIAGRAM	REVISION DATE	
	TOLERANCES ON DIMENSIONS (UNLESS OTHERWISE SPECIFIED)			ISSUED BY	APPROVED BY
	INCHES	mm	R. KING	C. CADE	
MATERIAL	ANGLES X°= ±1°		CODE	DWG NO.	REV
				0834066	G
					1 OF 1
					A



970798

# SPACE HEATER CONNECTION DIAGRAM

SPACE HEATER LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX  
OR IF SO EQUIPPED, AN AUXILIARY BOX



THIS EQUIPMENT IS SUPPLIED WITH ANTI-  
CONDENSATION HEATERS. HEATERS  
SHOULD BE ENERGIZED WHEN EQUIPMENT  
IS NOT OPERATING TO PROTECT UNIT BY  
PREVENTING INTERNAL CONDENSATION.  
CONNECT THE "H" OR HEATER  
LEADS TO

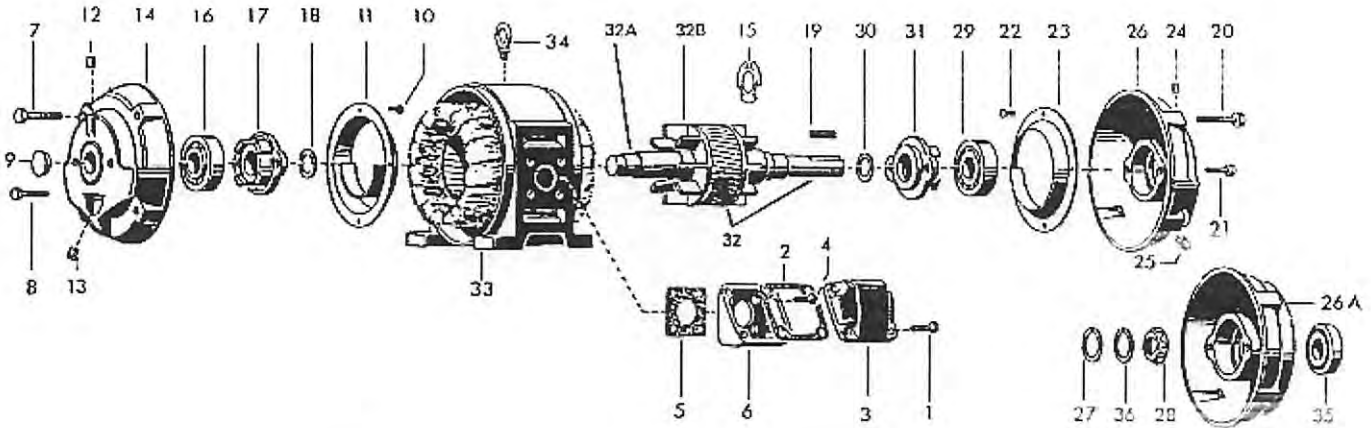
<b>115V</b> VOLTS	<b>144W</b> WATTS RATING
-------------------	--------------------------

**SPACE HEATER NAMEPLATE (ON MOTOR)**

## RENEWAL PARTS

### FRAMES 182 THRU 405 - OPEN DRIPPROOF

TYPES: A, A2, A4, AE, AEF, AEF1, AEF4, AF, AF1, AF4, AFI, AFI1, D, D1, D2, D3, D4, DE, DE1, DE4, DEF, DEF1, DEF4, DF, DF1, DF3, DF4, DFI, DFI1, DFI4, DI, DI1, DI4, FD, FD1, FD4, FDF, FDF1, FDF4, FR, FRF1, R, R1, R2, R4, RE, RE1, REF, REF1, REI, RF, RF1, RI, RI1



ITEM NO.	QTY	NAME OF PART
1	4	Screw
2	1	Gasket
3	1	Outlet Box Cover
4	2	Screw
5	1	Gasket
6	1	OutLet Box Base
7	4	Screw
8	2	Screw
9	1	Bracket Plug
10	4	Sem
11	1	Air Deflector (Short End)
12	1	Pipe Plug
13	1	Pipe Plug
14	1	Short End Bracket
15	1	Disc Spring (Short End)
16	1	Ball Bearing (Short End)
17	1	Bearing Cap (Short End)
18	1	Slinger (Short End)
19	1	Key
20	4	Screw

ITEM NO.	QTY	NAME OF PART
21	2	Screw
22	4	Sem
23	1	Air Deflector(Pulley End)
24	1	Pipe Plug
25	1	Pipe Plug
26	1	Pulley End Bracket
26A	1	Bracket ('C' Style & R-1)
27	1	Snap Ring
28	1	Locknut & Lockwasher
29	1	Ball Bearing (Pulley End) Refer to section 775)
30	1	Slinger (Pulley End)
31	1	Bearing Cap (Pulley End) (R-1)
32	1	Rotor Assembly (Includes Items 32A & 32B)
32A	1	Rotor Shaft
32B	1	Rotor Core
33	1	Wound Stator Assembly
34	1	Eyebolt
35	1	Water Slinger
36	1	Snap Ring

**WARNING:**

Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

**BEARINGS:**

Refer to motor nameplate for the bearing numbers.

**PRICES:**

Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

reference: Renewal Parts Section 700, Page 4



EFFECTIVE:  
21-SEP-12

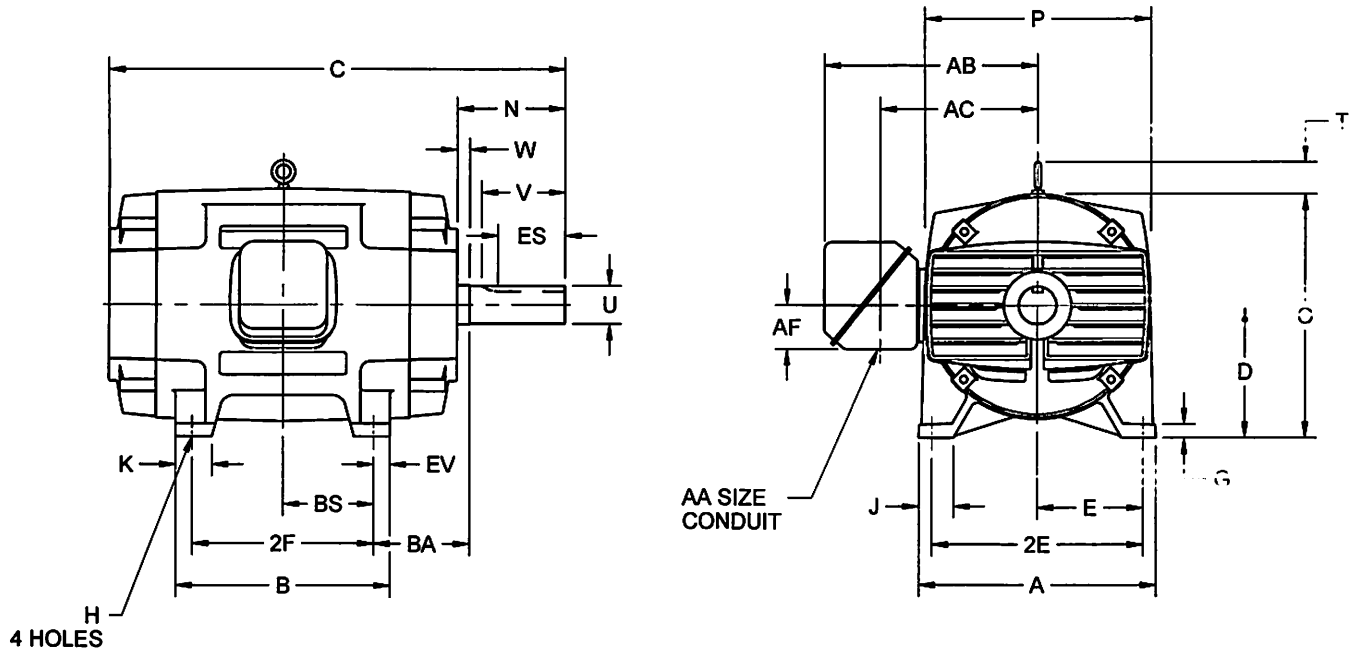
SUPERSEDES:  
29-AUG-12

# HORIZONTAL MOTORS WITH OVERSIZED MAIN CONDUIT BOX

FRAME: 400T,TS  
BASIC TYPE: R

PRINT:  
07-3031

SHEET:  
1 OF 1



ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

UNITS	A	D -.06	E	2E ±.03	G	H +.05	J	K	O	P <sup>2</sup>	T	W
IN	18.00	10.00	8.00	16.00	1.00	.81	2.63	2.75	18.81	17.63	2.50	.25
MM	457	254	203	406	25	21	67	70	478	448	64	6

UNITS	AA	AB	AC	AF	BA	EV
IN		17.25	12.75	4.72	6.63	1.25
MM	3.00	438	324	120	168	32

FRAME	UNITS	B	C	2F ±.03	N	U -.001	V MIN	BS	ES MIN	SQ KEY
404T	IN	14.75	32.50	12.25	7.50	2.875	7.00	6.13	5.65	.750
	MM	375	828	311	191	73.03	178	156	144	19.05
404TS	IN	14.75	29.50	12.25	4.50	2.125	4.00	6.13	2.78	.500
	MM	375	749	311	114	53.98	102	156	71	12.70
405T	IN	16.25	34.00	13.75	7.50	2.875	7.00	6.88	5.65	.750
	MM	413	863	349	191	73.03	178	175	144	19.05
405TS	IN	16.25	31.00	13.75	4.50	2.125	4.00	6.88	2.78	.500
	MM	413	787	349	114	53.98	102	175	71	12.70

1. ALL ROUGH DIMENSIONS MAY VARY BY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS.  
2. LARGEST MOTOR WIDTH.

3. CONDUIT BOX CAN BE LOCATED ON EITHER SIDE AND OPENING MAY BE LOCATED IN STEPS OF 90 DEGREES REGARDLESS OF LOCATION. STANDARD AS SHOWN WITH CONDUIT DOWN.  
4. TOLERANCES SHOWN ARE IN INCHES ONLY.

07-3031/B

**Nidec Motor Corporation**  
St. Louis, Missouri

INFORMATION DISCLOSED ON THIS DOCUMENT IS CONSIDERED PROPRIETARY AND SHALL NOT BE REPRODUCED OR DISCLOSED WITHOUT WRITTEN CONSENT OF NIDEC MOTOR CORPORATION



ISSUED BY  
**D. MENDEZ**  
APPROVED BY  
**R. TIMMERMAN**

IHP\_DP\_NMCA (R-2011) SOLIDEC

MODEL 422

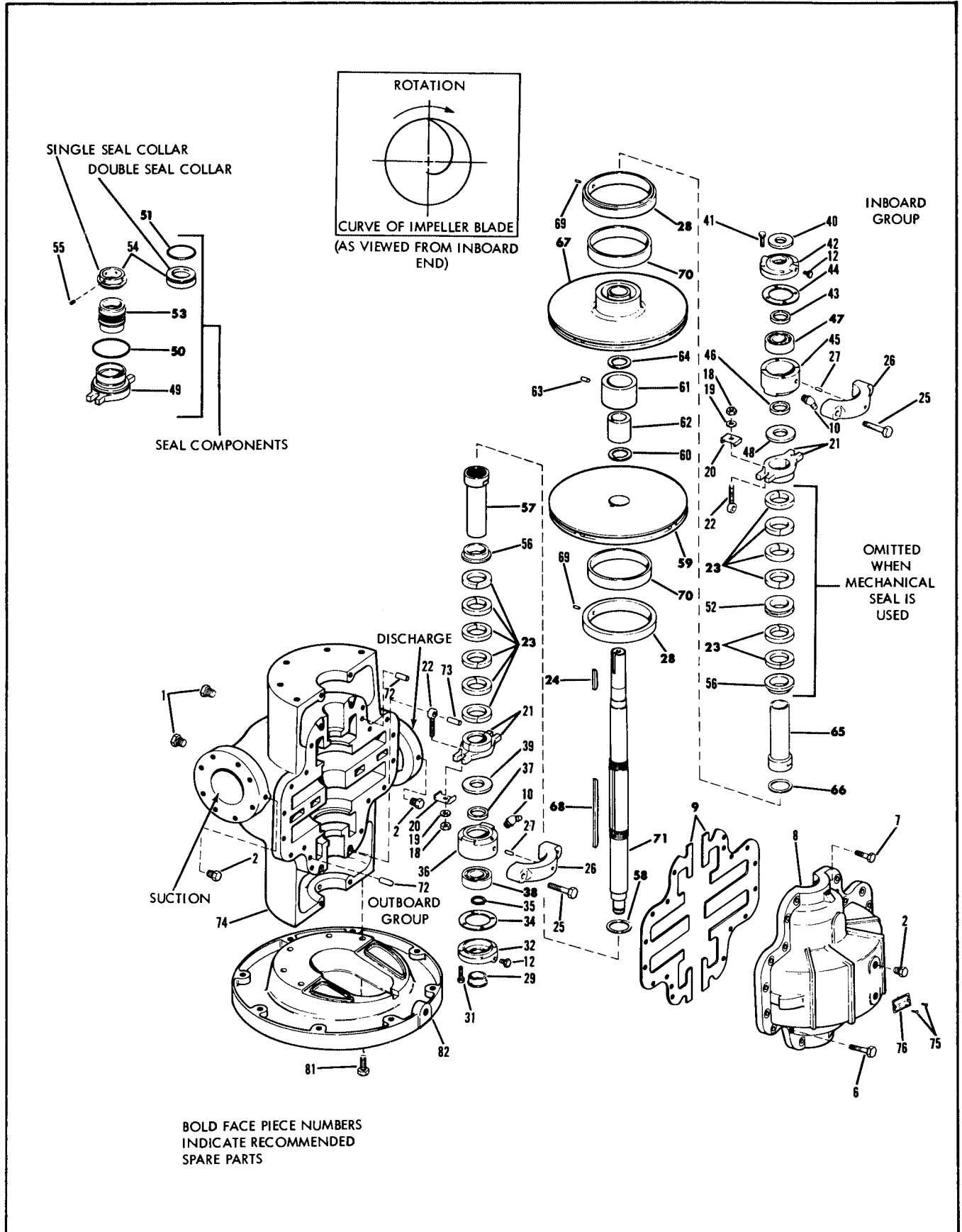


Figure 5. 422 Pump Exploded View

MODEL 423

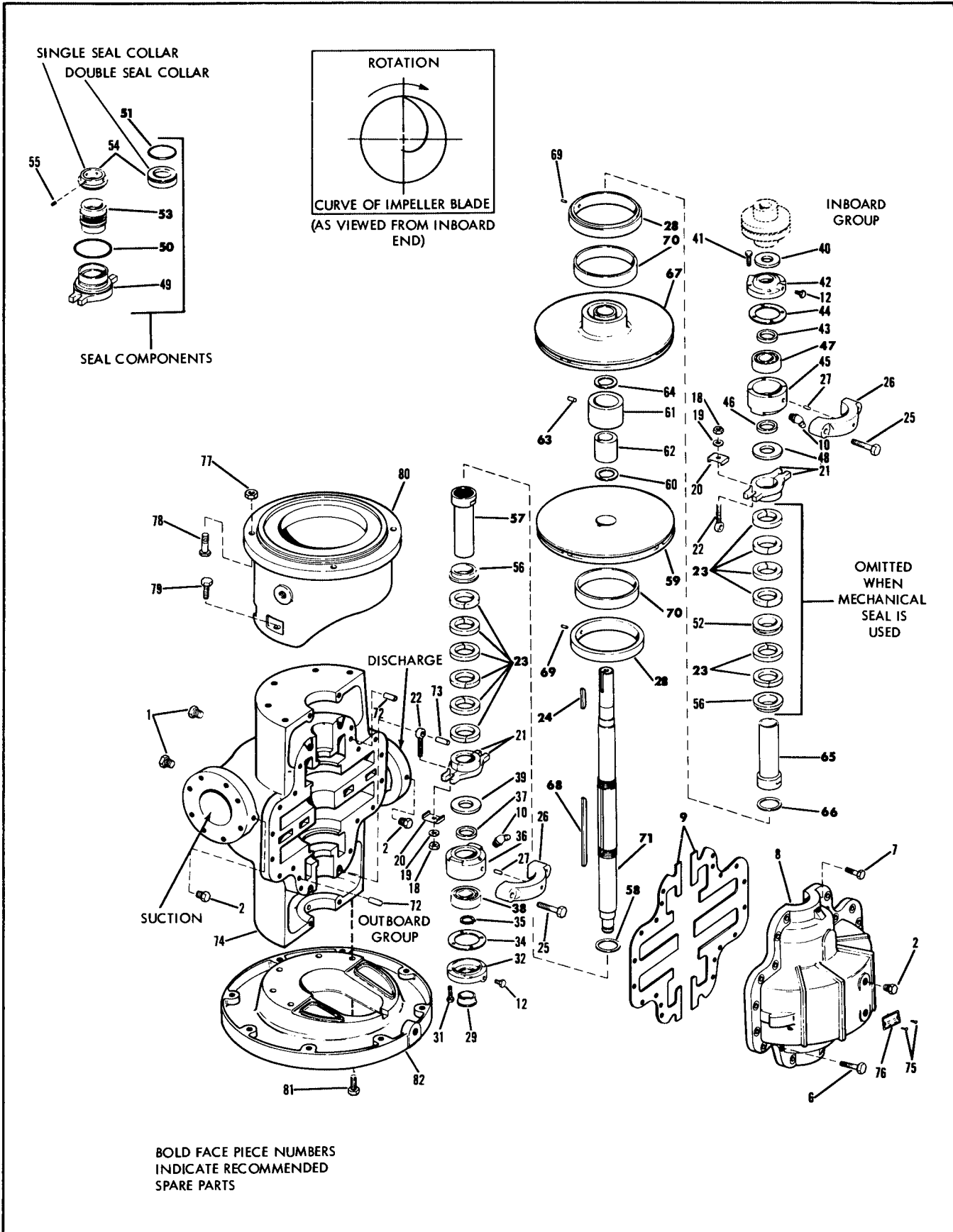
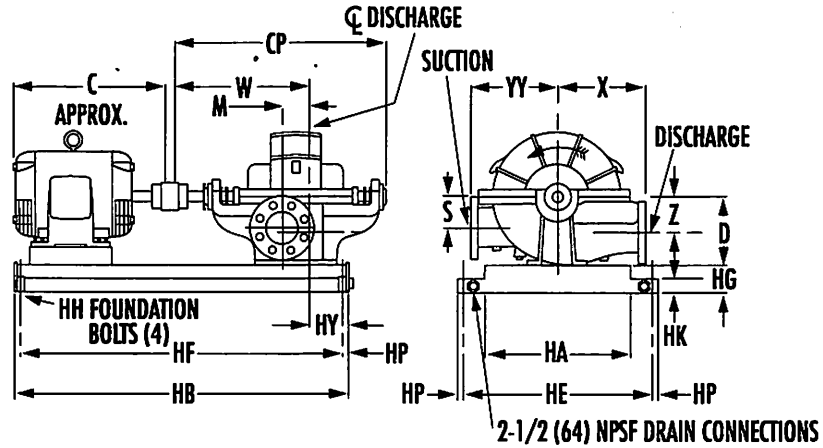


Figure 6. 423 Pump Exploded View

# 421 PUMPS ON STEEL DRIP RIM BASE RIGHT HAND PUMP



## RIGHT HAND PUMP

BASE	SIZE	HA	HB	HE	HF	HG	HH	HK	HP
3	9x33	9 (229)	33-1/2 (851)	13-3/4 (349)	32-1/4 (826)	3 (76)	3/8 (10)	1-1/2 (38)	5/8 (16)
5	11x36	11 (279)	36-1/2 (927)	15-7/8 (403)	35-1/8 (892)	3 (76)	1/2 (13)	1-1/2 (38)	11/16 (17)
6	11x42	11 (279)	42-1/2 (1080)	15-7/8 (403)	41-1/8 (1045)	3 (76)	1/2 (13)	1-1/2 (38)	11/16 (17)
8	14x42	14 (356)	42-1/2 (1080)	19 (483)	41 (1041)	3 (76)	5/8 (16)	1-1/2 (38)	3/4 (19)
9	14x48	14 (356)	48-1/2 (1232)	19 (483)	47 (1194)	3 (76)	5/8 (16)	1-1/2 (38)	3/4 (19)
10	14x56	14 (356)	56-1/2 (1435)	19 (483)	55 (1397)	3 (76)	5/8 (16)	1-1/2 (38)	3/4 (19)
11	18x46	18 (457)	46-1/2 (1181)	25-1/8 (638)	44-7/8 (1140)	4 (102)	3/4 (19)	2 (51)	13/16 (21)
12	18x54	18 (457)	54-1/2 (1384)	25-1/8 (638)	52-7/8 (1343)	4 (102)	3/4 (19)	2 (51)	13/16 (21)
13	18x64	18 (457)	64-1/2 (1638)	25-1/8 (638)	62-7/8 (1597)	4 (102)	3/4 (19)	2 (51)	13/16 (21)
15	22x54	22 (559)	54-1/2 (1384)	29-1/8 (740)	52-7/8 (1343)	4-1/2 (114)	3/4 (19)	2 (51)	13/16 (21)
16	22x64	22 (559)	64-1/2 (1638)	29-1/8 (740)	62-7/8 (1597)	4-1/2 (114)	3/4 (19)	2 (51)	13/16 (21)
17	22x74	22 (559)	74-1/2 (1892)	29-1/8 (740)	72-7/8 (1851)	4-1/2 (114)	3/4 (19)	2 (51)	13/16 (21)
18	22x82	22 (559)	82-1/2 (2273)	29-1/8 (740)	80-7/8 (2054)	4-1/2 (114)	3/4 (19)	2 (51)	13/16 (21)

**NOTES**

- All dimensions are in inches.
- Dimensions may vary  $\pm 3/8"$ .
- Not for construction purposes unless certified.
- Coupling gap may vary 1/8" thru 1".
- Conduit box is shown in approximate location. Dimensions are not specified as they vary with each motor manufacturer.
- Suction and discharge flanges are ANSI standard flat face.

PUMP SIZE		STANDARD 125# SUCTION FLANGE, 250# DISCHARGE FLANGE	OPTIONAL 250# SUCTION AND DISCHARGE FLANGES	STANDARD 5x5x12 & 6x6x12 150# SUCTION FLANGE, 300# DISCHARGE FLANGE	OPTIONAL 5x5x12 & 6x6x12 300# SUCTION AND DISCHARGE FLANGES	145T (330)	182T (330)	184T (335)	213T (406)	215T (457)	259T (539)	256T (584)	284T (558)	284T (609)	286T (635)	324T (660)	326T (660)	326T (711)	364T (735)	364T (711)	365T (761)	404T (688)	404T (787)	405T (863)	444T (863)	444T (965)	445T (914)	445T (1016)	447T (991)	449T (1143)								
DISCH	SUCTION	CASE BORE	POWER SERIES	D	M	S	W	Z	CP	HY	X	YY	C FRAME	13 (330)	13 (330)	14 (335)	16 (406)	18 (457)	21 (539)	23 (584)	24 (609)	24 (635)	25 (660)	26 (660)	26 (711)	28 (735)	29 (711)	30 (761)	30 (688)	33 (787)	34 (863)	34 (965)	36 (914)	40 (1016)	39 (991)	45 (1143)		
2	2-1/2	12	2	9 (228)	4-3/4 (121)	4 (102)	15-3/4 (400)	5-1/2 (140)	26-1/4 (666)	4-1/4 (108)	10 (254)	10-1/4 (260)	BASE	3	3	5	6	8	8	8	9	9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
2-1/2	3	12	2	9-3/4 (248)	5-3/8 (136)	4 (102)	15-7/8 (403)	5-1/2 (140)	26-1/4 (666)	4-1/8 (105)	11 (279)	11 (279)	BASE	3	3	5	6	8	8	8	9	9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
3	4	14	3	10-3/4 (273)	6-3/4 (171)	4-1/2 (114)	18-3/4 (476)	6 (157)	31 (787)	4-3/4 (121)	12 (305)	12-3/8 (314)	BASE					6	9	9	9	9	9	12	12	12	12	12	15	16	15							
4	5	15	3	11 (279)	7-1/8 (181)	5 (130)	18-7/8 (479)	6-1/2 (165)	31 (787)	4-5/8 (117)	13 (330)	13-1/2 (343)	BASE						9	9	9	9	12	12	12	12	12	15	16	15	16	16	16					
5	5	12	4A	14 (356)	6-5/8 (168)	7 (178)	20-7/8 (530)	7 (178)	35-3/8 (899)	11-1/8 (283)	13 (330)	13 (330)	BASE														17	17	17	17	17	17	17	18	18			
5	6	15	4	12-1/2 (317)	9-1/8 (232)	5-1/2 (140)	21-1/8 (536)	7-1/2 (190)	34-1/2 (876)	5-3/8 (137)	15 (381)	15-7/16 (392)	BASE											12	12	12	12	13	16	16	16	16	16	16	16	16	16	
6	6	12	5A	15 (381)	7-1/2 (191)	8 (203)	22-7/8 (581)	8 (203)	38-1/2 (978)	10-7/8 (276)	14 (356)	14 (356)	BASE															17	17	17	17	17	17	17	18	18		
6	8	17	5	14-3/4 (374)	11 (279)	7 (178)	24-1/2 (622)	9 (228)	38 (964)	4 (102)	16 (406)	16-1/2 (419)	BASE											10	10	10	10	12	12	13	13	13	13	13	13	13	13	13

*Tim Frang*

06/27/2023

Certified By

Date



**AURORA**

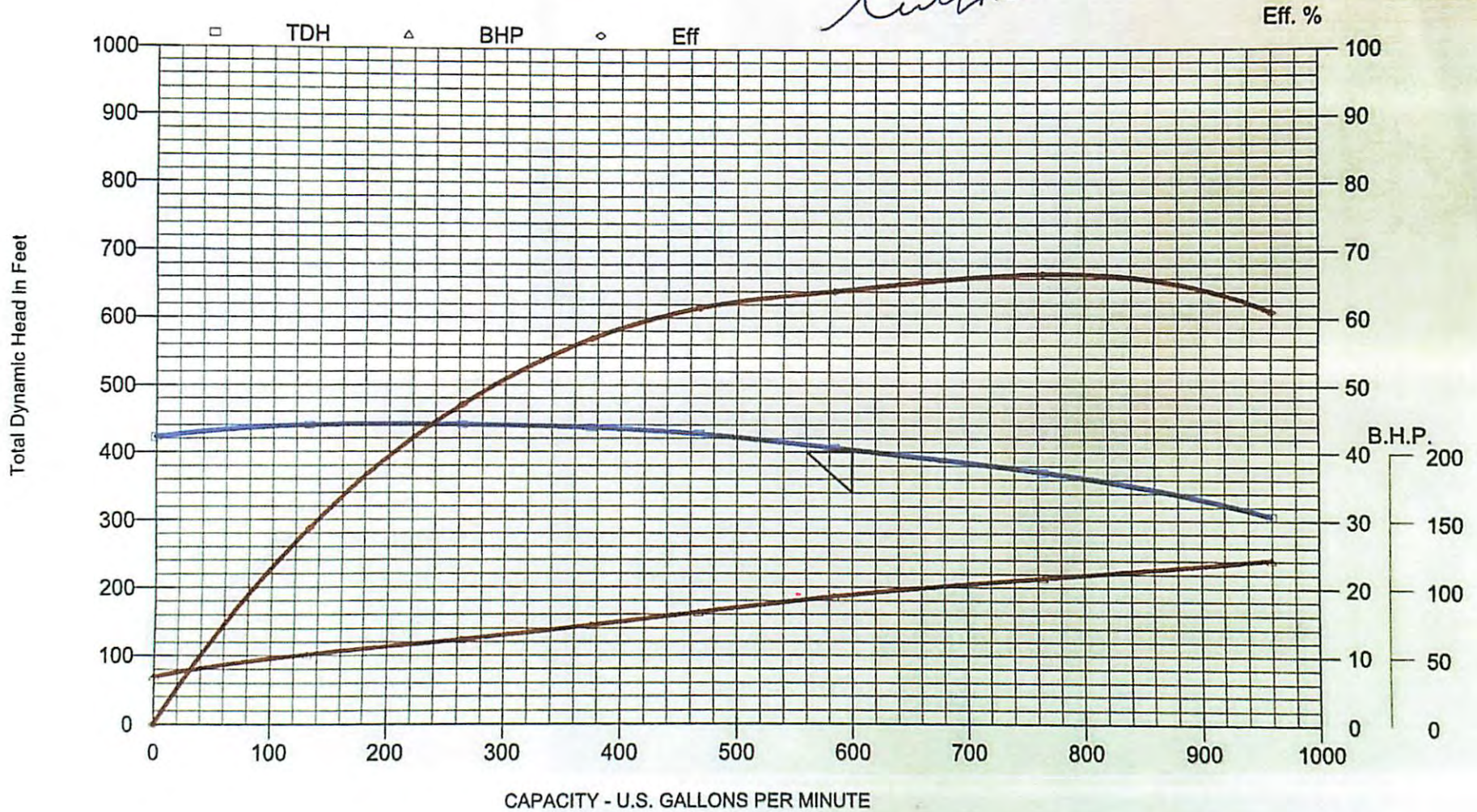
**GELLERT CO**  
Customer



*Andrew R. Petersen*

Sales Order: Z8510/8-1W  
Size: 4x5x15  
Type: 421  
R.P.M.: 1750  
Stage: 2  
Spec. Gravity: 1.0  
Imp. Dia.: 14.5  
WO/Serial No.: 2639346-1W  
Curve No: 323955  
Test No: 623400  
Plotted By: 4646, TF  
Date: 6/27/2023

Pump #1



**PENTAIR PUMP GROUP**

**AURORA**

**FAIRBANKS MORSE**

**HYDROMATIC**

**MYERS**

800 Airport Road, North Aurora, IL 60542

**Pump Performance Program**

Test No 623400

Serial No: 2851078-1W *Pump #1*  
Customer GELLERT CO  
Pump Size 4x5x15  
Pump Model 421

	Primary	Secondary	Other
GPM	600.00		
TDH	400.00		
EFF	65.00		

Impeller Diameter 14.500  
Filing Tip Work  
Stages 2

<u>Data Point</u>	<u>GPM</u>	<u>TDH (psi)</u>	<u>BHP</u>	<u>Efficiency</u>	<u>RPM</u>
1	0.00	421.38	34.78	0.00	1750.00
2	131.27	438.92	50.75	28.67	1750.00
3	262.52	439.53	61.81	47.13	1750.00
4	374.39	435.06	72.22	56.95	1750.00
5	467.16	425.73	81.59	61.55	1750.00
6	584.36	405.08	93.21	64.13	1750.00
7	764.84	369.83	107.07	66.71	1750.00
8	959.35	305.92	121.30	61.10	1750.00

*600  
GPM*

*→ 65%*

*Tim Frong*  
Certified By

06/27/2023  
Date



AURORA

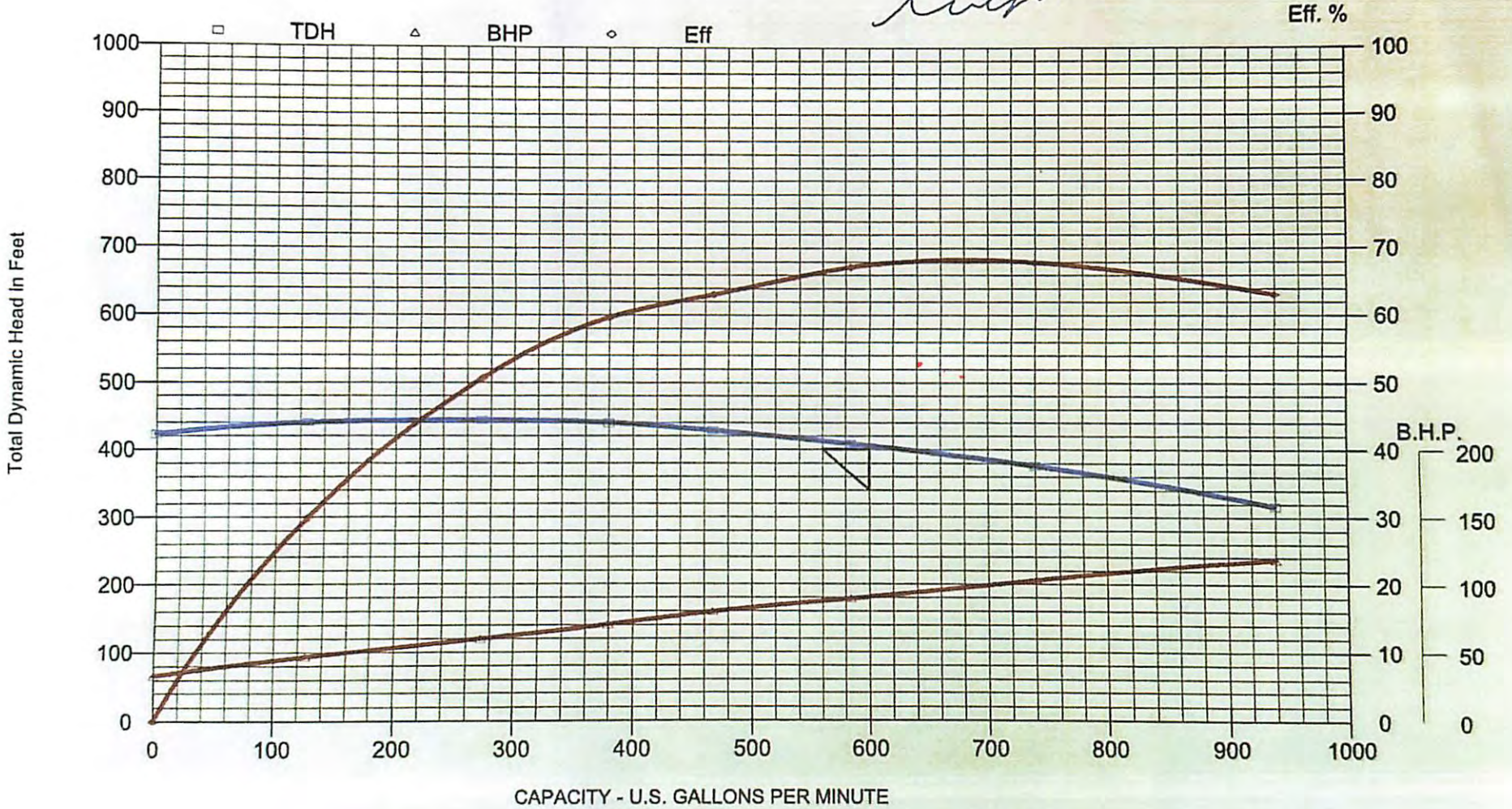
GELLERT CO  
Customer



*Andrew R. Petersen*

Sales Order: 20510/8-2W  
Size: 4x5x15  
Type: 421  
R.P.M.: 1750  
Stage: 2  
Spec. Gravity: 1.0  
Imp. Dia.: 14.5  
WO/Serial No.: 2639346-2W  
Curve No: 324330  
Test No: 623401  
Plotted By: 4646, TF  
Date: 6/27/2023

PUMP  
#2



**PENTAIR PUMP GROUP**

**AURORA**

**FAIRBANKS MORSE**

**HYDROMATIC**

**MYERS**

800 Airport Road, North Aurora, IL 60542

**Pump Performance Program**

Test No 623401

Serial No: 2851078-2W  
Customer: GELLERT CO  
Pump Size: 4x5x15  
Pump Model: 421

*Pump #2*

	Primary	Secondary	Other
GPM	600.00		
TDH	400.00		
EFF	65.00		

Impeller Diameter 14.500  
Filing Tip Work  
Stages 2

<u>Data Point</u>	<u>GPM</u>	<u>TDH (psi)</u>	<u>BHP</u>	<u>Efficiency</u>	<u>RPM</u>
1	0.00	421.70	33.16	0.00	1750.00
2	126.47	438.87	46.88	29.90	1750.00
3	272.52	442.68	60.15	50.64	1750.00
4	379.55	438.81	70.45	59.69	1750.00
5	467.40	427.17	79.85	63.14	1750.00
6	584.20	407.63	89.45	67.23	1750.00
7	739.94	374.86	103.10	67.93	1750.00
8	939.68	315.19	118.45	63.14	1750.00

*600 —  
GPM*

*— 65%*



*Tim Frang*

06/27/2023

Certified By

Date

**PENTAIR**  
**AURORA**

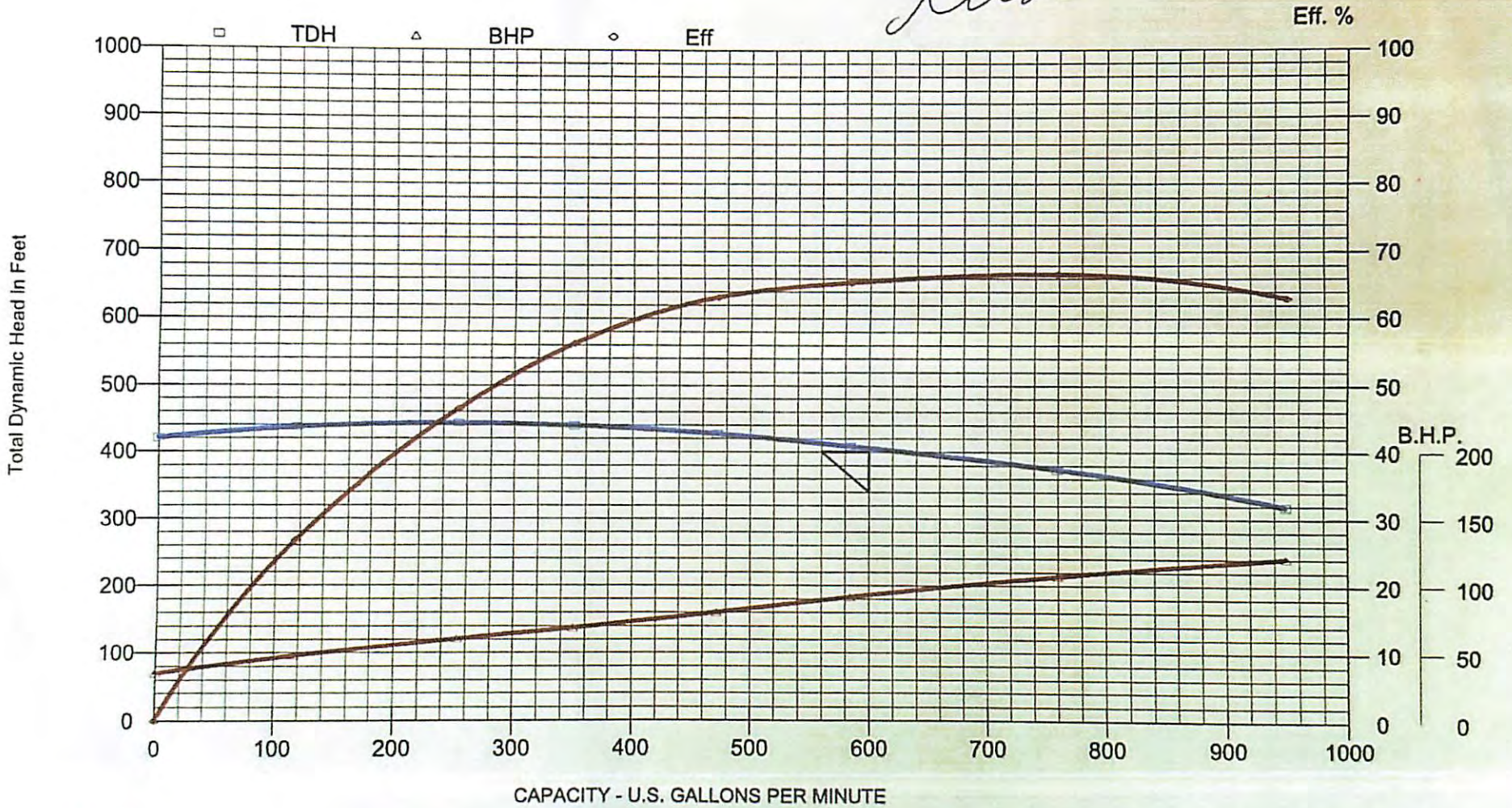
**GELLERT CO**  
Customer



*Andrew R. Petersen*

Sales Order: 28510/U-3W  
Size: 4x5x15  
Type: 421  
R.P.M.: 1750  
Stage: 2  
Spec. Gravity: 1.0  
Imp. Dia.: 14.1875  
WO/Serial No.: 2639346-3W  
Curve No: 324331  
Test No: 623407  
Plotted By: 4646, TF  
Date: 6/27/2023

Pump # 3



**PENTAIR PUMP GROUP**

**AURORA**

**FAIRBANKS MORSE**

**HYDROMATIC**

**MYERS**

800 Airport Road, North Aurora, IL 60542

**Pump Performance Program**

Test No 623407

Serial No: 2851078-3W  
Customer: GELLERT CO  
Pump Size: 4x5x15  
Pump Model: 421

*Pump #3*

	Primary	Secondary	Other
GPM	600.00		
TDH	400.00		
EFF	65.00		

Impeller Diameter: 14.188  
Filing Tip Work  
Stages: 2

<u>Data Point</u>	<u>GPM</u>	<u>TDH (psi)</u>	<u>BHP</u>	<u>Efficiency</u>	<u>RPM</u>
1	0.00	419.49	35.12	0.00	1750.00
2	116.72	435.58	47.94	26.78	1750.00
3	252.98	441.70	60.68	46.50	1750.00
4	350.32	438.19	68.93	56.23	1750.00
5	472.01	426.04	80.36	63.19	1750.00
6	584.08	407.65	91.83	65.47	1750.00
7	759.33	373.07	107.27	66.69	1750.00
8	949.30	317.73	120.93	62.99	1750.00

*600  
GPM*

*65%*

**NIDEC MOTOR CORPORATION**

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



**DATE:** 8/17/2022

**P.O. NO.:** 100HP-RFQ  
**Order/Line NO.:** 1605087 IN 100

**TO:** Aurora Pump  
Pentair Water Aurora Pump  
1101 Myers Parkway  
Ashland, OH, 44805

**ATTN:** CUSTOMER

**Model Number:** NA  
**Catalog Number:** D100V2BS-P  
Horiz. ODP VFD Duty Config.  
CONF,MOTOR,HORIZ. ODP VFD DUTY

**REVISIONS:**

**ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.  
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.**

**Features:**

Temporary - DO NOT COPY  
Horsepower ..... 00100.00 ~ KW: 74.6  
Enclosure ..... ODP  
Poles ..... 04 ~ RPM: 1800  
Frame Size ..... 404~TS  
Phase/Frequency/Voltage.. 3~060~230/460  
Winding Type ..... Random Wound  
Service Factor ..... 1.15  
Insulation Class ..... Class "F" ~ Insulife 2000  
Altitude In Feet (Max) .. 3300 Ft.(1000 M)  
Ambient In Degree C (Max) +40 C  
Assembly Position ..... "F-1" Assembly Position  
Efficiency Class ..... Premium Efficient  
Application ..... Centrifugal Pump  
Inverter Duty NEMA MG1 Part 31  
Customer Part Number ....  
Inverter Duty Rating Details:  
Load Type (Base Hz & Below) .. Variable Torque  
Speed Range (Base Hz & Below). 10:1  
VFD Service Factor 1.00  
"AK" Dimension (Inches).. NA  
Temperature Rise (Sine Wave): "F" Rise @ SF (Resist)  
Design Letter ..... B  
Starting Method ..... Direct-On-Line Start  
Duty Cycle ..... Continuous Duty  
Efficiency Value ..... 95.4 % ~ Typical  
Load Inertia: NEMA ~ Standard Inertia: 441 LB-FT2  
Number Of Starts Per Hour: NEMA  
Motor Type Code ..... RI  
Rotor Inertia (LB-FT<sup>2</sup>) ..... 18.3 LB-FT<sup>2</sup>  
Qty. of Bearings PE (Shaft) ..... 1  
Qty. of Bearings SE (OPP) ..... 1  
Bearing Number PE (Shaft) ..... 6215-2Z-J  
Bearing Number SE (OPP) ..... 6212-2Z-J

Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

# NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.  
ST. LOUIS, MO 63136



**DATE:** 8/17/2022

**P.O. NO.:** 100HP-RFQ  
**Order/Line NO.:** 1605087 IN 100

**TO:** Aurora Pump  
Pentair Water Aurora Pump  
1101 Myers Parkway  
Ashland, OH, 44805

**ATTN:** CUSTOMER

**Model Number:** NA  
**Catalog Number:** D100V2BS-P  
Horiz. ODP VFD Duty Config.  
CONF,MOTOR,HORIZ. ODP VFD DUTY

**REVISIONS:**

**ALL DOCUMENTS HEREIN ARE CONSIDERED TYPICAL BY NIDEC MOTOR CORPORATION.  
THANK YOU FOR YOUR INQUIRY AND THE OPPORTUNITY TO SERVE YOU.**

**Accessories:**

Direct Connected To Load  
Clockwise Rotation FODE  
AEGIS Grounding Ring (SGR)  
Insulated Bearing - Short End  
115 Volt Space Heaters  
Special Balance  
Thermostats - Normally Closed

**USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT**

<b>Horsepower</b>	100
<b>Pole(s)</b>	04
<b>Voltage(s)</b>	460-230
<b>Frame Size</b>	404TS
<b>Shaft U Diameter</b>	2.125
<b>Outlet Box AF</b>	4.72
<b>Outlet Box AA</b>	3.00

Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

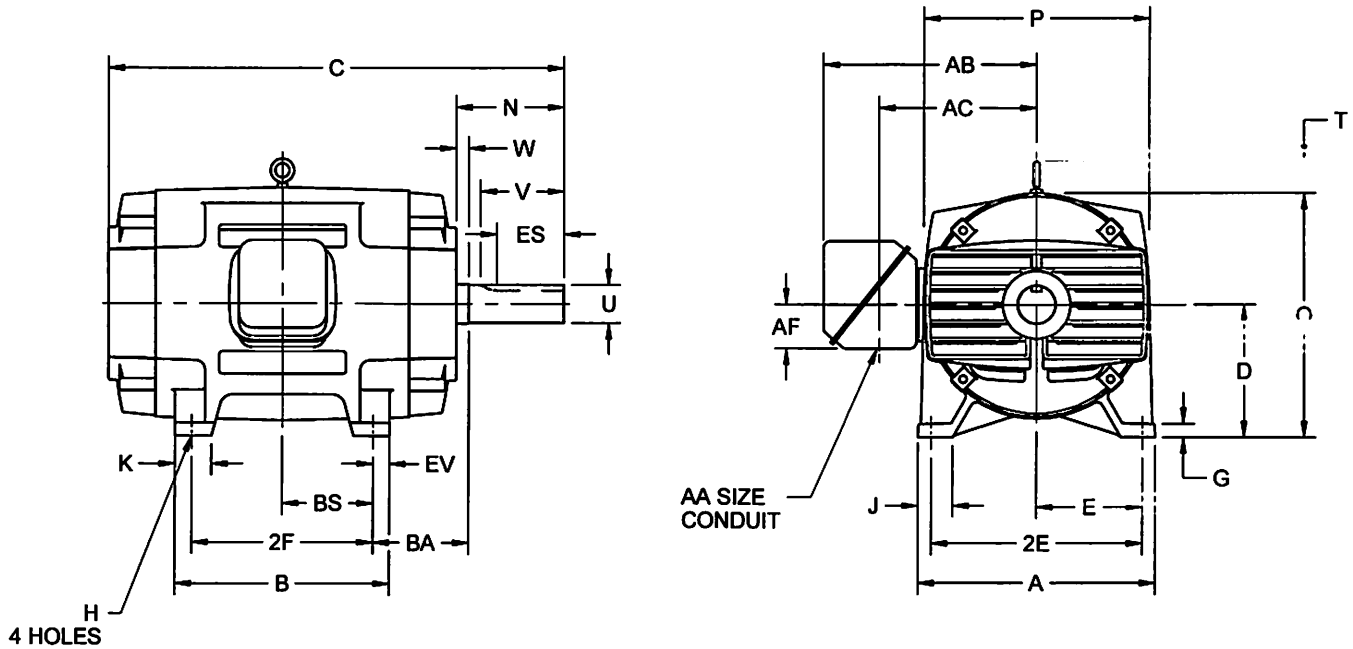
EFFECTIVE:  
**21-SEP-12**

SUPERSEDES:  
**29-AUG-12**

**HORIZONTAL MOTORS  
WITH OVERSIZED MAIN CONDUIT BOX**  
FRAME: 400T,TS  
BASIC TYPE: R

PRINT:  
**07-3031**

SHEET:  
**1 OF 1**



ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

UNITS	A	D -.06	E	2E ±.03	G	H +.05	J	K	O	P <sup>2</sup>	T	W
IN	18.00	10.00	8.00	16.00	1.00	.81	2.63	2.75	18.81	17.63	2.50	2.00
MM	457	254	203	406	25	21	67	70	478	448	64	51

UNITS	AA	AB	AC	AF	BA	EV
IN		17.25	12.75	4.72	6.63	1.25
MM	3.00	438	324	120	168	32

FRAME	UNITS	B	C	2F ±.03	N	U -.001	V MIN	BS	ES MIN	SQ KEY
404T	IN	14.75	32.50	12.25	7.50	2.875	7.00	6.13	5.65	.750
	MM	375	826	311	191	73.03	178	156	144	19.05
404TS	IN	14.75	29.50	12.25	4.50	2.125	4.00	6.13	2.78	.500
	MM	375	749	311	114	53.98	102	156	71	12.70
405T	IN	16.25	34.00	13.75	7.50	2.875	7.00	6.88	5.65	.750
	MM	413	863	349	191	73.03	178	175	144	19.05
405TS	IN	16.25	31.00	13.75	4.50	2.125	4.00	6.88	2.78	.500
	MM	413	787	349	114	53.98	102	175	71	12.70

1. ALL ROUGH DIMENSIONS MAY VARY BY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS.  
2. LARGEST MOTOR WIDTH.

3. CONDUIT BOX CAN BE LOCATED ON EITHER SIDE AND OPENING MAY BE LOCATED IN STEPS OF 90 DEGREES REGARDLESS OF LOCATION. STANDARD AS SHOWN WITH CONDUIT DOWN.  
4. TOLERANCES SHOWN ARE IN INCHES ONLY.

07-3031/B

**Nidec Motor Corporation**  
St. Louis, Missouri

INFORMATION DISCLOSED ON THIS DOCUMENT IS CONSIDERED PROPRIETARY AND SHALL NOT BE REPRODUCED OR DISCLOSED WITHOUT WRITTEN CONSENT OF NIDEC MOTOR CORPORATION



ISSUED BY  
**D. MENDEZ**  
APPROVED BY  
**R. TIMMERMAN**

IHP\_DP\_NV.C (MAR-2011) SOLID 3E

# NAMEPLATE DATA

CATALOG NUMBER: <input style="width: 150px;" type="text" value="D100V2BS-P"/>	NAMEPLATE PART #: <input style="width: 150px;" type="text" value="422699-007"/>
MODEL <input style="width: 100px;" type="text" value="FR"/> <input style="width: 100px;" type="text" value="404TS"/>	TYPE <input style="width: 100px;" type="text" value="RI"/> ENCL <input style="width: 100px;" type="text" value="ODP"/>
SHAFT END BRG <input style="width: 150px;" type="text" value="6215-2Z-J - QTY 1"/>	OPP END BRG <input style="width: 150px;" type="text" value="6212-2Z-J - QTY 1"/>
PH <input style="width: 50px;" type="text" value="3"/> MAX AMB <input style="width: 80px;" type="text" value="40 C"/>	ID# <input style="width: 200px;" type="text" value="(ref: Order#: 1605087, Type: IN, Line#: 100)"/>
INSUL CLASS <input style="width: 50px;" type="text" value="F"/> Asm. Pos. <input style="width: 150px;" type="text" value="F1"/>	DUTY <input style="width: 150px;" type="text" value="CONT"/>
HP <input style="width: 50px;" type="text" value="100"/> RPM <input style="width: 50px;" type="text" value="1785"/>	HP <input style="width: 50px;" type="text"/> RPM <input style="width: 50px;" type="text"/>
VOLTS <input style="width: 50px;" type="text" value="460"/> <input style="width: 50px;" type="text" value="230"/>	VOLTS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
FL AMPS <input style="width: 50px;" type="text" value="112.0"/> <input style="width: 50px;" type="text" value="225.0"/>	FL AMPS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
SF AMPS <input style="width: 50px;" type="text" value="130.0"/> <input style="width: 50px;" type="text" value="260.0"/>	SF AMPS <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>
SF <input style="width: 50px;" type="text" value="1.15"/> DESIGN <input style="width: 50px;" type="text" value="B"/> CODE <input style="width: 50px;" type="text" value="F"/>	SF <input style="width: 50px;" type="text"/> DESIGN <input style="width: 50px;" type="text"/> CODE <input style="width: 50px;" type="text"/>
NEMA NOM EFFICIENCY <input style="width: 50px;" type="text" value="95.4"/> NOM PF <input style="width: 50px;" type="text" value="87.4"/> KiloWatt <input style="width: 50px;" type="text" value="74.60"/>	NEMA NOM EFFICIENCY <input style="width: 50px;" type="text"/> NOM PF <input style="width: 50px;" type="text"/>
GUARANTEED EFFICIENCY <input style="width: 50px;" type="text" value="94.5"/> MAX KVAR <input style="width: 50px;" type="text"/> HZ <input style="width: 50px;" type="text" value="60"/>	GUARANTEED EFFICIENCY <input style="width: 50px;" type="text"/> MAX KVAR <input style="width: 50px;" type="text"/> HZ <input style="width: 50px;" type="text"/>

**HAZARDOUS LOCATION DATA (IF APPLICABLE):**

DIVISION <input style="width: 100px;" type="text"/>	CLASS I <input style="width: 100px;" type="text"/>	GROUP I <input style="width: 100px;" type="text"/>
TEMP CODE <input style="width: 100px;" type="text"/>	CLASS II <input style="width: 100px;" type="text"/>	GROUP II <input style="width: 100px;" type="text"/>



**VFD DATA (IF APPLICABLE):**

VOLTS <input style="width: 50px;" type="text" value="460"/> <input style="width: 50px;" type="text" value="230"/>	AMPS <input style="width: 50px;" type="text" value="117.6"/> <input style="width: 50px;" type="text" value="236.3"/>
TORQUE 1 <input style="width: 150px;" type="text" value="294.50LB-FT"/>	TORQUE 2 <input style="width: 150px;" type="text"/>
VFD LOAD TYPE 1 <input style="width: 150px;" type="text" value="VT/PWM"/>	VFD LOAD TYPE 2 <input style="width: 150px;" type="text"/>
VFD HERTZ RANGE 1 <input style="width: 100px;" type="text" value="6-60"/>	VFD HERTZ RANGE 2 <input style="width: 100px;" type="text"/>
VFD SPEED RANGE 1 <input style="width: 100px;" type="text" value="180-1800"/>	VFD SPEED RANGE 2 <input style="width: 100px;" type="text"/>
SERVICE FACTOR <input style="width: 50px;" type="text" value="1.00"/>	FL SLIP <input style="width: 50px;" type="text"/>
NO. POLES <input style="width: 50px;" type="text"/>	MAGNETIZING AMPS <input style="width: 50px;" type="text"/>
VECTOR MAX RPM <input style="width: 50px;" type="text"/>	Encoder PPR <input style="width: 50px;" type="text"/>
Radians / Seconds <input style="width: 50px;" type="text"/>	Encoder Volts <input style="width: 50px;" type="text"/>

**TEAO DATA (IF APPLICABLE):**

HP (AIR OVER) <input style="width: 50px;" type="text"/>	HP (AIR OVER M/S) <input style="width: 50px;" type="text"/>	RPM (AIR OVER) <input style="width: 50px;" type="text"/>	RPM (AIR OVER M/S) <input style="width: 50px;" type="text"/>
FPM AIR VELOCITY <input style="width: 50px;" type="text"/>	FPM AIR VELOCITY M/S <input style="width: 50px;" type="text"/>	FPM AIR VELOCITY SEC <input style="width: 50px;" type="text"/>	

**ADDITIONAL NAMEPLATE DATA:**

Decal / Plate	WD=109145	Customer PN	
Notes		Non Rev Ratchet	
Max Temp Rise		OPP/Upper Oil Cap	GREASE
Thermal (WDG)	OVER TEMP PROT 2	SHAFT/Lower Oil Cap	GREASE
Altitude		Usable At	
Regulatory Notes		Regulatory Compliance	CC 030A
COS		Marine Duty	
Balance	0.08 IN/SEC	Arctic Duty	
3/4 Load Eff.	96.1	Inrush Limit	
Motor Weight (LBS)	750	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)		Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps		SH Max. Temp.	
190V 50 hz Max Amps		SH Voltage	SH VOLTS=115v
380V 50 Hz Max Amps		SH Watts	SH WATTS=144W
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	
Heater in C/B Voltage		Heater in C/B Watts	
Zone 2 Group		Division 2 Service Factor	
Note 1		Note 2	
Note 3		Note 4	
Note 5		Note 6	
Note 7		Note 8	
Note 9		Note 10	
Note 11		Note 12	
Note 13		Note 14	
Note 15		Note 16	
Note 17		Note 18	
Note 19		Note 20	
Note 21		Note 22	

**NIDEC MOTOR CORPORATION**  
 ST. LOUIS, MO  
 TYPICAL NAMEPLATE DATA  
 ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY  
 SOME FIELDS MAY BE OMITTED



Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

## MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME
NA	D100V2BS-P	3	RI	404TS
ORDER NO.	1605087	LINE NO.	100	
MPI:			131651	131652
HP:			100	100
POLES:			4	4
VOLTS:			460	230
HZ:			60	60
SERVICE FACTOR:			1.15	1.15
EFFICIENCY (%):				
S.F.			95.1	95.1
FULL			95.4	95.4
3/4			96.1	96.1
1/2			96	96
1/4			94.2	94.2
POWER FACTOR (%):				
S.F.			87.1	87.1
FULL			87.4	87.4
3/4			86.5	86.5
1/2			82	82
1/4			65.2	65.2
NO LOAD			4.4	4.4
LOCKED ROTOR			33	33
AMPS:				
S.F.			130	260
FULL			112	225
3/4			84	169
1/2			59	119
1/4			38	76
NO LOAD			27.1	54.2
LOCKED ROTOR			687.5	1376
NEMA CODE LETTER			F	F
NEMA DESIGN LETTER			B	B
FULL LOAD RPM			1785	1785
NEMA NOMINAL / EFFICIENCY (%)			95.4	95.4
GUARANTEED EFFICIENCY (%)			94.5	94.5
MAX KVAR			18.4	18.4
AMBIENT (°C)			40	40
ALTITUDE (FASL)			3300	3300
SAFE STALL TIME-HOT (SEC)			30	30
SOUND PRESSURE (DBA @ 1M)			68	68
TORQUES:				
BREAKDOWN{% F.L.}			214	214
LOCKED ROTOR{% F.L.}			175	175
FULL LOAD{LB-FT}			294.5	294.5

NEMA Nominal and Guaranteed Efficiencies are up to 3,300 feet above sea level and 25 ° C ambient

The Above Data Is Typical, Sinewave Power Unless Noted Otherwise

**NIDEC MOTOR CORPORATION**  
ST. LOUIS, MO



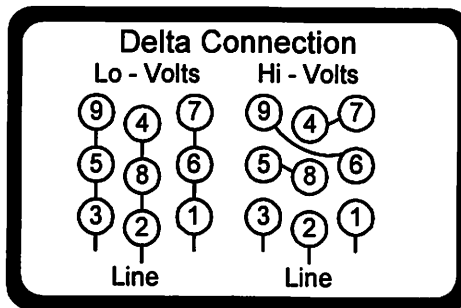
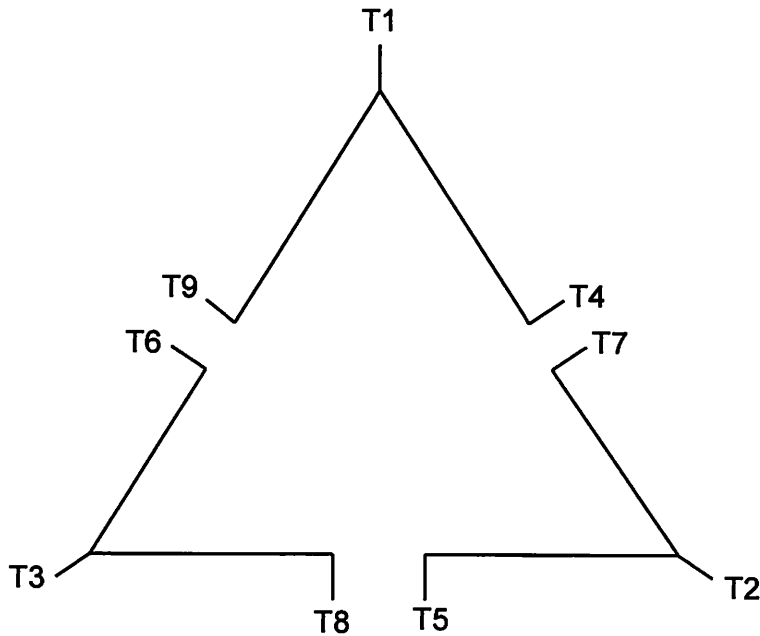
Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.





**A109145**

**Motor Wiring Diagram**  
**9 Lead, Dual Voltage (DELTA Conn.)**



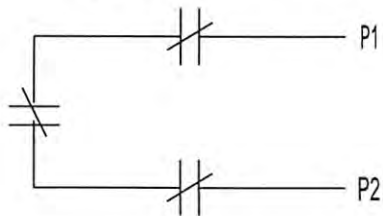
To reverse direction of rotation interchange connections L1 and L2.

Each lead may have one or more cables comprising that lead.  
In such case each cable will be marked with the appropriate lead number.

THERMOSTATS

1. MOTOR IS EQUIPPED WITH QTY-3 (1 PER PHASE) NORMALLY CLOSED THERMOSTATS. THERMOSTATS ARE SET TO OPEN AT HIGH TEMPERATURE.
2. CONTACT RATINGS FOR THERMOSTATS: 120-600 VAC, 720 VA

N. C. THERMOSTATS



NOTE: THERMOSTATS LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX OR IF SO EQUIPPED, AN AUXILIARY BOX.

ACCESSORY LISTING
QTY-3 N.C. THERMOSTATS

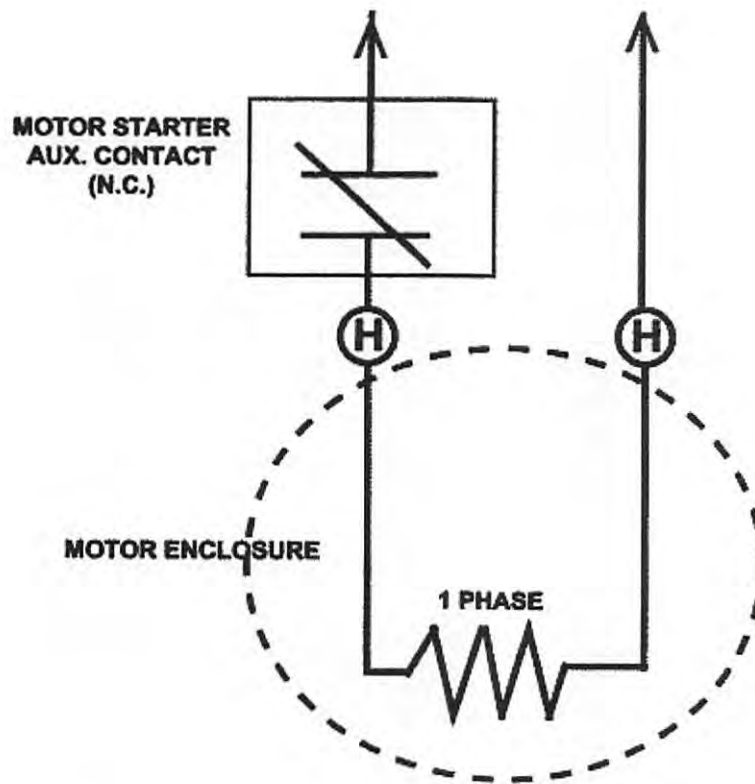
REVISION DESCRIPTION FOR: MISC STL0211 - UPDATED FORMAT	SCALE NONE	UNITS IN	TITLE CUSTOMER CONNECTION DIAGRAM	NIDEC MOTOR CORPORATION
MATERIAL ---	TOLERANCES ON DIMENSIONS (UNLESS OTHERWISE SPECIFIED) INCHES MILLIMETERS		ISSUED BY R. KING	APPROVED BY C. CADE
MUST BE COMPLIANT TO THIS DIRECTIVE EU 2002/95/EC AND REGULATION EC 1907/2006 (REACH) AS AMENDED	ANGLES X° = ±1°		CODE	DWG NO. 0834066
			REV G	REVISION DATE 24-FEB-11
				SHEET NUMBER OF 1
				DWG SIZE A



970798

# SPACE HEATER CONNECTION DIAGRAM

SPACE HEATER LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX  
OR IF SO EQUIPPED, AN AUXILIARY BOX



THIS EQUIPMENT IS SUPPLIED WITH ANTI-  
CONDENSATION HEATERS. HEATERS  
SHOULD BE ENERGIZED WHEN EQUIPMENT  
IS NOT OPERATING TO PROTECT UNIT BY  
PREVENTING INTERNAL CONDENSATION.  
CONNECT THE "H" OR HEATER  
LEADS TO

<b>115V</b> VOLTS	<b>144W</b> WATTS RATING
-------------------	--------------------------

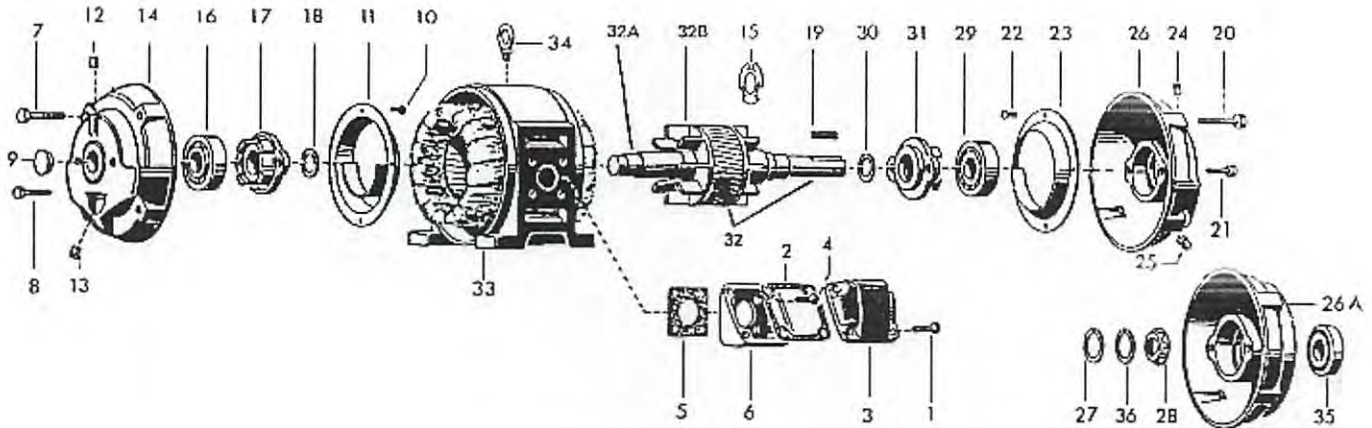
**SPACE HEATER NAMEPLATE (ON MOTOR)**

Revision: 7/30/2008  
Mike Cullen

## RENEWAL PARTS

### FRAMES 182 THRU 405 - OPEN DRIPPROOF

TYPES: A, A2, A4, AE, AEF, AEF1, AEF4, AF, AF1, AF4, AFI, AFI1, D, D1, D2, D3, D4, DE, DE1, DE4, DEF, DEF1, DEF4, DF, DF1, DF3, DF4, DFI, DFI1, DFI4, DI, DI1, DI4, FD, FD1, FD4, FDF, FDF1, FDF4, FR, FRF1, R, R1, R2, R4, RE, RE1, RE4, REF1, REI, RF, RF1, RI, RI1



ITEM NO.	QTY	NAME OF PART
1	4	Screw
2	1	Gasket
3	1	Outlet Box Cover
4	2	Screw
5	1	Gasket
6	1	OutLet Box Base
7	4	Screw
8	2	Screw
9	1	Bracket Plug
10	4	Sem
11	1	Air Deflector (Short End)
12	1	Pipe Plug
13	1	Pipe Plug
14	1	Short End Bracket
15	1	Disc Spring (Short End)
16	1	Ball Bearing (Short End)
17	1	Bearing Cap (Short End)
18	1	Slinger (Short End)
19	1	Key
20	4	Screw

ITEM NO.	QTY	NAME OF PART
21	2	Screw
22	4	Sem
23	1	Air Deflector(Pulley End)
24	1	Pipe Plug
25	1	Pipe Plug
26	1	Pulley End Bracket
26A	1	Bracket ('C' Style & R-1)
27	1	Snap Ring
28	1	Locknut & Lockwasher
29	1	Ball Bearing (Pulley End) Refer to section 775)
30	1	Slinger (Pulley End)
31	1	Bearing Cap (Pulley End) (R-1)
32	1	Rotor Assembly (Includes Items 32A & 32B)
32A	1	Rotor Shaft
32B	1	Rotor Core
33	1	Wound Stator Assembly
34	1	Eyebolt
35	1	Water Slinger
36	1	Snap Ring

**WARNING:**

Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

**BEARINGS:**

Refer to motor nameplate for the bearing numbers.

**PRICES:**

Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

reference: Renewal Parts Section 700, Page 4



## DIRECTION OF ROTATION

This motor is unidirectional and can only be operated in one direction to ensure proper cooling.

The motor will be supplied with CW (clockwise) rotation as shown below. CCW rotation is available upon request.



NIDEC MOTOR CORPORATION  
ST. LOUIS, MISSOURI

80-288

# General Information for Integral Horsepower (IHP) Motors on Variable Frequency Drives (VFDs)

## Variable Frequency Drives (VFD)

A VFD is a type of controller used to vary the speed of an electric motor. The VFD takes a fixed AC voltage and frequency and allows it to be adjusted in order to get different speeds from the motor. Motor speed can be varied by changing the frequency of the input power waveform. The equation below shows how the frequency affects the speed of a three phase induction motor.

$$\text{Speed} = \frac{120 * \text{Fundamental Input Frequency}}{\text{Number of Motor Poles}}$$

## How does a VFD work?

A VFD takes the fixed frequency and voltage sine wave from the power grid or power station and puts it through a few steps in order to allow the VFD user to vary the frequency and in turn control the motor speed. First it rectifies the AC power into DC Power. Because of this step, a term commonly used instead of VFD is inverter. This only describes one step of what the VFD does to the power waveform. Once rectified into a DC voltage the drive sends the power through a set of transistors or switches. These switches can take the DC waveform and by opening and closing at certain speeds and durations can create an output waveform that mimics the sine wave that is required to drive a three phase electric motor. The output wave form is known as a Pulse Width Modulation (PWM) waveform because the waveform is created by multiple pulses of the switches at short intervals.

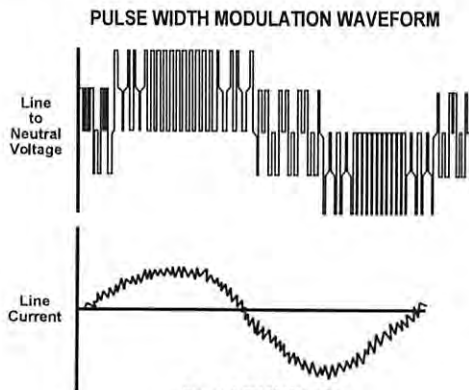


Figure 1 PWM Waveform

## What variables should be considered when deciding whether to power a motor with a VFD?

VFD compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of a particular motor for use with a VFD. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line / System Voltage
- Cable length between the VFD and the motor
- Drive switching (carrier) frequency
- Motor construction

- VFD dv/dt - winding end turn differential in voltage versus differential in time
- High temperatures or high humidity
- Grounding system

Wider speed ranges, higher voltages, higher switching frequencies, insufficient grounding and increased cable lengths all add to the severity of the application and, therefore, the potential for premature motor failure.

## How does a VFD affect the motor?

There are many things to consider when a motor is powered using a VFD or PWM power. When a motor is powered by a PWM waveform the motor windings very often see a large differential voltage, either from phase to phase or turn to turn. When the voltage differential becomes large enough it creates a reaction at the molecular level that converts available oxygen into O<sub>3</sub>. This phenomenon is called partial discharge or corona. This reaction creates energy in the form of light and heat. This energy has a corrosive effect on the varnish used to protect the motor windings. PWM waveforms can also magnify shaft voltages which lead to arcing across the bearing and causing premature bearing failure. Corrective action must be taken to mitigate these issues that arise when using an electric motor with a VFD.

## How do I protect the motor?

Nidec Motor Corporation (NMC) has developed specific motor designs to decrease the harmful affects that a VFD can have on a motor. NMC's INVERTER GRADE<sup>®</sup> insulation system is the first line of defense against corona and phase to phase faults that can be common when a motor is powered using a PWM waveform. The INVERTER GRADE<sup>®</sup> insulation system is standard on all of NMC's Inverter Duty products. Along with the INVERTER GRADE<sup>®</sup> insulation, thermostats are installed as a minimum protection against over heating the motor. Special consideration must also be given to bearings in motors powered by VFD's. In order to create a low resistance path to ground for built up shaft voltages a shaft grounding device can be used. On larger horsepower motors an insulated bearing system should be used in conjunction with the shaft grounding device when installed, to force the stray shaft voltages to ground. The bearing failures are more prominent on motors with thrust handling bearings. NMC has created an Inverter Duty vertical motor line that not only uses the INVERTER GRADE<sup>®</sup> insulation system, but that also comes standard with a shaft grounding device. On motors that are 100 HP and greater the thrust bearing is also insulated for additional protection.

## What does "Inverter Duty" mean?

An Inverter Duty motor should describe a motor that helps mitigate potential failure modes of a motor that is powered by a VFD. Inverter duty motor windings should be able to withstand the voltage spikes per NEMA MG1 Part 31.4.4.2 and protect against overheating when the motor is run at slow speeds. On thrust handling bearings it is apparent that the bearings require additional protection. Inverter Duty vertical motors should have a shaft grounding device to protect the motor bearings from fluting due to voltage discharge through the bearing. On larger motors (100HP and larger) the shaft should also be electrically isolated from the frame in order to aid the shaft grounding ring in discharging the shaft voltages to ground.

\*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL<sup>®</sup> & CSA<sup>®</sup> listings where indicated.

# Motor / Inverter Compatibility

## Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermostats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD.  
(consult codes for installation requirements)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA® 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask a Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

## Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%) mismatch impedance.

## 690V Applications

Motors that are rated for 690VAC and that will be powered by 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

## Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

## Bearing Currents Related to PWM Waveforms

Protection of the motor bearings from shaft currents caused by common mode voltages is becoming a standard feature on Inverter Duty motor products. Some installations may be prone to a voltage discharge condition through the motor bearings called Electrical Discharge Machining (EDM) or fluting. Vertical HOLLOWSHAFT and HOSTILE DUTY World Motor come with grounding devices installed as standard. EDM damage is related to characteristics of the PWM waveform, and the VFD programming, and installations factors.

### Bearing Protection on Inverter Duty Vertical Motors

All U.S. MOTORS® brand "Inverter Duty" vertical products have a shaft grounding system that allows damaging shaft currents a low resistance path to ground. **Bearings on vertical motors fed by VFD power without this bearing protection are not covered under any warranty.** All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to EDM damage.

## Guideline For Insulated Anti-Friction Bearings

Bearing insulation is required to prevent circulating shaft currents which can damage bearings. Circulating shaft current can be caused by use of improper power and/or ground cables, improper grounding systems and higher switching frequencies. Finding and correcting the external condition(s) is the responsibility of the system designer or specifying engineer. To prevent circulating shaft current in motors with anti-friction bearings, Nidec Motor Corporation's standard practice is to insulate the non-drive end bearing.

Adjustable Speed Drives produce a common mode voltage condition. To interrupt common mode voltage on induction motors of all sizes, NEMA MG1-2018 Part 31 recommends insulating both bearings. In cases where both anti-friction bearings are insulated, the system designer or specifying engineer should determine whether to apply one or more of the following options to prevent or reduce shaft currents: sinewave filters, line reactors or mechanical devices, such as shaft grounding or an insulated half coupling. Motors with shaft grounding devices are not suitable for installation in hazardous locations unless housed in an enclosure suitable for the specified Division (or Zone), Class and Group(s).

\* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL® & CSA® listings where indicated.

## Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

## Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor-related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

## Integrated Motor and Inverter

By integrating the motor and inverter at NMC's manufacturing facility, many of the motor compatibility problems are minimized or eliminated. During the manufacturing process, the motor is matched to the inverter characteristics which ensures the winding temperature and torque levels meet the design specification. Since the inverter output wiring to the motor is nearly eliminated, bearing currents are rarely experienced. When the unit is properly grounded, reducing the output cable lengths in conjunction with an inverter grade insulation system and low factory setting of the switching frequency of the inverter drive results in low risk of voltage peaks produced by the PWM waveform.

## Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Locked rotor and drive tripping caused by non-reversing-ratchet operation at low motor speeds. It is not recommended to operate motors at less than 1/3 of synchronous speed. If slow speeds are required contact NMC engineering.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/deceleration and torque of the motor on VFD power and the building of system pressure
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

## Humidity and Non-operational Conditions

The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased risk of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the resistance of the motor winding to ground, and lower the Corona Inception Voltage (CIV) level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the common methods for drying out a winding that has low resistance readings. **Damage caused by these factors are not covered by the limited warranty provided for the motor unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.**

NEMA® Application Guide for AC Adjustable Speed Drive Systems: <http://www.nema.org/stds/acadjustable.cfm#download>

# Warranty Guidelines for Integral Horsepower (IHP)\* Motors on Variable Frequency Drives

## Warranty Guidelines

The information in the following section refers to the motor and drive application guidelines and limitations for warranty.

## Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division 1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. **No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive.** If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

## 575 Volt Motors

575 volt motors can be applied on Inverters when output filters are used. Contact the drive manufacturer for filter selection and installation requirements.

## Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA® MG-1 Part 31 standard. Nidec Motor Corporation provides a three-year limited warranty on all NEMA® frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter applications or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA® frame motors good for 20:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI (10:1 V.T.)
- Inverter Duty motors rated for 20:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed or 5000:1
- 841 Plus® NEMA® Frame Motors

## Applying Premium Efficient motors (that do not have INVERTER GRADE® insulation) on Variable Frequency Drives (2, 4, 6 pole)

Premium efficient motors without INVERTER GRADE insulation meet minimum NEMA® MG-1, Section IV, Part 31.4.4.2. These motors can be used with Variable Frequency Drives (with a reduced warranty period) under the following parameters:

- On NEMA® frame 447 and smaller motors, 20:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads.
- On TITAN® 449 and larger frame motors, 10:1 speed rating on variable torque loads.

- On TITAN® frame motors, inquiry required for suitability on constant torque loads.

Cable distances are for reference only and can be further limited by hot and humid environments (refer to Table 1). Refer to specific VFD

Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	330 Volt
3 KHz	127 ft	400 ft	218 ft
6 KHz	90 ft	307 ft	154 ft
9 KHz	73 ft	251 ft	126 ft
12 KHz	64 ft	217 ft	109 ft
15 KHz	57 ft	194 ft	98 ft
20 KHz	49 ft	168 ft	85 ft

manufacturers cable limits. Refer to the Motor/ Inverter Compatibility page for special consideration of vertical motor bearings.

## Warranty Period Clarifications and Exceptions

### Standard Energy Efficient Exclusion

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors will not be covered under warranty.

### Vertical Motor Windings

Premium efficient vertical motors without INVERTER GRADE® insulation that are installed using the criteria described in this document and applied in the correct applications shall have a warranty while powered by a VFD for 12 months from date of installation or 18 months from date of manufacturing whichever comes first. See limited warranty page for horizontal motor warranty periods.

### Bearing Exclusion for Thrust Handling Bearings

Bearings used in premium efficient vertical motors, and all thrust handling bearings, that are powered by VFDs without shaft grounding devices or insulated bearings (when required) will not be covered under any warranty for damages caused from being powered by a VFD. All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to Electrical Discharge Machining.

### Medium Voltage and Slow Speed Considerations

Motors that are rated above 700 VAC or that are eight pole and slower require special consideration and installation and are not covered under the warranty guidelines in this document. Motors that are rated above 700VAC have special cable length and voltage differential issues that are specific to the VFD type and manufacture. The motor construction and cost may vary dramatically depending on the VFD topology and construction. Contact your NMC representative with VFD manufacturer name and model type for application and motor construction considerations. Motors that are designed eight pole and slower also require special installation and filters per the drive manufacturer.

\* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL® & CSA® listings where indicated.



Item #2      Cla-Val Pump Control Valve

Model 60-39

- Combination pressure regulating, Pressure sustaining, pump control

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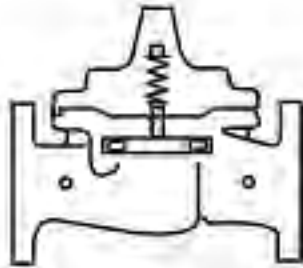
# **CLA-VAL**

**AUTOMATIC CONTROL VALVES**

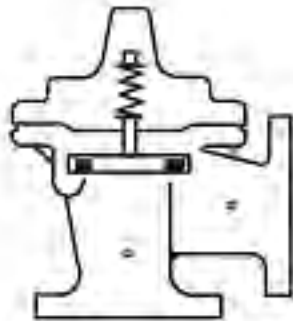
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**60-39/660-39**

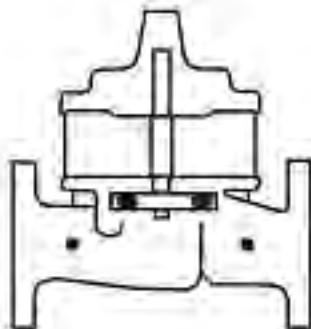
Place this manual with personnel responsible  
for maintenance of this valve.



***Installation***



***Operation***



***Maintenance***





NEWPORT BEACH, CALIFORNIA

CATALOG NO.  
60-39/660-39

DRAWING NO.  
10476

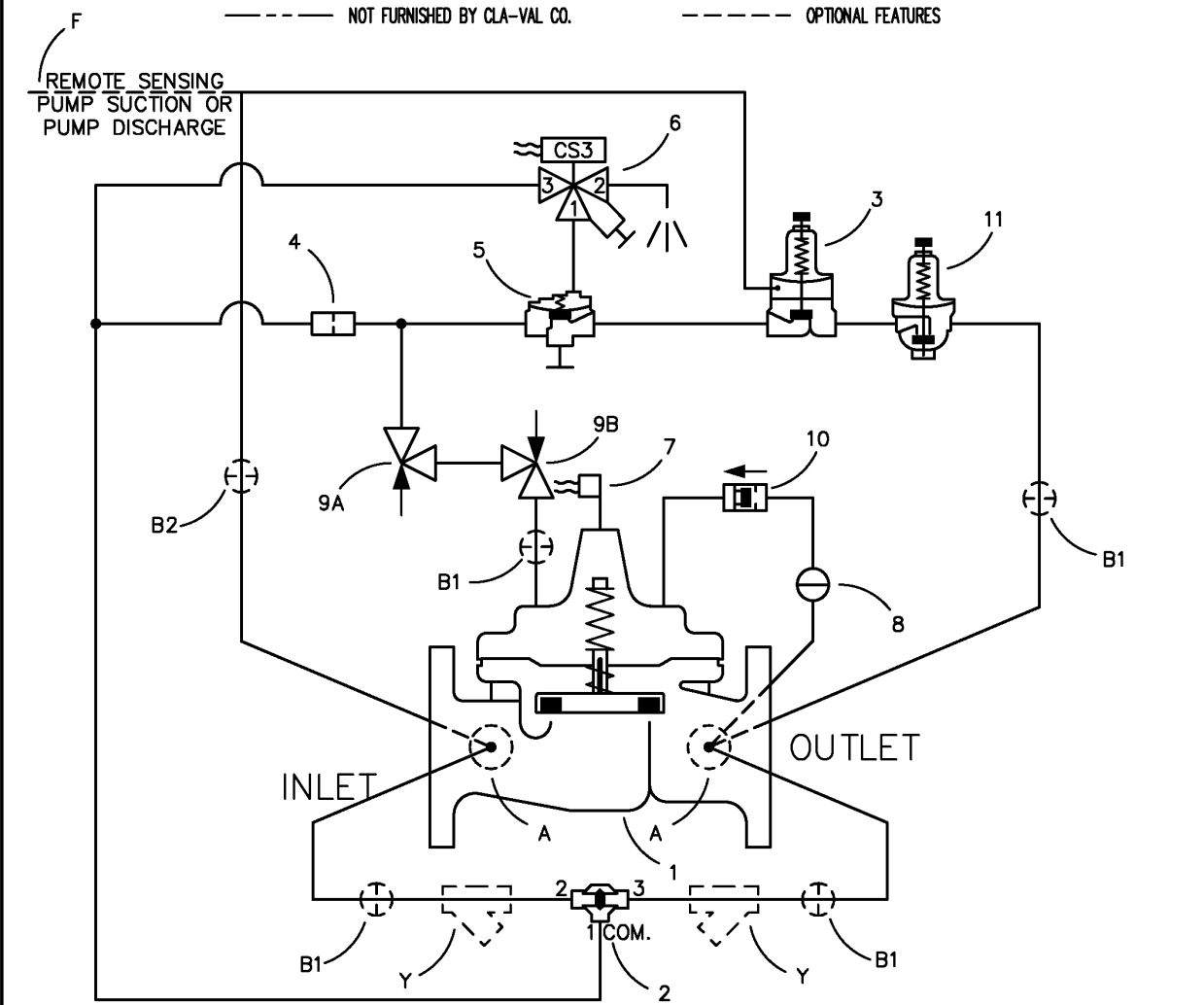
REV  
F

TYPE OF VALVE AND MAIN FEATURES  
COMBINATION PUMP CONTROL, PRESSURE SUSTAINING,  
AND PRESSURE REDUCING VALVE  
(60-39 FOR 4" AND LARGER ONLY, 660-39 FOR 6" AND LARGER ONLY)

DESIGN		
DRAWN	CFV	7-17-81
CHK'D	MGR	7-21-81
APVD	CH	7-23-81

D CAT. NO WAS 60-39; ADDED 100-23 HY-CHECK  
(660-39) TO ITEM 1 (ECO 14671)  
E ADDED CRL60 TO COMPONENT LIST (ECO 23596)  
F REVISED PARAGRAPH OF FEATURE F (ECO 25468)

CAD REVISION RECORD - DO NOT REVISE MANUALLY  
DESCRIPTION BY DATE  
A-B SEE REVISION FILE  
C REVISED ON CAD & QTY OF OPTIONAL ITEM B WAS 4 (ECO 13630) TLC 2-26-93



ITEM NO.	BASIC COMPONENTS	QTY			
1	100-04 HY-CHECK (60-39) MAIN VALVE	1	8	CK2 COCK (ISOLATION VALVE)	1
	100-23 HY-CHECK (660-39) MAIN VALVE			9	CV FLOW CONTROL
2	CVS-1 SHUTTLE VALVE	1	10	CDC/CSC CHECK VALVE	1
3	CRL/CRL60 PRESSURE RELIEF CONTROL	1	11	CRD PRESSURE REDUCING CONTROL	1
4	X58C RESTRICTION ASSEMBLY	1			
5	100-01 AUXILIARY HYTROL (REV. FLOW)	1			
6	CS3M SOLENOID CONTROL	1			
7	X105LCW LIMIT SWITCH ASSEMBLY	1			

OPTIONAL FEATURE SUFFIX		ADDED TO CATALOG NUMBER		
A	X46A FLOW CLEAN STRAINER	2		
B	CK2 COCK (ISOLATION VALVE)	5		
F	REMOTE SENSING PUMP SUCTION OR PUMP DISCHARGE			
Y	X43 "Y" STRAINER	2		

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**CLA-VAL CO.**

NEWPORT BEACH, CALIFORNIA

CATALOG NO.

60-39/660-39

DRAWING NO.

10476

REV

F

TYPE OF VALVE AND MAIN FEATURES

COMBINATION PUMP CONTROL, PRESSURE SUSTAINING,  
AND PRESSURE REDUCING VALVE  
(60-39 FOR 4" AND LARGER ONLY, 660-39 FOR 6" AND LARGER ONLY)

DESIGN

DRAWN CFV 7-17-81

CHK'D MGR 7-21-81

APVD CH 7-23-81

OPERATING DATAI. SOLENOID CONTROL FEATURE:

SOLENOID CONTROL (6) IS A DIRECT-ACTING, 3-WAY SOLENOID CONTROL THAT CHANGES POSITION WHEN THE COIL IS DE-ENERGIZED OR ENERGIZED. THIS APPLIES OR RELIEVES PRESSURE IN THE COVER CHAMBER OF AUXILIARY HYTROL (5), PROVIDING THE OPERATION SHOWN IN THE FOLLOWING TABLE:

SOLENOID CONTROL (6)		AUXILIARY HYTROL (5) POSITION	MAIN VALVE (1) POSITION
POSITION	PORTS CONNECTED		
ENERGIZED	1 & 2	OPEN	OPEN UNDER COMMAND OF CONTROLS (3) & (11)
DE-ENERGIZED	1 & 3	CLOSED	CLOSED

NOTE: SOLENOID CONTROL (6) IS EQUIPPED WITH A MANUAL ACTUATOR WHICH CAN BE USED TO OPERATE THE SOLENOID WITHOUT ELECTRICAL POWER. AFTER MANUAL ACTUATION, ALWAYS RETURN THE ACTUATOR TO ITS ORIGINAL POSITION OR THE SOLENOID WILL NOT RETURN TO THE DE-ENERGIZED POSITION.

II. PRESSURE SUSTAINING FEATURE [AUXILIARY HYTROL (5) MUST BE OPEN]:

PRESSURE RELIEF CONTROL (3) IS A NORMALLY CLOSED CONTROL THAT RESPONDS TO MAIN VALVE INLET PRESSURE CHANGES. IF INLET PRESSURE IS HIGHER THAN THE SET POINT OF CONTROL (3), CONTROL (3) IS OPEN. THIS PLACES THE MAIN VALVE COVER UNDER COMMAND OF PRESSURE REDUCING CONTROL (11). IF INLET PRESSURE LOWERS TO THE SET POINT OF CONTROL (3), CONTROL (3) CLOSURES. THIS PRESSURIZES THE COVER CHAMBER OF THE MAIN VALVE AND THE MAIN VALVE CLOSURES, SUSTAINING THE DESIRED MINIMUM INLET PRESSURE. PRESSURE RELIEF CONTROL (3) ADJUSTMENT: TURN THE ADJUSTING SCREW CLOCKWISE TO INCREASE THE SETTING.

III. PRESSURE REDUCING FEATURE:

PRESSURE REDUCING CONTROL (11) IS A NORMALLY OPEN CONTROL THAT RESPONDS TO MAIN VALVE OUTLET PRESSURE CHANGES. AN INCREASE IN OUTLET PRESSURE TENDS TO CLOSE CONTROL (11) AND A DECREASE IN OUTLET PRESSURE TENDS TO OPEN CONTROL (11). THIS CAUSES MAIN VALVE COVER PRESSURE TO VARY AND THE MAIN VALVE MODULATES (OPENS AND CLOSURES), MAINTAINING A RELATIVELY CONSTANT OUTLET PRESSURE. PRESSURE REDUCING CONTROL (11) ADJUSTMENT: TURN THE ADJUSTING SCREW CLOCKWISE TO INCREASE THE SETTING.

CAD REVISION RECORD - DO NOT REVERSE MANUALLY


DATE

BY

DESCRIPTION

LTR

SEE SHEET 1

 <b>CLA-VAL CO.</b> NEWPORT BEACH, CALIFORNIA	CATALOG NO. 60-39/660-39	DRAWING NO. 10476	REV F
	TYPE OF VALVE AND MAIN FEATURES COMBINATION PUMP CONTROL, PRESSURE SUSTAINING, AND PRESSURE REDUCING VALVE (60-39 FOR 4" AND LARGER ONLY, 660-39 FOR 6" AND LARGER ONLY)		DESIGN DRAWN CFV 7-17-81 CHK'D MGR 7-21-81 APVD CH 7-23-81

OPERATING DATA-CONTINUED

IV. CHECK VALVE FEATURE:

THE MAIN VALVE (1) HAS AN INTEGRAL CHECK FEATURE. WHEN OUTLET PRESSURE IS HIGHER THAN INLET PRESSURE, THE MAIN VALVE (1) CLOSES PREVENTING REVERSE FLOW. CHECK VALVE (10) OPENS AND PERMITS THE HIGHER OUTLET PRESSURE INTO THE MAIN VALVE COVER CHAMBER AND THE DIAPHRAGM ASSEMBLY MOVES TO THE DOWN POSITION.

V. SWITCH ASSEMBLY FEATURE:

SWITCH ASSEMBLY (7) IS ACTUATED BY A STEM EXTENSION ATTACHED TO THE MAIN VALVE STEM. THE SWITCH ASSEMBLY IS FACTORY ADJUSTED TO ACTUATE A SINGLE-POLE DOUBLE-THROW SWITCH WHEN THE MAIN VALVE IS ALMOST CLOSED. WHEN THE MAIN VALVE STARTS TO OPEN, THE SPRING-LOADED SWITCH-ACTUATING LEVER IS RELEASED AND RETURNS THE SWITCH TO ITS NORMAL POSITION.

VI. DUAL SUPPLY FEATURE:

WHEN MAIN VALVE (1) INLET PRESSURE EXCEEDS OUTLET PRESSURE, SHUTTLE VALVE (2) SHIFTS, INTERCONNECTING PORTS 1 AND 2. WHEN MAIN VALVE (1) OUTLET PRESSURE EXCEEDS INLET PRESSURE, SHUTTLE VALVE (2) SHIFTS, INTERCONNECTING PORTS 1 AND 3. THIS DIRECTS THE HIGHEST PRESSURE INTO THE PILOT SYSTEM.

VII. CLOSING SPEED CONTROL:

FLOW CONTROL (9B) CONTROLS THE CLOSING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE CLOSE SLOWER.

VIII. OPENING SPEED CONTROL:

FLOW CONTROL (9A) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.

CAD REVISION RECORD - DO NOT REVISE MANUALLY	DATE	
	BY	
DESCRIPTION	SEE SHEET 1	
LTR		

**CLA-VAL CO.**

NEWPORT BEACH, CALIFORNIA

CATALOG NO.

60-39/660-39

DRAWING NO.

10476

REV

F

TYPE OF VALVE AND MAIN FEATURES

COMBINATION PUMP CONTROL, PRESSURE SUSTAINING,  
AND PRESSURE REDUCING VALVE  
(60-39 FOR 4" AND LARGER ONLY, 660-39 FOR 6" AND LARGER ONLY)

DESIGN

DRAWN	CFV	7-17-81
CHK'D	MGR	7-21-81
APVD	CH	7-23-81

OPERATING DATA-CONTINUEDIX. OPTIONAL FEATURE OPERATING DATA:SUFFIX A (FLOW CLEAN STRAINER):

A SELF-CLEANING STRAINER IS INSTALLED IN THE MAIN VALVE INLET BODY BOSS WHICH PROTECTS THE PILOT SYSTEM FROM FOREIGN PARTICLES.

SUFFIX B (ISOLATION VALVES):

CK2 COCKS (B1) AND (B2) ARE USED TO ISOLATE THE PILOT SYSTEM FROM MAIN LINE PRESSURE. THESE VALVES MUST BE OPEN DURING NORMAL OPERATION.

SUFFIX F (REMOTE SENSING PUMP SUCTION OR PUMP DISCHARGE):

PILOT SENSING PRESSURE IS OBTAINED FROM PUMP INLET FOR PUMP SUCTION CONTROL OR FROM PUMP DISCHARGE FOR PUMP DISCHARGE CONTROL. [PILOT SENSING PRESSURE IS OBTAINED FROM THE MAIN VALVE INLET IF SUFFIX (F) IS NOT SPECIFIED]. NOTE: WHEN USED FOR PUMP SUCTION CONTROL, SUCTION PRESSURE MUST BE POSITIVE.

SUFFIX Y (Y-STRAINER):

A Y-PATTERN STRAINER IS INSTALLED IN THE PILOT SUPPLY LINE TO PROTECT THE PILOT SYSTEM FROM FOREIGN PARTICLES. THE STRAINER SCREEN MUST BE CLEANED PERIODICALLY.

X. CHECK LIST FOR PROPER OPERATION:

- ( ) SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
- ( ) AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
- ( ) PERIODIC CLEANING OF STRAINERS (Y) IS RECOMMENDED (OPTIONAL FEATURE).
- ( ) PUMP SUCTION OR PUMP DISCHARGE SENSING LINE PROPERLY CONNECTED (OPTIONAL FEATURE).
- ( ) CV FLOW CONTROLS (9A) AND (9B) OPEN AT LEAST 4 TURNS.
- ( ) CORRECT VOLTAGE TO SOLENOID CONTROL (6).
- ( ) MANUAL OPERATOR OF SOLENOID CONTROL (6) DISENGAGED.
- ( ) LIMIT SWITCH ASSEMBLY (7) PROPERLY WIRED.
- ( ) CK2 COCK (8) OPEN DURING NORMAL OPERATION.
- ( ) CK2 COCKS (B1) AND (B2) OPEN (OPTIONAL FEATURE).

CAD REVISION RECORD - DO NOT REVISE MANUALLY

DATE

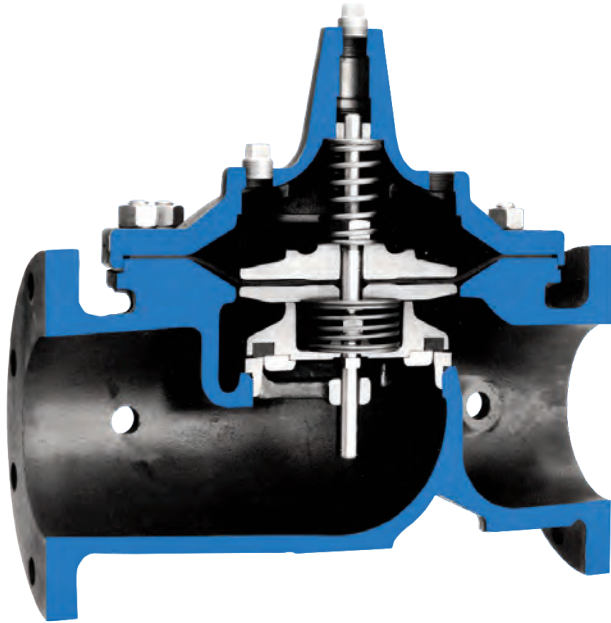
BY

DESCRIPTION

SEE SHEET 1

LTR

# Hy-Check Valve



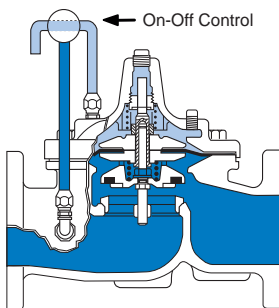
- Built-in Automatic Check Valve
- Drip Tight, Positive Seating
- Globe or Angle Pattern
- Service Without Removal From Line
- Every valve factory-tested

The Cla-Val Model 100-04 Hy-Check Valve is a hydraulically operated diaphragm valve with a built-in check feature to prevent return flow. Available in globe or angle pattern, it consists of a body, cover and diaphragm assembly. The diaphragm assembly which is guided top and bottom by a precision machined stem is the only moving part.

A synthetic rubber disc retained on three and one half sides forms a drip-tight seal with the renewable seat when operating pressure is applied above the non-wicking diaphragm. When pressure above the diaphragm is relieved, the valve opens wide. The rate of closing or opening can be controlled by modulating the flow into or out of the cover chamber. When a pressure reversal occurs the split stem will immediately allow the disc retainer assembly to check closed **regardless of the position of the diaphragm.**

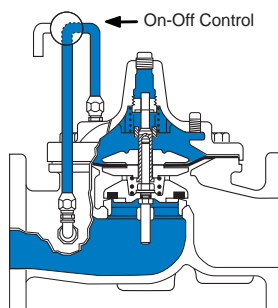
The Model 100-04 is used on system applications such as remote control, pressure regulation, solenoid control, etc.; wherever a positive check feature is necessary to prevent reverse flow. Its packless construction and simplicity of design minimizes maintenance and assures a long dependable service life.

## Principle of Operation



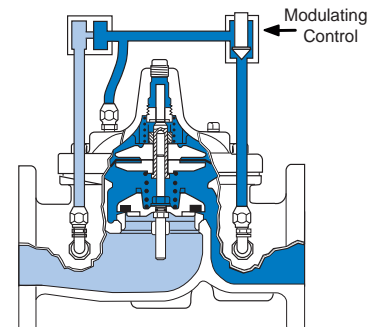
### Full Open Operation

When pressure in the cover chamber is relieved to a zone of lower pressure, the line pressure at the valve inlet opens the valve, allowing full flow.



### Tight Closing Operation

When pressure from the valve inlet is applied to the cover chamber, the valve closes drip-tight.



### Check Action

When a static condition or pressure reversal occurs, the split stem design allows the valve to instantly check closed. Return flow is prevented regardless of the diaphragm's position.

Note: For optimum operation of built-in check feature, installation with stem vertically up is recommended.

## Specifications

### Available Sizes

Pattern	Flanged
Globe	2" - 16" 50 - 400 mm
Angle	3" - 16" 80 - 400 mm

### Operating Temp. Range

Fluids
-40° to 180° F -40° to 82° C

### Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class			
		Flanged		Threaded	
Grade	Material	ANSI Standards*	150 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400
UNS 87850	Bronze	B16.24	225	400	400

Note: \* ANSI standards are for flange dimensions only.  
Flanged valves are available faced but not drilled.  
‡ End Details machined to ANSI B2.1 specifications.

**Valves for higher pressure are available; consult factory for details**

## Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes (inches)	2" - 16"	2" - 16"	2" - 16"
Available Sizes (mm)	50 - 400 mm	50 - 400 mm	50 - 400 mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		
For material options not listed, consult factory. Cla-Val manufactures valves in more than 50 different alloys.			

## Options

### Epoxy Coating - suffix KC

This option NSF 61 Listed and FDA approved, fusion bonded epoxy coating is for use with cast iron, ductile iron or steel valves. This coating is resistant to various water conditions, certain acids, chemicals, solvents and alkalis. Epoxy coatings are applied in accordance with AWWA coating specifications C116-03.

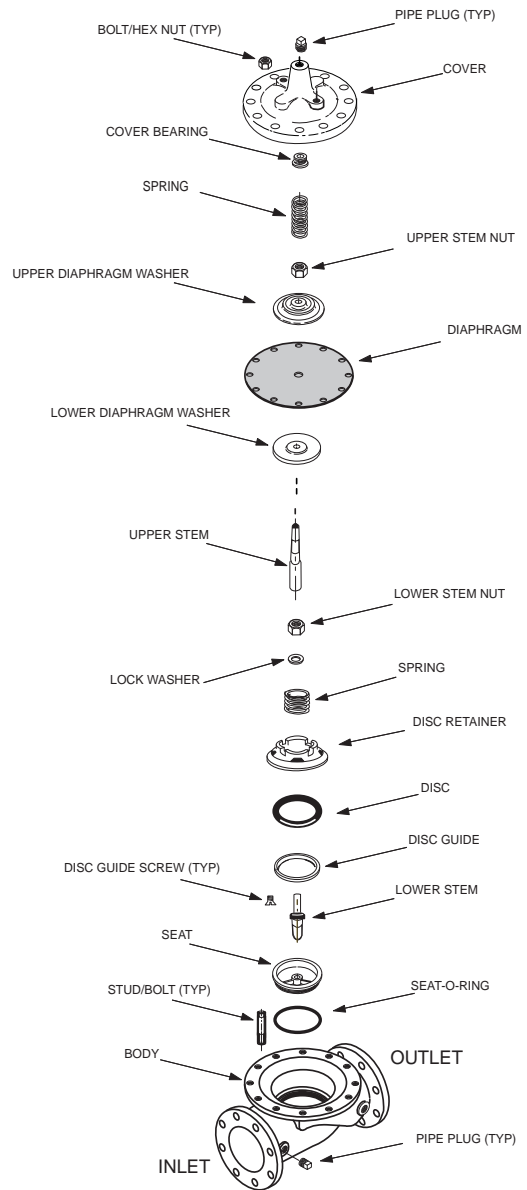
Do not use with temperatures above 175° F /80°C.

### Viton® Rubber Parts - suffix KB

Optional diaphragm, disc and o-ring fabricated with Viton® synthetic rubber. Viton® is well suited for use with mineral acids, salt solutions, chlorinated hydrocarbons, and petroleum oils; and is primarily used in high temperature applications up to 250°F/120°C. Do not use with epoxy coating above 175°F/80°C.

**For assistance in selecting appropriate valve options or valves manufactured with special design requirements, please contact our Regional Sales Office or Factory.**

## Model 100-04





Valve Size		Inches	2	3	4	6	8	10	12	14	16
		mm.	50	80	100	150	200	250	300	350	400
C <sub>V</sub> Factor	Globe Pattern	Gal./Min. (gpm.)	54	115	200	440	770	1245	1725	2300	3130
		Litres/Sec. (l/s.)	13	27.6	48	105.6	184.8	299	414	552	706
	Angle Pattern	Gal./Min. (gpm.)	61	139	240	541	990	1575	2500*	3060*	4200*
		Litres/Sec. (l/s.)	14.6	33.4	58	130	238	378	600	734.4	1008
Equivalent Length of Pipe	Globe Pattern	Feet (ft.)	51	85	116	211	291	347	467	422	503
		Meters (m.)	15.5	25.9	35.3	64.2	88.6	105.8	142.4	128.6	153.6
	Angle Pattern	Feet (ft.)	40	58	80	139	176	217	222*	238*	247*
		Meters (m.)	12.1	17.8	24.5	42.5	53.6	66.1	67.8	72.7	75.2
K Factor	Globe Pattern		5.6	6.0	5.9	6.2	6.1	5.8	6.1	5.0	4.6
	Angle Pattern		4.4	4.1	4.1	4.1	3.7	3.6	2.9	2.8	2.6
Liquid Displaced from Cover Chamber When Valve Opens	Fl. Oz		—	—	—	—	—	—	—	—	—
	U.S. Gal.		0.3	.08	.17	.53	1.26	2.51	4.0	6.5	9.6
	ml		121	303	643	—	—	—	—	—	—
	Litres		—	—	—	2.0	4.8	9.5	15.1	24.6	36.2

\*Estimated

**C<sub>V</sub> Factor**

Formulas for computing C<sub>V</sub> Factor, Flow (Q) and Pressure Drop (ΔP):

$$C_V = \frac{Q}{\sqrt{\Delta P}} \quad Q = C_V \sqrt{\Delta P} \quad \Delta P = \left(\frac{Q}{C_V}\right)^2$$

**K Factor (Resistance Coefficient)**

The Value of K is calculated from the formula:  $K = \frac{894d^4}{C_V^2}$  (U.S. system units)

**Equivalent Length of Pipe**

Equivalent lengths of pipe (L) are determined from the formula:  $L = \frac{Kd}{12f}$  (U.S. system units)

**Fluid Velocity**

Fluid velocity can be calculated from the following formula:  $V = \frac{.4085 Q}{d^2}$  (U.S. system units)

**Where:**

C<sub>V</sub> = U.S. (gpm) @ 1 psi differential at 60° F water  
or

= (l/s) @ 1 bar (14.5 PSIG) differential at 15° C water

d = inside pipe diameter of Schedule 40 Steel Pipe (inches)

f = friction factor for clean, new Schedule 40 pipe (dimensionless) (from Cameron Hydraulic Data, 18th Edition, P 3-119)

K = Resistance Coefficient (calculated)

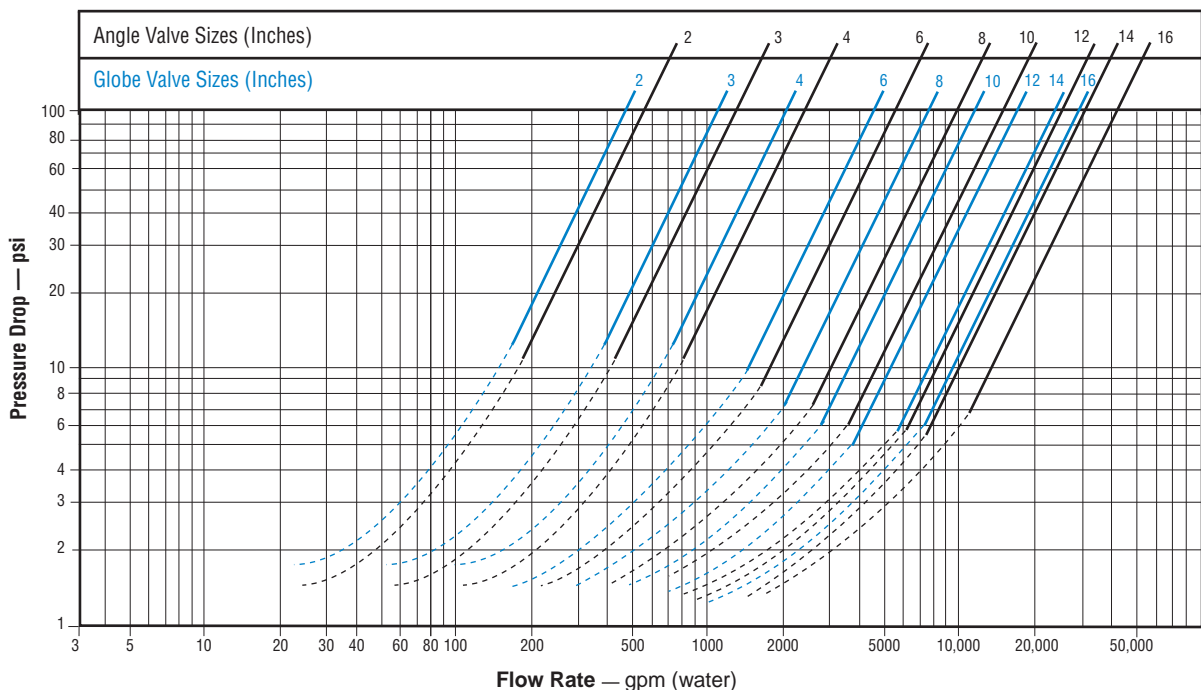
L = Equivalent Length of Pipe (feet)

Q = Flow Rate in U.S. (gpm) or (l/s)

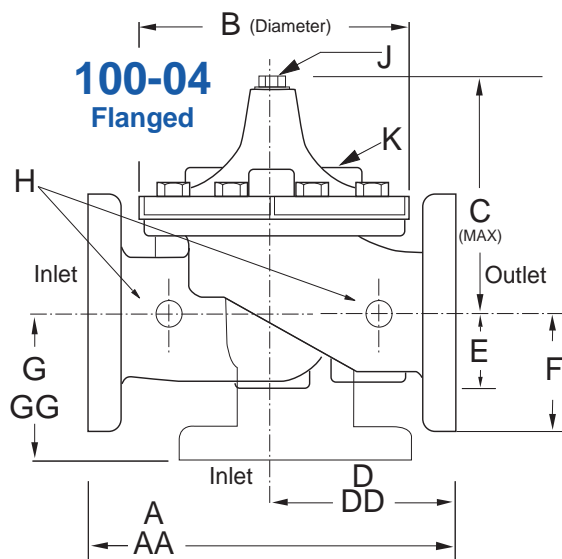
V = Fluid Velocity (feet per second) or (meters per second)

ΔP = Pressure Drop in (psi) or (bar)

**Model 100-04 Flow Chart (Based on normal flow through a wide open valve)**



## Cla-Val 100-04 Hy-Check Main Valve Dimensions

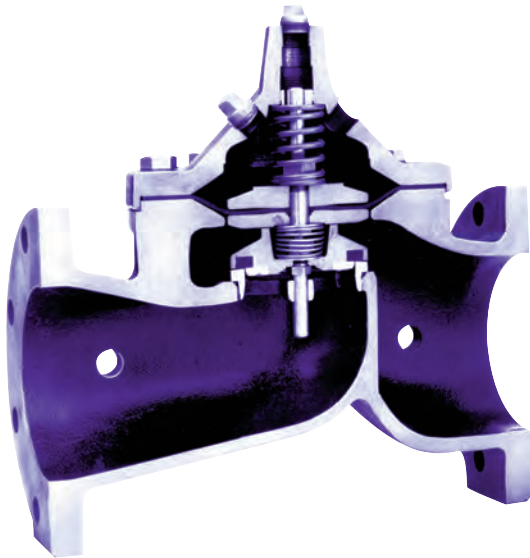


Valve Size (Inches)	2	3	4	6	8	10	12	14	16
A 150 ANSI	9.38	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38
AA 300 ANSI	10.00	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50
B Diameter	6.62	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50
C Maximum	6.50	8.19	10.62	13.38	16.00	17.12	20.88	24.19	25.00
D 150 ANSI	4.75	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.69
DD 300 ANSI	5.00	6.38	7.81	10.50	13.19	15.56	17.75	20.25	21.75
E	1.50	2.56	3.19	4.31	5.31	9.25	10.75	12.62	15.50
F 150 ANSI	2.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75
FF 300 ANSI	3.25	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75
G 150 ANSI	3.25	4.00	5.00	6.00	8.00	8.62	13.75	14.88	15.69
GG 300 ANSI	3.25	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50
H NPT Body Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00
K NPT Cover Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
Stem Travel	0.60	.080	1.10	1.70	2.30	2.80	3.40	4.00	4.50
Approx. Ship Weight (lbs)	35	70	140	285	500	780	1165	1500	2265

Valve Size (mm)	50	80	100	150	200	250	300	350	400
A 150 ANSI	238	305	381	508	645	756	864	991	1051
AA 300 ANSI	254	337	397	533	670	790	902	1029	1105
B Diameter	168	232	292	400	508	600	711	832	902
C Maximum	165	208	270	340	406	435	530	614	635
D 150 ANSI	121	152	191	254	322	378	432	495	526
DD 300 ANSI	127	162	200	267	335	395	451	514	552
E	38	65	81	109	135	235	273	321	394
F 150 ANSI	76	95	114	140	171	203	241	267	298
FF 300 ANSI	83	105	127	159	191	222	260	292	324
G 150 ANSI	83	102	127	152	203	219	349	378	399
GG 300 ANSI	89	111	135	165	216	236	368	397	419
H NPT Body Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00
K NPT Cover Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
Stem Travel	15	20	28	43	58	71	86	102	114
Approx. Ship Weight (kgs)	16	32	64	129	227	354	528	726	1027

### Service

Cla-Val Control Valves operate with maximum efficiency when mounted in horizontal piping with the main valve cover UP, however, other positions are acceptable. Due to component size and weight of 8 inch and larger valves, installation with cover UP is advisable. We recommend isolation valves be installed on inlet and outlet for maintenance. Adequate space above and around the valve for service personnel should be considered essential. A regular maintenance program should be established based on the specific application data. However, we recommend a thorough inspection be done at least once a year. Consult factory for specific recommendations.



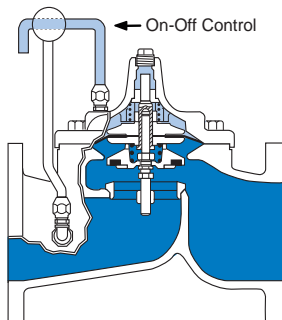
- **Built-in Automatic Check Valve**
- **Improved Flow Characteristics**
- **Drip Tight, Positive Seating**
- **Globe or Angle Pattern**
- **Packless Construction**

The Cla-Val Model 100-23 Hy-Check Valve is a hydraulically operated diaphragm valve with a built-in check feature to prevent return flow. Available in a globe or angle pattern, it consists of three parts: body, cover and diaphragm assembly. The only moving part is the diaphragm assembly which is guided top and bottom by a precision machined stem.

When operating pressure is applied above the non-wicking diaphragm, a synthetic rubber disc retained on three and one-half sides forms a drip-tight seal with the renewable seat. When pressure above the diaphragm is relieved the valve opens wide. The rate of closing or opening can be controlled by modulating the flow into or out of the diaphragm chamber. When a pressure reversal occurs the split valve stem will allow the disc retainer assembly to check closed **regardless of the position of the diaphragm.**

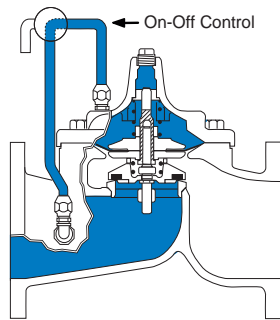
The Model 100-23 is used on system applications requiring remote control, pressure regulation, solenoid control, rate of flow control, liquid level control, or wherever a positive check feature is necessary to prevent reverse flow.

### Principle of Operation



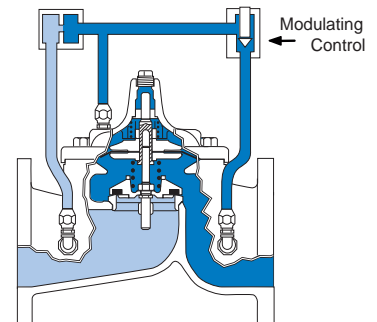
#### Full Open Operation

When pressure in the cover chamber is relieved to a zone of lower pressure, the line pressure at the valve inlet opens the valve, allowing full flow.



#### Tight Closing Operation

When pressure from the valve inlet is applied to the cover chamber, the valve closes drip-tight.



#### Check Action

When a static condition or pressure reversal occurs, the split stem design allows the valve to instantly check closed. Return flow is prevented regardless of the diaphragm's position.

## Cla-Val 100-23 Hy-Check Main Valve Specifications

### Available Sizes

Pattern	Flanged
Globe (inches)	3" - 24"
Globe (mm)	80 - 600 mm
Angle (inches)	6", 8"
Angle (mm)	150 and 200 mm

### Operating Temp. Range

Fluids
-40° to 180° F -40° to 82° C



6" Globe, Flanged



6" Angle, Flanged



12" Globe, Flanged



20" Globe, Flanged

### Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class		
		Flanged		
Grade	Material	ANSI Standards*	150 Class	300 Class
ASTM A536	Ductile Iron	B16.42	250	400
ASTM A216-WCB	Cast Steel	B16.5	285	400
UNS 87850	Bronze	B16.24	225	400

Note: \* ANSI standards are for flange dimensions only.  
Flanged valves are available faced but not drilled.  
**Valves for higher pressure are available; consult factory for details**

### Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes (inches)	3" - 24"	3" - 16"	3" - 16"
Available Sizes (mm)	80 - 600 mm	80 - 400 mm	80 - 400 mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		

For material options not listed, consult factory.  
Cla-Val manufactures valves in more than 50 different alloys.

### Options

#### NSF/ANSI 61 Fusion Bonded Epoxy Coating - suffix KC

The fusion bonded epoxy coating option is for use with cast iron, ductile iron or steel valves. This coating is resistant to various water conditions, certain acids, chemicals, solvents and alkalis. epoxy coatings are applied in accordance with AWWA coating specifications C116-03. Do not use with temperatures above 175° F.

#### Viton® Rubber Parts - suffix KB

Optional diaphragm, disc and o-ring fabricated with Viton® synthetic rubber. Viton® is well suited for use with mineral acids, salt solutions, chlorinated hydrocarbons, and petroleum oils; and is primarily used in high temperature applications up to 250° F. Do not use with epoxy coating above 175°F.

**For assistance in selecting appropriate valve options or valves manufactured with special design requirements, please contact our Regional Sales Office or Factory.**

## Cla-Val 100-23 Hy-Check Main Valve Functional Data

Valve Size		Inches	3	4	6	8	10	12	14	16	18	20	24
		mm.	80	100	150	200	250	300	350	400	460	500	600
$C_V$ Factor	<b>Globe Pattern</b>	Gal./Min. (gpm.)	62	136	229	480	930	1458	1725	2110	3250*	3400*	4020
		Litres/Sec. (l/s.)	15	32.5	55	115	223	350	414	506	705	816	965
	<b>Angle Pattern</b>	Gal./Min. (gpm.)	—	135	233	545	—	—	—	—	—	—	—
		Litres/Sec. (l/s.)	—	32	56	132	—	—	—	—	—	—	—
Equivalent Length of Pipe	<b>Globe Pattern</b>	Feet (ft.)	293	251	777	748	621	654	750	977	983	1125	3005
		Meters (m.)	89.3	76.4	237.1	228.1	189.5	199.4	228.7	298.1	299.9	343.2	916.6
	<b>Angle Pattern</b>	Feet (ft.)	—	254	751	580	—	—	—	—	—	—	—
		Meters (m.)	—	77.6	229	176.9	—	—	—	—	—	—	—
K Factor	<b>Globe Pattern</b>		20.6	12.7	23.1	15.7	10.4	8.5	8.9	10.2	6.9	9.7	14.5
	<b>Angle Pattern</b>		—	12.9	22.3	12.2	—	—	—	—	—	—	—
Liquid Displaced from Cover Chamber When Valve Opens		Fl. Oz	—	—	—	—	—	—	—	—	—	—	—
		U.S. Gal.	0.32	.08	.17	.53	1.26	2.51	4.0	4.0	9.6	9.6	9.6
		ml	—	—	—	—	—	—	—	—	—	—	—
		Litres	.12	.30	.64	2.0	4.8	9.5	15.1	15.1	36.2	36.2	36.2

\*Estimated

### $C_V$ Factor

Formulas for computing  $C_V$  Factor, Flow (Q) and Pressure Drop ( $\Delta P$ ):

$$C_V = \frac{Q}{\sqrt{\Delta P}} \quad Q = C_V \sqrt{\Delta P} \quad \Delta P = \left( \frac{Q}{C_V} \right)^2$$

### K Factor (Resistance Coefficient)

The Value of K is calculated from the formula:  $K = \frac{894d^4}{C_V^2}$   
(U.S. system units)

### Equivalent Length of Pipe

Equivalent lengths of pipe (L) are determined from the formula:  $L = \frac{Kd}{12f}$   
(U.S. system units)

### Fluid Velocity

Fluid velocity can be calculated from the following formula:  $V = \frac{.4085 Q}{d^2}$   
(U.S. system units)

### Where:

$C_V$  = U.S. (gpm) @ 1 psi differential at 60° F water  
or

= (l/s) @ 1 bar (14.5 PSIG) differential  
at 15° C water

**d** = inside pipe diameter of Schedule 40 Steel Pipe (inches)

**f** = friction factor for clean, new Schedule 40 pipe  
(dimensionless) (from Cameron Hydraulic Data,  
18th Edition, P 3-119)

**K** = Resistance Coefficient (calculated)

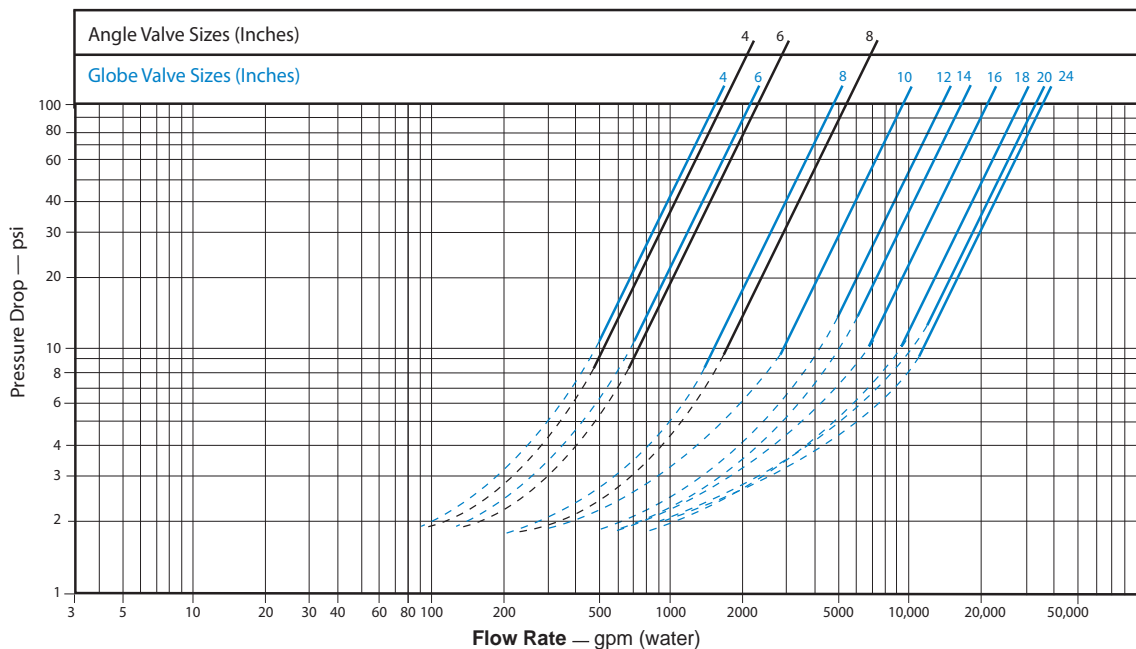
**L** = Equivalent Length of Pipe (feet)

**Q** = Flow Rate in U.S. (gpm) or (l/s)

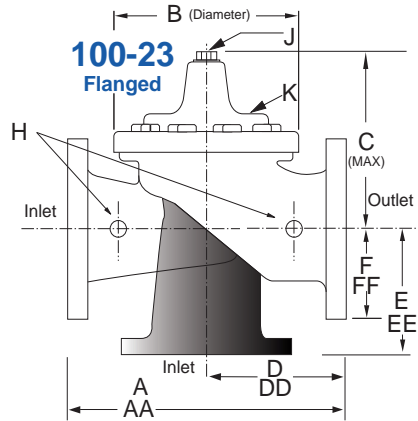
**V** = Fluid Velocity (feet per second) or (meters per second)

$\Delta P$  = Pressure Drop in (psi) or (bar)

## Model 100-23 Flow Chart (Based on normal flow through a wide open valve)



## Cla-Val 100-23 Hy-Check Main Valve Dimensions



Valve Size (Inches)	3	4	6	8	10	12	14	16	18	20	24
A 150 ANSI	10.25	13.88	17.75	21.38	26.00	30.00	34.25	35.00	42.12	48.00	48.00
AA 300 ANSI	11.00	14.50	18.62	22.38	27.38	31.50	35.75	36.62	43.63	49.62	49.75
B Diameter	6.62	9.12	11.50	15.75	20.00	23.62	27.47	28.00	35.44	35.44	35.44
C Maximum	7.00	8.62	11.62	15.00	17.88	21.00	20.88	25.75	25.00	31.50	31.50
D 150 ANSI	—	6.94	8.88	10.69	—	—	—	—	—	—	—
DD 300 ANSI	—	7.25	9.38	11.19	—	—	—	—	—	—	—
E 150 ANSI	—	5.50	6.75	7.25	—	—	—	—	—	—	—
EE 300 ANSI	—	5.81	7.25	7.75	—	—	—	—	—	—	—
F 150 ANSI	3.75	4.50	5.50	6.75	8.00	9.50	11.00	11.75	15.88	14.56	17.00
FF 300 ANSI	4.12	5.00	6.25	7.50	8.75	10.25	—	12.75	15.88	16.06	19.00
H NPT Body Tapping	.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.25	2.00	2.00	2.00
K NPT Cover Tapping	.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Stem Travel	0.60	0.80	1.10	1.70	2.30	2.80	3.40	3.40	4.50	4.50	4.50
Approx. Ship Weight (lbs)	45	85	195	330	625	900	1250	1380	2365	2551	2733
Approx. X Pilot System	13.00	15.00	27.00	30.00	33.00	36.00	36.00	41.00	40.00	46.00	55.00
Approx. Y Pilot System	10.00	11.00	18.00	20.00	22.00	24.00	26.00	26.00	30.00	30.00	30.00
Approx. Z Pilot System	10.00	11.00	18.00	20.00	22.00	24.00	26.00	26.00	30.00	30.00	30.00

Valve Size (mm)	80	100	150	200	250	300	350	400	450	500	600
A 150 ANSI	260	353	451	543	660	762	870	889	1070	1219	1219
AA 300 ANSI	279	368	473	568	695	800	908	930	1108	1260	1263
B Diameter	168	232	292	400	508	600	698	711	900	900	900
C Maximum	178	219	295	381	454	533	530	654	635	800	800
D 150 ANSI	—	176	226	272	CF*	CF*	CF*	CF*	CF*	CF*	CF*
DD 300 ANSI	—	184	238	284	CF*	CF*	CF*	CF*	CF*	CF*	CF*
E 150 ANSI	—	140	171	184	CF*	CF*	CF*	CF*	CF*	CF*	CF*
EE 300 ANSI	—	148	184	197	CF*	CF*	CF*	CF*	CF*	CF*	CF*
F 150 ANSI	95	114	140	171	203	241	279	298	403	370	432
FF 300 ANSI	105	127	159	191	222	260	—	324	403	408	483
H NPT Body Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.25	2.00	2.00	2.00
K NPT Cover Tapping	0.38	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Stem Travel	15	20	28	43	58	71	86	86	86	114	114
Approx. Ship Weight (kgs)	20	39	89	150	284	409	568	627	681	1157	1249
Approx. X Pilot System	330	381	686	762	838	914	914	1041	1016	1168	1397
Approx. Y Pilot System	254	279	457	508	559	610	660	660	762	762	762
Approx. Z Pilot System	254	279	457	508	559	610	660	660	762	762	762

For assistance in selecting appropriate valve options or valves manufactured with special design requirements, please contact our Regional Sales Office or Factory.

### Service and Installation

Cla-Val Control Valves operate with maximum efficiency when mounted in horizontal piping with the main valve cover UP, however, other positions are acceptable. Due to component size and weight of 10 inch and larger valves, installation with cover UP is advisable. We recommend isolation valves be installed on inlet and outlet for maintenance. Adequate space above and around the valve for service personnel should be considered essential. A regular maintenance program should be established based on the specific application data. However, we recommend a thorough inspection be done at least once a year. Consult factory for specific recommendations.



## 60 Series Booster Pump Control Valves - Electrical Controls

### Note:

Please refer to Cla-Val. drawing #69548, the Product Data Catalog and the Installation, Operation, & Maintenance Manual shipped with the Control Valve.

### Start Up Procedure

The limit switch (SW2) on the valve should be adjusted before the pump control valve is placed in service. The stop collar on the limit switch stem should be adjusted to strike the switch arm roller as the valve travels closed to the 95% (approx.) closed position. The N.O. contacts on the SW2 limit switch will close when the adjustable collar strikes the limit switch roller and moves the switch arm.

*Please read the operating instructions carefully. Make all adjustments (opening speed control, closing speed control and limit switch) before starting the booster pump or turning on the electrical control power.*

### Pump Starting - Pump Running Cycle

There are two ways in which the pump motor (M) starting cycle may be “called” on:

1 - The pump motor may be “called” on by manually placing the H-O-A switch in the hand position. This action bypasses the automatic remote switch (SW1) and calls the pump on.

2 - The pump motor may be “called” on by manually placing the H-O-A switch in the “automatic” position provided that the automatic switch (SW1) contacts close. This action places the pump motor under the command of SW1 and the associated safety controls. The pump motor (M) can not be called on, under any conditions, if the H-O-A

After the above adjustments have been made the H-O-A switch should be placed in the “off” position and the electrical control power should be turned on. The 60 Series control valve should then be permitted to close (please see manual) and allow the limit switch (SW2) stop collar to contact the SW2 switch roller. This action closes the N.O. contacts on SW2 and energizes the coil on relay 3CR.

The H-O-A switch can now be placed in the “automatic” position and the following operation should result:

switch is manually placed in the “off” position.

When SW1 contacts close (assuming that 3CR coil is energized—see start up procedure above) coil 1CR is energized, both contacts 1CR close to energize pilot valve solenoid (PVS) and relay coil 2CR. Both contacts 2CR close and the pump motor (M) starts immediately as the valve begins to open. As the limit switch SW2 stem collar lifts off the roller, SW2 contacts N.C., close. The pump is now locked on the line by SW2 and the valve slowly continues to go completely open, directing all liquid flow to the pipeline.

### Power Failure (While Pump Is Running) Conditions

If a momentary power failure should occur while the pump is running, relay coil 3CR would be de-energized and contacts 3CR<sub>1</sub>, 3CR<sub>2</sub>, and 3CR<sub>3</sub> would open. This action would completely lock the pump motor out from restarting and keep the valve solenoid PVS de-energized until the diaphragm assembly lowers to the setpoint of SW2 limit switch. The Cla-Val 60 Series valve is equipped with an integral “drop” check that will close immediately

when the pump motor stops and prevent backflow. However, a time period of several seconds is required for the diaphragm assembly to travel to the down position to hold the valve closed when the pump restarts. Thus, even though the power is restored immediately following the power failure the pump cannot restart until the system is “ready”, hydraulically, for a new start up.

### Pump Stopping - Pump Off Conditions

When SW1 contacts are opened, or the H-O-A switch is manually placed in the off position, coil 1CR contacts open and the PVS coil is de-energized. Since the SW2 contacts are in the normally closed position the pump motor (M) continues to run as the pump control valve slowly closes. When the SW2 stop collar reaches the roller arm, the SW2

N.C. contacts will open, 2CR coil will be de-energized, both 2CR contacts will open and the pump motor (M) will stop. The pump motor will remain off under these conditions. Coil 3 CR will remain energized and contacts 3CR<sub>1</sub>, 3CR<sub>2</sub>, and 3CR<sub>3</sub> will remain closed. The Cla-Val 60 Series will remain closed under these conditions.



# CVS-1 SHUTTLE VALVE

## Features

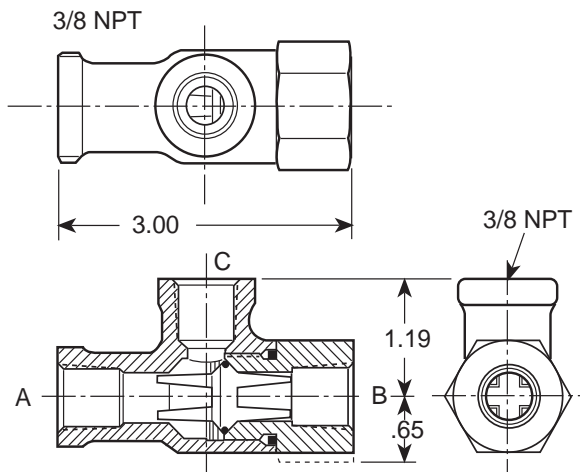
- No Lubrication
- Corrosion Resistant
- One Moving Part
- Replaceable Teflon Coated Seal
- Fast Acting
- Simplified design - low maintenance
- Non-Sticking
- Drip tight sealing
- Easy Maintenance

## DESCRIPTION

The Cla-Val Model CVS-1 Shuttle Valve is precision engineered for lasting dependable service. The CVS-1 combines instantaneous action with one moving part designed for smooth positive operation with minimum wear. The flow pattern interconnects the highest pressure from two separate pressure zones (ports "A" or "B") to a common port "C". The two pressure zones, ports A or B can never flow to one another.

The design incorporates precision sealing required for low pressure or high pressure operation. The seal is teflon coated to prevent sticking under the most adverse conditions of exposure or prolonged actuation in one position. The Cla-Val Model CVS-1 Shuttle Valve incorporates all the required features for lasting dependable service.

## Dimensions



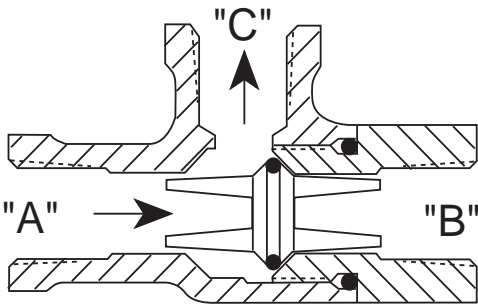
## Specifications

<b>Size</b>	3/8" NPT
<b>End Detail</b>	300 ANSI B2.1
<b>Pressure Rating</b>	400 psi Max.
<b>Shifting Differential</b>	10" Water Column Differential
<b>CV Factor</b>	A" to "C" 3.5 "B" to "C" 3.1
<b>Temperature Range</b>	Water to 140°F
<b>Materials</b>	<b>Body</b> Cast Bronze ASTM B-62 <b>Internal Trim</b> Delrin (Dupont 500) <b>Rubber Parts</b> Static Seal - Buna N® Synthetic Rubber Shuttle Seal - Buna N® Synthetic Rubber Teflon Coated



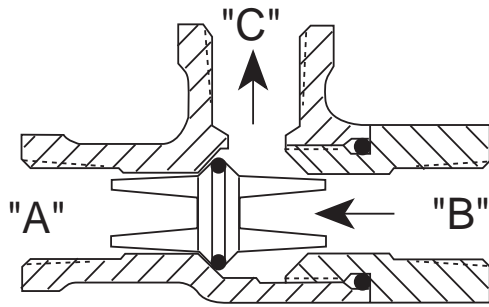


## Principle of Operation



Flow Direction "A" to "C"

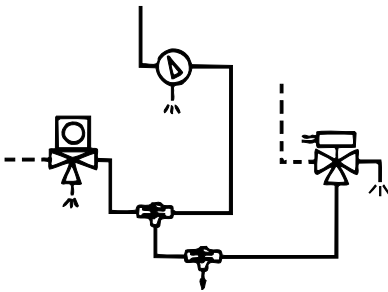
When pressure at port "A" is greater than port "B", the shuttle shifts allowing flow from port "A" to "C",



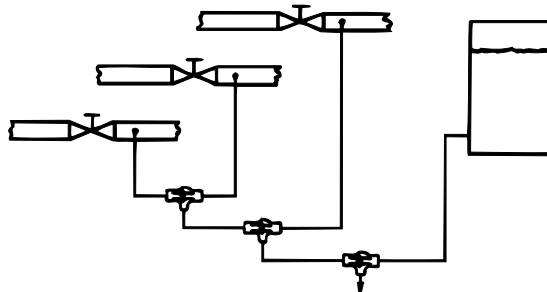
Flow Direction "B" to "C"

When pressure at port "B" is greater than port "A", the shuttle shifts allowing flow from port "B" to "C",

## APPLICATIONS

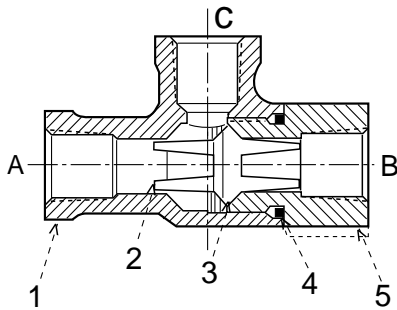


Sending remote pressure signals form several locations.



Receiving pressure signals form the highest pressure available.

## PARTS LIST



Item No.	Description	Qty
1	Body-Shuttle Valve	1
2	Poppet	1
3	O-Ring	1
4.	O-Ring	1
5.	Seat-Shuttle Valve	1

## PURCHASE SPECIFICATIONS

The valve shall be a three-way type equipped with on moving part and a replaceable teflon coated seal. The seal shall be drip tight throughout the entire pressure range. The minimum shifting differential for the valve shall be 10 inches of water column differential. The valve shall be a Model CVS-1 as manufactured by Cla-Val, Newport Beach, California 92659

## When Ordering, Please Specify

1. Catalog Number
2. Size
3. Fluid to be handled
4. Temperature
5. Materials



—MODEL— **CRL**

# Pressure Relief Control

**DESCRIPTION**

The CRL Pressure Relief Control is a direct acting, spring loaded, diaphragm type relief valve. It may be used as a self-contained valve or as a pilot control for a Cla-Val Main valve. It opens and closes within very close pressure limits.

**INSTALLATION**

The CRL Pressure Relief Control may be installed in any position. The control body (7) has one inlet and one outlet port with a side pipe plug (24) at each port. These plugs are used for control connections or gauge applications. The inlet in the power unit body (6) is the sensing line port. A flow arrow is marked on the body casting.

**OPERATION**

The CRL Pressure Relief Control is normally held closed by the force of the compression spring above the diaphragm; control pressure is applied under the diaphragm.

When the controlling pressure exceeds the spring setting, the disc is lifted off its seat, permitting flow through the control.

When controlling pressure drops below spring setting, the spring returns the control to its normally closed position.

**ADJUSTMENT PROCEDURE**

The CRL Pressure Relief Control can be adjusted to provide a relief setting at any point within the range found on the nameplate.

Pressure adjustment is made by turning the adjustment screw (9) to vary the spring pressure on the diaphragm. Turning the adjustment screw clockwise increases the pressure required to open the valve. Counterclockwise decreases the pressure required to open the valve.

When pressure adjustments are complete the jam nut (10) should be tightened and the protective cap (1) replaced. If there is a problem of tampering, lock wire holes have been provided in cap and cover. Wire the cap to cover and secure with lead seal.

**DISASSEMBLY**

The CRL Pressure Relief Control does not need to be removed from the line for disassembly. Make sure that pressure shut down is accompanied prior to disassembly. If the CRL is removed from the line for disassembly be sure to use a soft jawed vise to hold body during work.

Refer to Parts List Drawing for Item Numbers.

1. Remove cap (1), loosen jam nut (10) and turn adjusting screw counterclockwise until spring tension is relieved.
2. Remove the eight screws (4) holding the cover (3) and powerunit body (6). Hold the cover and powerunit together and place on a suitable work surface.  
See NOTE under REASSEMBLY.
3. Remove the cover (3) from powerunit body (6). The spring (12) and two spring guides (11).
4. Remove nut (13) from stem (19) and slide off the belleville washer (14), the upper diaphragm washer (15) and the diaphragm (16).
5. Pull the stem (19) with the disc retainer assembly (21) through the bottom of powerunit. The lower diaphragm washer (17) will slide off of stem top.
6. Remove jam nut (23) and disc retainer assembly (21) from stem. Use soft jawed pliers or vise to hold stem. The polished surface of stem must not be scored or scratched.
7. The seat (22) need not be removed unless it is damaged. If removal is necessary use proper size socket wrench and turn counterclockwise.

Note: Some models have an integral seat in the body (7).

**INSPECTION**

Inspect all parts for damage, or evidence of cross threading. Check diaphragm and disc retainer assembly for tears, abrasions or other damage. Check all metal parts for damage, corrosion or excessive wear.

**REPAIR AND REPLACEMENT**

Minor nicks and scratches may be polished out using 400 grit wet or dry sandpaper fine emery or crocus cloth. Replace all O-rings and any damaged parts.

When ordering replacement parts, be sure to specify parts list item number and all nameplate data.

**REASSEMBLY**

In general, reassembly is the reverse of disassembly. However, the following steps should be observed:

1. Lubricate the O-Ring (18) with a small amount of a good grade of waterproof grease, (Dow Corning 44 medium grade or equal). Use grease sparingly and install O-ring in powerunit body (6).
2. Install stem (19) in powerunit body (6). Use a rotating motion with minimum pressure to let stem pass through O-ring.  
Do Not Cut O-Ring.
3. Install O-ring (5) at top of stem (19). Place lower diaphragm washer (17) on the stem with the serrated side up. Position diaphragm (16), upper diaphragm washer (15), with serration down, and belleville washer (14) with concave side down.
4. Position powerunit body (6) as shown on parts list drawing (top view).
5. Continue reassembly as outlined in disassembly steps 1 through 3.

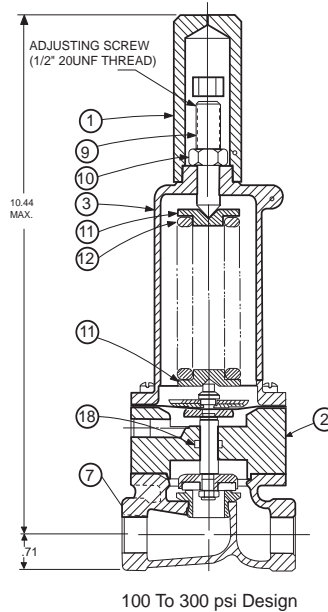
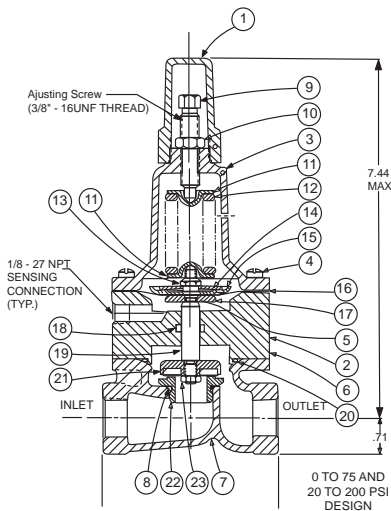
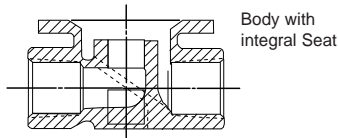
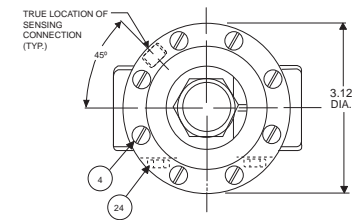
**Note:** Item (4) Screw will have a quantity of 8 for the 0-75 and 20-200psi design and a quantity of 4 for the 100-300psi design. Item (25) Screw is used on the 100-300psi design only. Install item (25), before item (4) for preload of item (12) spring.

SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to open.	Controlling pressure too low.	Back off adjusting screw until valve opens.
Fails to open with spring compression removed.	Mechanical obstruction, corrosion, scale build-up on stem.	Disassemble, locate, and remove obstruction, scale.
Leakage from cover vent hole when controlling pressure is applied.	Diaphragm Damage	Disassembly replace damaged diaphragm.
	Loose diaphragm assembly.	Tighten upper diaphragm washer.
Fails to close.	No spring compression.	Re-set pressure adjustment.
Fails to close with spring compressed.	Mechanical obstruction.	Disassemble, locate and remove obstruction.



# 1/2" & 3/4" PRESSURE RELIEF CONTROL

(Bronze Body with 303SS Trim)



SIZE	SPRING	PART NUMBER
1/2"	0-75 PSI	7922201E
1/2"	20-105 PSI	7922205F
1/2"	20-200 PSI	7922202C
1/2"	100-300 PSI	8280901D
3/4"	0-75 PSI	7922901K
3/4"	20-105 PSI	7922903F
3/4"	20-200 PSI	7922902H
3/4"	100-300 PSI	8600501E

For 250-600 PSI Contact Factory

CRL Range PSI	APPROX. INCREASE FOR EACH CLOCKWISE TURN OF ADJUSTING SCREW
0 to 75	8.5 PSI
20 to 105	12.5 PSI
20 to 200	28.0 PSI
100 to 300	18.0 PSI

**When ordering parts please specify:**

1. All Nameplate Data
2. Item Part Number
3. Item Description

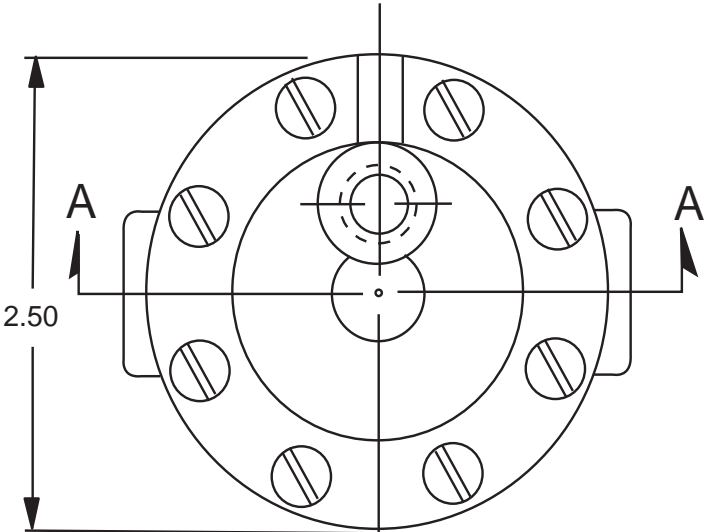
Item	Description	Material	Part Number			
			0-75	20-105	20-200	100-300
1	Cap	Plastic	67628J	67628J	67628J	1257601D
2	Nameplate	Brass	--	--	--	--
3	Cover	Bronze	C2544K	C2544K	C2544K	44587E
4*	Screw Fil. Hd. 10-32 x 1.88 (Qty 8)	303 SS	6757867E	6757867E	6757867E	6757867E
5*	O-Ring	Rubber	00902H	00902H	00902H	00902H
6	Body, Powerunit	Bronze	7920504D	7920504D	7920504D	7920504D
7	1/2" Body	Bronze	C7928K	C7928K	C7928K	C7928K
	3/4" Body	Bronze	C9083B	C9083B	C9083B	C9083B
8*	O-Ring, Seat	Rubber	00718H	00718H	00718H	00718H
9	Screw, Adjusting	Brass	7188201D	7188201D	7188201D	82811B
10	Nut Hex (Locking)	303 SS	6780106J	6780106J	6780106J	6780606H
11	Guide, Spring	303 SS	71881H	71881H	71881H	1630301J
12	Spring	CHR/VAN	71884B	20632101E	71885J	1630201A
13	Nut, Stem Upper	Bronze	73034B	73034B	73034B	73034B
14	Washer, Belleville	Steel	7055007E	7055007E	7055007E	7055007E
15	Washer, Diaphragm (upper)	303 SS	71891G	71891G	71891G	71891G
16*	Diaphragm	Rubber	C1505B	C1505B	C1505B	C1505B
17	Washer, Diaphragm (lower)	303 SS	45871B	45871B	45871B	45871B
18*	O-Ring, Stem	Rubber	00746J	00746J	00746J	00746J
19	Stem	303 SS	8982401F	8982401F	8982401F	8982401F
20*	O-Ring, Body	Rubber	00767E	00767E	00767E	00767E
21*	Retainer Assembly, Disc	303 SS	C9158B	C9158B	C9158B	C9158B
22	Seat	303Rub	62187A	62187A	62187A	62187A
23	Nut, Hex, Stem, Lower	Bronze	6779806G	6779806G	6779806G	6779806G
24	Pipe Plug	Bronze	6784701C	6784701C	6784701C	6784701C
	<b>FACTORY SET POINT</b>		<b>50 PSI</b>	<b>60 PSI</b>	<b>60 PSI</b>	<b>100 PSI</b>
	<b>REPAIR KIT*</b>		9170007A	9170007A	9170007A	9170007A



—MODEL —

100-01

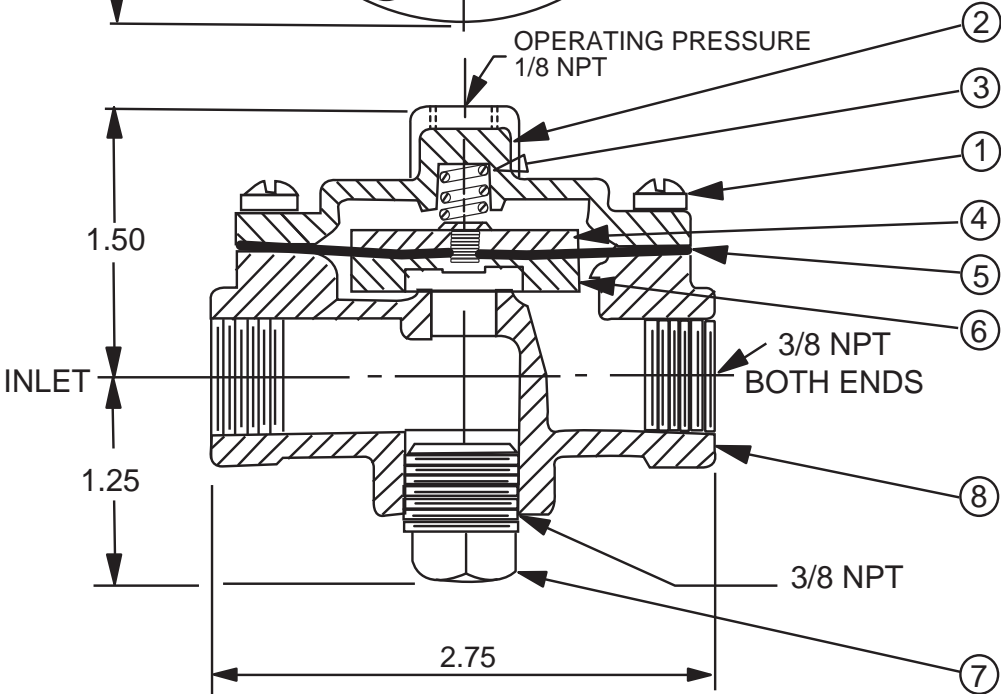
# 3/8"-1 Hytrol Valve



### PARTS LIST

ITEM	DESCRIPTION
1.	Cover Screw (8 Required)
2.	Cover
3.	Spring
4.	Diaphragm Washer
* 5.	Diaphragm
* 6.	Disc Retainer Assembly
7.	Body Plug (3/8 NPT)
8.	Body

\* Recommended Spare Parts

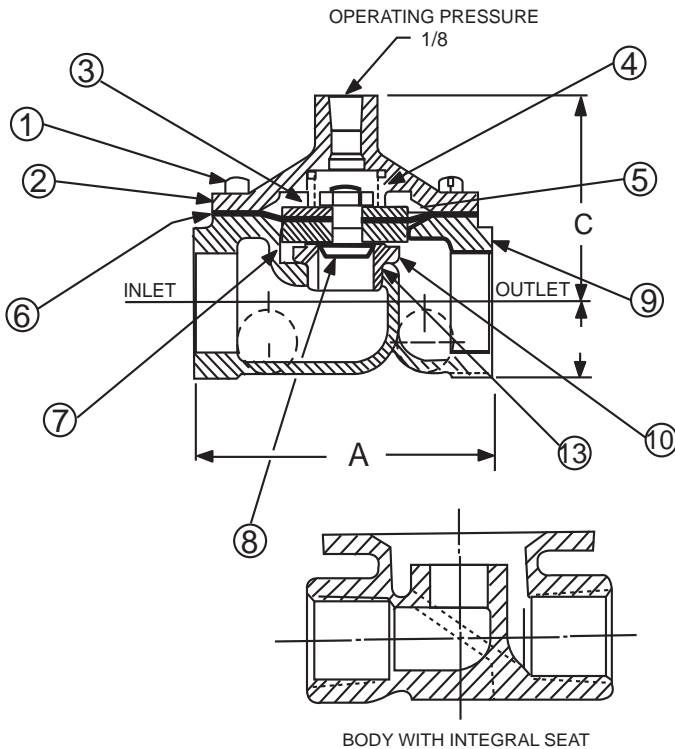


## SECTION AA

## 100-01 3/8" HYTROL VALVE

**When Ordering parts, please specify**

- All nameplate data
- Description
- Item Number
- Material

—MODEL— **100-01****1/2"-3/4"-1" Hytrol Valve****100-01 3/4" & 1/2" Hytrol Valve****PARTS LIST**

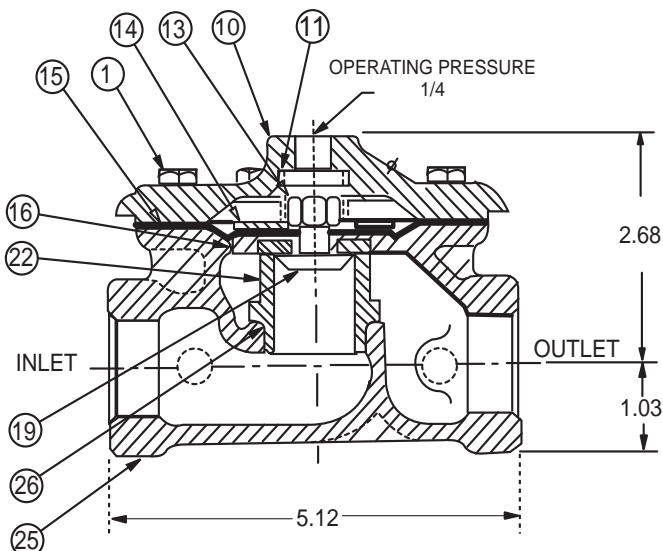
ITEM	DESCRIPTION
1	COVER SCREW
2	COVER
3	SPRING
4	STEM NUT
5	DIAPHRAGM WASHER
*6	DIAPHRAGM
*7	DISC RETAINER ASSEMBLY
8	DISC GUIDE & STEM
9	BODY
10	SEAT
11	NAMEPLATE
12	BODY PLUG HEX HD.
13	O-RING SEAT (FOR OLD STYLE BODY ONLY)

\* Recommended Spare Parts

	1/2	3/4
A	1-7/16	3-1/2
C (MAXIMUM)	2-3/8	2-3/8
D	25/32	29/32

**When Ordering parts, please specify**

- All nameplate data
- Description
- Item Number
- Material

**100-01 1" Hytrol Valve****PARTS LIST**

ITEM	DESCRIPTION
1	COVER SCREW
2	NAMEPLATE
3	NAMEPLATE SCREW
10	COVER
11	SPRING
13	STEM NUT
14	DIAPHRAGM WASHER
15	DIAPHRAGM
16	DISC RETAINER ASSEMBLY
19	DISC GUIDE
22	SEAT
24	BODY PLUG
25	BODY
26	O-RING, SEAT

\* Recommended Spare Parts

# INSTALLATION AND MAINTENANCE INSTRUCTIONS

## 3-WAY SOLENOID VALVES, NORMALLY OPEN NORMALLY CLOSED AND UNIVERSAL CONSTRUCTION

**BULLETIN  
8320**

ASCO  
FORM NO. V5291R2

### DESCRIPTION

Bulletin 8320 is a small 3-way solenoid operated valve with all three pipe connections located in the body. The bodies are of brass or stainless steel construction. Standard valves have General Purpose, Nema Type 1 Solenoid Enclosures. Valves that are equipped with a solenoid enclosure which is designed to meet Nema Type 4-Water tight, Nema Type 7 (C or D) Hazardous Locations - Class I, Group C or D, and Nema Type 9 (E, F or G) Hazardous Locations - Class II, Group E, F or G are shown on separate sheets of Installation and Maintenance Instructions, Form Numbers V-5391 and V-5381.

### MANUAL OPERATORS (OPTIONAL)

Valves with suffix "MO" or "MS" in catalog number are provided with a Manual Operator which allows manual operation when desired or during an interruption of electrical power.

### OPERATION

**Normally Closed:** Applies pressure when solenoid is energized; exhausts pressure when solenoid is de-energized

**Normally Open:** Applies pressure when solenoid is de-energized; exhausts pressure when solenoid is energized.

**Universal:** For normally closed or normally open operation, selection or diversion of pressure can be applied at port 1 (A), 2 (B), or 3 (C).

NORMALLY OPEN PRESS AT 3 (C)	NORMALLY CLOSED PRESS AT 3 (C)	UNIVERSAL-PRESS AT ANY ORIFICE.	FORM
			SOLENOID DE- ENERGIZED
			SOLENOID ENERGIZED

**NOTE: Port Markings 1, 2, and 3 correspond directly to A, B and C.**

### INSTALLATION

Check Nameplate for correct Catalog Number, pressure, voltage and service.

### POSITIONING

Valve may be mounted in any position

### PIPING

Connect piping to valve according to markings on valve body. Refer to Flow Diagram provided. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening pipe, do not use valve as lever.

**IMPORTANT:** For protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required depending on the service conditions.

### WIRING

Wiring must comply with local and National Electrical Codes. For valves equipped with an explosion-proof, watertight solenoid enclosure, the electrical fittings must be approved for use in the approved hazardous locations. Housings for all solenoids are made with connections for 1/2 inch conduit. The general purpose enclosure may be rotated to facilitate wiring by removing the retaining cap.

### NOTE

Alternating Current (A-C) and Direct Current (D-C) solenoids are built differently. To convert from one to other, it is necessary to change the complete solenoid, including the core assembly.

### SOLENOID TEMPERATURE

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched with the bare hand for only an instant. This safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

### MAINTENANCE

**WARNING:** Turn off electrical power and line pressure to valve before making repairs. It is not necessary to remove valve from pipe line for repairs.

### CLEANING

A periodic cleaning of all valves is desirable. The time between cleanings will vary, depending on the media and service conditions. In general, if the voltage to the coils is correct, sluggish valve operation or excessive leakage will indicate that cleaning is required.

### IMPROPER OPERATION

- Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic click signifies the solenoid is operating. Absence of the click indicate loss of power supply. Check for loose or blown-out fuses, open-circuited or grounded coil, broken lead wires or splice.
- Burned-out Coil:** Check for open-circuited coil. Replace coil, if necessary.
- Low Voltage:** Check voltage across coil leads. Voltage must be at least 85% of nameplate ratings.
- Incorrect Pressure:** Check valve pressure. Pressure to valve must be within the range specified on nameplate.
- Excessive Leakage:** Disassemble valve and clean all parts. Replace parts that are worn or damaged with a complete Spare Parts Kit for best results.

### COIL REPLACEMENT (REF. FIG. 2)

Turn off electrical power, disconnect coil lead wires and proceed as follows:

- Remove retaining cap, nameplate and cover.
- Slip yoke containing coil, sleeves and insulating washers off the solenoid base sub-assembly. Insulating washers are omitted when molded coil is used. In some D.C. Constructions, a single flux plate over the coil replaces yoke, sleeves and insulating washers.
- Reassemble in reverse order of disassembly.

### VALVE DISASSEMBLY AND REASSEMBLY (REF. FIG. 2)

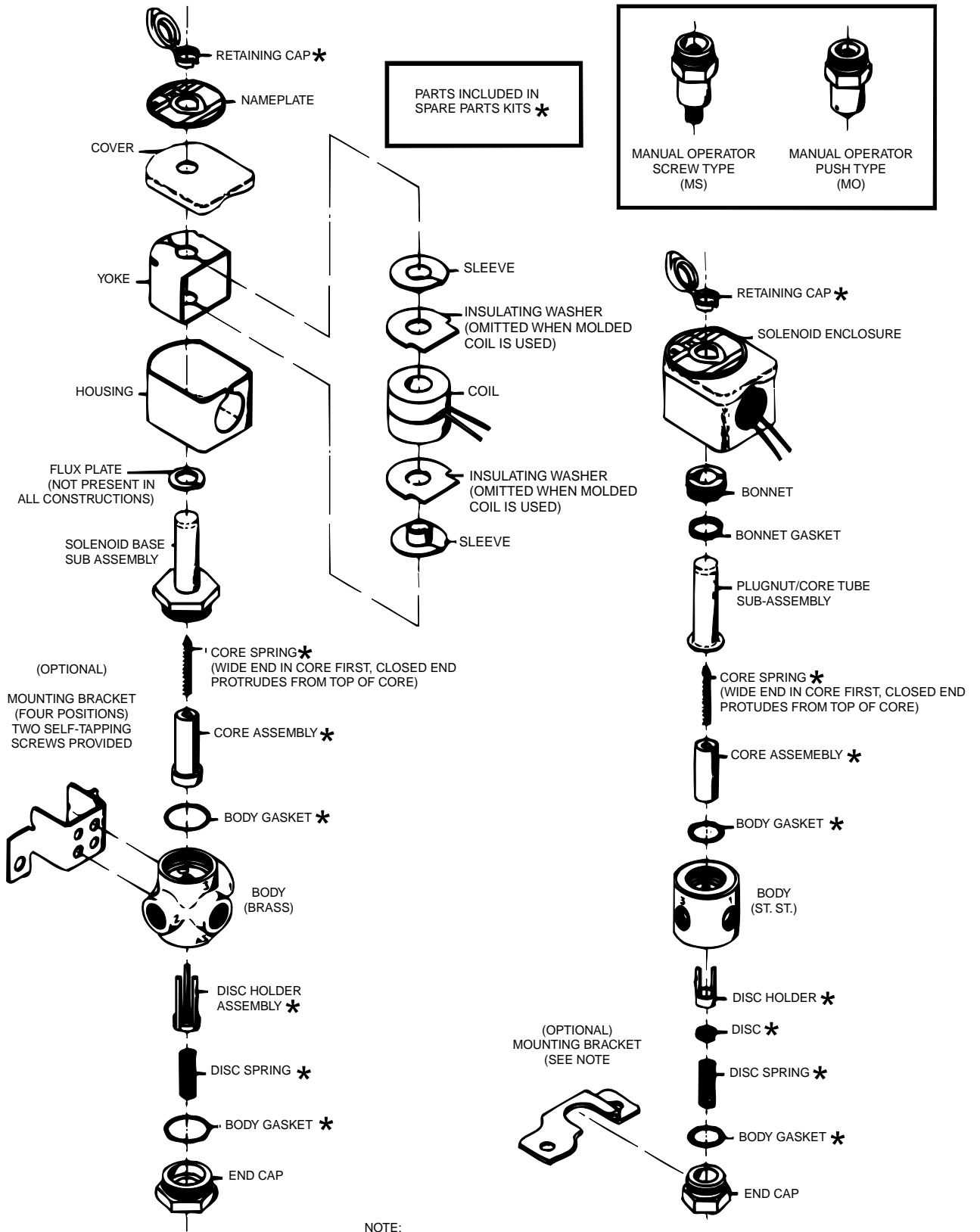
Turn off electrical power supply and de-pressurize valve.

- Remove retaining cap and slip entire solenoid off solenoid base subassembly or plugnut/core tube sub-assembly.
- Unscrew bonnet or solenoid base sub-assembly. Remove core assembly, core spring and body gasket.
- Remove end cap, body gasket, disc spring, disc holder, disc or disc holder assembly.
- All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.
- Reassemble in reverse order of disassembly paying careful attention to exploded view provided.

### ORDERING INFORMATION FOR SPARE PARTS KITS

When Ordering Spare Parts Kits or Coils  
Specify Valve Catalog Number,  
Serial Number and Voltage

Spare Parts Kits and Coils are available for ASCO valves. Parts marked with



**NOTE:**  
 1. FOR MOUNTING, A FLAT SURFACE MUST BE PROVIDED ACROSS THE ENTIRE LENGTH OF THE BRACKET. THE VALVE BODY BECOMES SECURE TO BRACKET, WHEN BRACKET IS TIGHTENED IN TO POSITION. IF THE VALVE HAS A MANUAL OPERATOR, A HOLE MUST BE MADE THROUGH THE MOUNTING SURFACE FOR THE OPERATOR STEM.

# INSTALLATION AND MAINTENANCE INSTRUCTIONS

## OPEN-FLAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

**BULLETIN  
8016G**

ASCO  
FORM NO. V6583R5

### -SERVICE NOTICE-

ASCO® solenoid valves with design change letter "G" in the catalog number (example: 8210G 1) have an epoxy encapsulated ASCO® Red Hat II. solenoid. This solenoid replaces some of the solenoids with metal enclosures and open-frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

### DESCRIPTION

Catalog numbers 8016G1 and 8016G2 are epoxy encapsulated pull-type solenoids. The green solenoid with lead wires and 1/2" conduit connection is designed to meet Enclosure Type 1 -General Purpose, Type 2-Dripproof, Types 3 and 3S-Raintight, and Types 4 and 4X-Watertight. The black solenoid on catalog numbers prefixed "EF" is designed to meet Enclosure Types 3 and 3S-Raintight, Types 4 and 4X-Watertight, Types 6 and 6P-Submersible, type 7 (A, B, C, & D) Explosionproof Class 1, Division 1, Groups A, B, C, & D and Type 9 (E, F, & G)-Dust-Ignitionproof Class 11, Division 1, Groups E, F, & G. The Class 11, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See Temperature Limitations section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250-28 UNF-2B tapped hole, 0.38 minimum full thread.

#### Series 8016G solenoids are available in:

- **Open-Frame Construction**  
The green solenoid may be supplied with 1/4" spade, screw, or DIN terminals (Refer to Figure 4).
- **Panel Mounted Construction**  
These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. (Refer to Figure 3 and section on Installation of Panel Mounted Solenoid).

#### Optional Features For Type 1—General Purpose Construction Only

- **Junction Box**  
This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4" spade or screw terminals may have a junction box. The junction box provides a 1/2" conduit connection, grounding and spade or screw terminal Connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No. K236 - 034**  
Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

### OPERATION

When the solenoid is energized, the core is drawn into the solenoid base sub-assembly. **IMPORTANT:** When the solenoid is de-energized, the initial return force for the core, Whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 4 ounces for DC construction.

### INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

**WARNING: To prevent the possibility of electrical shock from the accessibility of live parts, install the open-frame solenoid in an enclosure.**

### FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

**CAUTION:** To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180° C. See nameplate/retainer for service. **NOTE:** These solenoids have an internal non-resettable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust-ignitionproof enclosures (types 7&9).

**IMPORTANT:** To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service condition & See ASCO Series 8600, 8601, and 8602 for strainers.

#### Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature. **NOTE:** For steam service, refer to Wiring section, Junction Box for temperature rating of supply wires.

Temperature Limitations For Series 8016G Solenoids for use Valves Rated at 6.1, 8.1,9.1,10.6 or 11.1 Watts			
Watts Rating	Catalog Number Coil prefix	Class of Insulation	Maximum ambient Temp. °F
6.1, 8.1, 9.1, & 11.1	None, FB, KF, KP, SF, SP, SC, & SD	F	125
6.1, 8.1, 9.1, & 11.1	HB, HT, KB, KH, SS, ST, SU, & ST	H	140
10.6	None, KF, SF, & SC	F	104
10.6	HT, KH, SU, & ST	H	104

Minimum ambient temperature -40° F (-40° C). Positioning

#### Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

#### Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2" conduit connection. To facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

#### Additional Wiring Instructions For Optional Features:

- **Open-Frame solenoid with 1/4" spade terminals**  
For solenoids supplied with screw terminal connections use #12-18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to 10 ± 2 in-lbs (1.0 + 1.2 Nm). A tapped hole is provided in the solenoid for grounding, use a #Y10-32 machine screw. Torque grounding screw to 15 -20



in-lbs (1,7 - 2,3 Nm). On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 - 20 in-lbs (1,7 - 2,3 Nm). with a 5/32" hex key wrench.

#### • Junction Box

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2" conduit connection. Connect #12-18AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

#### • DIN Plug Connector Kit No. KC236-034

1. The open—frame solenoid is provided with DIN terminals to accommodate the DIN plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12-18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4" for installation in socket terminals. The use of wire-end sleeves is also recommended for these socket terminals. Maximum length of wire-end sleeves to be approximately 1/4". Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer, and connector cover.

**NOTE:** Connector cover may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to  $5 \pm 1$  in-lbs ( $0,6 \pm 1,1$  Nm).

**NOTE:** Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub-assembly, not just the solenoid. Consult ASCO.

#### Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid. The 3/4" bonnet construction (Figure 1) must be disassembled for installation and installed with a special wrench adapter.

#### Installation of Panel Mounted Solenoid (See Figure 3)

Disassemble solenoid following instruction under Solenoid Replacement then proceed

#### 3/4" Valve Bonnet Construction

1. Install retainer(convex side to solenoid) in 1.312 diameter mounting hole in customer panel.
2. Then position spring washer over plugnut/core tube sub-assembly.
3. Install plugnut/core tube sub-assembly through retainer in customer panel. Then replace solenoid, nameplate/retainer and red cap.

#### 15/16" Valve Bonnet Construction

1. Install solenoid base sub-assembly through 0.69 diameter mounting hole in customer panel.
2. Position spring washer on opposite side of panel over solenoid base sub-assembly then replace.

#### Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

### MAINTENANCE

**WARNING:** To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

#### Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve,

#### Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

#### Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic click signifies that the solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned-Out Solenoid:** Check for open-circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

#### Solenoid Replacement

1. On solenoids with lead wires disconnect conduit, coil leads, and grounding wire.

**NOTE:** Any optional parts attached to the old solenoid must be reinstalled on the new solenoid.

2. Disassemble solenoids with optional features as follows:

#### • Spade or Screw Terminals

Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

**NOTE:** For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- Junction Box  
Remove conduit and socket head screw (use 5/32" hex key wrench) from center of junction box. Disconnect junction box from solenoid.
- DIN Plug Connector  
Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32" hex key wrench), DIN terminal adapter, and gasket from solenoid.
  3. Snap off red cap from top of solenoid base sub-assembly.
  4. Push down on solenoid. Then using a suitable screwdriver, insert blade in slot provided between solenoid and nameplate/retainer. Pry up slightly and push to remove. Then remove solenoid from solenoid base sub-assembly.
  5. Reassemble using exploded views for parts identification and placement

#### Disassembly and Reassembly of Solenoids

1. Remove solenoid, see Solenoid Replacement.
2. Remove finger washer or spring washer from solenoid base sub-assembly.
3. Unscrew solenoid base sub-assembly.

**NOTE:** Some solenoid constructions have a plugnut/core tube sub-assembly, bonnet gasket and bonnet in place of the solenoid base sub-assembly. To remove bonnet use special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order ASCO Wrench Kit No.K218 - 948.

4. The core is now accessible for cleaning or replacement.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Reassemble using exploded views for identification and placement of parts.

#### ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

## Torque Chart

Part Name	Torque Value in inch-Pounds	Torque Value in Newton-Meters
solenoid base sub-assembly	175 ± 25	19.8 ± 2.8
valve bonnet (3/4" bonnet constructions)	90 ± 10	10.2 ± 1.1
bonnet screw (3/8" or 1/2" NPT pipe size)	25	2.8
bonnet screw (3/4" NPT pipe size)	40	4.5

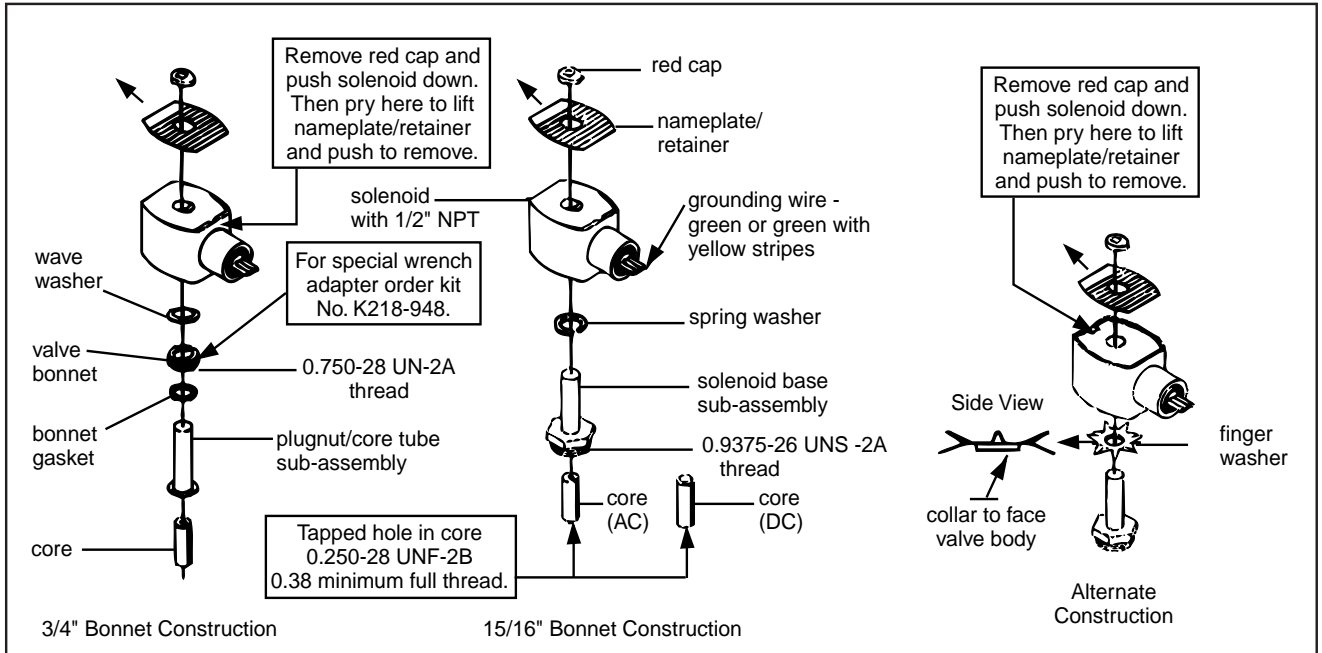


Figure 1. Series 8016G solenoids

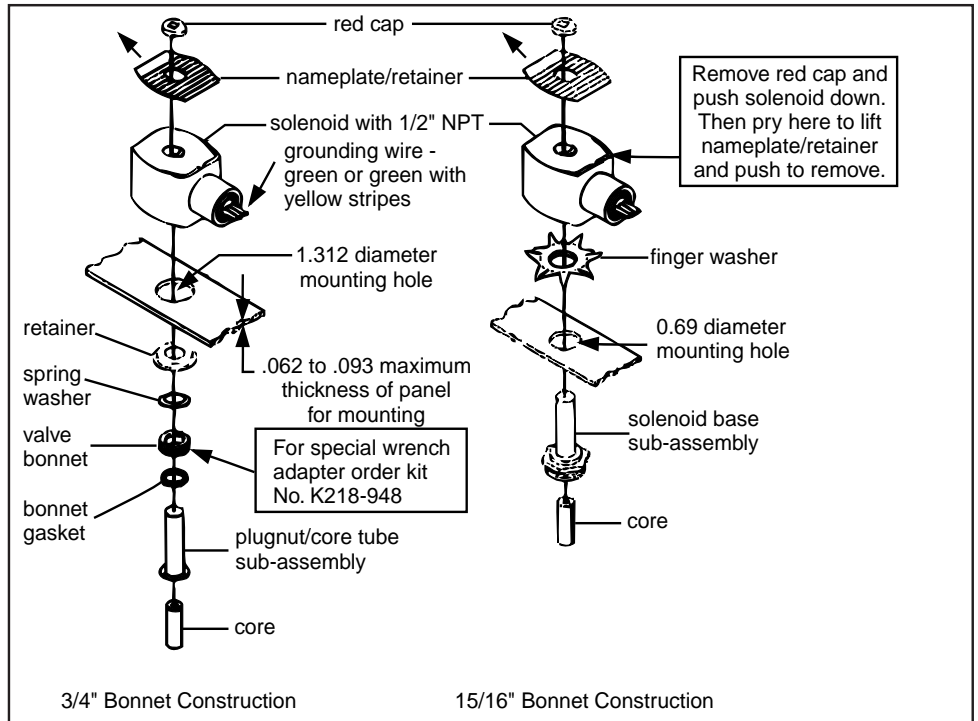
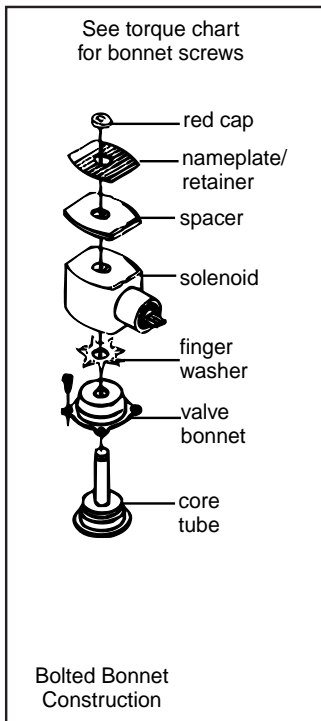


Figure 2. Series 8016G solenoid

Figure 3. Series 8016G panel mounted solenoids

## Torque Chart

Part Name	Torque Value in inch-Pounds	Torque Value in Newton-Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 - 20	1,7 - 2,3
center screw	5 ± 1	0,6 ± 0,1

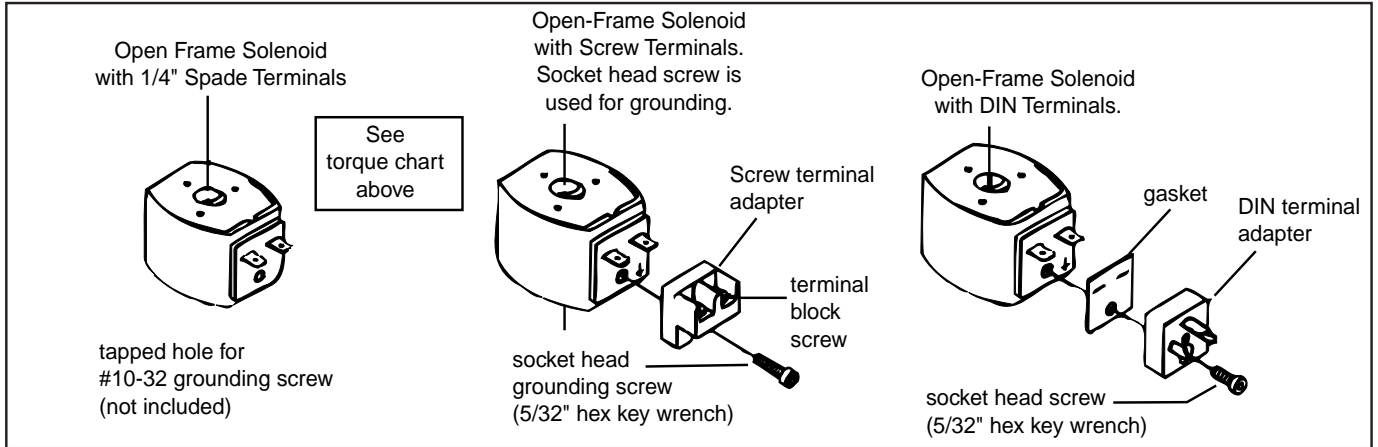


Figure 4. Open - frame solenoids

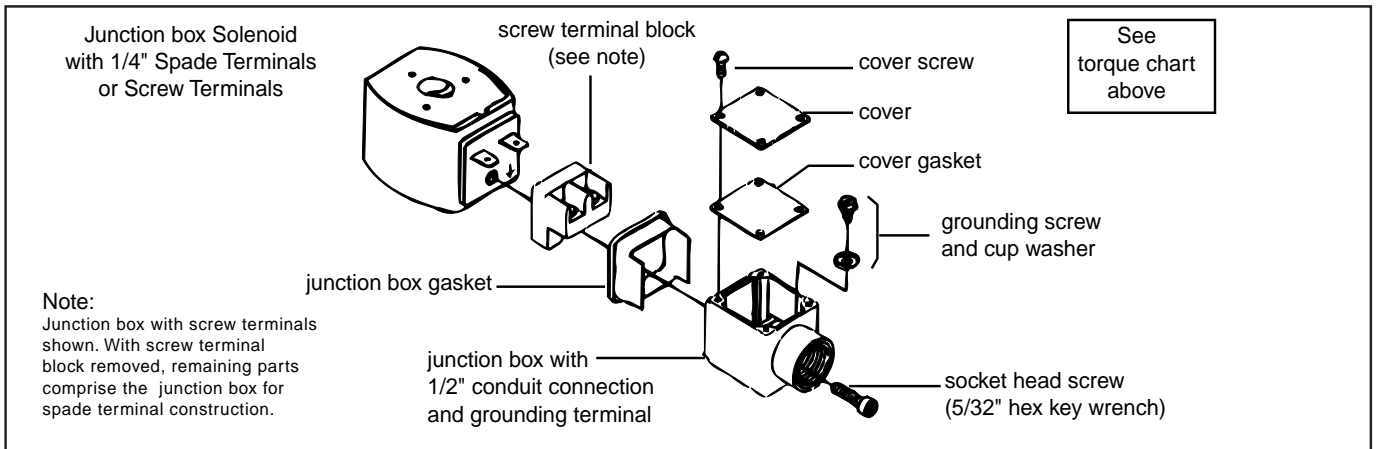
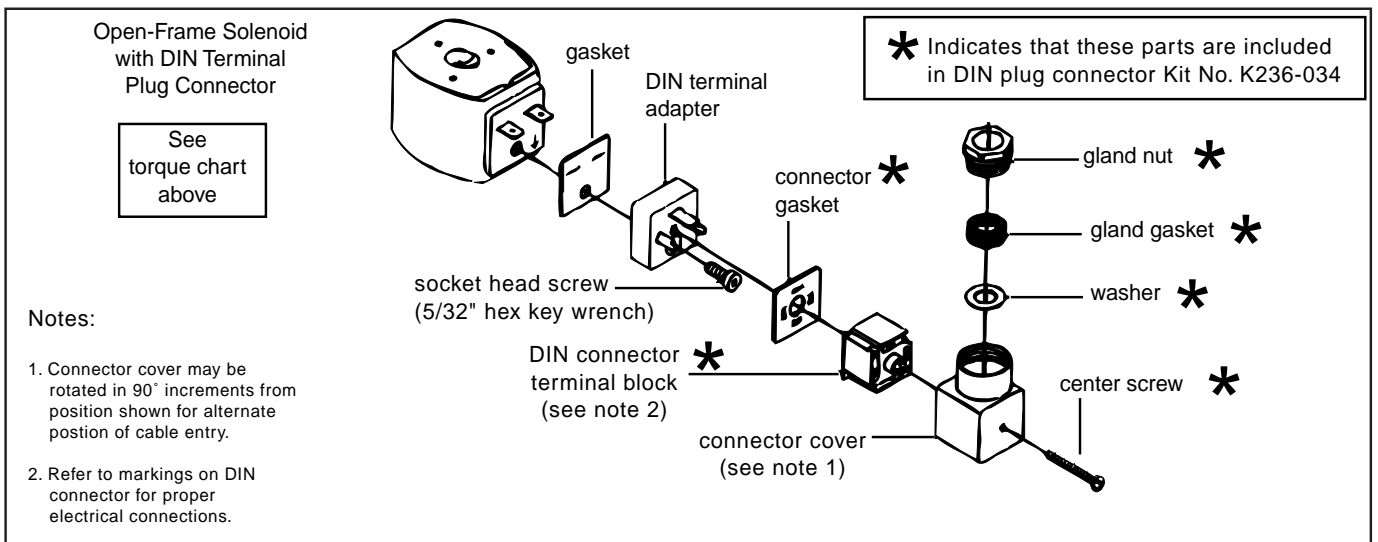


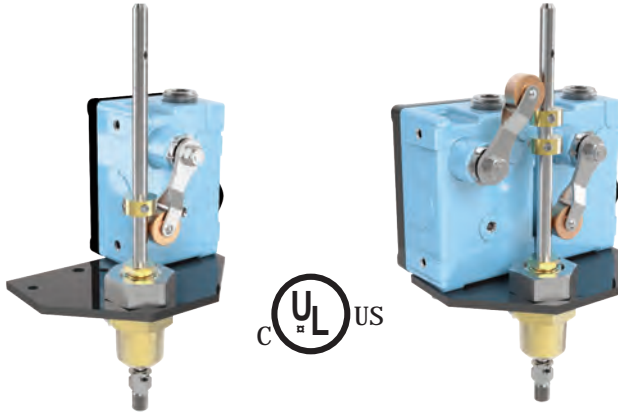
Figure 5. Open - frame solenoids





— MODELS — **X105L**  
**X105L2**

# Limit Switch Assemblies

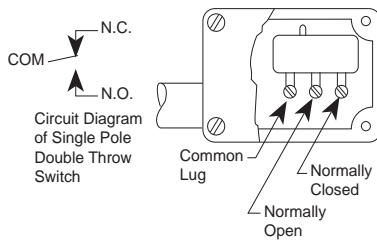


- **UL/ULC Listed**
- **Positive Action**
- **Rugged and Dependable**
- **Weather Proof or Explosion Proof**
- **Easy To Adjust**

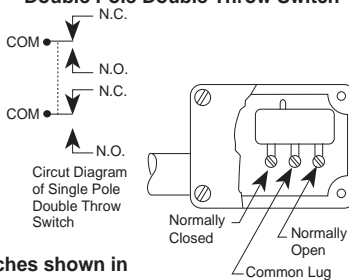
The Cla-Val Model X105L/X105L2 Limit Switch Assembly is a rugged, dependable and positive acting switch assembly actuated by the opening or closing of a Cla-Val control valve on which it is mounted. The single pole, double throw micro switch can be connected either to open or to close an electrical circuit when actuated. By loosening the allen screw on the actuating collar and raising or lowering the collar on the stem, the X105L is easily adjusted to signal that the valve has fully reached the desired position (open or closed).

## Installation

### Single Pole Double Throw Switch

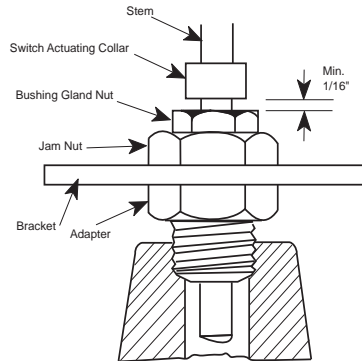


### Double Pole Double Throw Switch



Switches shown in unactivated position.

1. Remove plug in top of valve cover.
2. Screw actuating stem into main valve stem.
3. Slip adapter down over stem and screw into place on valve cover.
4. Attach micro switch housing and bracket to adapter with jam nut.
5. Bring electrical supply circuit into unit through the 1/2" tapping in micro switch housing.
6. Adjust switch collars. (Set collar to trip switch after valve is positioned fully open or fully closed)



### Actuating Collar Adjustment Minimum Setting

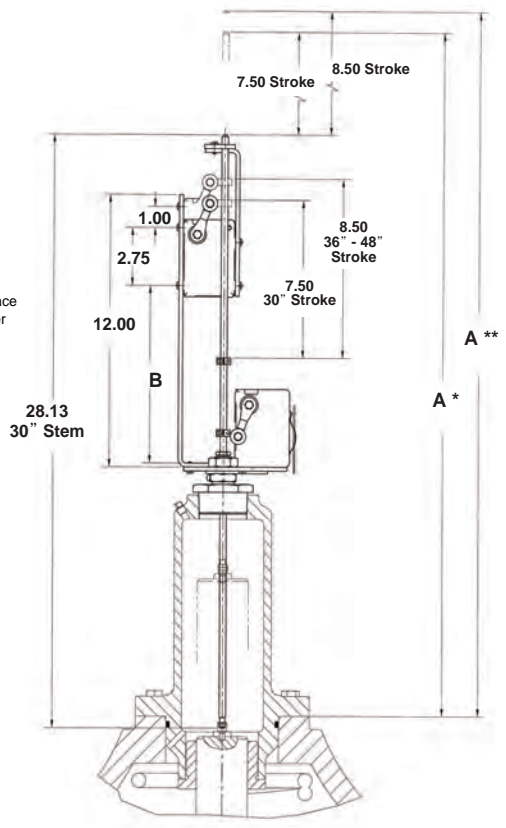
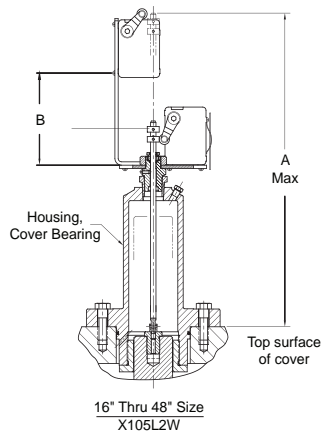
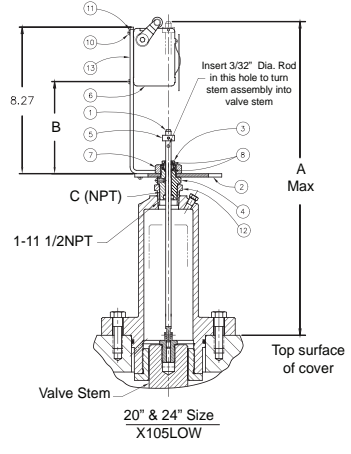
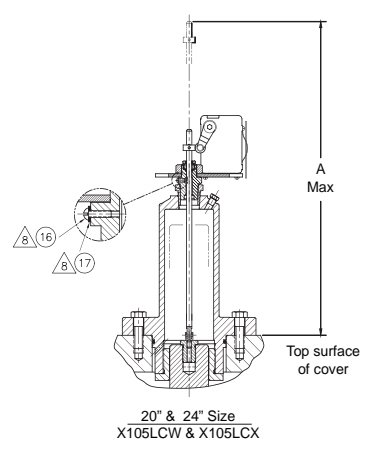
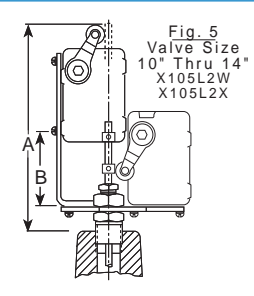
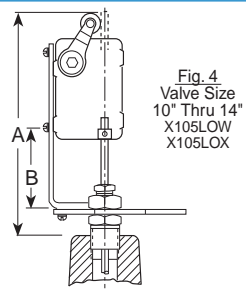
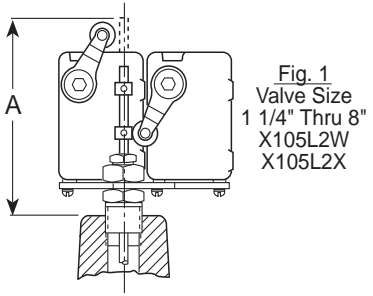
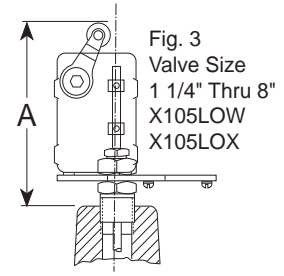
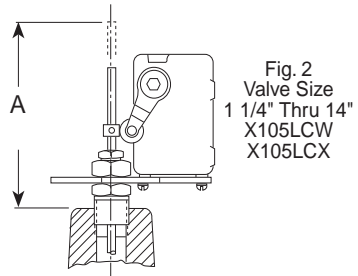
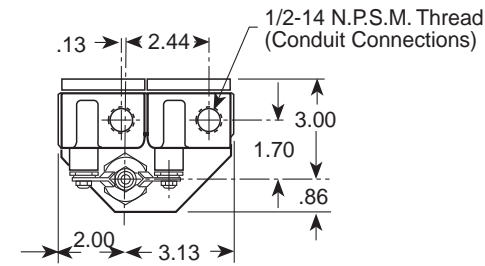
When adjusting actuating collar for proper switch action, a clearance of at least 1/16" (1/8" for 48" valve) must be provided between the collar and the bushing gland nut when valve is in the fully closed position.

## Purchase Specifications

The assembly shall be bracket-mounted to exterior of an adapter attached to the center of the main valve cover. A stainless steel actuating stem with a swivel adapter shall be fastened directly to the main valve stem and move vertically through an adapter and gland with two O-ring seals as the valve moves. An adjustable collar located on the actuating stem shall actuate the sensor arm of a switch when valve has fully reached the open or closed (specify) position. The rotary-type position sensor arm shall actuate SPDT or DPDT type (specify) micro-switches mounted inside protective housing either weather-tight or explosion-proof NEMA rated (specify).

Provisions shall be made for bleeding air from valve cover through a small bleed screw and washer located on one wrench flat of adapter. All assemblies shall be capable of accommodating up to three switches. Standard materials in contact with operating fluid are brass, stainless steel, Monel and Buna-N.

A conduit hub opening in the switch enclosure shall be provided for attaching protective weatherproof conduit for the electrical switch wires (wiring and conduit supplied by others). A sealing plug shall be provided to protect conduit opening during shipping or storage.



A\* - 30" • A\*\* - 36", 42" & 48" Size

**X105 Series Dimensions** (In Inches)

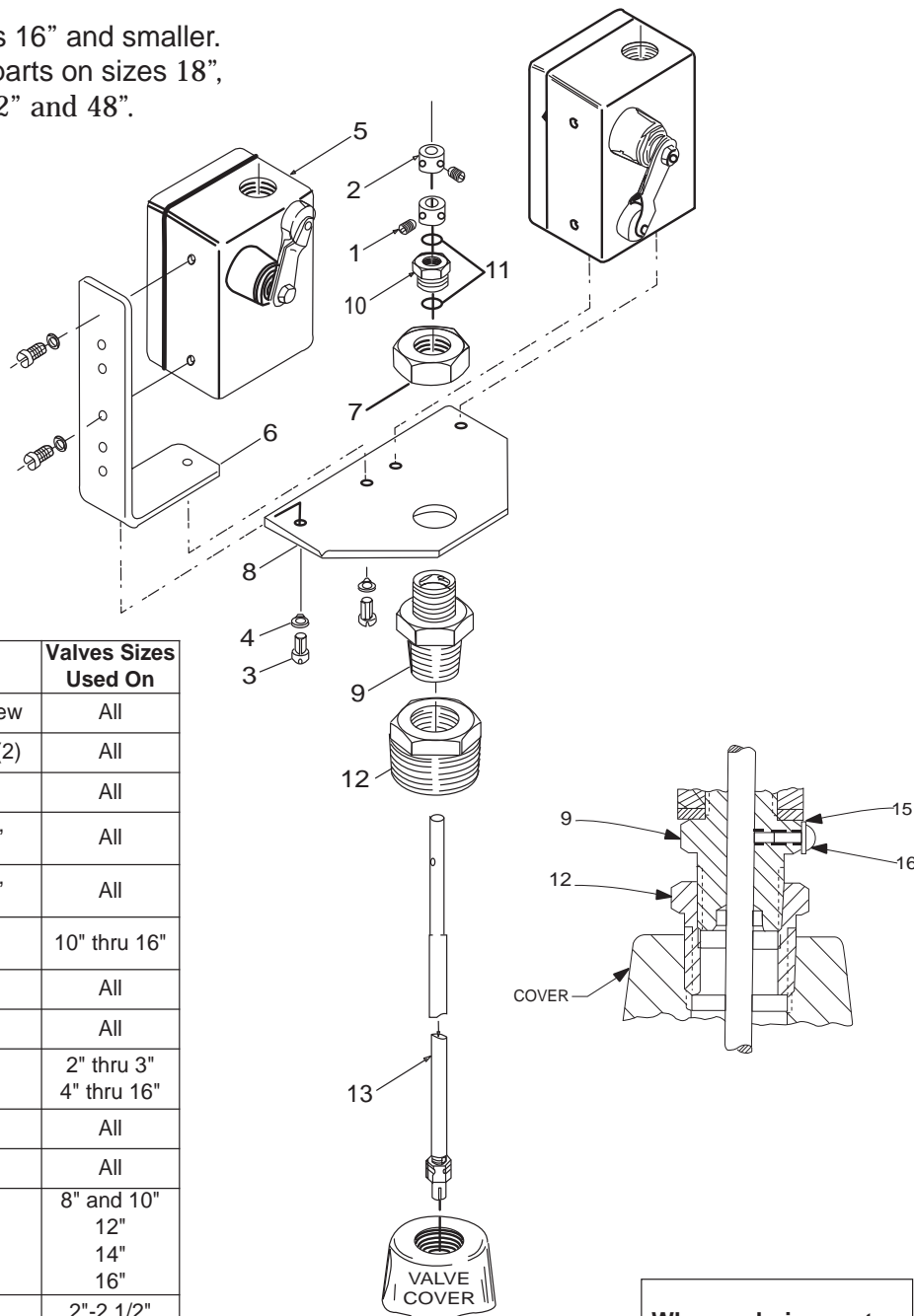
BasicValve 100-01	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36*	42*	48*
Dimension "A"	10.19	10.19	7.16	7.16	7.34	7.00	6.69	6.91	9.88	9.59	9.16	10.78	10.78	18.23	19.10	35.07	36.07	36.07	36.07
Dimension "B"							1.69	1.69	2.44	2.94	2.94	2.94	2.94	4.32	5.19	8.40	8.40	8.40	8.40
C (NPT)	1/4	1/4	1/2	1/2	1/2	3/4	3/4	1	1	1 1/4	1 1/2	2	2	3/4	3/4	2	2	2	2
BasicValve 100-20					3	4	6	8	10	12	14	16	18	20	24	30	36*	42*	48*
Dimension "A"					7.16	7.34	7.00	6.69	6.91	9.88	9.59	9.59	10.78	10.78	10.78	11.30	35.07	36.07	36.07
Dimension "B"								1.69	1.69	2.44	2.94	2.94	2.94	2.94	2.94	5.19	8.40	8.40	8.40
C (NPT)					1/2	1/2	3/4	3/4	1	1	1 1/4	1 1/4	2	2	2	1	2	2	2



# X105L

## Limit Switch Assembly

Parts list shown is for sizes 16" and smaller.  
Please consult factory for parts on sizes 18",  
20", 24", 30", 36", 42" and 48".

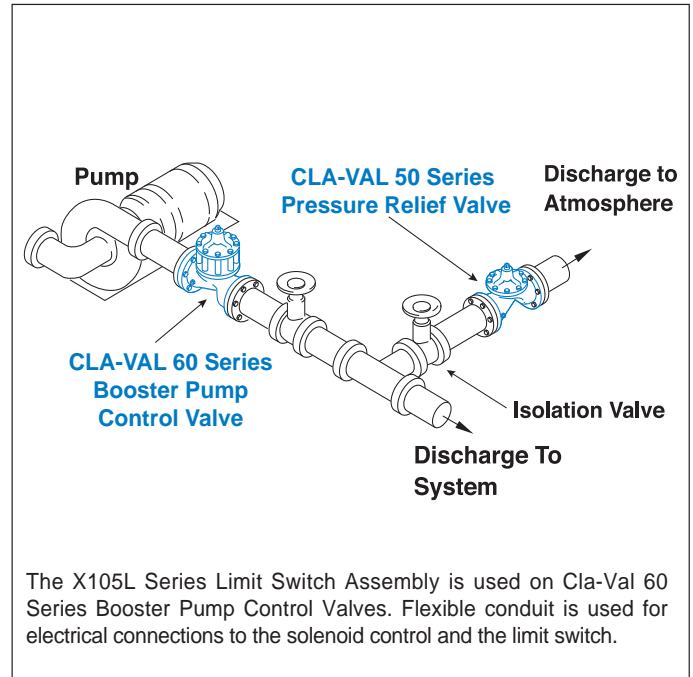
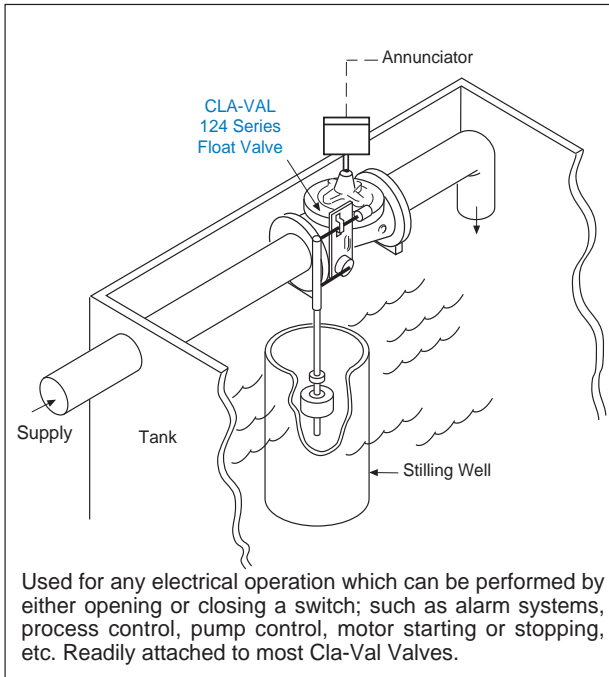


Item	Part Number	Description	Valves Sizes Used On
1-2	20441701E	Collar W/Set Screw	All
3	67578-21B	Screw, Machine (2)	All
4	67584-23F	Washer, Lock (2)	All
5	34637K	Switch Assembly, Weather Proof	All
	34633J	Switch Assembly, Explosion Proof	All
6	64310G	Bracket Switch Mounting	10" thru 16"
7	67815-06J	Nut, Jam	All
8	63674G	Plate, Mounting	All
9	2838201J	Adapter	2" thru 3"
	2838202G	Adapter	4" thru 16"
10	63398C	Bushing, Gland	All
11	00951E	O-Ring (2)	All
12	6764417K	Bushing	8" and 10"
	6764418H	Bushing	12"
	6764419F	Bushing	14"
	6764491J	Bell Reducer	16"
13	8970101F	Stem, Actuating	2"-2 1/2"
	8970102D	Stem, Actuating	3"-4"
	8970103B	Stem, Actuating	6"-8"
	8970104K	Stem, Actuating	10"-12"-14"
	8970105G	Stem, Actuating	16"
15	6551201H	Fiber Washer	All
16	6824421K	Screw 8-32 x 3/8	All

**When ordering parts, please specify:**

- Item Number
- Description
- Part Number

## Typical Applications



## Specifications

**Materials:** Aluminum switch housing  
Steel bracket and brass adapter  
Stainless steel stem

**Electrical:** 1/2" Conduit connection

**Switch Type:** SPDT UL, File No. E12252,  
CSA Certified, File No. LR57325  
Weather proof  
NEMA 1,3,4, and13

**Switch Rating:** UL/CSA rating: L96  
15 amp. 125, 250, or 480 volts AC  
1/2 amp. 125 volts DC  
1/4 amp. 250 volts DC

**Switch Options:** DPDT switches available on request  
UL/CSA Rating: L59, 10 amps

Explosion proof micro switches are  
NEMA 1,7, and 9  
UL Listed, File No. E14274 and CSA  
Certified, File No. LR57324: Class I,  
Group C and D and Class II, Group  
E, F and G.

## When Ordering, Please Specify

1. Valve Size and Basic Valve Model Number
2. Catalog Number from Table Below
3. All Valve Name Plate Data
4. Select Single or Double Pole Switch
5. Explosion Proof or Weather Proof Type Enclosure
6. Amperes and Voltage, AC or DC
7. Actuating Position (Valve Open or Closed)

CATALOG NO.	ACTUATION POSITION	SWITCH ENCLOSURE
X105LCW	Valve Closed	Weather Proof
X105LCX	Valve Closed	Explosion Proof
X105LOW	Valve Open	Weather Proof
X105LOX	Valve Open	Explosion Proof
X105L2W	Dual	Weather Proof
X105L2X	Dual	Explosion Proof



## CLA-VAL

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### CLA-VAL CANADA

4687 Christie Drive  
Beamsville, Ontario  
Canada L0R 1B4  
Phone: 905-563-4963  
E-mail: [sales@cla-val.ca](mailto:sales@cla-val.ca)

### CLA-VAL EUROPE

Chemin des Mésanges 1  
CH-1032 Romanel/  
Lausanne, Switzerland  
Phone: 41-21-643-15-55  
E-mail: [cla-val@cla-val.ch](mailto:cla-val@cla-val.ch)

### CLA-VAL UK

Dainton House, Goods Station Road  
Tunbridge Wells  
Kent TN1 2 DH England  
Phone: 44-1892-514-400  
E-mail: [info@cla-val.co.uk](mailto:info@cla-val.co.uk)

### CLA-VAL FRANCE

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ZAC du Champ du Pérignon  
France - 01700 Neyron  
Phone: 33-4-72-25-92-93  
E-mail: [cla-val@cla-val.fr](mailto:cla-val@cla-val.fr)

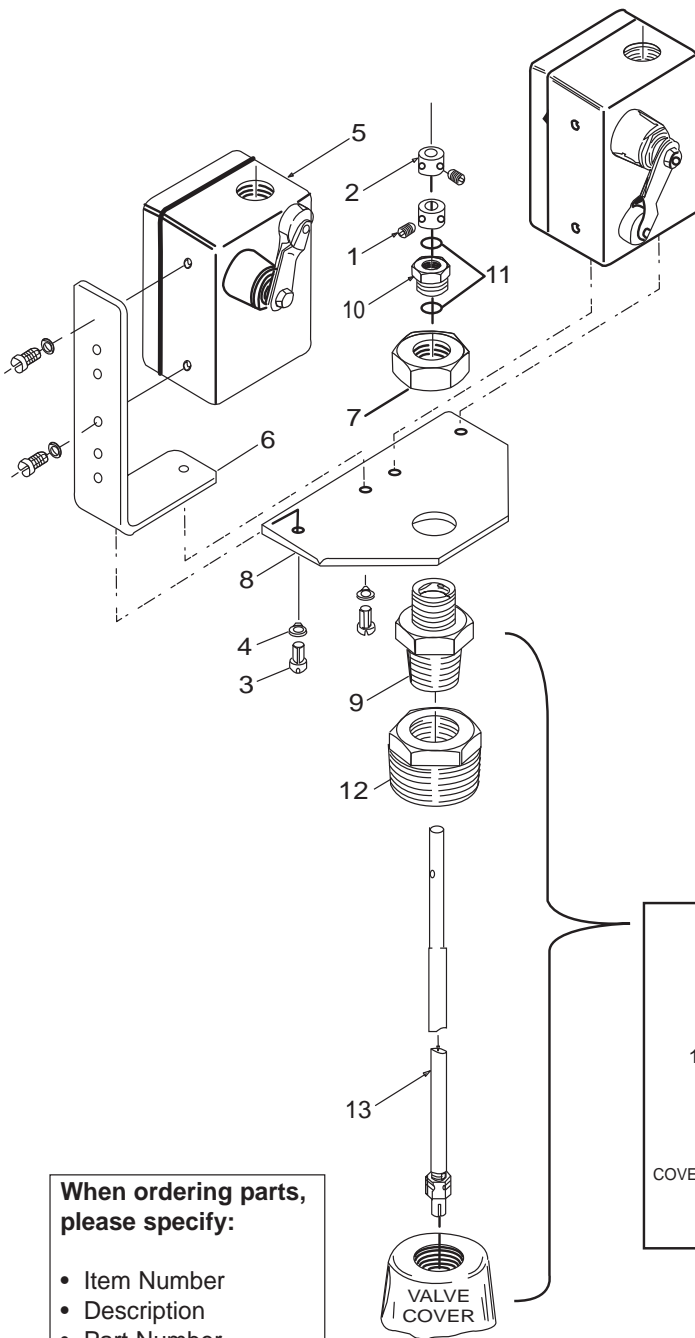
### CLA-VAL PACIFIC

45 Kennaway Road  
Woolston, Christchurch, 8023  
New Zealand  
Phone: 64-39644860  
[www.cla-valpacific.com](http://www.cla-valpacific.com)  
E-mail: [info@cla-valpacific.com](mailto:info@cla-valpacific.com)



# X105L

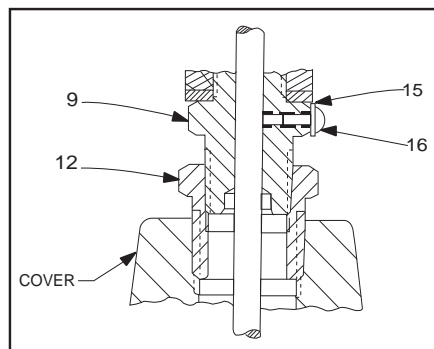
## Limit Switch Assembly



Item	Part Number	Description	Valves Sizes Used On
1-2	20441701E	Collar W/Set Screw	All
3	6757821B	Screw, Machine (2)	All
4	6758423F	Washer, Lock (2)	All
5	34637K	Switch Assembly, Weather Proof	All
	34633J	Switch Assembly, Explosion Proof	All
6	64310G	Bracket Switch Mounting	10" thru 16"
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	8970103B	Stem, Actuating	6"-8"
	8970104K	Stem, Actuating	10"-12"-14"
	8970105G	Stem, Actuating	16"
15	6551201H	Fiber Washer	All
16	6824421K	Screw 8-32 x 3/8	All

**When ordering parts, please specify:**

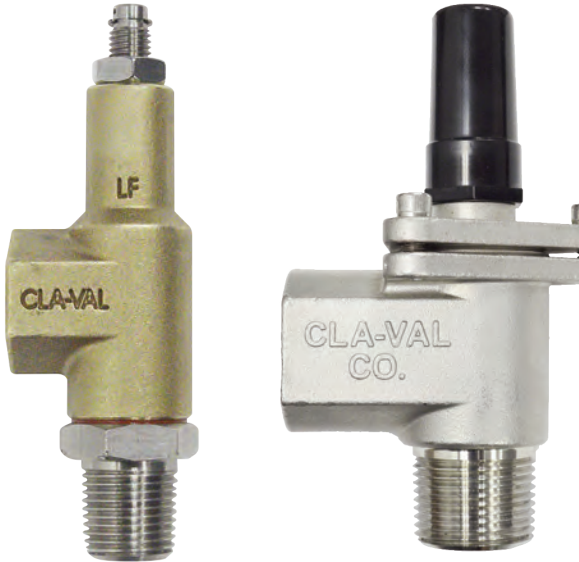
- Item Number
- Description
- Part Number







—MODEL— **CV**  
**Flow Control**



**DESCRIPTION**

The CV Control is an adjustable restriction which acts as a needle valve when flow is in the direction of the stem. When flow is in the reverse direction, the port area opens fully to allow unrestricted flow. When installed in the control system of a Cla-Val automatic valve, it can be arranged to function as either an opening or closing speed control.

**OPERATION**

The CV Flow Control permits full flow from port A to B, and restricted flow in the reverse direction. Flow from port A to B lifts the disc from seat, permitting full flow. Flow in the reverse direction seats the disc, causing fluid to pass through the clearance between the stem and the disc. This clearance can be increased, thereby increasing the restricted flow, by screwing the stem out, or counter-clockwise. Turning the stem in, or clockwise reduces the clearance between the stem and the disc, thereby reducing the restricted flow.'

**INSTALLATION**

Install the CV Flow Control as shown in the valve schematic. All connections must be tight to prevent leakage.

**DISASSEMBLY**

Follow the sequence of the item numbers assigned to the parts in the cross sectional illustration for recommended order of disassembly.

Use a scriber, or similar sharp-pointed tool to remove O-ring from the stem.

**INSPECTION**

Inspect all threads for damage or evidence of cross-threading. Check mating surface of seat and valve disc for excessive scoring or embedded foreign particles. Check spring for visible distortion, cracks and breaks. Inspect all parts for damage, corrosion and cleanliness.

**CLEANING**

After disassembly and inspection, cleaning of the parts can begin. Water service usually will produce mineral or lime deposits on metal parts in contact with water. These deposits can be cleaned by dipping the parts in a 5-percent muriatic acid solution just long enough for deposits to dissolve. This will remove most of the common types of deposits. **Caution: use extreme care when handling acid.** If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water. Rinse parts in water before handling. An appropriate solvent can clean parts used in fueling service. Dry with compressed air or a clean, lint-free cloth. Protect from damage and dust until reassembled.

**REPAIR AND REPLACEMENT**

Minor nicks and scratches may be polished out using a fine grade of emery or crocus cloth; replace parts if scratches cannot be removed.

Replace O-ring packing and gasket each time CV Flow Control is overhauled.

Replace all parts which are defective. Replace any parts which create the slightest doubt that they will not afford completely satisfactory operation. Use Inspection steps as a guide.

**REASSEMBLY**

Reassembly is the reverse of disassembly; no special tools are required.

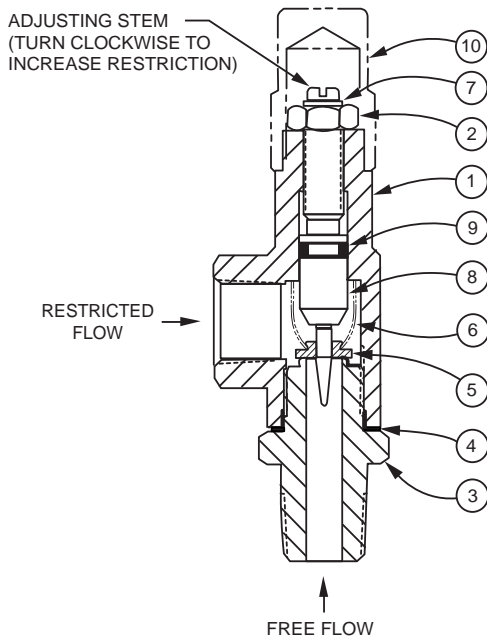
**TEST PROCEDURE**

No testing of the flow Control is required prior to reassembly to the pilot control system on Cla-Val Main Valve.



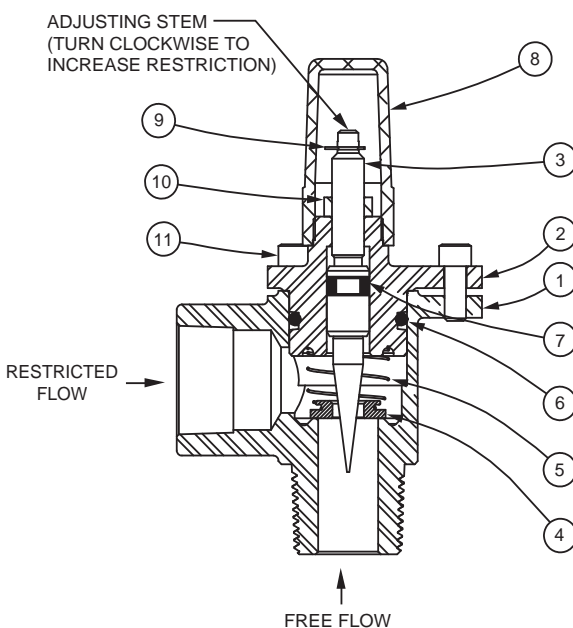
# CV Flow Control

## 3/8" CV Flow Control



ITEM	DESCRIPTION	QTY
1	Housing	1
2	Nut, Jam	1
3	Seat	1
4	Gasket	1
5	Disc	1
6	Spring	1
7	Ring, Retaining	1
8	Stem	1
9	O-Ring	1
10	Cap (SS only)	1

## 1/2", 3/4", 1" CV Flow Control



### When ordering parts, please specify:

- Number Stamped on Side
- Description (CV Flow Control)
- Part Description
- Material

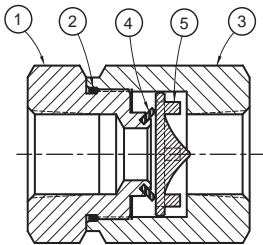
ITEM	DESCRIPTION	QTY
1	Body	1
2	Cover	1
3	Stem	1
4	Disc	1
5	Spring	1
6	O-Ring	1
7	O-Ring	1
8	Cap	1
9	Ring, Retaining	1
10	Nut, Jam	1
11	Socket Head Cap Screw	3



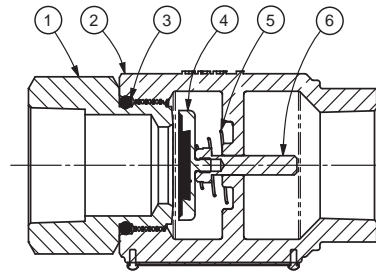
— MODEL — **CDC-1**  
**Check Valve**  
 Sizes 3/8", 1/2", 3/4" and 1"



- Meets Low Lead Requirements
- Patented Seal Design Allows for Drip Tight Shut-off at Low DP
- No Spring Required due to Patented Seal Design
- Delrin® Disc with Flow Profile Designed to Minimize Head Loss
- Delrin® Disc Resists Corrosion and/or Mineral Build-up
- Drip Tight Seating at both Low and High Operating Pressures
- Temperature Range: 10°F to 210°F
- EPR, NBR and Fluorocarbon Seal Options



CDC-1 - 3/8" and 1/2"		
Item	Description	Quantity
1	Retainer, Seal	1
*2	O-Ring	1
3	Retainer, Valve	1
*4	Seal, Valve Ring	1
*5	Plate, Valve	1

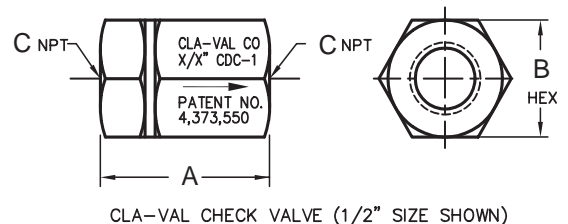


CDC-1 - 3/4" and 1"		
Item	Description	Quantity
1	Seat, Valve	1
2	Body, Valve	1
*3	O-Ring	1
*4	Disc Retainer Assembly	1
*5	Spring	1
*6	Stem, Valve	1

\* Included in Repair Kit

**Dimensions**

Size (NPT)	A	B	C
3/8"	2.06	1.06	0.38 (3/8) - 18.0 NPT
1/2"	2.12	1.38	0.50 (1/2) - 14.0 NPT
3/4"	4.06	2.26	0.75 (3/4) - 14.0 NPT
1"	4.06	2.19	1.00 (1) - 11.5 NPT





NEWPORT BEACH, CALIFORNIA

CATALOG NO.  
CSC

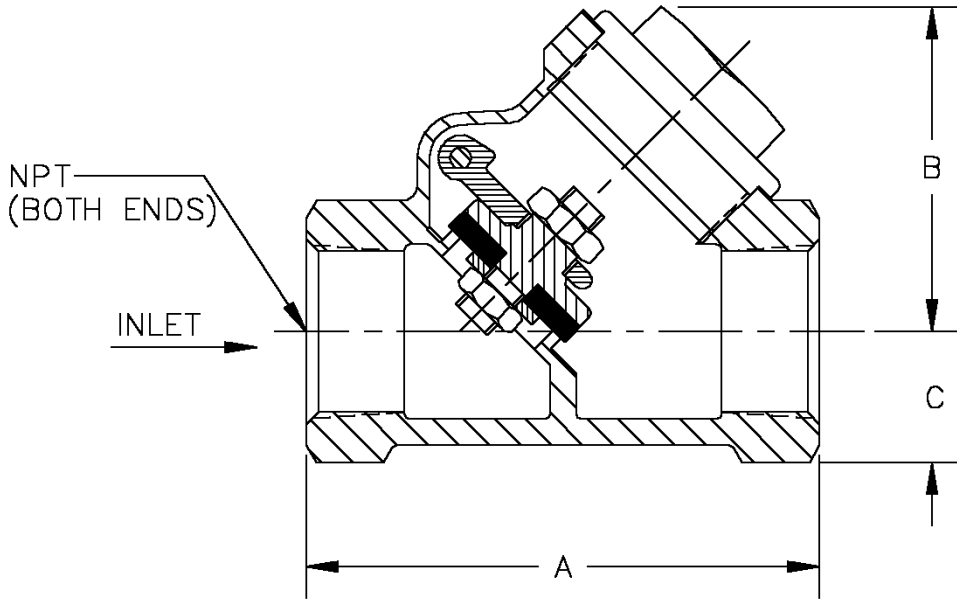
DRAWING NO.  
92667

REV.  
A

TYPE OF VALVE AND MAIN FEATURES

CSC SWING CHECK VALVE

DESIGN		
DRAWN	CH	11-5-76
CHK'D	MF	11-8-76
APVD	JAZ	11-9-76



PIPE SIZE NPT	A	B	C
.25 (1/4)	2.13	1.63	.50
.38 (3/8)	2.13	1.63	.50
.50 (1/2)	2.44	1.69	.63
.75 (3/4)	2.94	1.88	.75
1.00 (1)	3.19	2.09	.94

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A	REDRAWN ON CAD (ECO 14229)	EK	11-15-93

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—MODEL— **CRD**

# Pressure Reducing Control



## DESCRIPTION

The Cla-Val Model CRD Pressure Reducing Control automatically reduces a higher inlet pressure to a lower outlet pressure. It is a direct acting, spring loaded, diaphragm type control that operates hydraulically or pneumatically. It may be used as a self-contained valve or as a pilot control for a Cla-Val main valve. It will hold a constant downstream pressure within very close pressure limits.

## OPERATION

The CRD Pressure Reducing Control is normally held open by the force of the compression spring above the diaphragm; and delivery pressure acts on the underside of the diaphragm. Flow through the valve responds to changes in downstream demand to maintain a pressure.

## INSTALLATION

The CRD Pressure Reducing Control may be installed in any position. There is one inlet port and two outlets, for either straight or angle installation. The second outlet port can be used for a gage connection. A flow arrow is marked on the body casting.

## ADJUSTMENT PROCEDURE

The CRD Pressure Reducing Control can be adjusted to provide a delivery pressure range as specified on the nameplate. Pressure adjustment is made by turning the adjustment screw to vary the spring pressure on the diaphragm. The greater the compression on the spring the higher the pressure setting.

1. Turn the adjustment screw in (clockwise) to increase delivery pressure.
2. Turn the adjustment screw out (counter-clockwise) to decrease the delivery pressure.
3. When pressure adjustment is completed tighten jam nut on adjusting screw and replace protective cap.
4. When this control is used, as a pilot control on a Cla-Val main valve, the adjustment should be made under flowing conditions. The flow rate is not critical, but generally should be somewhat lower than normal in order to provide an inlet pressure several psi higher than the desired setting

*The approximate minimum flow rates given in the table are for the main valve on which the CRD is installed.*

Valve Size	1 1/4" -3"	4"-8"	10"-16"
Minimum Flow GPM	1-2	4-15	35-95

SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to open when delivery pressure lowers	No spring compression	Tighten adjusting screw
	Damaged spring	Disassemble and replace
	Spring guide (8) is not in place	Assemble properly
	Yoke dragging on inlet nozzle	Disassemble and reassemble properly (refer to Reassembly)
Fails to close when delivery pressure rises	Spring compressed solid	Back off adjusting screw
	Mechanical obstruction	Disassemble and reassemble properly (refer to Reassembly)
	Worn disc	Disassemble remove and replace disc retainer assembly
	Yoke dragging on inlet nozzle	Disassemble and reassemble properly (refer to Reassembly)
Leakage from cover vent hole	Damaged diaphragm	Disassemble and replace
	Loose diaphragm nut	Remove cover and tighten nut

## MAINTENANCE

### Disassembly

To disassemble follow the sequence of the item numbers assigned to parts in the sectional illustration.

### Reassembly

Reassembly is the reverse of disassembly. Caution must be taken to avoid having the yoke (17) drag on the inlet nozzle of the body (18). Follow this procedure:

1. Place yoke (17) in body and screw the disc retainer assembly (16) until it bottoms.
2. Install gasket (14) and spring (19) for 2-30 and 2-6.5 psi range onto plug (13) and fasten into body. Disc retainer must enter guide hole in plug as it is assembled. Screw the plug in by hand. Use wrench to tighten only.
3. Place diaphragm (12) diaphragm washer (11) and Belleville washer (20) on yoke. Screw on hex nut (10).
4. Hold the diaphragm so that the screw holes in the diaphragm and body align. Tighten diaphragm nut with a wrench. At the final tightening release the diaphragm and permit it to rotate 5° to 10°. The diaphragm holes should now be properly aligned with the body holes.

### To check for proper alignment proceed as follows:

Rotate diaphragm clockwise and counterclockwise as far as possible. Diaphragm screw holes should rotate equal distance on either side of body screw holes ±1/8".

Repeat assembly procedure until diaphragm and yoke are properly aligned. There must be no contact between yoke and body nozzle during its normal movement. To simulate this movement hold body and diaphragm holes aligned. Move yoke to open and closed positions. There must be no evidence of contact or dragging.

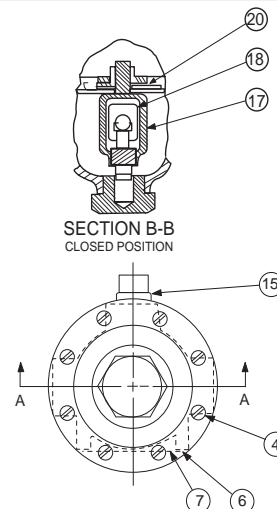
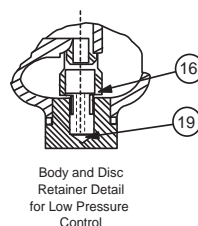
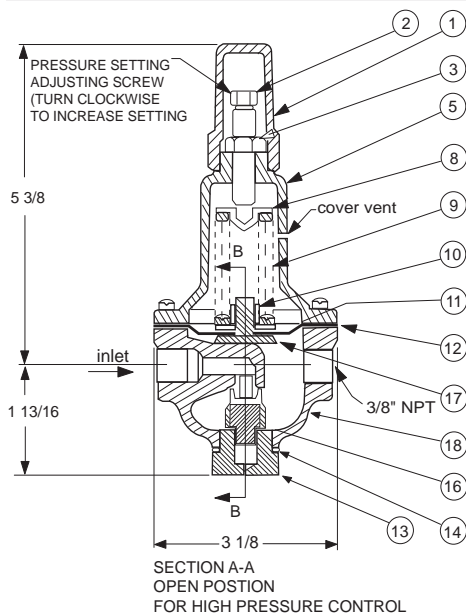
5. Install spring (9) with spring guide (8).
6. Install cover (5), adjusting screw (2) and nut (3), then cap (1).



# CRD

## Pressure Reducing Control

(Bronze Body with 303SS Trim)



Size (inch)	Stock Number	Adjustment Range	
		psi	Ft of Water
3/8	7194307A	2 - 6.5	4.5 - 15
3/8	7194308J	2 - 30	4.5 - 69
3/8	7194303K	15 - 75	35 - 173
3/8	7194311C	20 - 105	46 - 242
3/8	7194304H	30 - 300	69 - 692
Factory Set Pressure		PSI per Turn*	
2 - 6.5 set @ 3.5 psi		.61	
2 - 30 set @ 10 psi		3.0	
15 - 75 set @ 20 psi		9.0	
20 - 105 set @ 60 psi		12.0	
30 - 300 set @ 60 psi		27.0	

\*Approximate-Final Adjustment should be with a pressure gauge and with flow.

### When ordering parts specify:

- All nameplate data
- Item Description
- Item number

Item	Description	Material	Part Number
1	Cap	PL	67628J
2	Adjusting Screw	BRS	7188201D
3	Jam Nut (3/8-16)	SS	6780106J
4*	Machine Screw (Fil.Hd.) 8 Req'd	303	6757821B
5	Cover	BRS	C2544K
6	Nameplate Screw	SS	67999D
7	Nameplate	BRS	C0022001G
8	Spring Guide	302	71881H
	Spring Guide (20 - 105 psi)	303	205620F
9	Spring (15-75 psi)	CHR/VAN	71884B
	Spring (2 - 6.5 psi)	SS	82575C
	Spring (2 - 30 psi)	SS	81594E
	Spring (20 - 105 psi)	316	20632101E
	Spring (30 - 300 psi)	CHR/VAN	71885J
10	Hex Nut	303	71883D
11	Diaphragm Washer	302	71891G
12*	Diaphragm	NBR	C6936D
13	Plug, Body	BRS	V5653A
14*	Gasket	Fiber	40174F
15	Plug	BRS	6766003F
16*	Disc Retainer Assy. (2 - 30 psi)	SS/Rub	C8348K
	Disc Retainer Assy. (15 - 75 psi)	SS/Rub	37133G
	Disc Retainer Assy. (20 - 105 psi)	SS/Rub	37133G
	Disc Retainer Assy. (30 - 300 psi)	SS/Rub	37133G
17	Yoke	VBZ	V6951H
18	Body & 1/4" Seat Assy	BR/SS	8339702G
19*	Bucking Spring (2 - 6.5 psi)(2 - 30psi)	302	V0558G
20	Belleville Washer	STL	7055007E
*	Repair Kit (No Bucking Spring)	Buna®-N	9170003K
*	Repair Kit (with Bucking Spring)	Buna®-N	9170002B

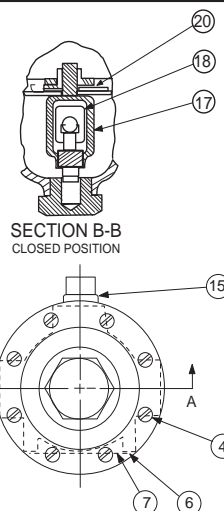
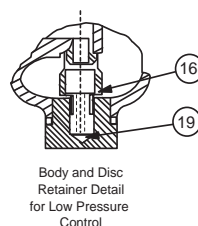
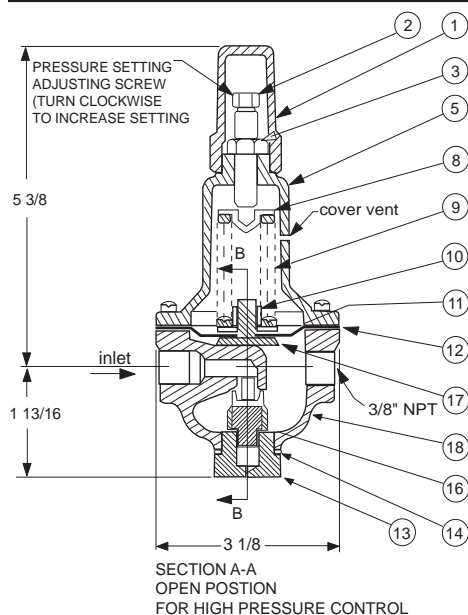
\*SUGGESTED REPAIR PARTS



# CRD

## Pressure Reducing Control

(Bronze Body with 303SS Trim)



Size (inch)	Stock Number	Adjustment Range	
		psi	Ft of Water
3/8	7194307A	2 - 6.5	4.5 - 15
3/8	7194308J	2 - 30	4.5 - 69
3/8	7194303K	15 - 75	35 - 173
3/8	7194311C	20 - 105	46 - 242
3/8	7194304H	30 - 300	69 - 692
Factory Set Pressure		PSI per Turn*	
2 - 6.5 set @ 3.5 psi		.61	
2 - 30 set @ 10 psi		3.0	
15 - 75 set @ 20 psi		9.0	
20 - 105 set @ 40 psi		12.0	
30 - 300 set @ 60 psi		27.0	

\*Approximate-Final Adjustment should be with a pressure gauge and with flow.

### When ordering parts specify:

- All nameplate data
- Item Description
- Item number

Item	Description	Material	Part Number
1	Cap	PL	67628J
2	Adjusting Screw	BRS	7188201D
3	Jam Nut (3/8-16)	SS	6780106J
4*	Machine Screw (Fil.Hd.) 8 Req'd	303	6757821B
5	Cover	BRS	C2544K
6	Nameplate	SS	67999D
7	Nameplate	BRS	C0022001G
8	Spring Guide	302	71881H
	Spring Guide (20 - 105 psi)	303	205620F
9	Spring (15-75 psi)	CHR/VAN	71884B
	Spring (2 - 6.5 psi)	SS	82575C
	Spring (2 - 30 psi)	SS	81594E
	Spring (20 - 105 psi)	316	20632101E
	Spring (30 - 300 psi)	CHR/VAN	71885J
10	Hex Nut	303	71883D
11	Diaphragm Washer	302	71891G
12*	Diaphragm	NBR	C6936D
13	Plug, Body	BRS	V5653A
14*	Gasket	Fiber	40174F
15	Plug	BRS	6766003F
16*	Disc Retainer Assy. (2 - 30 psi)	SS/Rub	C8348K
	Disc Retainer Assy. (15 - 75 psi)	SS/Rub	37133G
	Disc Retainer Assy. (20 - 105 psi)	SS/Rub	37133G
	Disc Retainer Assy. (30 - 300 psi)	SS/Rub	37133G
17	Yoke	VBZ	V6951H
18	Body & 1/4" Seat Assy	BR/SS	8339702G
19*	Bucking Spring (2 - 6.5 psi)(2 - 30psi)	302	V0558G
20	Belleville Washer	STL	7055007E
*	Repair Kit (No Bucking Spring)	Buna®-N	9170003K
*	Repair Kit (with Bucking Spring)	Buna®-N	9170002B

\*SUGGESTED REPAIR PARTS



— MODEL — **X46**

# Flow Clean Strainer



**X46A Straight**

- Self Scrubbing Cleaning Action
- Straight Type or Angle Type

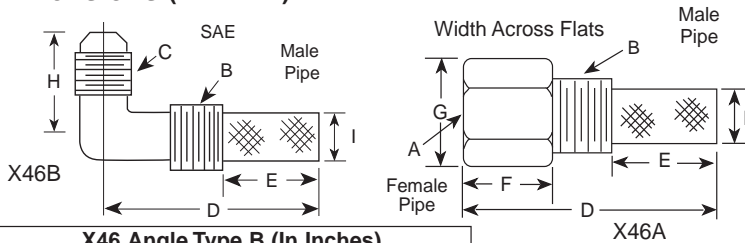
The Cla-Val Model X46 Strainer is designed to prevent passage of foreign particles larger than .015". It is especially effective against such contaminant as algae, mud, scale, wood pulp, moss, and root fibers. There is a model for every Cla-Val. valve.

**X46B Angle**



The X46 Flow Clean strainer operates on a velocity principle utilizing the circular "air foil" section to make it self cleaning. Impingement of particles is on the "leading edge" only. The low pressure area on the downstream side of the screen prevents foreign particles from clogging the screen. There is also a scouring action, due to eddy currents, which keeps most of the screen area clean.

## Dimensions (In Inches)



B(NPT)	C(SAE)	D	E	H	I
1/8	1/4	1-3/8	5/8	7/8	1/4
1/4	1/4	1-3/4	3/4	1	3/8
3/8	1/4	2	7/8	1	1/2
3/8	3/8	1-7/8	7/8	1	1/2
1/2	3/8	2-3/8	1	1-1/4	5/8

A (NPT)	B (NPT)	D	E	F	G	I
1/8	1/8	1-3/4	3/4	1/2	1/2	1/4
1/4	1/4	2-1/4	1	3/4	3/4	3/8
3/8	3/8	2-1/2	1	7/8	7/8	1/2
3/8	1/2	2-1/2	1-1/4	1/2	7/8	3/4
1/2	1/2	3	1-1/4	1	1-1/8	3/4
3/8	3/4	3-3/8	2	1/2	1	7/8
3/4	3/4	4	2	1	1-1/2	7/8
3/8	1	4-1/4	2-3/4	1/2	1-3/8	7/8
1	1	4-1/2	2-3/4	1-1/4	1-3/4	7/8
1/2	1	4-1/4	2-3/4	1/2	1-3/8	7/8

### When Ordering, Please Specify:

- Catalog Number X46
- Straight Type or Angle Type
- Size Inserted Into and Size Connection
- Materials

## INSTALLATION

The strainer is designed for use in conjunction with a Cla-Val Main Valve, but can be installed in any piping system where there is a moving fluid stream to keep it clean. When it is used with the Cla-Val Valve, it is threaded into the upstream body port provided for it on the side of the valve. It projects through the side of the Main Valve into the flow stream. All liquid shunted to the pilot control system and to the cover chamber of the Main Valve passes through the X46 Flow Clean Strainer.

## INSPECTION

Inspect internal and external threads for damage or evidence of cross-threading. Check inner and outer screens for clogging, embedded foreign particles, breaks, cracks, corrosion, fatigue, and other signs of damage.

## DISASSEMBLY

Do not attempt to remove the screens from the strainer housing.

## CLEANING

After inspection, cleaning of the X46 can begin. Water service usually will produce mineral or lime deposits on metal parts in contact with water. These deposits can be cleaned by dipping X46 in a 5-percent muriatic acid solution just long enough for deposit to dissolve. This will remove most of the common types of deposits.

**Caution: use extreme care when handling acid.** If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water. Rinse parts in water before handling. An appropriate solvent can clean parts used in fueling service. Dry with compressed air or a clean, lint-free cloth. Protect from damage and dust until reassembled.


## REPLACEMENT

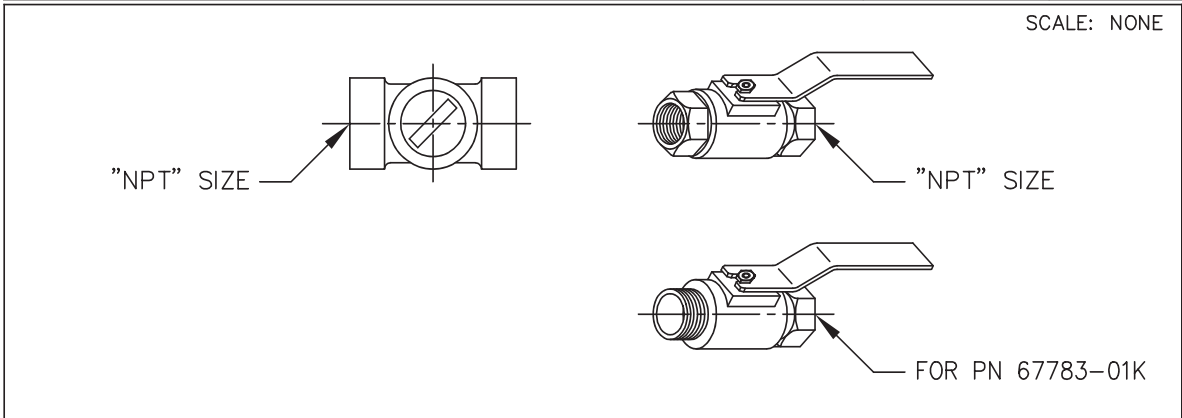
If there is any sign of damage, or if there is the slightest doubt that the Model X46 Flow Clean Strainer may not afford completely satisfactory operation, replace it. Use Inspection steps as a guide. Neither inner screen, outer screen, nor housing is furnished as a replacement part. Replace Model X46 Flow Clean Strainer as a complete unit.

When ordering replacement Flow-Clean Strainers, it is important to determine pipe size of the tapped hole into which the strainer will be inserted (refer to column A or F), and the size of the external connection (refer to column B or G).



AK	07-10-08	BB	ADDED PN'S 67783-62B (NED 62200)
AK	08-14-08	BC	ADDED PN'S 67783-63K (NED 62218)
PC	10-1-2008	BD	ADDED PN 67783-64H (NED 62446)
CAD REVISION RECORD - DO NOT REVISE MANUALLY		BY	DATE
LTR	DESCRIPTION		
A-AY	SEE REVISION FILE		
BA	ADDED PN'S 67783-59H, 67783-60F & 67783-61D (ECO 20434)	AK	03-14-06

 <b>CLA-VAL CO.</b> NEWPORT BEACH, CALIFORNIA	CATALOG NO.	DRAWING NO.	REV
		67783	BD
TYPE OF VALVE AND MAIN FEATURES		DESIGN	
<p style="text-align: center;">CK2 COCK/BALL VALVE</p>		DRAWN	MGR 4-02-80
		CHK'D	KD 4-03-80
		APV'D	CH 4-07-80



CLA-VAL PART NO. AND MATERIAL								
BRONZE WITH HANDLE	STEEL WITH HANDLE	IRON WITH HANDLE	316 SST WITH HANDLE	316 SST W/ LOCKING HANDLE	BRONZE WITH HANDLE	MONEL WITH HANDLE	MONEL W/ LOCKING HANDLE	SIZE "NPT"
67783-01K*	-09C	-17F	-25J SUPSD BY-26G		-41F SUPSD BY-01K			1/8"
-02H	-10A	-18D	-26G	-51E SUPSD BY-26G -52C	-42D SUPSD BY-02H	-55F		1/4"
-03F * -59H***	-11J	-19B	-27E	-46E SUPSD BY-27E -53A	-45G -57B * *	-48A SUPSD BY-49J	-63K	3/8"
-04D -60F ***	-12G	-20K	-28C	-54J	-43B SUPSD BY-04D	-49J	-62B	1/2"
-05A -61D ***	-13E	-21H	-29A	-64H	-44K SUPSD BY-05A	-56D		3/4"
-06J	-14C	-22F	-30J			-58K		1"
-07G	-15K	-23D	-31G					1 1/4"
-08E	-16H	-24B	-32E					1 1/2"
-50G			-47C					2"

\* SEE ENGINEERING APPROVED VENDORS TABLE (SHEET 2 OF 2).

\*\* HAMMOND VALVE 8501 ONLY.

\*\*\* WILKINS CK2 (SEE SHEET 2 OF 2)

"THIS DRAWING IS THE PROPERTY OF CLA-VAL CO. AND SAME AND COPIES MADE THEREOF, IF ANY, SHALL BE RETURNED TO IT UPON DEMAND. DELIVERY AND DISCLOSURE HEREOF ARE SOLELY UPON CONDITION THAT THE SAME SHALL NOT BE USED, COPIED OR REPRODUCED, NOR SHALL THE SUBJECT HEREOF BE DISCLOSED IN ANY MANNER TO ANYONE FOR ANY PURPOSE, EXCEPT AS HEREIN AUTHORIZED, WITHOUT PRIOR WRITTEN APPROVAL OF CLA-VAL CO. THIS DRAWING IS SUBMITTED CONFIDENTIALLY AND MAY NOT BE USED IN THE MANUFACTURE OF ANY MATERIAL OR PRODUCT OTHER THAN SUCH MATERIALS AND PRODUCTS FURNISHED TO CLA-VAL CO. WHETHER OR NOT THE EQUIPMENT OR INFORMATION SHOWN HEREON IS PATENTED OR OTHERWISE PROTECTED, FULL TITLE AND COPYRIGHTS, IF ANY, IN AND TO THIS DRAWING AND/OR INFORMATION DELIVERED OR SUBMITTED ARE FULLY RESERVED CLA-VAL CO."

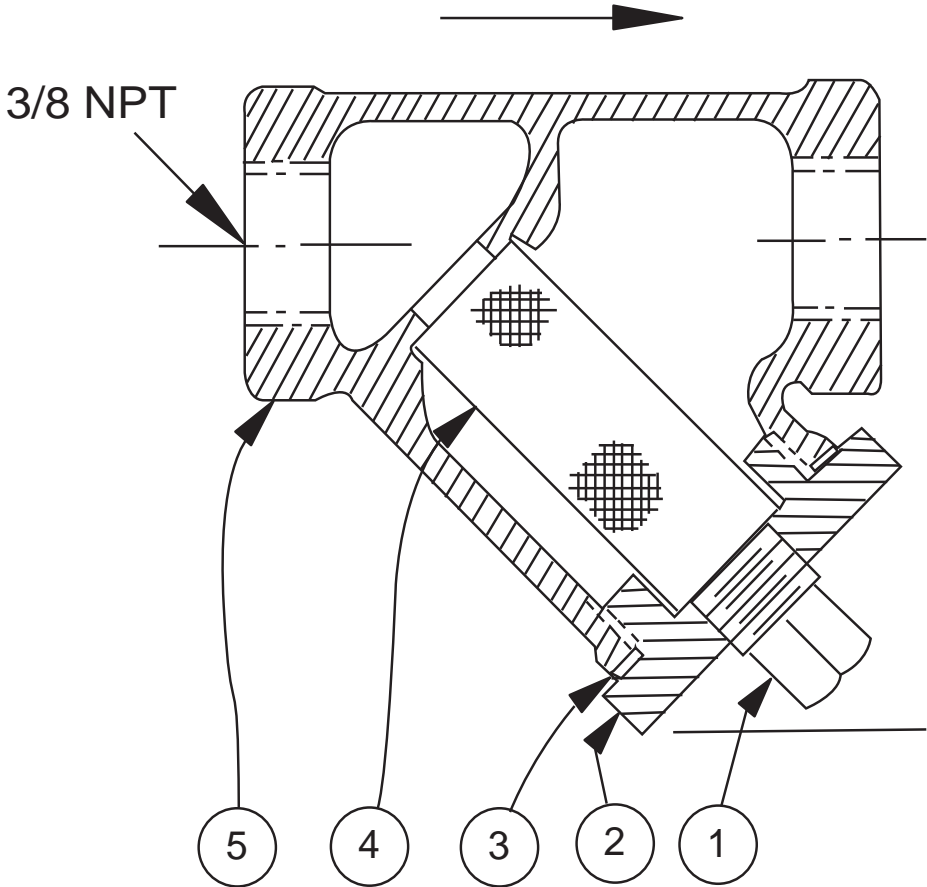


# X43 Strainer

ITEM	DESCRIPTION	MATERIAL
1	Pipe Plug	Stainless Steel
2	Strainer Plug	Stainless Steel
3	Gasket	Fiber
4	Screen	Stainless Steel
5	Body	Stainless Steel
No parts available. Replacement assembly only.		

Standard 60 mesh pilot system strainer for fluid service.

Size	Stock Number
3/8 x 3/8	8850604D

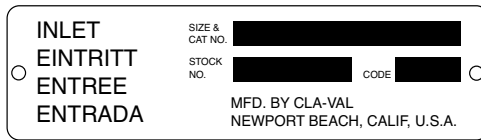


### Proper Identification

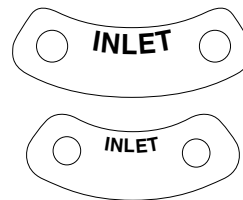
For ordering repair kits, replacement parts, or for inquiries concerning valve operation, it is important to properly identify Cla-Val products already in service by including all nameplate data with your inquiry. Pertinent product data includes valve function, size, material, pressure rating, end details, type of pilot controls used and control adjustment ranges.

### Identification Plates

For product identification, cast-in body markings are supplemented by identification plates as illustrated on this page. The plates, depending on type and size of product, are mounted in the most practical position. **It is extremely important that these identification plates are not painted over, removed, or in any other way rendered illegible.**



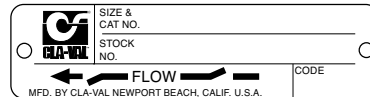
This brass plate appears on valves sized 2 1/2" and larger and is located on the top of the inlet flange.



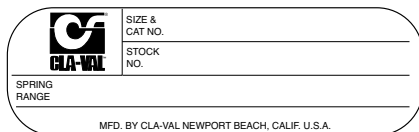
These two brass plates appear on 3/8", 1/2", and 3/4" size valves and are located on the valve cover.



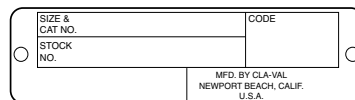
This brass plate appears on altitude valves only and is found on top of the outlet flange.



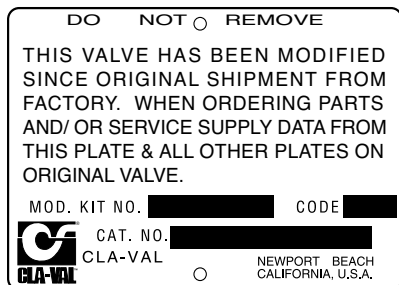
These two brass plates appear on threaded valves 1" through 3" size or flanged valves 1" through 2". It is located on only one side of the valve body.



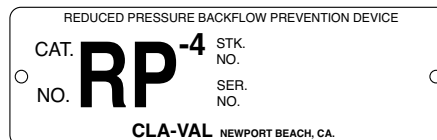
This tag is affixed to the cover of the pilot control valve. The adjustment range appears in the spring range section.



This brass plate is used to identify pilot control valves. The adjustment range is stamped into the plate.



This aluminum plate is included in pilot system modification kits and is to be wired to the new pilot control system after installation.



This brass plate is used on our backflow prevention assemblies. It is located on the side of the Number Two check (2" through 10"). The serial number of the assembly is also stamped on the top of the inlet flange of the Number One check.

## HOW TO ORDER

Because of the vast number of possible configurations and combinations available, many valves and controls are not shown in published product and price lists. For ordering information, price and availability on product that are not listed, please contact your local Cla-Val office or our factory office located at:

P. O. Box 1325  
Newport Beach, California 92659-0325  
(949) 722-4800  
FAX (949) 548-5441

## SPECIFY WHEN ORDERING

- Model Number
- Globe or Angle Pattern
- Adjustment Range (As Applicable)
- Valve Size
- Threaded or Flanged
- Body and Trim Materials
- Optional Features
- Pressure Class

## UNLESS OTHERWISE SPECIFIED

- Globe or angle pattern are the same price
- Ductile iron body and bronze trim are standard
- X46 Flow Clean Strainer or X43 "Y" Strainer are included
- CK2 Isolation Valves are included in price on 4" and larger valve sizes (6" and larger on 600 Series)

## LIMITED WARRANTY

Automatic valves and controls as manufactured by Cla-Val are warranted for three years from date of shipment against manufacturing defects in material and workmanship that develop in the service for which they are designed, provided the products are installed and used in accordance with all applicable instructions and limitations issued by Cla-Val. Electronic components manufactured by Cla-Val are warranted for one year from the date of shipment.

We will repair or replace defective material, free of charge, that is returned to our factory, transportation charges prepaid, if upon inspection, the material is found to have been defective at time of original shipment. This warranty is expressly conditioned on the purchaser's providing written notification to Cla-Val immediate upon discovery of the defect.

Components used by Cla-Val but manufactured by others, are warranted only to the extent of that manufacturer's guarantee.

This warranty shall not apply if the product has been altered or repaired by others, Cla-Val shall make no allowance or credit for such repairs or alterations unless authorized in writing by Cla-Val.

## DISCLAIMER OF WARRANTIES AND LIMITATIONS OF LIABILITY

The foregoing warranty is exclusive and in lieu of all other warranties and representations, whether expressed, implied, oral or written, including but not limited to any implied warranties or merchantability or fitness for a particular purpose. All such other warranties and representations are hereby cancelled.

Cla-Val shall not be liable for any incidental or consequential loss, damage or expense arising directly or indirectly from the use of the product. Cla-Val shall not be liable for any damages or charges for labor or expense in making repairs or adjustments to the product. Cla-Val shall not be liable for any damages or charges sustained in the adaptation or use of its engineering data and services. No representative of Cla-Val may change any of the foregoing or assume any additional liability or responsibility in connection with the product. The liability of Cla-Val is limited to material replacements F.O.B. Newport Beach, California.

## TERMS OF SALE

### ACCEPTANCE OF ORDERS

All orders are subject to acceptance by our main office at Newport Beach, California.

### CREDIT TERMS

Credit terms are net thirty (30) days from date of invoice.

### PURCHASE ORDER FORMS

Orders submitted on customer's own purchase order forms will be accepted only with the express understanding that no statements, clauses, or conditions contained in said order form will be binding on the Seller if they in any way modify the Seller's own terms and conditions of sales.

### PRODUCT CHANGES

The right is reserved to make changes in pattern, design or materials when deemed necessary, without prior notice.

### PRICES

All prices are F.O.B. Newport Beach, California unless expressly stated otherwise on our acknowledgement of the order. Prices are subject to change without notice. The prices at which any order is accepted are subject to adjustment to the Seller's price in effect at the time of shipment. Prices do not include sales, excise, municipal, state or any other Government taxes. Minimum order charge \$100.00.

### RESPONSIBILITY

We will not be responsible for delays resulting from strikes, accidents, negligence of carriers, or other causes beyond our control. Also, we will not be liable for any unauthorized product alterations or charges accruing there from.

### RISK

All goods are shipped at the risk of the purchaser after they have been delivered by to the carrier. Claims for error, shortages, etc., must be made upon receipt of goods.

### EXPORT SHIPMENTS

Export shipments are subject to an additional charge for export packing.

### RETURNED GOODS

1. Customers must obtain written approval from Cla-Val prior to returning any material.
2. Cla-Val reserves the right to refuse the return of any products.
3. Products more than six (6) months old cannot be returned for credit.
4. Specially produced, non-standard models cannot be returned for credit.
5. Rubber goods such as diaphragms, discs, o-rings, etc., cannot be returned for credit, unless as part of an unopened vacuum sealed repair kit which is less than six months old.
6. Goods authorized for return are subject to a 35% (\$100 minimum) restocking charge and a service charge for inspection, reconditioning, replacement of rubber parts, retesting, repainting and repackaging as required.
7. Authorized returned goods must be packaged and shipped prepaid to Cla-Val, 1701 Placentia Avenue, Costa Mesa, California 92627.



E-Product I.D. (R-3/2011)

## CLA-VAL

PO Box 1325 Newport Beach CA 92659-0325  
Phone: 949-722-4800 • Fax: 949-548-5441

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Fax: 41-21-643-15-50

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[www.cla-val.com](http://www.cla-val.com)

Represented By:



—MODEL— **REPAIR KITS**

**Model 100-01 Hytrol Main Valve**

BUNA-N MATERIAL				
	RUBBER KIT STOCK #	REPAIR KIT STOCK #	REBUILD ASSEMBLY STOCK #	STUD & NUT KIT STOCK #
3/8"	9169801K		21176614B	21176633J
1/2"	9169802H	21176602F	21176615A	21176634H
3/4"	9169802H	21176602F	21176615A	21176634H
1" Non-Guided	9169803F	21176601G	21176616K	21176636F
1"	9169804D	21176603E	21176617J	21176636F
1 1/4"	9169804D	21176603E	21176617J	21176636F
1 1/2"	9169804D	21176603E	21176617J	21176636F
2"	9169805A	21176608K	21176618H	21176637E
2 1/2"	9169811J	21176609J	21176619G	21176638D
3"	9169812G	21176604D	21176620D	21176639C
4"	9169813E	21176605C	21176621C	21176640K
6"	9169815K	21176606B	21176622B	21176641J
8"	9817901D	21176607A	21176623A	21176642H
10"	9817902B	21176610F	21176654C	21176643G
12"	9817903K	21176611E	21176625J	21176644F
14"	9817904H	21176612D	21176626H	21176645E
16"	9817905E	21176613C	21176627G	21176645E

**Model 100-20 Hytrol Main Valve**

BUNA-N MATERIAL				
	RUBBER KIT STOCK #	REPAIR KIT STOCK #	REBUILD ASSEMBLY STOCK #	STUD & NUT KIT STOCK #
3"	9169805A	21176608K	21176618H	21176637E
4"	9169812G	21176604D	21176620D	21176639C
6"	9169813E	21176605C	21176621C	21176640K
8"	9169815K	21176606B	21176622B	21176641J
10"	9817901D	21176607A	21176623A	21176642H
12"	9817902B	21176610F	21176624K	21176643G
14"	9817903K	21176611E	21176625J	21176644F
16"	9817903K	21176611E	21176625J	21176644F

**Model 100-30 Hytrol Main Valve**

BUNA-N MATERIAL		
	RUBBER KIT STOCK #	REBUILD ASSEMBLY STOCK #
2 1/2"	21112704H	21235401C
3"	21112702K	21235402B
4"	21112703J	21235403A
6"	27496886J	21235404K
8"	21112701A	21235405J
10"	CF	21235406H

**Rubber Kit Includes:** Diaphragm, Disc, Spacer Washers. **Model 100-30 also includes:** Stem O-Ring, Seal, Bearing O-Ring.

**Repair Kit Includes:** Diaphragm, Disc, Spacer Washers, Epoxy Coated Disc Retainer, Epoxy Coated Diaphragm Washer, Protective Washer

**Rebuild Assembly Includes:** Diaphragm, Disc, Spacer Washers, Epoxy Coated Disc Retainer, Epoxy Coated Diaphragm Washer, Protective Washer, Stainless Steel Bolts & Washers (6" & Below), Stainless Steel Studs, Nuts, & Washers (8" & Above), Stem, Stem Nut, Disc Guide, Standard Cover Spring, Cover Washer. **Model 100-30 also includes:** Upper and Lower Stem and Stem Nut, Stem O-Ring, Seal, Lower Spring, PU Bearing, Bearing O-Ring, Bearing Retainer Ring.

**Stud & Nut Kit Includes:** Stainless Steel Bolts & Washers (6" & Below), Stainless Steel Studs, Nuts, & Washers (8" & Above)

## Repair Kits for 100-02/100-21 Powertrol and 100-03/100-22 Powercheck Main Valves

**For:** Powertrol and Powercheck Main Valves—150 Pressure Class Only

**Includes:** Diaphragm, Disc (or Disc Assembly) and O-rings and full set of spare Spacer Washers.

Valve Size	Kit Stock Number 100-02	Valve Size	Kit Stock Number	
			100-02 & 100-03	100-21 & 100-22
3/8"	9169901H	2 1/2"	9169910J	N/A
1/2" & 3/4"	9169902F	3"	9169911G	9169905J
1"	9169903D	4"	9169912E	9169911G
1 1/4" & 1 1/2"	9169904B	6"	9169913C	9169912E
2"	9169905J	8"	9169950E	9169913C
		10"	9169939H	9169950E
		12"	9169937B	9169939H

Larger Sizes: Consult Factory.

## Repair Kits for 100-04/100-23 Hy-Check Main Valves

**For:** Hy-Check Main Valves—150 Pressure Class Only

**Includes:** Diaphragm, Disc and O-Rings and full set of spare Spacer Washers.

Valve Size	Kit Stock Number		Valve Size	Kit Stock Number	
	100-04	100-23		100-04	100-23
4"	20210901B	N/A	12"	20210905H	20210904J
6"	20210902A	20210901B	14"	20210906G	N/A
8"	20210903K	20210902A	16"	20210907F	20210905H
10"	20210904J	20210903K	20"	N/A	20210907F
			24"	N/A	20210907F

Larger Sizes: Consult Factory.

## Repair Kits for Pilot Control Valves (In Standard Materials Only)

**Includes:** Diaphragm, Disc (or Disc Assembly), O-Rings, Gaskets or spare Screws as appropriate.

BUNA-N® (Standard Material)				VITON (For KB Controls)	
Pilot Control	Kit Stock Number	Pilot Control	Kit Stock Number	Pilot Control	Kit Stock Number
CDB	9170006C	CFM-7A	1263901K	CDB-KB	9170012A
CDB-30	9170023H	CFM-9	12223E	CRA-KB	N/A
CDB-31	9170024F	CRA (w/bucking spring)	9170001D	CRD-KB (w/bucking spring)	9170008J
CDB-7	9170017K	CRD (w/bucking spring)	9170002B	CRL-KB	9170013J
CDH-2	18225D	CRD (no bucking spring)	9170003K	CDHS-2BKB	9170010E
CDHS-2	44607A	CRD-18	20275401K	CDHS-2FKB	9170011C
CDHS-2B	9170004H	CRD-22	98923G	CDHS-18KB (no bucking spring)	9170009G
CDHS-2F	9170005E	CRL (55F, 55L)	9170007A	102C-KB	1726202D
CDHS-3C-A2	24657K	CRL60/55L-60	9170033G		
CDHS-8A	2666901A	CRL60/55L60 1"	9170042H		
CDHS-18	9170003K	CRL-4A	43413E		
CDS-4	9170014G	CRL-5 (55B)	65755B		
CDS-5	14200A	CRL-5A (55G)	20666E		
CDS-6	20119301A	CRL-18	20309801C		
CDS-6A	20349401C	Universal CRL	9170041K		
CDS-7	20349402B	CV	9170019F		
CDS-7DO	20349403A	X105L (O-ring)	00951E		
CFCM-M1	1222301C	102B-1	1502201F	Buna-N®	
CFM-2	12223E	102C-2	1726201F	CRD Disc Ret. (Solid)	C5256H
CFM-7	1263901K	102C-3	1726201F	CRD Disc Ret. (Spring)	C5255K

## Repair Assemblies (In Standard Materials Only)

Control	Description	Stock Number
CF1-C1	Pilot Assembly Only	89541H
CF1-CI	Complete Float Control less Ball and Rod	89016A
CFC2-C1	Disc, Distributor and Seals	2674701E
CSM 11-A2-2	Mechanical Parts Assembly	97544B
CSM 11-A2-2	Pilot Assembly Only	18053K
33A 1"	Complete Internal Assembly and Seal	2036030B
33A 2"	Complete Internal Assembly and Seal	2040830J

When ordering, please give complete nameplate data of the valve and/or control being repaired. MINIMUM ORDER CHARGE APPLIES

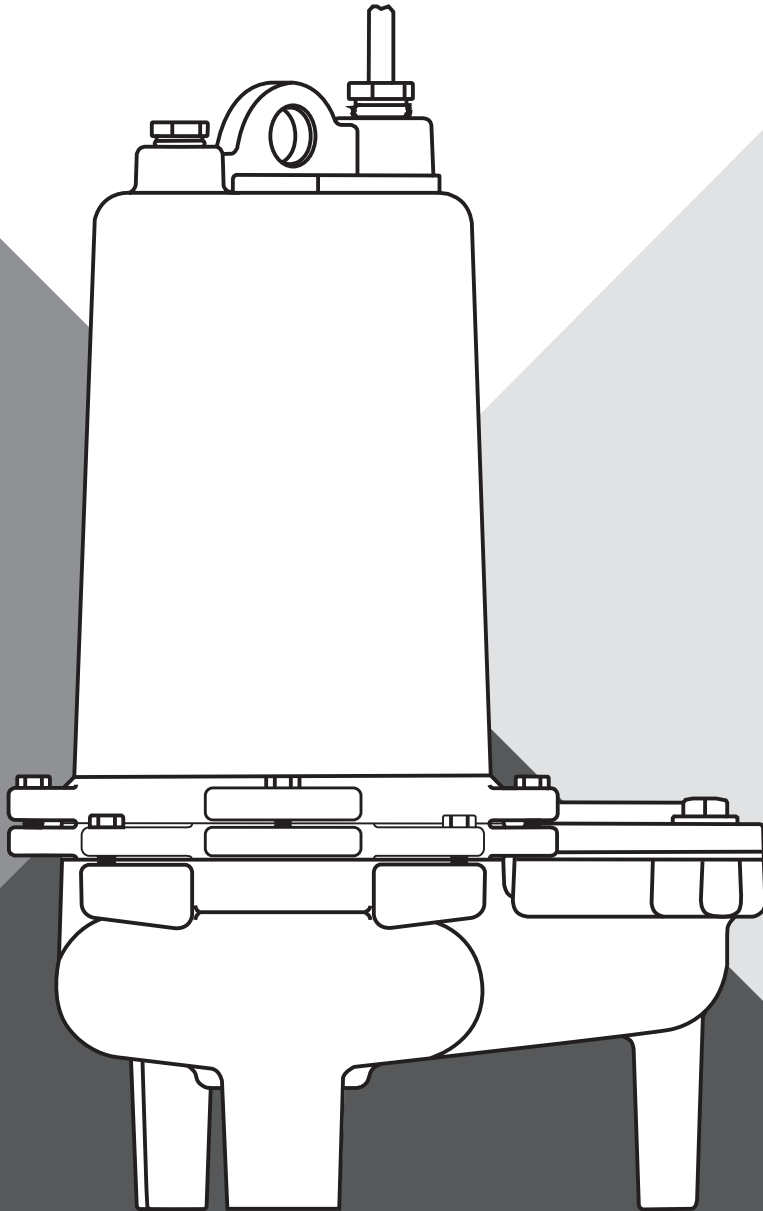
Item #3    Myers Submersible Sump Pump

- ½ HP
- 250 VAC – 1d



# SUBMERSIBLE SEWAGE PUMPS

## WHR5H, 10H, 15H, 20H SERIES



# INSTALLATION & OPERATION MANUAL

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MY23833A551 (10-01-2022)




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# SAFETY INFORMATION

## SAFETY SYMBOLS

 This is the safety alert symbol. When you see this symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury:


 **DANGER** warns about hazards that will cause serious personal injury, death or major property damage if ignored.

 **WARNING** warns about hazards that can cause serious personal injury, death or major property damage if ignored.


 **CAUTION** warns about hazards that will or can cause minor personal injury or property damage if ignored.


The word **NOTICE** indicates special instructions that are important but not related to hazards.


### CALIFORNIA PROPOSITION 65 WARNING


 **WARNING** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.


Before Installation: This manual contains important information for the safe use of this product. Read this manual completely and follow the instructions carefully. Reasonable care and safe methods relating to the installation and operation of this product should be practiced. Check local codes and requirements before installation.

 **DANGER RISK OF ELECTRICAL SHOCK AND FIRE.** May result in serious injury, death or fire hazard. Disconnect all electrical sources prior to installation, handling or servicing. Only qualified personnel may install this system. NFPA 70/ National Electric Code (NEC) or local codes must be followed. System must be properly grounded according to NEC. Do not lift pump by power cord.


 **DANGER BIOHAZARD RISK.** Once wastewater source has been connected to system, Biohazard Risk exists. Installer(s) and/or service personnel must use proper Personal Protective Equipment and follow handling procedures per OSHA 29 CFR 1910.1030 when handling equipment after wastewater source has been connected to system.


 **DANGER RISK OF ASPHYXIATION.** Installer(s) and/or service personnel must use proper Personal Protective Equipment and follow OSHA 29 CFR 1910.146 or OSHA 29 CFR 1926. Pump may be installed in a location classified by OSHA as a confined space.

 **DANGER RISK OF FIRE OR EXPLOSION.** Do not smoke or use open flames in or around this system. This system is not intended for use in hazardous locations per NFPA 70 National Electric Code. Do not pump flammable liquids.

 **DANGER CUTTING RISK.** Risk of serious cutting or amputation exists. Disconnect all power sources prior to servicing pump. Pump may start without warning.

- ◆ **DO NOT** modify the cord and plug. When using the cord and plug, plug into a grounded outlet only. When wiring to a system control, connect the pump ground lead to the system ground.
- ◆ **DO NOT** run the pump dry. Dry running can overheat the pump (causing burns to anyone handling it) and will void the warranty.
- ◆ The pump normally runs hot. To avoid burns, allow it to cool for 30 minutes after shutdown before handling it.
- ◆ Submersible sewage pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common. Pump is designed to be installed in a sump or wet location where drainage collects.
- ◆ **DO NOT THROW AWAY OR LOSE THIS MANUAL.** Keep it in a safe place so that you may refer to it often for the continued safe operation of the product.

 **CAUTION** Single phase pumps with automatic heat sensor reset will restart without warning as the motor cools. Therefore, never do service work on the pump unless power supply is disconnected.

 **DANGER RISK OF ELECTRIC SHOCK.** Pumps without seal leak detectors are supplied with a grounding connector and grounding-type attachment plug on the power cord. To reduce the risk of electric shock, be certain that it is connected only to a properly grounded, grounding-type receptacle. DO NOT cut off ground pin or use an adapter fitting. DO NOT use an extension cord with this pump. Entire plug may be cut off if a control panel is used.

When wiring this pump follow all local electrical and safety codes and ordinances as well as the most recent National Electric Code (NEC-ANSI/NFPA 70).

All pumps have a GROUND WIRE that is connected to a screw in the metal motor housing. This wire goes to the receptacle or control box which must be connected to an NEC approved ground.

# INSTALLATION & MAINTENANCE

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## GENERAL DESCRIPTION AND USES

The WHR Series are solids handling pumps that can be used to pump RAW SEWAGE for COMMERCIAL and DOMESTIC use, but are not intended to handle large rags, mop heads or strings. All pumps can be used for normal sewage duty where extra capacity is required.

### RECESSED IMPELLERS

All of the pumps are of the recessed impeller type that provides a clear volute passage for solids as no solids pass through the impeller.

All of the pumps listed can be used to pump septic tank EFFLUENT or GROUND sewage as used in some pressure sewer systems.

**⚠ WARNING** THESE PUMPS ARE NOT APPROVED FOR, AND SHOULD NOT BE USED IN SWIMMING POOLS OR FOUNTAINS.

### AIR LOCKING

A sewage pump is air locked if water traps air in the pump and it cannot get out, thus preventing the pump from operating.

In installations of this type a 1/8" hole should be drilled in the discharge pipe below the check valve. The check valve should be 12 to 18 inches above pump discharge. Do not put check valve directly into pump discharge opening.

### LEVEL CONTROLS

All pumps must use certified level control switches for automatic operation. Level control rating must be at least equal to the horsepower rating of the pump.

Plug-in cords can be used on all the single phase pumps without seal leak detector. This cord has a GROUND pin that plugs into a grounded receptacle. The grounded receptacle cannot be used in the wet sump or basin due to DANGER of current leakage.

Sealed junction boxes must be used in wet sumps or basins to make connections to motor cord.

### MOTOR TYPES

All single phase pump motors have internal capacitors. Automatic reset overload switches are attached directly to the motor windings on single phase pumps. Three phase pump motors are squirrel cage induction type.

## INSTALLATION

Pumps can be installed inside sealed basins with proper venting for either simplex or duplex systems. Simplex or duplex basin systems are available.

Basins are not intended for use with home septic systems. They are for use in office buildings and small industrial buildings and factories.

If raw sewage must be pumped from the home's sewage system, use outside basins that connect with pressure sewer mains or gravity sewers, or run to septic tanks.

Basins can be used inside the home where extra capacity sump pumps are required for water softeners and wash water.

If an inside basin is used, it is usually installed at the time of pouring the concrete basement floor.

Pumps can be installed in a compartment of septic tanks for pumping to pressure sewer mains, gravity sewers, leach fields, or evaporation mounds.

### PROPER VENTING FOR BASINS INSTALLED INSIDE

All inside sealed basins must have a 2" or 3" vent pipe installed in accordance with local codes. Basins for handling softener water, wash or drainage water do not have to be sealed or vented.

Outside basins are usually of fiberglass and from 4 to 8 feet deep and have a sealed cover. Pump is usually installed with a lift-out rail system so that pump can be removed without disturbing the discharge piping. The check valve comes out with pump for servicing. Complete lift-out systems mounted in fiberglass basins are available to meet customer specifications.

**⚠ WARNING** Basin must be vented in accordance with local plumbing codes. These pumps are not designed for and CANNOT be installed in locations classified as hazardous in accordance with the National Electric Code.

### PIPING

Pumps are fitted with 2" or 3" female threaded pipe flange. Galvanized or PVC plastic pipe can be used. Plastic pipe is preferred for raw sewage or septic tank effluent.

### CHECK VALVES AND SHUT-OFF VALVES

All pumps must have check valves and shut-off valves in the discharge line. Check valves must be flapper type with outside spring or ball type. Shut-off valves can be ball or gate type. Plastic construction for both check and shut-off valves is preferred.

# INSTALLATION & MAINTENANCE

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## HOW TO SET CONTROLS FOR SIMPLEX SYSTEMS

1. Automatic systems – These systems have the float switches mounted on the pump, so pump is installed in the basin and motor cord is plugged into GROUNDED receptacle. For sealed basin cover, power cord is brought through a split rubber plug in the basin cover.
2. Where 2 float controls are used, the turn-on control is set 3" to 6" above top of motor, and the turn-off control is set about 6" to 8" above bottom of basin. If a high level alarm control is used, it is set about 6" above upper control. If basin depth will not allow these settings, closer spacing can be used.

## HOW TO START SIMPLEX SYSTEMS

**NOTE:** ALWAYS HAVE ELECTRICIAN MAKE ELECTRICAL CHECKS.

1. For single-phase pumps with plug cords piggyback into receptacle and run water into basin until pump starts. Allow pump to make several on/off cycles. Leave power cord plugged in.

If pump runs but does not pump it may be air locked. Unplug cord and crack union in the discharge line, then restart pump. This should vent off any trapped air. Retighten union.

2. With 2 float controls turn on power at the control box and run water into basin. When level gets above top control, pump should start and continue to pump until level drops to lower control, stopping pump. Run pump through several cycles. If pump runs but does not pump, turn off power and check for an air lock. Leave power on for automatic operation.

For all cases if motor does not start when water level is up, check for proper plug-in or that start switch is on, or if fuse is blown.

## STARTING PUMP PIGGYBACK (AUTOMATIC) USING MECHANICAL SWITCH WITH SERIES PLUG – SIMPLEX SYSTEM

1. These pumps have a mechanical (mercury-free) float switch with a 20 ft. cord and a 115 volt or 230 volt series piggyback plug on 1/2 HP with switch mounted to the pump. On 3/4, 1, and 2 HP, it requires 20 ft. cord and 230 volt only.
2. Plug the switch cord plug into a proper voltage, properly grounded outlet.
3. Plug the pump power cord into the back of the switch cord series plug.
4. Tape the cords to the discharge pipe every 12".
5. Run water into basin until pump starts. Be sure discharge line valve is open.
6. Allow pump to operate through several on/off cycles.

## HOW TO SET CONTROLS AND START DUPLEX SYSTEMS

1. Control box must be used on all duplex systems
2. Four float controls are used for duplex systems. Set turn-on control 6" to 8" above pumps. Set turn-off control 8" to 10" above bottom of basin. Set override control 6" to 8" above turn-on control. Set high level alarm control about 6" to 8" above override control. Mark all control cords so that they can be connected correctly in the control box.
3. Turn Hand-Off-Auto switches to OFF position and close circuit breaker.
4. Turn both H-O-A switches to the AUTO position and run water into basin. When level rises and activates the turn-on switch, one pump should start and run. Pump will continue to run until lower control is exposed, stopping pump.
5. Run water into sump again and when water level raises the turn-on control, opposite pump will start and run until level drops exposing lower control, stopping pump.
6. Run this test several times to be sure pumps are alternating properly.
7. To check high level alarm, again turn both switches to OFF and fill basin until level is above the alarm control. Turn switches to AUTO position and alarm buzzer should sound and alarm light should come on. When level drops below the alarm, control buzzer should stop.
8. If pumps operate as described, then set both H-O-A to AUTO and pumps are ready to operate automatically. NEVER WORK ON PUMPS OR CONTROL BOXES UNTIL CIRCUIT BREAKERS ARE TURNED OFF. Always have a qualified electrician make electrical connections and service checks.

# INSTALLATION & MAINTENANCE

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**⚠ CAUTION** NEVER WORK ON PUMPS OR CONTROL BOXES UNTIL CIRCUIT BREAKERS ARE TURNED OFF. Always have a qualified electrician make electrical connections and service checks.

## SPECIAL INSTRUCTIONS FOR 3-PHASE PUMPS

**⚠ WARNING** Only qualified persons shall service and install this pump. The pump must be wired by a qualified electrician, using an approved starter box and switching device.

**⚠ WARNING** Risk of electric shock. Do not remove cord and strain relief. Do not connect conduit to pump.

1. Three phase pumps are always installed with control boxes having magnetic starters with 3-leg overload protection. **DO NOT TRY TO RUN THREE PHASE PUMPS DIRECTLY ACROSS THE LINE.**
2. To Connect Pump: Run wire from pump to the bottom of control box or appropriate junction box suitable for enclosing splice connections. A hole must be cut into the control box for the wires. With power to control box off, connect green (ground) line to ground lug. Connect black (power) wires to power lead terminals. Make sure that all wires are inside control box and not in a position to be pinched or shorted when the door is closed.
3. All three phase motors can run either direction. Rotation can be changed by interchanging any two line leads at magnetic starter. **BE SURE CIRCUIT BREAKER IS OFF BEFORE MAKING THIS CHANGE.**  
To find if rotation is correct, operate pumps and check delivery operation. If flow and head are low, the rotation is wrong. With duplex pumps check operation of both pumps.
4. All pump impellers either single or three phase must turn counterclockwise when looking into pump inlet. If uncertain of rotation, **TURN OFF POWER** and lift pump from basin using the lifting ring (with cord connected) and lay pump on side so impeller can be seen. Turn on power and start pump using hand position of H-O-A switch. Turn on and off fast, so that coast of impeller can be seen.

**⚠ DANGER** RISK OF AMPUTATION WHEN PUMP STARTS.

Never put hand or fingers on the impeller. Interchange any two line leads at the magnetic starter to change rotation.

## TROUBLESHOOTING

### PUMP DOES NOT RUN OR START WHEN WATER IS UP IN TANK.

1. Check for blown fuse or tripped circuit breaker.
2. Check for defective level switch.
3. Where control panel is used be sure H-O-A switch is in the AUTO position. If it does not run, turn switch to the HAND position and if the pump runs then the trouble is in the automatic electrical system. Have an electrician make electrical checks.
4. Check for burned-out motor. Occasionally lightning can damage a motor even with lightning protection.
5. Where plug-in cords are used be sure contact blades are clean and making good contact. **DO NOT USE PLUG-IN CORDS INSIDE A BASIN OR WET WELL.**

### PUMP RUNS BUT DOES NOT DELIVER FLOW.

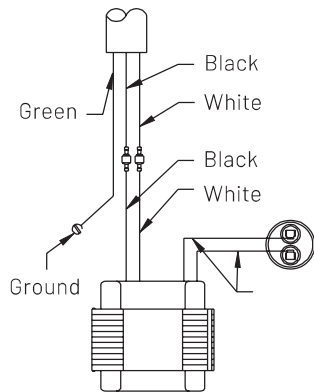
1. Check for airlock. Start and stop pump several times. If this does not help it may be necessary to loosen a union in the discharge line to relieve airlock.
2. Check valve may be installed backward. Check flow arrow on valve body. Check shut-off valve. It may be closed.
3. Check vertical elevation of discharge pipe. It may be higher than pump can support.
4. Pump inlet may be plugged. Remove pump to check.
5. Level control ball or weight may be stuck on side of basin. Be sure it floats freely.

**⚠ WARNING** RISK OF ELECTRICAL SHOCK. Always unplug power cords or turn off all main and branch circuit breakers before doing any work on the pump. If control panel is remote from pump, disconnect lead wires to motor so that no one can turn the circuit breaker back on.

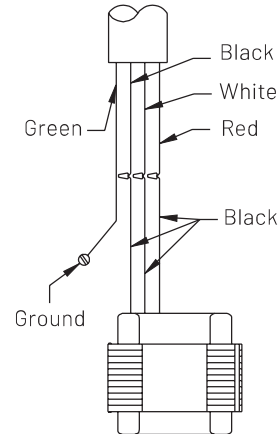
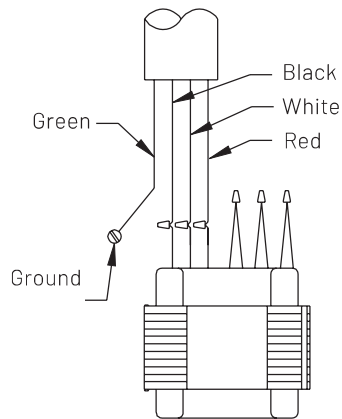
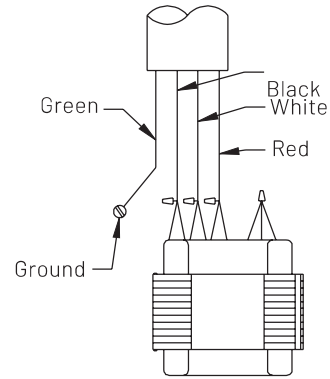
# WIRING DIAGRAMS & DIMENSIONS

## WIRING DIAGRAMS

**115V, 200V OR 230V  
1 PHASE, P.S.C.**



**230V - 3 PHASE  
208V - 3 PHASE (1-2 HP)**

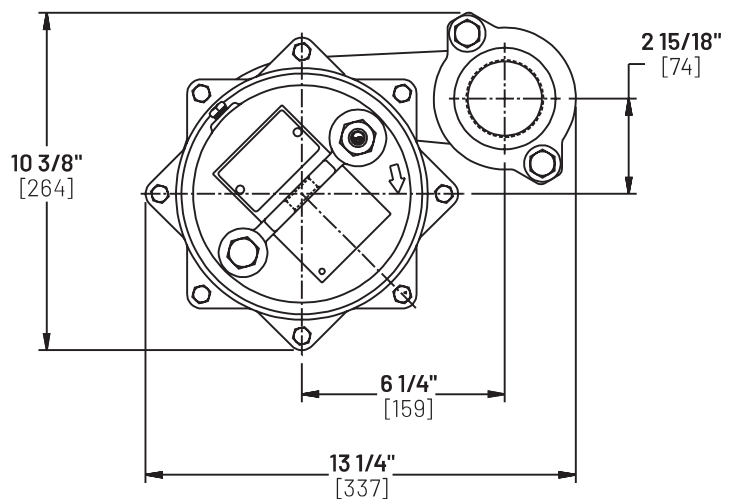
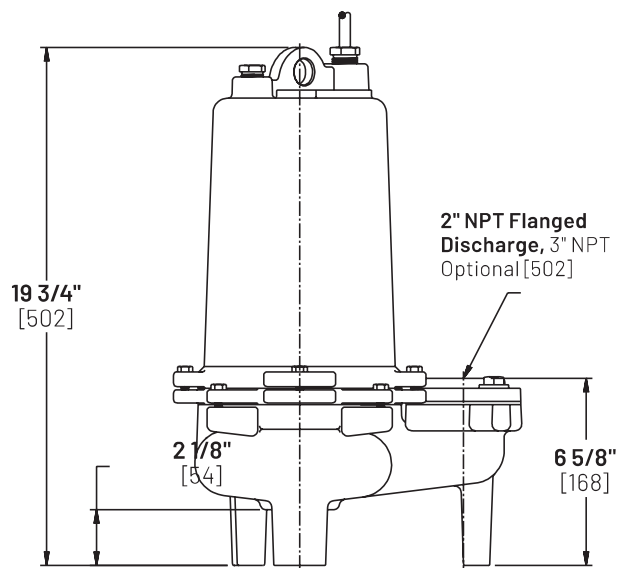


**460V - 3 PHASE**

**575V - 3 PHASE  
200V - 3 PHASE**

## DIMENSIONS

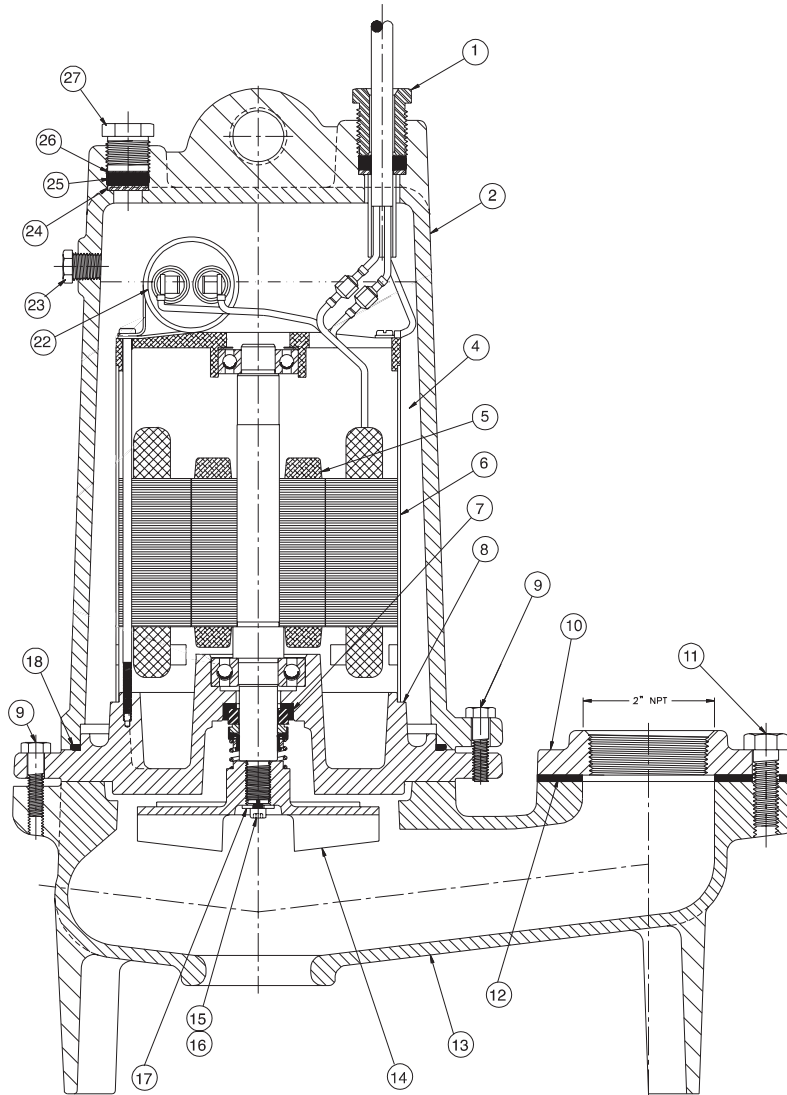
[DIMENSIONS IN MM]



# REPAIR PARTS LIST

REF.	DESCRIPTION	QTY.	PART NUMBER
1	Cord, Power	1	See Chart
2	Housing Motor	1	25327D000P
4	Oil, Transformer (5 gal.)	.8-1 gal	RTF
5, 6	Stator, Rotor shaft with shell	1	See Chart
6A	Connectors (3 ph only)	3-6	15781A001
7	Seal, shaft	1	25370A000
8	Plate, brg & seal	1	25367D000
9	Screw, cap, 5/16 x 1-1/4	8	19100A012
10	Flange, 2" CI	8	002080002
10	Flange, 3" CI alternate	8	002070002
11	Screw, cap, 1/2-13 x 1-1/2	2	19103A043
12	Gasket, rubber	1	003240011

REF.	DESCRIPTION	QTY.	PART NUMBER
13	Case, volute	1	27195E000
14	Impeller, DI (std. series)	1	See Chart
15	Screw, Machine #10 x 3/8	1	06106A042
16	Sealant (Grade 271 Loctite®)	1	14550A001
17	Washer, Impeller Retainer	1	05030A262
18	Gasket, tetraseal, 7x6-3/4x1/8	1	05014A181
22	Capacitor (1 ph only)	1	See Chart
23	Plug, 1/4" pipe	1	05022A092
24	Washer, 3/32" Thk.	1	05030A235
25	Gasket, rubber	1	05014A193
26	Washer, 1/32" Thk.	1	05030A234
27	Nut, cord plug, solid	1	25341A002



# VARIABLE PARTS CHART

HP	VOLTS	PH	POWER CORD W/ PLUG	POWER CORD NO PLUG	CAP.	STATOR ROTOR AND SHAFT ASSEMBLY	WHRH IMPELLER DI
1/2	115	1	25338B004	25338B006	23839A000	25484D100	27194C002
1/2	208	1		25338B006	23839A000	25484D101	27194C002
1/2	230	1	25338B005	25338B006	23839A000	25484D101	27194C002
1/2	208	3		25338B003		25484D102	27194C002
1/2	230	3		25338B003		25484D102	27194C002
1/2	460	3		25338B003		25484D102	27194C002
1/2	575	3		25338B003		25484D103	27194C002
1	208	1		25338B002	23838A000	25484D104	27194C001
1	230	1	25338B001	25338B002	23838A000	25484D105	27194C001
1	208	3		25338B003		25484D106	27194C001
1	230	3		25338B003		25484D106	27194C001
1	460	3		25338B003		25484D106	27194C001
1	575	3		25338B003		25484D107	27194C001
1-1/2	208	1		25338B002	23838A000	25484D104	27194C004
1-1/2	230	1	25338B001	25338B002	23838A000	25484D105	27194C004
1-1/2	208	3		25338B003		25484D106	27194C004
1-1/2	230	3		25338B003		25484D106	27194C004
1-1/2	460	3		25338B003		25484D106	27194C004
1-1/2	575	3		25338B003		25484D107	27194C004
2	208	1		25338B009	23839A000	25484D108	27194C011
2	230	1		25338B009	23839A000	25484D109	27194C011
2	208	3		25338B008		25484D111	27194C011
2	230	3		25338B008		25484D111	27194C011
2	460	3		25338B003		25484D111	27194C011
2	575	3		25338B003		25484D112	27194C011



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# WARRANTY

## Limited Warranty

Myers warrants to the original consumer purchaser ("Purchaser" or "You") of the products listed below, that they will be free from defects in material and workmanship for the Warranty Period shown below.

<b>Product</b>	<b>Warranty Period</b> whichever occurs first:
Jet pumps, small centrifugal pumps, submersible pumps and related accessories	12 months from date of original installation, or 18 months from date of manufacture
Fibrewound Tanks	5 years from date of original installation
Steel Pressure Tanks	5 years from date of original installation
Sump/Sewage/Effluent/Utility/Battery Backup Products	36 months from date of manufacture
Wastewater Solids Handling Pumps	12 months from date of shipment from factory or 18 months from date of manufacture

Our warranty applies **only** where such products are used in compliance with the requirements of the applicable product catalog and/or manuals. For additional information, please refer to the applicable standard limited warranty featured in the product manual.

Our warranty will **not** apply to any product that, in our sole judgment, has been subject to negligence, misapplication, improper installation, or improper maintenance. Without limiting the foregoing, operating a three phase motor with single phase power through a phase converter will void the warranty. Note also that three phase motors must be protected by three-leg, ambient compensated, extra-quick trip overload relays of the recommended size or the warranty is void.

Your only remedy, and MYERS's only duty, is that MYERS repair or replace defective products (at MYERS's choice). You must pay all labor and shipping charges associated with this warranty and must request warranty service through the installing dealer as soon as a problem is discovered. No request for service will be accepted if received after the Warranty Period has expired. This warranty is not transferable.

MYERS SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING LIMITED WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING LIMITED WARRANTIES SHALL NOT EXTEND BEYOND THE DURATION PROVIDED HEREIN.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of an implied warranty, so the above limitations or exclusions may not apply to You. This warranty gives You specific legal rights and You may also have other rights which vary from state to state.

This Limited Warranty is effective January 1, 2021 and replaces all undated warranties and warranties dated before January 1, 2021.

**PENTAIR MYERS**  
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MY23833A551(10-01-22)

Item #4    Warranty

## WARRANTY

Seller warrants equipment (and its component parts) of its own manufacture against defects in materials and workmanship under normal use and service for one (1) year from the date of installation or start-up, or for eighteen (18) months after the date of shipment, whichever occurs first. Seller does not warrant accessories or components that are not manufactured by Seller; however, to the extent possible, Seller agrees to assign to Buyer its rights under the original manufacturer's warranty, without recourse to Seller. Buyer must give Seller notice in writing of any alleged defect covered by this warranty (together with all identifying details, including the serial number, the type of equipment, and the date of purchase) within thirty (30) days of the discovery of such defect during the warranty period. No claim made more than 30 days after the expiration of the warranty period shall be valid. Guarantees of performance and warranties are based on the use of original equipment manufactured (OEM) replacement parts. Seller assumes no responsibility or liability if alterations, non-authorized design modifications and/or non-OEM replacement parts are incorporated. If requested by Seller, any equipment (or its component parts) must be promptly returned to Seller prior to any attempted repair, or sent to an authorized service station designated by Seller, and Buyer shall prepay all shipping expenses. Seller shall not be liable for any loss or damage to goods in transit, nor will any warranty claim be valid unless the returned goods are received intact and undamaged as a result of shipment. Repaired or replaced material returned to customer will be shipped F.O.B., Seller's factory. Seller will not give Buyer credit for parts or equipment returned to Seller, and will not accept delivery of any such parts or equipment, unless Buyer has obtained Seller's approval in writing. The warranty extends to repaired or replaced parts of Seller's manufacture for ninety (90) days or for the remainder of the original warranty period applicable to the equipment or parts being repaired or replaced, whichever is greater. This warranty applies to the repaired or replaced part and is not extended to the product or any other component of the product being repaired. Repair parts of its own manufacture sold after the original warranty period are warranted for a period of one (1) year from shipment against defects in materials and workmanship under normal use and service. This warranty applies to the replacement part only and is not extended to the product or any other component of the product being repaired. Seller may substitute new equipment or improve part(s) of any equipment judged defective without further liability. All repairs or services performed by Seller, which are not covered by this warranty, will be charged in accordance with Seller's standard prices then in effect.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its component parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part. Under the terms of this warranty, Seller shall not be liable for (a) consequential, collateral, special or liquidated losses or damages; (b) equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; (c) the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; (d) damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper voltage, mishandling, or other similar conditions; (e) any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; (f) any labor costs or charges incurred in repairing or replacing defective equipment or parts, including the cost of reinstalling parts that are repaired or replaced by Seller; (g) any expense of shipment of equipment or repaired or replacement parts; or (h) any other loss, damage or expense of any nature.

The above warranty shall not apply to any equipment which may be separately covered by any alternate or special warranties.

**PERFORMANCE:** In the absence of Certified Pump Performance Tests, equipment performance is not warranted or guaranteed. Performance curves and other information submitted to Buyer are approximate and no warranty or guarantee shall be deemed to arise as a result of such submittal. All testing shall be done in accordance with Seller's standard policy under Hydraulic Institute procedures.

**LIABILITY LIMITATIONS:** Under no circumstances shall the Seller have any liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses or for loss of production or progress of construction, regardless of the cause of such damages or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price.

**ACTS OF GOD:** Seller shall in no event be liable for delays in delivery of the equipment or other failures to perform caused by fires, acts of God, strikes, labor difficulties, acts of governmental or military authorities, delays in transportation or procuring materials, or causes of any kind beyond Seller's control.

**COMPLIANCE WITH LAW:** Seller agrees to comply with all United States laws and regulations applicable to the manufacturing of the subject equipment. Such compliance shall include: The Fair Labor Standards Acts of 1938, as amended; Equal Employment Opportunity clauses of Executive Order 11246, as amended; Occupational Safety and Health Act of 1970 and the standards promulgated thereunder, if applicable. Since compliance with the various Federal, State, and Local laws and regulations concerning occupational health and safety, pollution or local codes are affected by the use, installation and operation of the equipment and other matters over which Seller has no control, Seller assumes no responsibility for compliance with those laws and regulations, whether by way of indemnity, warranty, or otherwise. It is incumbent upon the Buyer to specify equipment which complies with local codes and ordinances.



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