REGENT

Model 9470-011
Bead Breaker/Tire Assembler

OPERATION and MAINTENANCE MANUAL
with ILLUSTRATED PARTS LIST

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Nov-00

MODEL 9470-011
Bead Breaker/Tire Assembler

1.0 Introduction

This manual is issued as a basic service and maintenance manual covering the Model 9470-011 Bead Breaker/Tire Assembler, manufactured by Regent Mfg., Inc., 11905 Regentview Avenue, Downey, CA, U.S.A., phone number (562) 862-1174, FAX No. (562) 861-9624.

To derive maximum service, it is recommended that personnel have an understanding of the equipment before attempting to operate it. It is mandatory that the operating procedures herein be followed.

2.0 Specifications

Capacity	12,000 Lbs
Minimum Tire Dia	20 Inches
Hydraulic Stroke	5 Inches
Screw Stroke	6 Inches
Maximum Tire Dia	38 Inches
Working Pressure	1000 Psi
Reservoir Capacity	2 Gallons
Electrical Requirements	220VAC

3.0 Features

The Model 9470-011 Bead Breaker/Tire Assembler is used to "break" (separate) the bead of an aircraft pneumatic tire from the rim of the wheel in order to facilitate tire de-mounting. By repositioning the bumpers on the fingers, the bead breaker can also be used in the assembly and mounting of tires on split-rim wheels.

The bead breaker consists of a welded steel "U" shaped frame that carries the functional components. The tire which is to be de-mounted, is placed vertically between the open ends of the "U" frame. A hydraulic cylinder assembly on one side provides the means for clamping the tire and wheel in place and applying the bead breaking force to the tire.

Hydraulic power for the operation of the elevation and bead breaker cylinders is provided by a separate floor mounted hydraulic power unit. The power unit consists of a hydraulic pump, valve assemblies and a hydraulic fluid reservoir. The pump is driven by an electric motor.

The hydraulic power unit is equipped with an automatic safety valve to bypass hydraulic fluid from the pump back to the reservoir at 110% of rated capacity.

4.0 Pre-Operation Procedure:

4.1 Perform visual inspection, checking for loose, damaged or missing parts.

4.2 Check oil levels and inspect fittings for leaks.

5.0 Bead Breaking Procedure:

5.1 Start the Hydraulic Power Supply by depressing the green button labeled "START".

5.2 Center the tire and wheel assembly on the lift assembly between the spyders.

5.3 Adjust the left spyder by rotating it counter-clockwise until fingers are within an inch of the tire.

5.4 Lift the tire and wheel assembly by positioning the Tire Lift switch to the "UP" position and depressing the left foot pedal. Raise the tire and wheel assembly until it is centered with the left fingers. Once the tire and wheel assembly is centered, place the Tire Lift switch in the center "OFF" position.

Note: The lift speed can be controlled with the Speed Selector in either a "FAST" or "SLOW" mode. With the selector in the "SLOW" mode, additional speed control is possible with the Flow Control valve. Rotate the valve handle clockwise to go slower and counter-clockwise to go faster.

5.5 Adjust the fingers on the left spyder until they are about ½ to 1 inch away from the wheel diameter, by loosening the knurled hand-knob on each finger and sliding the finger along the leg of the spyder. Re-tighten the knurled hand-knob. Adjust the finger bumper to the desired depth (See Figure A).

5.6 Using the scales on the left spyder as a reference, adjust the fingers on the right spyder.

5.7 Start the breaking operation by positioning the Spyder In/Out switch to the "IN" position and depressing the right foot pedal.

CAUTION: AS THE RIGHT SPYDER MOVES TOWARD THE TIRE, ENSURE THE FINGERS ARE ADJUSTED CORRECTLY.

Note: The breaking speed can be controlled with the speed selector as described in step 5.4.

5.8 Once the tire bead is broken, position the Spyder In/Out switch to the "OUT" position and depress the right foot pedal until fingers are clear. Place switch to the center "OFF" position when the spyder is positioned as desired.

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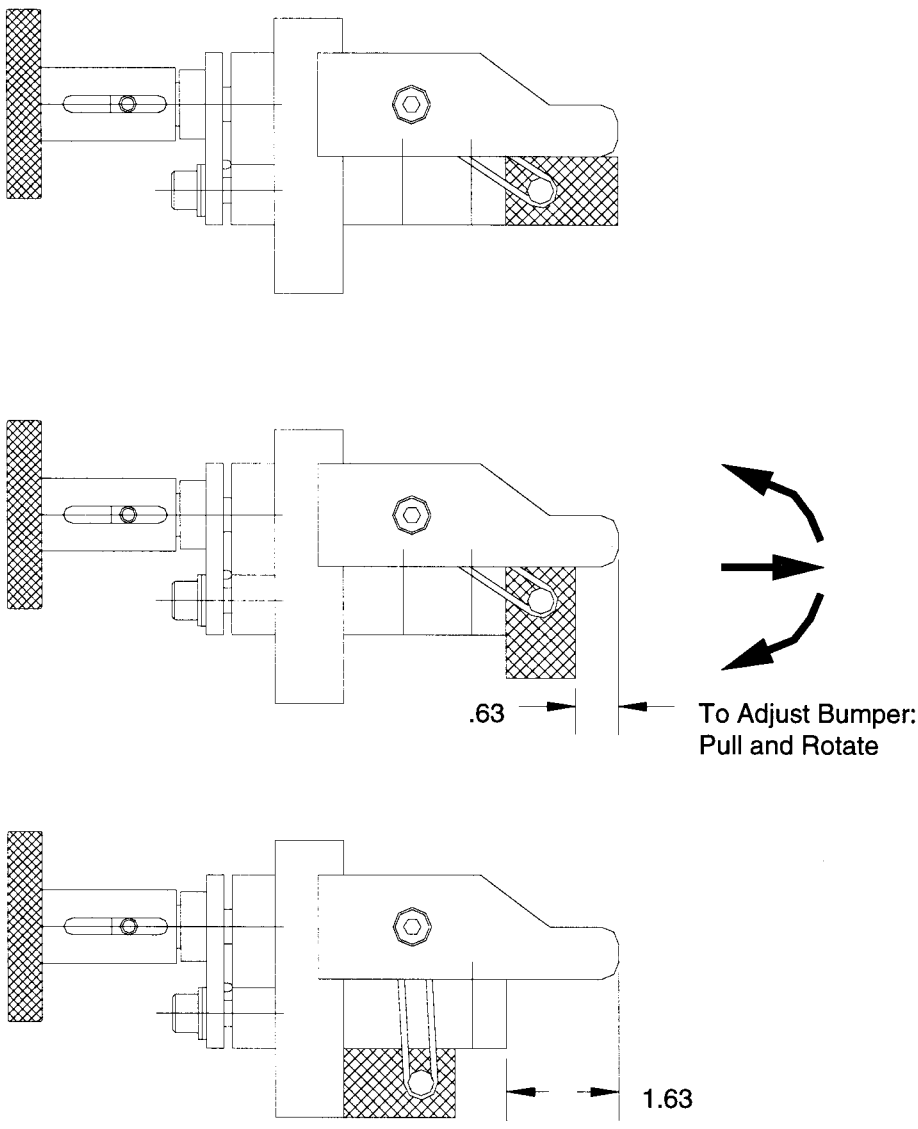
Figure A



5.0 Bead Breaking Procedure: (Continued)

5.9 Lower the tire and wheel assembly by positioning the Tire Lift switch to the "DOWN" position and depressing the left foot pedal. Once the tire and wheel assembly is lowered, place the Tire Lift switch to the center "OFF" position.

6.0 Tire Disassembly Procedure (Split Rim): (Reference Instructions in 5.0)

6.1 Break tire bead and position tire and wheel assembly with the split rim on the right side in center of spyders as described in 5.0.

6.2 Position bumper on each finger flush with end of finger (See Figure A).

6.3 Adjust the left fingers until the bumper will contact the wheel rim.

6.4 Using the left spyder as a guide, adjust the fingers on the right spyder.

6.5 Position the Spyder In/Out switch to the "IN" position and depress the right foot pedal until the right fingers push the split rim past the keeper. Once the split rim is past the keeper, place the Spyder In/Out switch to the center "OFF" position.

6.6 Carefully remove the keeper from the wheel.

6.7 Position the Spyder In/Out switch to the "OUT" position and depress the right foot pedal until fingers are clear. Place switch to the center "OFF" position when the spyder is positioned as desired.

6.8 Lower the tire and wheel assembly by positioning the Tire Lift switch to the "DOWN" position and depressing the left foot pedal. Once the tire and wheel assembly is lowered, place the Tire Lift switch to the center "OFF" position.

7.0 Tire Assembly Procedure (Split Rim): (Reference Instructions in 5.0)

7.1 Position tire and wheel assembly with the split rim on the right side in center of spyders as described in 5.0.

7.2 Position bumper on each finger flush with end of finger (See Figure A).

7.3 Adjust the left fingers until the bumper will contact the wheel rim.

7.4 Using the left spyder as a guide, adjust the fingers on the right spyder.

7.5 Position the Spyder In/Out switch to the "IN" position and depress the right foot pedal until the right fingers push the split rim past the keeper. Once the split rim is past the keeper, place the Spyder In/Out switch to the center "OFF" position.

7.6 Carefully install the keeper on the wheel.

7.0 Tire Assembly Procedure (Split Rim): (Continued)

7.7 Position the Spyder In/Out switch to the "OUT" position and depress the right foot pedal until fingers are clear. Place switch to the center "OFF" position when the spyder is positioned as desired.

7.8 Lower the tire and wheel assembly by positioning the Tire Lift switch to the "DOWN" position and depressing the left foot pedal. Once the tire and wheel assembly is lowered, place the Tire Lift switch to the center "OFF" position.

8.0 Oil Level

Proper oil level for most efficient operation is 1" below the filler hole when rams are completely collapsed. The following hydraulic oils compatible with Buna-N O-Rings, are recommended for use in Regent products:

Tellus 15, (Shell Oil Company)
MIL-H-5606 (Shell Oil Co., Aero Shell No. 4)
MIL-H-6083a (Mobil Oil, MILVAC-6083)
Calol Engine Oil (Union Oil Co.)
Texaco Regal Oil AA (R&O) (Texas Co.)
Opaline 10W Motor Oil (Sinclair Co.)
MIL-H-83282 (Shell Oil Co.)

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Figure 1

FIG. & ITEM NO.	PART NUMBER	DESCRIPTION	UNITS PER ASS'Y
1-	9470-011	Bead Breaker Assembly	Ref.
-1	9470-B	Base Assembly	1
-2	9470-F	Finger Assembly	8
-3	9470-W	Spyder Assembly	2
-4	9470-AC	Cylinder Assembly	1
-5	9470-AS	Screw Assembly	1
-6	9470-22	Lift Base Assembly	1
-7	9470-24	Ramp Weldment	1
-8	9470-26	Retainer	2
-9	9470-30	Lift Support Weldment	1
-10	MSC1512	Cylinder (Berendsen Sales)	1
-11	SC-332	Hydraulic Power Supply (Royal Hydraulics)	1
-12	MS16998-97	Capscrew Skt Hd (.50-20UNF x 1.75Lg)	12
-13	MS27183-13	Washer Flat (.38 NOM)	10
-14	MS27183-18	Washer Flat (.50 NOM)	16
-15	MS35338-46	Lockwasher (.38 NOM)	8
-16	MS35691-21	Nut, Hex (.38-24UNF)	2
-17	MS90726-59	Capscrew, Hex (.38-24UNF x 1.00Lg)	8
-18	MS90726-61	Capscrew, Hex (.38-24UNF x 1.25Lg)	2
-19	MS90726-115	Capscrew, Hex (.50-20UNF x 2.00Lg)	4
-20	6CBTX-S	Male Elbow (Parker Hannifin)	3
-21	6-6CBTX-S	Male Elbow (Parker Hannifin)	1
-22	MS20392-7C41	Pin, Headed (.50 Dia x 1.281 Gr. Lg)	2
-23	MS24665-317	Cotter Pin	2
-24	GH781-4-72.0	Hose (Nelson Dunn)	4
-25	9470-44	Operation Panel	1

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Bead Breaker/Tire Assembler
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Figure 1

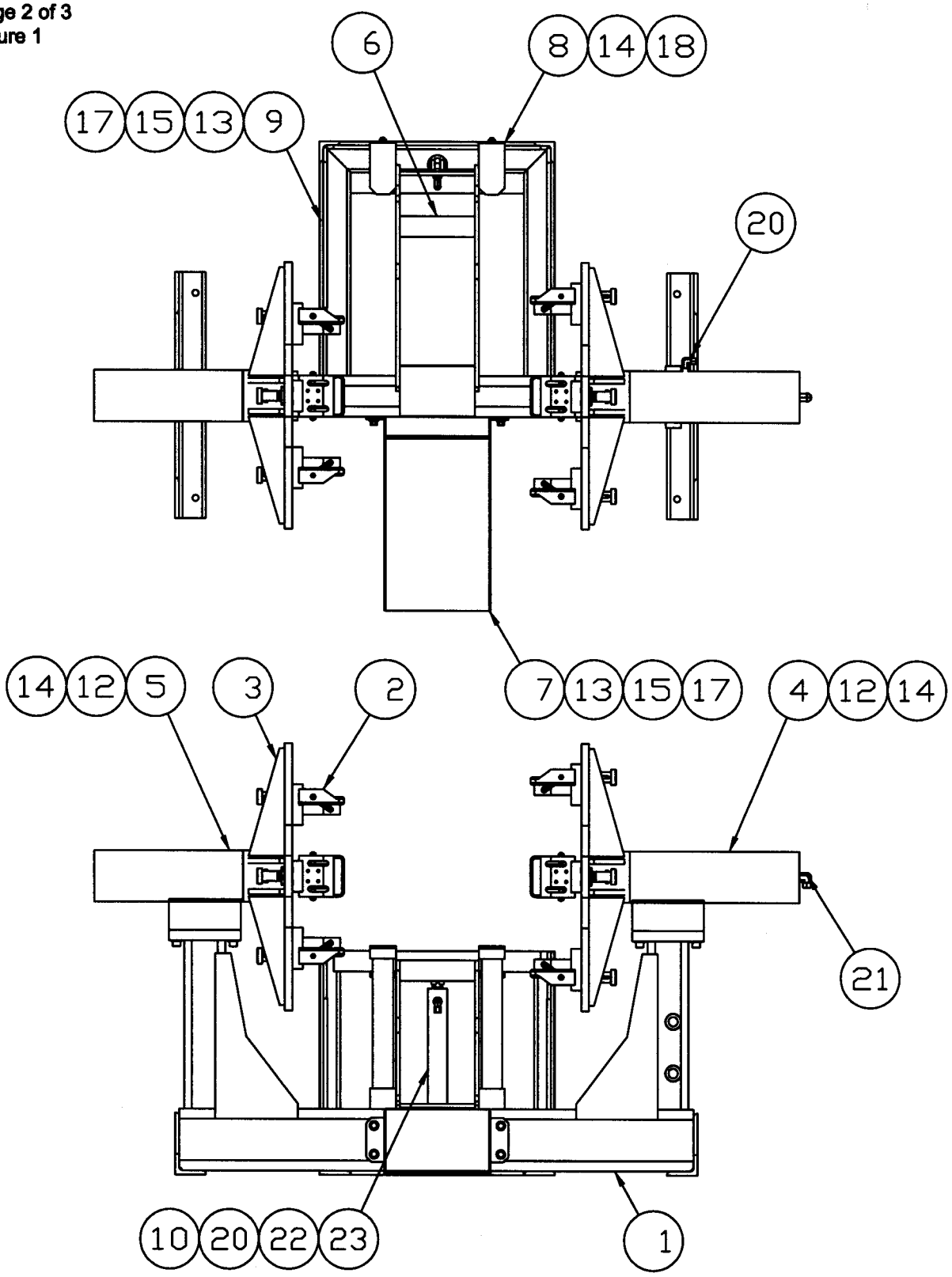

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Figure 1

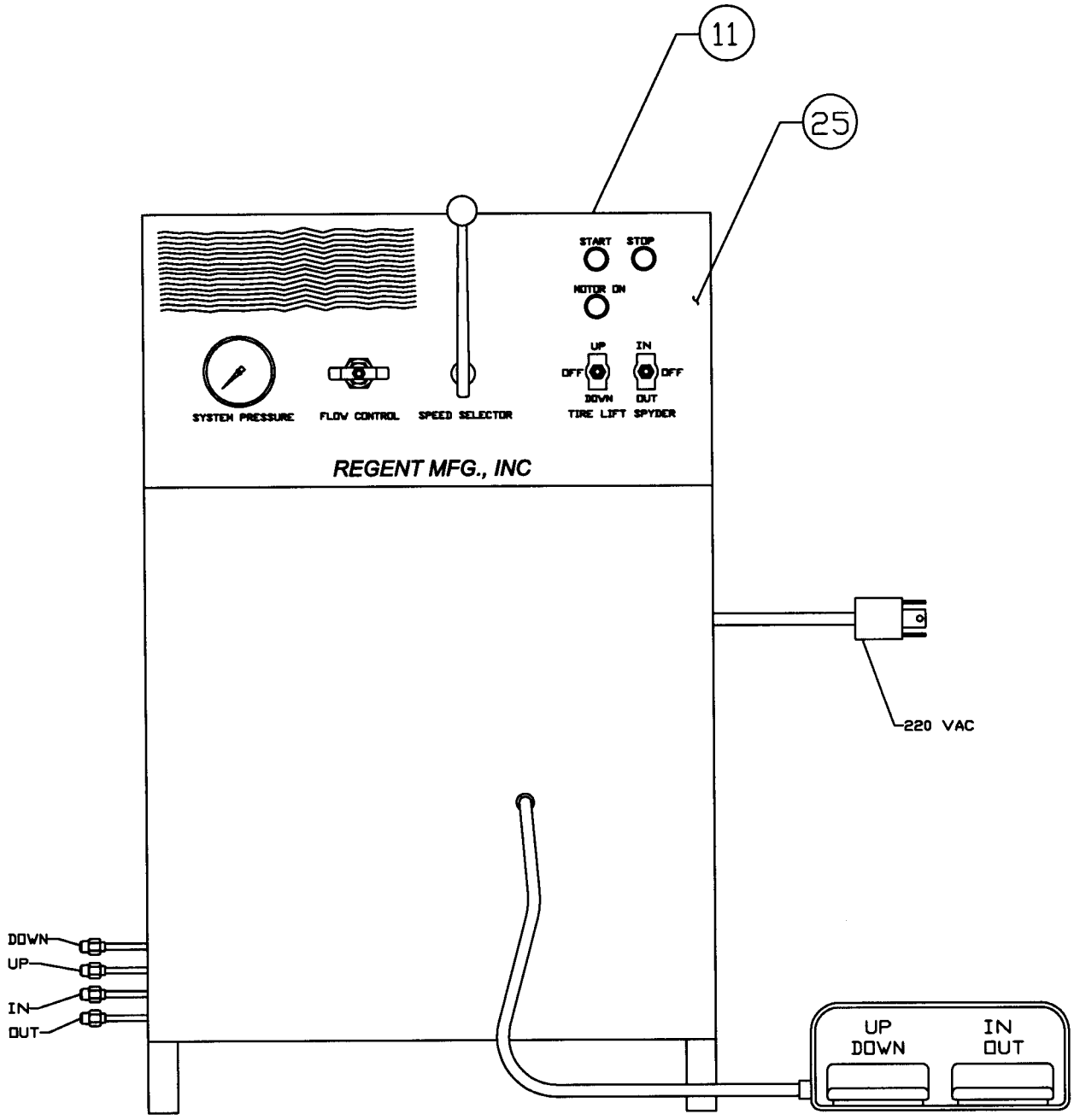

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Figure 2

FIG. & ITEM NO.	PART NUMBER	DESCRIPTION	UNITS PER ASS'Y
2-	9470-F	Finger Assembly	Ref.
-1	9470-10	Finger Weldment	1
-2	9470-120	Bumper	1
-3	9470-9	Pin	1
-4	91259A640	Shoulder Bolt	1
-5	9470-118	Clamp Plate	1
-6	9470-17	Handle Assembly	1
-7	MS28775-219	O-Ring (Parker Hannifin)	2
-8	CL-2-SW	Spherical Washer (Carr Lane)	1
-9	3/8-24UNF x 1.25Lg	Soc Head Cap Screw	1
-10	1/4-20UNC x 1.00 Lg	Soc Head Cap Screw	4
-11	5/16-18	Nut	1

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Figure 2

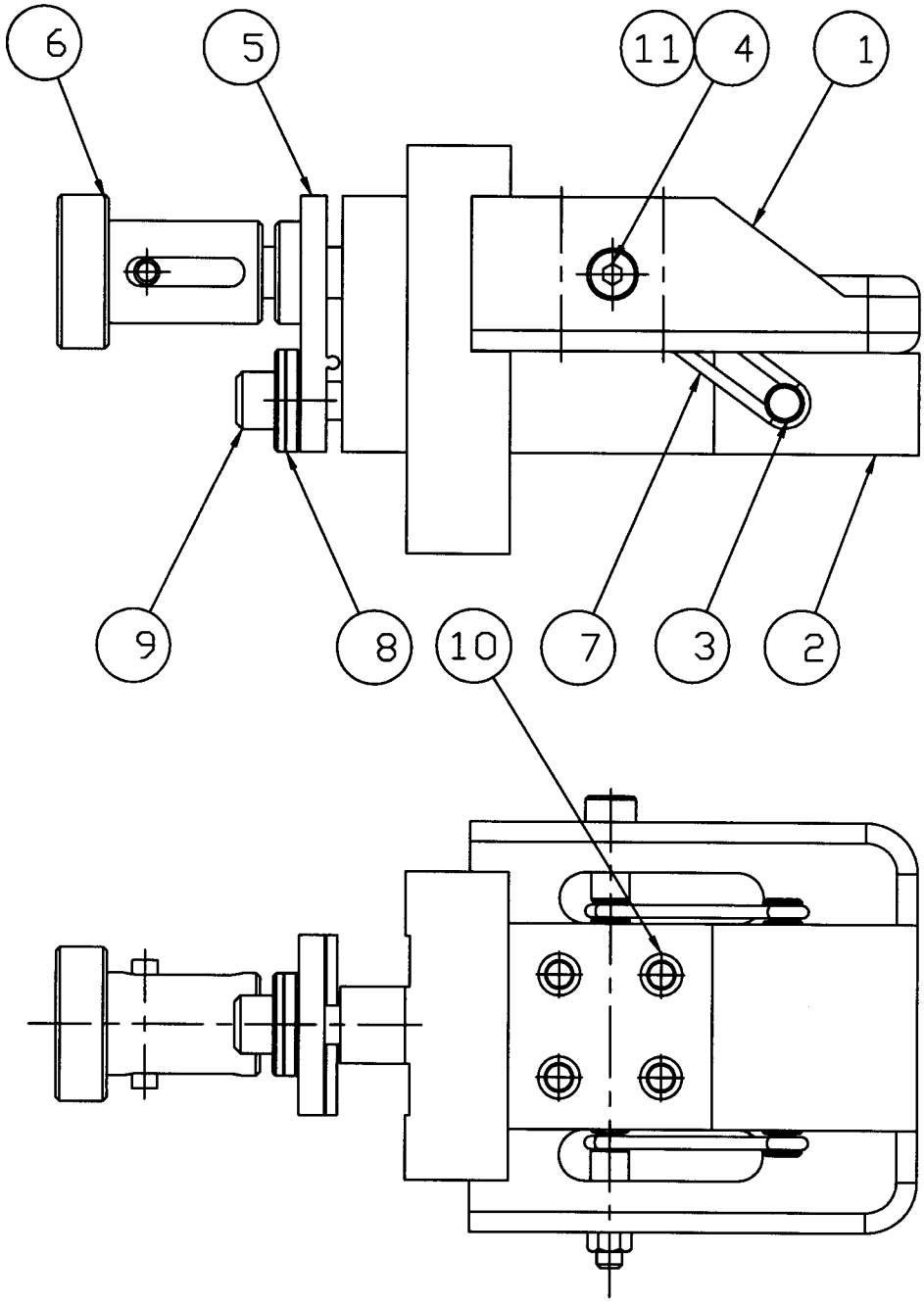

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Figure 3

FIG. & ITEM NO.	PART NUMBER	DESCRIPTION	UNITS PER ASS'Y
3-	9470-AC	Cylinder Assembly	Ref.
-1	9470-101	Cylinder Housing	1
-2	9470-102	Ram	1
-3	9470-3	Plug	1
-4	915-150.18-3.485	Snap Ring	1
-5	916-45-3.591	Back-up Ring	1
-6	MS28775-341	O-Ring	1
-7	MS28775-343	O-Ring	1
-8	Q4341	Quad Ring (Minnesota Rubber)	1

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Figure 3

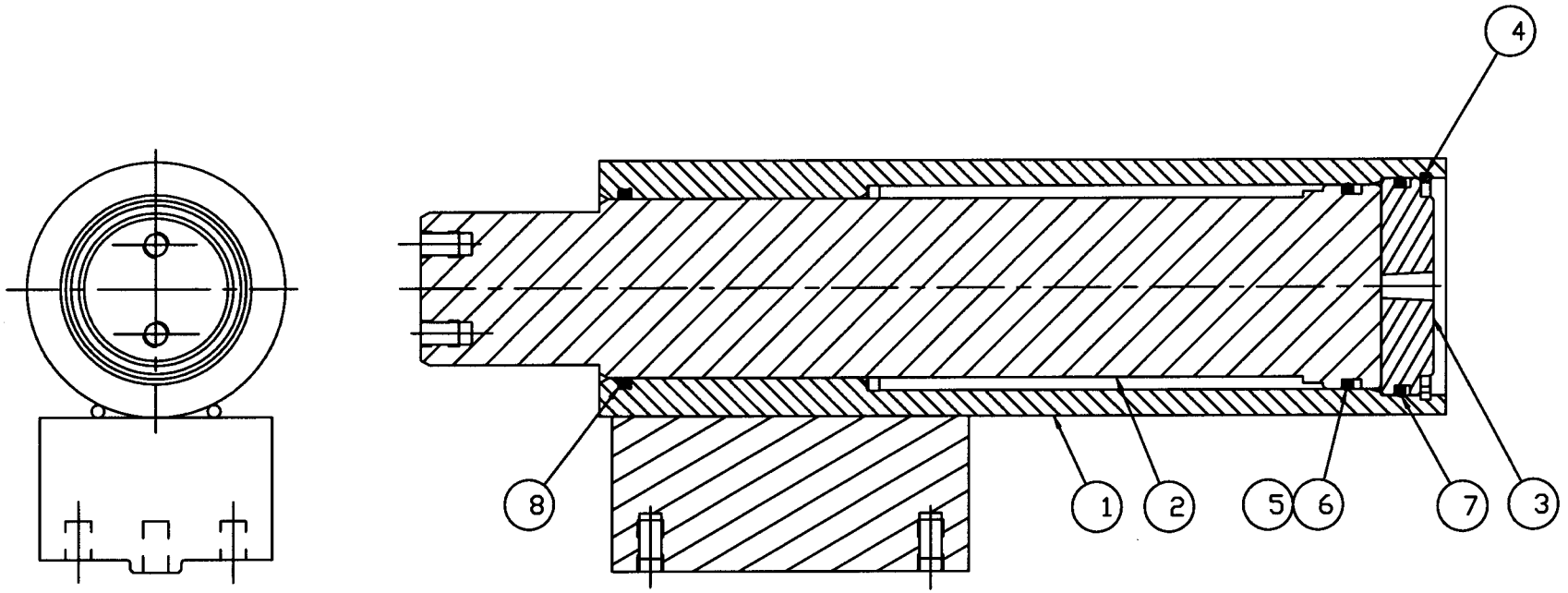

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Figure 4

FIG. & ITEM NO.	PART NUMBER	DESCRIPTION	UNITS PER ASS'Y
4-	9470-AS	Screw Assembly	Ref.
-1	9470-105	Cylinder Base	1
-2	9470-106	Screw	1

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Figure 4

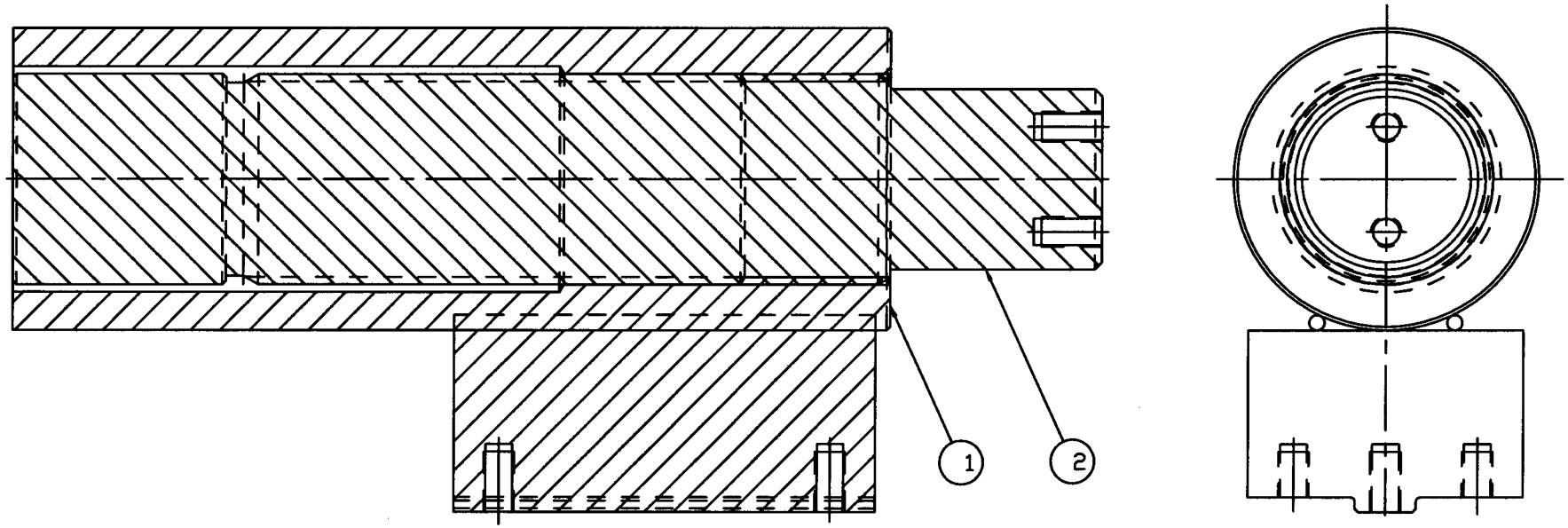

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Figure 5

FIG. & ITEM NO.	PART NUMBER	DESCRIPTION	UNITS PER ASS'Y
5-	9470-17	Handle Assembly	Ref.
-1	9324-18	Handle Weldment	1
-2	9470-19	Screw	1
-3	.25 Dia. x 1.25 Lg	Dowel, Pin	1

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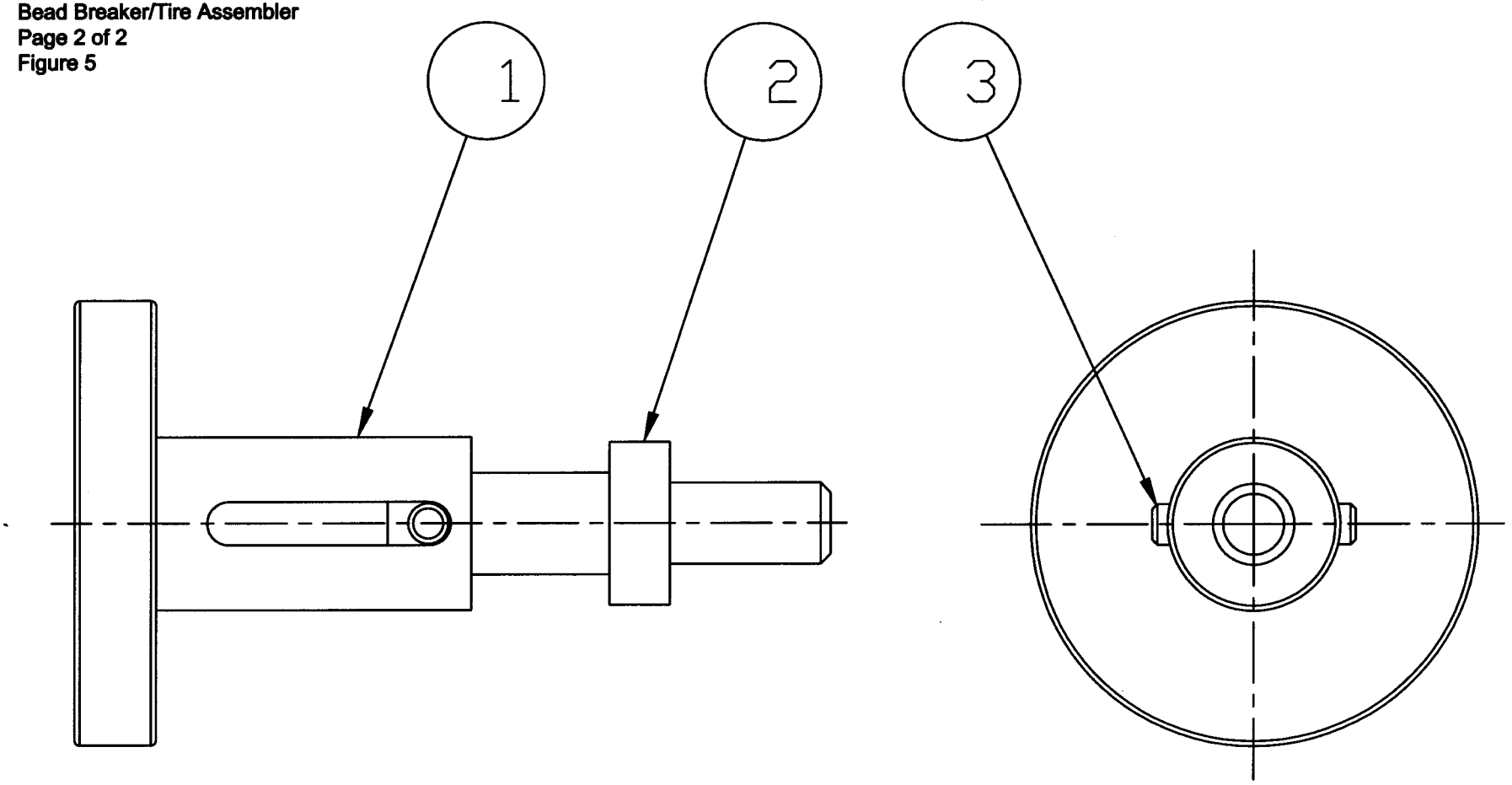
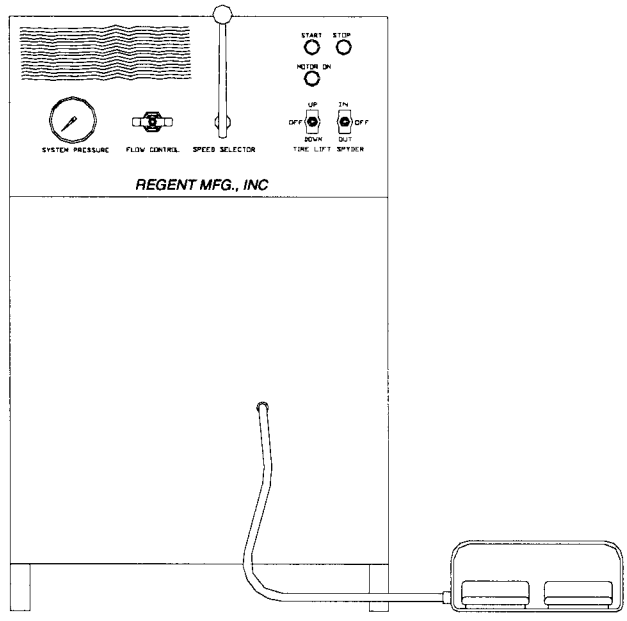
Figure 5



Technical Manual
For
Hydraulic Power Supply

P/N SC-332

Royal Hydraulics, Inc.



Electrical Parts List

Item	Part Number	Description
1	XMXL2Y	Disconnect Operator
1A	G813	Disconnect Accessories
2	ARR22 F0R -10G	22MM Green "Start" Button
3	ARR22E0R-01R	22MM Red "Stop" Button
4	4NK0ASY	Overload
5,6	6988K52	Transformer with Fuse Block
7	8002K73	3 Position Switch
8	7024K16	Twin Foot Switch
9	8002K73	3 Position Switch
10	4NC0F0210Y	230vac Contactor

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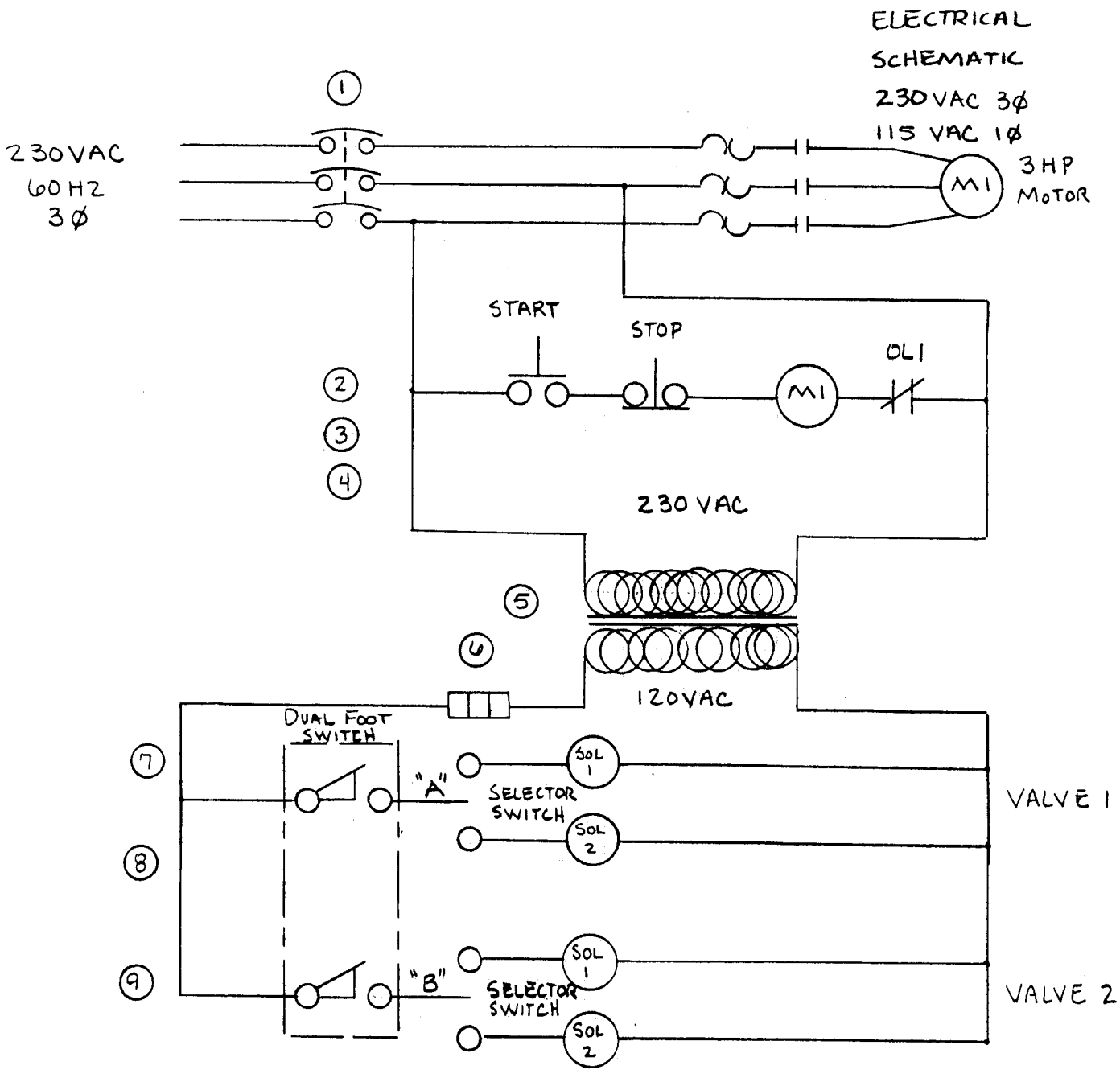


LOAD BREAK • DISCONNECT SWITCHES

HANDLE ASSEMBLIES

LOCKABLE STYLE HANDLE ASSEMBLIES

HANDLE ASSEMBLY FOR PANEL MOUNT DISCONNECT SWITCHES

LOCKABLE in the "OFF" position with up to 3 padlocks (not furnished) WITH DOOR INTERLOCK. Meets OSHA 1910.147 Lockout requirements. Available with red handle and yellow backplate or black handle with gray backplate. Operator is gasketed for Type 4 (IP65) environmental protection. Includes handle, shaft (7.8 inch), coupling, legend plate, and hardware.

HANDLE ASSEMBLY FOR DOOR MOUNT DISCONNECT SWITCHES

LOCKABLE in the "OFF" position with up to 3 padlocks (not furnished) NO DOOR INTERLOCK. Meets OSHA 1910.147 Lockout requirements. Operator is gasketed for Type 4 (IP65) environmental protection. Includes handle, legend plate, and hardware.

113223

HANDLE ASSEMBLY COLOR	SIZE (MM)	PANEL MOUNT DISCONNECT SWITCHES			DOOR MOUNT DISCONNECT SWITCHES		
		CATALOG NUMBER	MODEL NUMBER	LIST PRICE	**CATALOG NUMBER**	MODEL NUMBER	LIST PRICE
YELLOW/RED	72 x 72	**102689**	XMXL2Y	$ 20.00	**113223**	XMKL2Y	$ 20.00
GRAY/BLACK	72 x 72	**102690**	XMXN2Y	20.00	**113224**	XMKN2Y	20.00

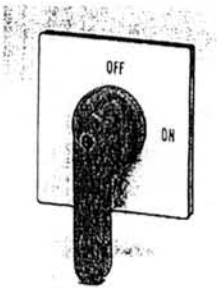
SELECTOR STYLE HANDLE ASSEMBLIES

HANDLE ASSEMBLY FOR PANEL MOUNT DISCONNECT SWITCHES

NON-LOCKABLE WITH DOOR INTERLOCK. Available with Red/Yellow or Black/Gray handle and backplate. Operator is gasketed for Type 4X (IP65) environmental protection. Includes handle, shaft (7.8 inch), coupling, legend plate, and hardware.

HANDLE ASSEMBLY FOR DOOR MOUNT DISCONNECT SWITCHES

NON-LOCKABLE - NO DOOR INTERLOCK. Available with Red/Yellow or Black/Gray handle and backplate. Operator is gasketed for Type 12 (IP65) environmental protection. Includes handle, legend plate, and hardware.



113226

HANDLE ASSEMBLY COLOR	SIZE (MM)	PANEL MOUNT DISCONNECT SWITCHES			DOOR MOUNT DISCONNECT SWITCHES		
		CATALOG NUMBER	MODEL NUMBER	LIST PRICE	**CATALOG NUMBER**	MODEL NUMBER	LIST PRICE
RED/YELLOW	48 x 48	**114832**	XMLG1Y	$ 24.00	**114834**	XMQG1Y	$ 24.00
	72 x 72	**102687**	XMLG2Y	24.00	**113226**	XMQG2Y	24.00
GRAY/BLACK	48 x 48	**114833**	XML01Y	$ 24.00	**114835**	XMQ01Y	$ 24.00
	72 x 72	**102685**	XMLO2Y	24.00	**113227**	XMQ02Y	24.00

KNOB STYLE HANDLE OPERATOR

HANDLE ASSEMBLY FOR PANEL MOUNT DISCONNECT SWITCHES

For direct control of Disconnect Switch. Mounts directly to the switch. NO DOOR INTERLOCK. Black Knob.

102249

HANDLE ASSEMBLY COLOR	SIZE (MM)	PANEL MOUNT DISCONNECT SWITCHES		
		CATALOG NUMBER	MODEL NUMBER	LIST PRICE
BLACK	59 MM	**102249**	G995N	$ 6.00

LOAD BREAK • DISCONNECT SWITCHES
HANDLE ASSEMBLIES

LOCKABLE STYLE HANDLE ASSEMBLIES

HANDLE ASSEMBLY FOR PANEL MOUNT DISCONNECT SWITCHES

LOCKABLE in the "OFF" position with up to 3 padlocks (not furnished) WITH DOOR INTERLOCK. Meets OSHA 1910.147 Lockout requirements. Available with red handle and yellow backplate or black handle with gray backplate. Operator is gasketed for Type 4 (IP65) environmental protection. Includes handle, shaft (7.8 inch), coupling, legend plate, and hardware.

HANDLE ASSEMBLY FOR DOOR MOUNT DISCONNECT SWITCHES

LOCKABLE in the "OFF" position with up to 3 padlocks (not furnished) NO DOOR INTERLOCK. Meets OSHA 1910.147 Lockout requirements. Operator is gasketed for Type 4 (IP65) environmental protection. Includes handle, legend plate, and hardware.

113223

HANDLE ASSEMBLY COLOR	SIZE (MM)	PANEL MOUNT DISCONNECT SWITCHES			DOOR MOUNT DISCONNECT SWITCHES		
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GRAY/BLACK	72 x 72	**102690**	XMXN2Y	20.00	**113224**	XMKN2Y	20.00

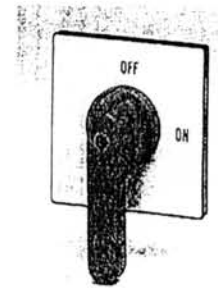
SELECTOR STYLE HANDLE ASSEMBLIES

HANDLE ASSEMBLY FOR PANEL MOUNT DISCONNECT SWITCHES

NON-LOCKABLE WITH DOOR INTERLOCK. Available with Red/Yellow or Black/Gray handle and backplate. Operator is gasketed for Type 4X (IP65) environmental protection. Includes handle, shaft (7.8 inch), coupling, legend plate, and hardware.

HANDLE ASSEMBLY FOR DOOR MOUNT DISCONNECT SWITCHES

NON-LOCKABLE - NO DOOR INTERLOCK. Available with Red/Yellow or Black/Gray handle and backplate. Operator is gasketed for Type 12 (IP65) environmental protection. Includes handle, legend plate, and hardware.



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	72 x 72	**102685**	XMLO2Y	24.00	**113227**	XMQ02Y	24.00

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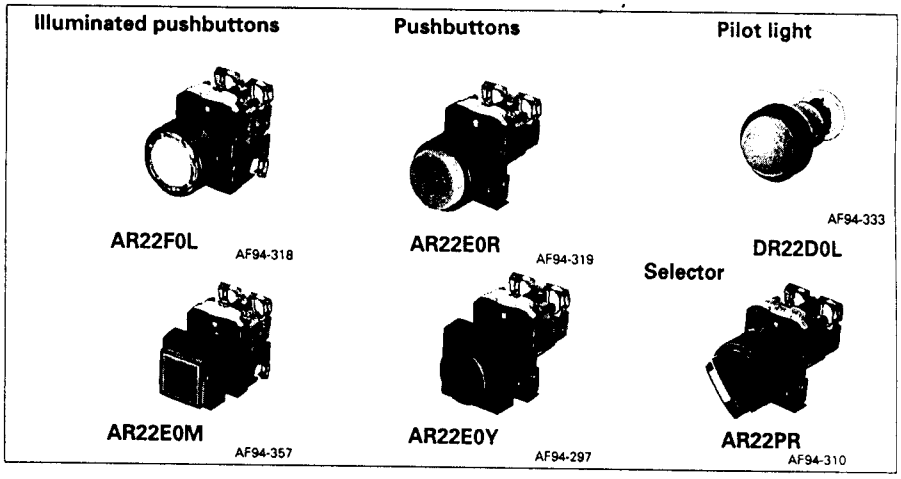
102249

HANDLE ASSEMBLY COLOR	SIZE (MM)	PANEL MOUNT DISCONNECT SWITCHES		
		CATALOG NUMBER	MODEL NUMBER	LIST PRICE
BLACK	59 MM	**102249**	G995N	$ 6.00

AR22 and DR22
General information

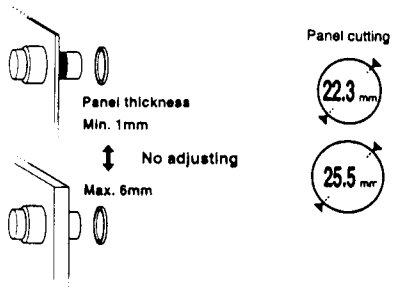
The AR22 and DR22 series command switches are new models developed from the AH22 series for improved usability. The AR22 now uses a release arm with a wedge mechanism developed by Fuji Electric. This enables you to mount or remove the operator and contact block without using any tools. When fitting the switch to a panel, you can ignore the panel thickness.
You have only to secure the operator with a locking nut from behind the panel without any need for adjustment. The improved locking nut is capable of mounting the operator in both 22.3mm and 25.5mm dia. panel cutout holes.



■ Features

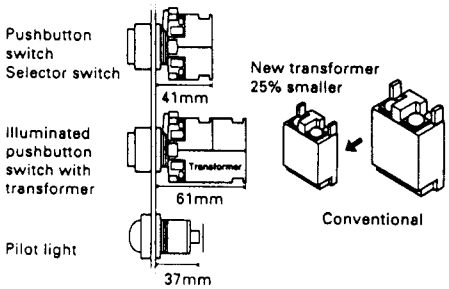
Facilitated mounting

- No adjusting of panel thickness is necessary.
- The button and lens can be mounted on a panel while the operator is engaged.
- Mountable even on a panel cutout 25.5mm in diameter.



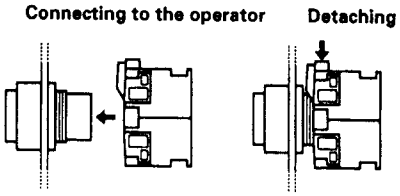
Miniaturization

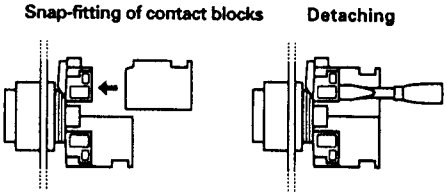
- The shortest among industrial pushbuttons.
  Pushbuttons and selector switches with 1NO+1NC: 41mm deep
  Pilot lights: 37mm deep
- The transformer now occupies far less space.
  75% of volume of FUJI's conventional transformer (220V or less only).



Easy replacing contact block and transformer

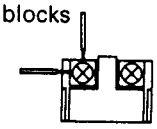
- Because of a snap-on mounting, replacement or addition of the contact block and transformer unit is very simple.
- The contact block is common to all the pushbuttons of this series.
- Contact block is easily replaced even when the pushbuttons are mounted closely together.
- Replacement of the contact block can be done with a screwdriver, without the need for any special tool.





Wiring

- Wiring from two directions is possible.
- Wiring in both vertical and lateral directions facilitates wiring in narrow spaces.
- Color coding of contact blocks makes wiring easy.
  1NO: Blue, 1NC: Red
  Lamp terminal and transformer unit: Black



Safety

- A terminal cover is provided, assuring safety and security.
- Emergency stop button/Push-lock turn-reset pushbutton
  FUJI's original Trigger Action mechanism provides safety. This mechanism ensures that the contact will not move until the button is pressed and locked.

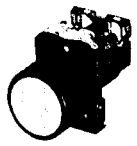
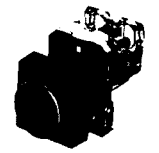
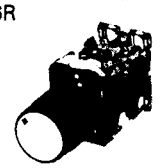
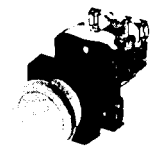
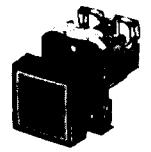
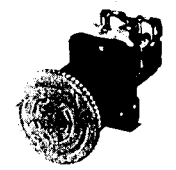
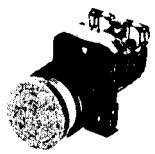
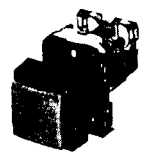
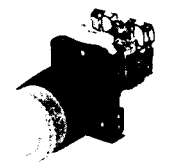
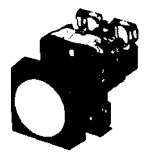
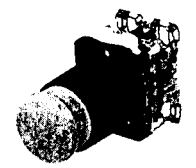
Protection

- Excellent oil-tight construction (IP65) of the operator.
- Closure of the contact block has been improved.

Approvals

UL, CSA and TÜV approved.

■ Pushbutton switches

Operator	Basic ordering code	Operator	Basic ordering code	Operator	Basic ordering code
Flush round head with round bezel	AR22F0R, F5R  AF94-320	With full guard ring (40mm dia.)	AR22M3R  AF94-372	Extended round head with square bezel	AR22E0Y, E5Y  AF94-297
Extended round head with round bezel	AR22E0R, E5R  AF94-319	With selector ring	AR22S1R, S2R, S3R S6R  AF94-355	Mushroom head with square bezel	AR22M4Y  AF94-298
Mushroom head with round bezel (40mm dia.)	AR22M0R, M5R  AF94-293	Flush square head with square bezel	AR22F0S, F5S  AF94-316	Push-lock, turn-reset (40mm dia.)	AR22V2R  AF94-432
Mushroom head with round bezel (29mm dia.)	AR22M4R  AF94-321	Extended square head with square bezel	AR22E0S, E5S  AF94-296	Push-lock, turn-reset (29mm dia.)	AR22V4R  AF95-53
With full guard ring (24mm dia.)	AR22G3R, G8R  AF94-292	Flush round head with square bezel	AR22F0Y, F5Y  AF94-295	Push, pull head	AR22Q2R  AF95-52

Pushbuttons/Selectors/Pilot Lights
AR22 and DR22
Ordering code system

■ Ordering code system
Pushbuttons, illuminated pushbuttons and pilot lights

AR22 E0 L – 10 E 3 G
① ② ③ ④ ⑤ ⑥ ⑦

① Product category
AR22: 22mm-dia. pushbutton switch
22mm-dia. illuminated pushbutton switch
22mm-dia. selector switch
22mm-dia. illuminated selector switch
DR22: 22mm-dia. pilot light

② Operator or lens
• Operator for pushbutton and illuminated pushbutton switches
F0: Flush head
F5: Flush head (Alternate)
E0: Extended head
E5: Extended head (Alternate)
M0: 40mm dia. mushroom head
M5: 40mm dia. mushroom head (Alternate)
M4: 29mm dia. mushroom head
G4: Extended with full guard
G9: Extended with full guard (Alternate)
G3: Extended with full guard
G8: Extended with full guard (Alternate)
M3: Giant head with full guard ring
S□: With selector ring
V2: Push-lock, turn-reset (40mm dia.)
VA: Push-lock, turn-reset (40mm dia.)
V4: Push-lock, turn-reset (29mm dia.)
Q2: Push-pull
• Lens for pilot light
D0: Dome
E3: Extended with legend plate
F3: Extended with legend plate
F4: Extended with color legend plate
• Operator for selector switch
P: Knob
W: Lever
R: Cylindrical knob
J: Key
PC: Knob operated control type
WC: Lever operated control type
RC: Cylindrical knob operated control type
JC: Key operated control type

③ Shape of button and bezel
• Illuminated type
L: Round button, round bezel
M: Square button, square bezel
P: Round button, square bezel
• Non-illuminated type
R: Round button, round bezel
S: Square button, square bezel
Y: Round button, square bezel

④ Contact arrangement

10: 1NO	30: 3NO
01: 1NC	03: 3NC
11: 1NO+1NC	33: 3NO+3NC*
20: 2NO	40: 4NO
02: 2NC	04: 4NC
22: 2NO+2NC	

* Not available for selector switch

Selector and illuminated selector switches

AR22 P R – 2 □ 10 E 3 B □
① ② ③ ⑧ ⑨ ④ ⑤ ⑥ ⑦ ⑩

⑤ Lamp voltage
• Incandescent lamp
5: 5V AC/DC, without transformer
E: 24V AC/DC, without transformer
H: 100-110V AC, with transformer
L: 115-127V AC, with transformer
M: 200-220V AC, with transformer
Q: 230-254V AC, with transformer
S: 350-380V AC, with transformer
T: 400-440V AC, with transformer
W: 500-550V AC, with transformer
• LED lamp
A: 6V AC, without transformer
6: 6V DC, without transformer
B: 12V AC/DC, without transformer
E: 24V AC/DC, without transformer
H: 100-110V AC, with transformer
L: 115-127V AC, with transformer
M: 200-220V AC, with transformer
Q: 230-254V AC, with transformer
S: 350-380V AC, with transformer
T: 400-440V AC, with transformer
W: 500-550V AC, with transformer

⑥ Type of lamp
3: LED lamp
4: Incandescent lamp

⑦ Color of button or lens
G: Green
R: Red
B: Black
W: White
Y: Yellow
A: Orange
S: Sky-blue*
* Not available for LED lamp

⑧ Operation
2: 2-position, maintained
0: 2-position, spring return
3: 3-position, maintained
6: 3-position, spring/manual return (Left to center)
7: 3-position, spring/manual return (Right to center)
1: 3-position, spring return
4: 4-position, maintained
5: 5-position, maintained

⑨ Key removable position
A: Left
B: Left and right
C: Left, right and center
D: Right
E: Center
F: Right and center
G: Left and center

⑩ Key type No.
A, B, C, D, E or F
("A" is standard)

■ Contact ratings

Description	Rated thermal current	AC		DC		
		Voltage	Operational current (A)	Voltage	Operational current (A)	
	(A)	(V)	AC15 (Ind. load)	(V)	DC12 (Res. load)	DC13 (Ind. load)
Pushbutton and illuminated pushbutton switches	10	24	6	24	6	6
		110	6	110	2.5	1.3
		220	6	220	1	0.45
Selector and illuminated selector switches (2-position)		440	2.5	—	—	—
		550	2	—	—	—
Pushbutton switches with selector ring	10	24	3	24	3	3
		110	3	110	1.3	0.65
		220	3	220	0.5	0.23
Selector and illuminated selector switches (3-position)		440	1.3	—	—	—
		550	1	—	—	—

Note: Rated operational currents conform to JIS C4520 test condition.

■ Specifications

Item		Specification
Rated insulation voltage		600V AC/DC *1
Life expectancy	Mechanical	See the table below
	Electrical	500,000 operations at 220V AC 6A 1 million operations at 220V AC 3A
Operating frequency		1800 operations/hour (On-load factor: 40%)
Dielectric strength		2500V AC, 1 minute *2
Insulation resistance		100MΩ or more (500V DC megger)
Vibration		Malfunction durabitity: 10-55Hz, double amplitude 0.1mm Mechanical durabitity: 16.7Hz, double amplitude 3.0mm
Shock		Malfunction durability: 100m/s² Mechanical durability: 500m/s²
Operating temperature range		–20°C to +70°C *3
Storage temperature range		–40°C to +80°C
Humidity		45 to 85% RH (within –5°C to +40°C)
Degree of protection		IP65 (Operator and indicator)

*1 Illuminated type without transformer 250V AC/DC
*2 Illuminated type without transformer 2000V AC, 1 minute
*3 Illuminated type –20°C to +50°C

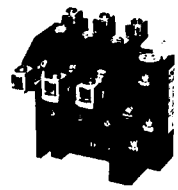
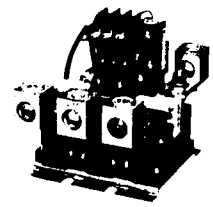
● Mechanical life

Description		Operations
Pushbutton switch Illuminated pushbutton switch	Momentary action	5 million
	Alternate action	1 million
	With selector ring	100,000
	Push-lock, turn-reset	100,000
Selector switch Illuminated selector switch	Maintained: 1NO+1NC, 2NO+2NC	1 million
	Maintained: 1NO, 1NC, 2NO, 2NC 3NO, 3NC, 4NO, 4NC	500,000
	Spring return, spring/manual return	200,000
	Control type:	

THERMAL OVERLOAD RELAYS
Selection Guide

■ FEATURES

- 1NO+1NC alarm contact (Automatic reset available.)
- Provided with a built-in heater, thus ensuring accurate operations.
- Calibrated Rated Current Dial.
- With manual trip device.
- With open-phase protection device.

■ THERMAL OVERLOAD RELAYS UL File No.E42419, E44592 CSA File No.LR20479

Maximum voltage	No. of heater element	Alarm contacts NO	Alarm contacts NC	Mounting	Thermal overload relays with open-phase protection type K U.S. CAT. No.	Thermal overload relays with open-phase protection type K FUJI type	Frame sizes used on
600	3	1	1	Exclusive (Inde.)*†	4NK0A*	TK-0N	0A, 0F & 0G
600	3	1	1	Exclusive (Inde.)†	4NK0H*	TK-5-1N	0Q, 0R & 0H
600	3	1	1	Exclusive	2NK1Q*	TK-2N/UD	0T, 1Q
600	3	1	1	Exclu. + Inde.	2NK2H*	TK-3N/UD	2F, 2H
600	3	1	1	Exclusive	2NK2T*	TK-4N/UD	2T
600	3	1	1	Exclu. + Inde.	2NK4F*	TK-6N/UD	3F, 3H, 4F
600	3	1	1	Exclusive	2NK4Q*	TK-8N/UD	4Q
600	3	1	1	Exclusive	2NK4H*	TK-10N/UD	4H
600	3	1	1	Independent	2NK4H*H	TK-10NH/UD	4H
600	3	1	1	Exclusive	2NK5F*	TK-11N/UD	5F
600	3	1	1	Independent	2NK5F*H	TK-11NH/UD	5F
600	3	1	1	Exclusive	2NK5H*	TK-12N/UD	5H

† Independent mounting is possible through the use of an additional mounting bracket
–For 4NK0A*, use mounting bracket part #SZ-HB
–For 4NK0H*, use mounting bracket part #SZ-HC
*†Also available with Quick Terminals (Y). See p.15 for details.

■ OVERLOAD RELAY AMPERE CODE SELECTION CHART

Select overload ampere range code from this table and insert in place of * mark in Catalog number of starters or overload relays.

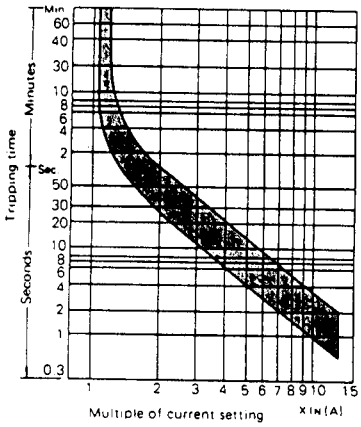
0A, 0F & 0G				0Q, 0R & 0H				0T, 1Q	
U.S. CAT. No. 4NK0A*		4NK0A*		4NK0H*		4NK0H*		2NK1Q*	
Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range
A	0.1–0.15	M	2.8–4.2	A	0.1–0.15	M	2.8–4.2	N	4–6
B	0.15–0.24	N	4–6	B	0.15–0.24	N	4–6	P	5–8
C	0.24–0.36	P	5–8	C	0.24–0.36	P	5–8	Q	6–9
D	0.36–0.54	Q	6–9	D	0.36–0.54	Q	6–9	S	7–11
E	0.48–0.72	S	7–11	E	0.48–0.72	S	7–11	T	9–13
F	0.64–0.96			F	0.64–0.96	T	9–13	V	12–18
G	0.8–1.2			G	0.8–1.2	V	12–18	W	18–26
H	0.95–1.45			H	0.95–1.45			X	24–28
J	1.4–2.2			J	1.4–2.2				
K	1.7–2.6			K	1.7–2.6				
L	2.2–3.4			L	2.2–3.4				

2F, 2H		2T		3F, 3H & 4F		4Q		4H		5F		5H	
U.S. CAT. No. 2NK2H*		2NK2T*		2NK4F*		2NK4Q*		2NK4H* 2NK4H*H		2NK5F* 2NK5F*H		2NK5H*	
Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range	Code letter	Amp. range
S	7–11	W	18–26	E	34–50	H	54–80	L	85–110	N	110–160	Q	160–250
T	9–13	Y	24–36	G	45–67	K	65–95	N	110–160	P	125–185	R	200–300
V	12–18	Z	28–40	H	54–80	L	85–110	P	125–185	Q	160–250	S	300–370
W	18–26	E	34–50	J	65–84	N	110–160	Q	160–195				
Y	24–36	G	45–67	K	65–95								
Z	28–40	A	54–70	W	85–104								
E	34–50			L	85–110								
F	45–56			M	110–130								

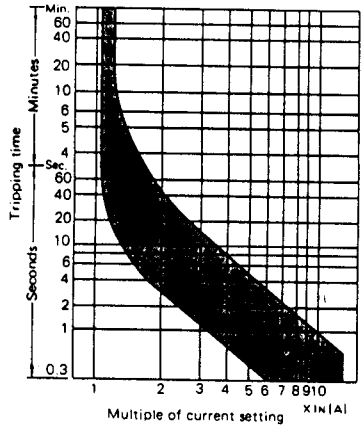
THERMAL OVERLOAD RELAYS
Overload Trip Curves

■ THERMAL OVERLOAD RELAYS/OPEN-PHASE PROTECTION TYPE K

Cold start

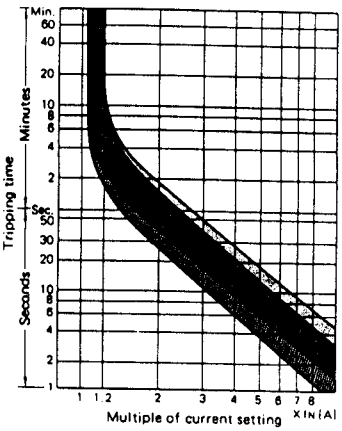


Hot start

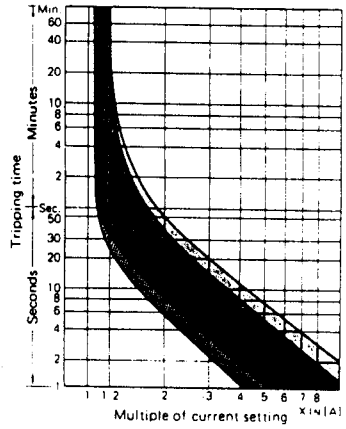


Cat. No.: 4NK0A*, 4NK0H*
FUJI type: TK-0N, TK-5-1N

Cold start 6-9A or less, 18-26A, 24-36A / 7-9A, 9-13A, 12-18A

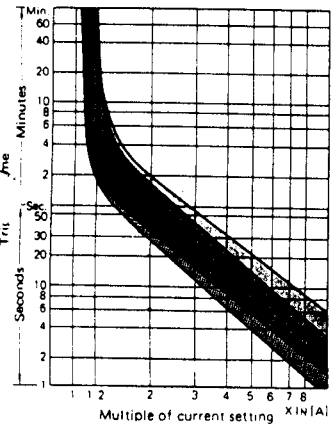


Hot start 6-9A or less, 18-26A, 24-36A / 7-11A, 9-13A, 12-18A

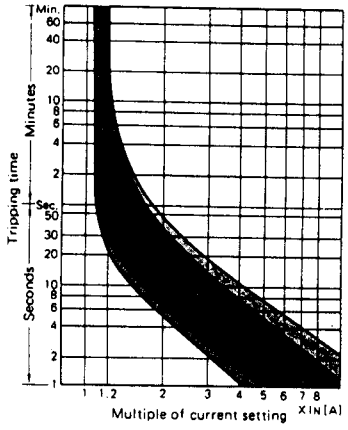


Cat. No.: 2NK1Q*
FUJI type: TK-2N/UD

Cold start 18–26A and over / 12–18A or less

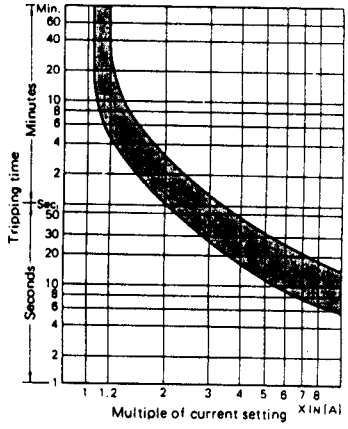


Hot start 18–26A and over / 12–18A or less

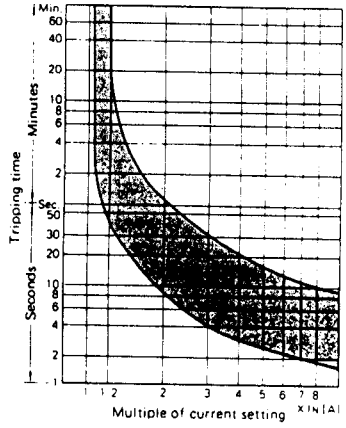


Cat. No.: 2NK2H*, 2NK2T*, 2NK4F*, 2NK4Q*
FUJI type: TK-3N/UD, TK-4N/UD, TK-6N/UD, TK-8N/UD

Cold start



Hot start

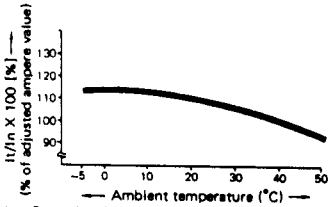


Cat. No.: 2NK4H*, 2NK4H*H, 2NK5F*, 2NK5F*H, 2NK5H*
FUJI type: TK-10N/UD, TK-10NH/UD, TK-11N/UD, TK-11NH/UD, TK-12N/UD

■ AMBIENT TEMPERATURE COMPENSATOR

FUJI overload relays are provided with an ambient temperature compensator. Their characteristics limit ampere value changes to approx. 10% as the ambient temperature changes between –5°C and 40°C.

Compensation characteristics (Average value)



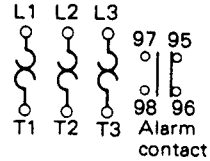
It : Operational current
In : Rated current

■ ALARM CONTACT RATINGS

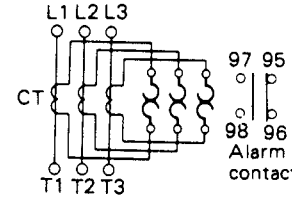
Contact rating Code Designation	Continuous Ampere Rating	Current–Make/Break (A)			
		110 to 120V	220 to 240V	440 to 480V	550 to 600V
C600	2.5	15/1.5	7.5/0.75	3.75/0.375	3.0/0.3

■ WIRING DIAGRAMS

(4NK0A* through 2NK4Q*)



(2NK4H* through 2NK5H*)



"ORANGE LINE" AC Contactors, AC Operated

AVAILABLE COILS

Code Letter	AC Coil 60Hz	AC Coil 50Hz
E	24–26V	24V
F	48V	48V
A	–	100V
1	110–120V	110V
G	127V	127V
B	208V	200V
2	220–240V	220V
H	277V	277V
C	–	380–400V
4	440–480V	440V
D	–	500V
5	550–600V	550V

■ COIL CHARACTERISTICS

Frame Size	Power Consumption (VA)		Pick-up Voltage (V)	Drop-out Voltage (V)	Operating Time (ms)	
					Coil ON ↓ Contact ON	Coil OFF ↓ Contact OFF
	Inrush	Sealed	240V, 60Hz	240V, 60Hz		
0A	95	9	120–142	76–110	9–20	15–16
0F, 0G	95	9	120–142	76–110	9–20	15–16
0Q, 0R	95	9	122–146	80–118	9–20	15–16
0H	95	9	128–150	84–120	9–20	15–16

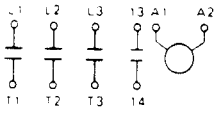
Notes: • Coil ratings 220-240V 60Hz.
• Operating time is based on 200V 50Hz

WIRING DIAGRAMS / AUXILIARY CONTACT INFORMATION

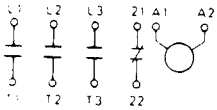
■ NON-REVERSING CONTACTORS

(4NC0A0, 0F0, 0Q0 and 0R0)

1NO* (Standard)*

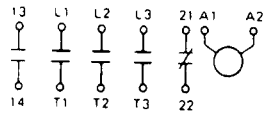


1NC* (Option)

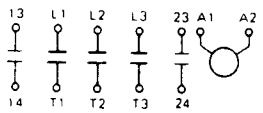


(4NC0G0 and 4NC0H0)

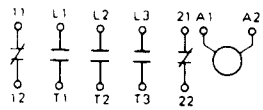
1NO+1NC (Standard)**



2NO** (Option)

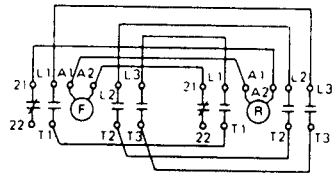


2NC** (Option)

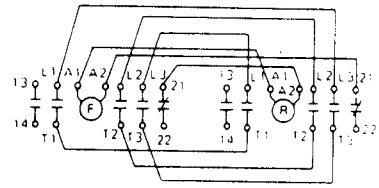


■ REVERSING CONTACTORS

(4ND0A0, 0F0, 0Q0, 0R0) ***



(4ND0G0 and 4ND0H0) ***



■ AUXILIARY CONTACT RATINGS

Operating	Contact rating Code Designation	Continuous Ampere Rating	Current–Make/Break (A)			
			110 to 120V	220 to 240V	440 to 480V	550 to 600V
AC	A600	10	60/6	30/3	15/1.5	12/1.2
DC	Q300	10	120V		240V	
			0.55/0.55		0.27/0.27	

* The 0A, 0F, 0Q & 0R frames offer 1 Aux. contact, NO standard. However, NC is available as an option.
** The 0G & 0H frames offer 2 Aux. contacts, 1NO + 1NC standard. However, 2NO or 2NC is available as an option.
*** Reversing contactors are NOT pre-wired with an electrical interlock unless requested when ordered.
Reversing contactors without at least 1NC Aux. contact can not be electrically interlocked.

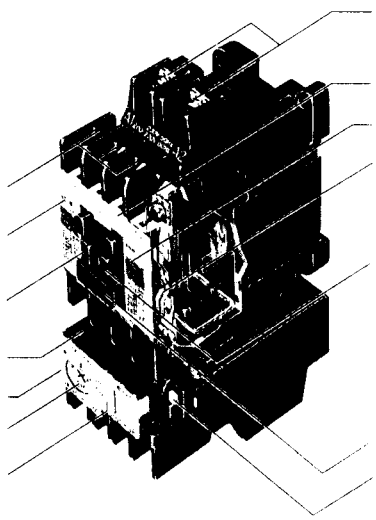
ORDERING INFORMATION

1. **Select the basic part number from the previous page.**
2. **Replace the # mark with the appropriate coil code from the chart above.**
3. **Verify the desired auxiliary contact arrangement.**

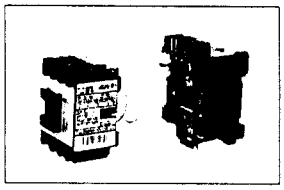
"ORANGE" LINE

UP TO 10HP@ 480VAC

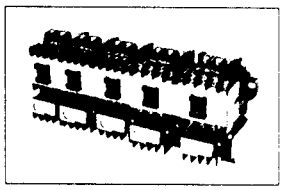
- 2 million electrical operations. The longest in the industry.
- "Logic level" aux contacts allow consistent operation down to 5VDC 3mA.
- Overloads offer "Open phase protection" as a standard feature.



Easy coil replacement without screws



Snap-on 35mm IEC and DIN rail mounting
Flat side construction allows side-by-side mounting

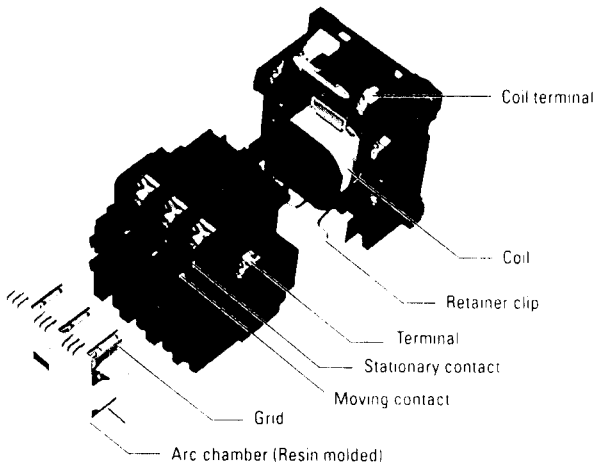


See pages 5 through 16 for details

"MID SIZED" LINE

UP TO 40HP@ 480VAC

- Redesigned coil offers lower power consumption characteristics.
- Compact size allows for efficient panel layout.
- 2NO+2NC aux contacts are included.

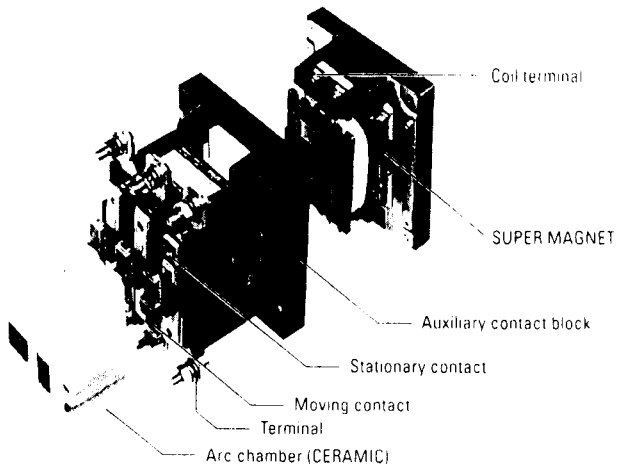


See pages 17 through 18 for details

"SUPER MAGNET" LINE

UP TO 300HP@ 480VAC

- Coil operates on either AC or DC voltage.
- Chatter-free operation-eliminates contact welding & coil burning.
- "Super magnet" design offers advanced electronics for maximum dependability.

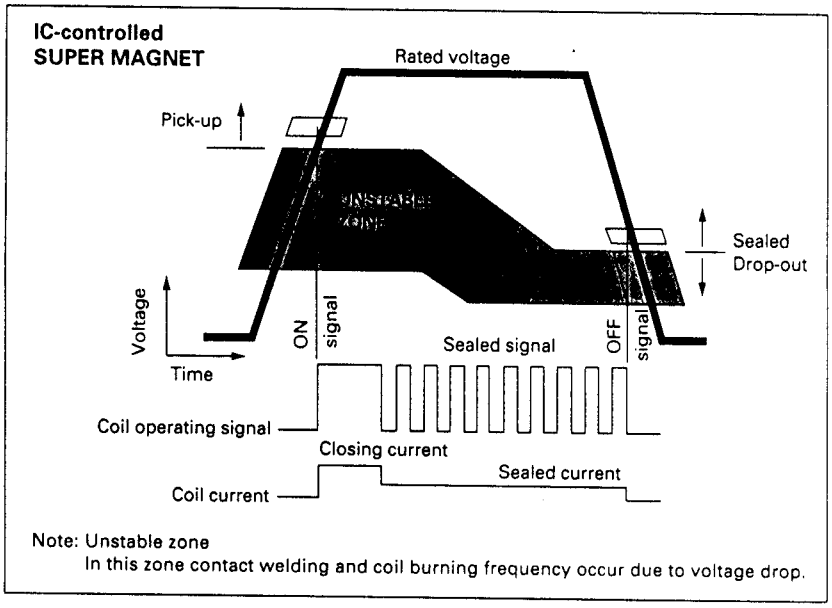


See pages 19 through 24 for details

ADVANTAGES OF SUPER MAGNET

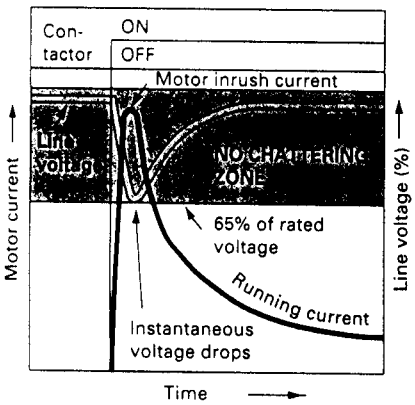
■ *POSITIVE PICK-UP AND DROP-OUT*

The SUPER MAGNET operation is electronically controlled. There is no unstable zone as will be seen in the diagram–an outstanding feature that other contactors can not provide.
Chattering is a phenomenon which occurs when the gravitational force of the starter magnet decreases through the line voltage drop at the time of motor starting. This may cause damage such as contact welding or coil burning.
The SUPER MAGNET holds without chattering even if the line voltage drops to 65% of its rated value, so preventing this type of trouble.



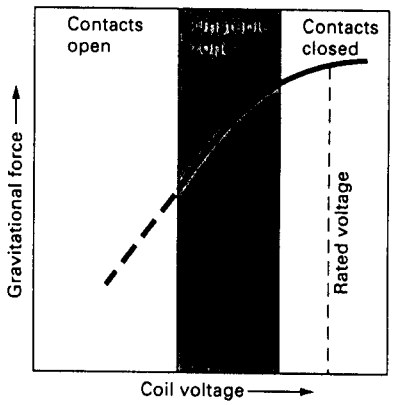
Note: Unstable zone
In this zone contact welding and coil burning frequency occur due to voltage drop.

Motor starting

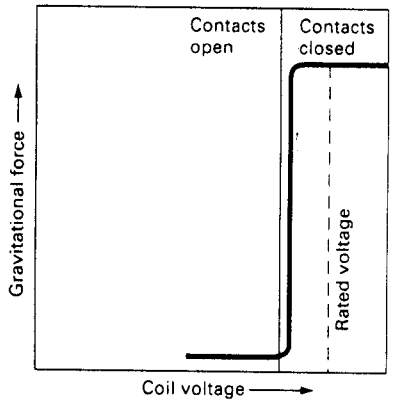


Note: No chattering occurs even if instantaneous voltage drops 65% of rated voltage.

Conventional contactors



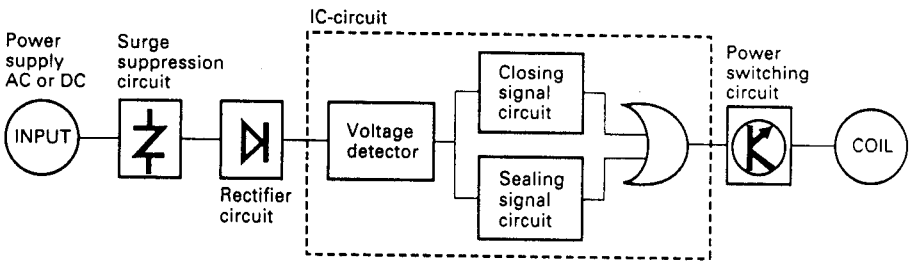
Super Magnet series



Note: Since SC series contactors are electronically controlled there is no unstable zone.

■ *OPERATION ON BOTH AC AND DC INPUTS*

The rated operational voltage range of the Super Magnet series contactors has been greatly expanded.
They operate on both AC (50/60Hz) and DC inputs.

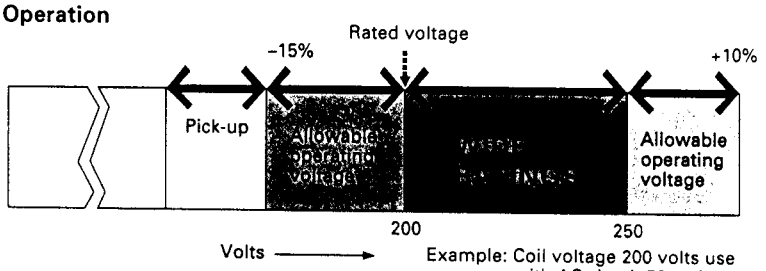


Coils (SC-4N to SC-16N)

Rated voltage	Rated coil voltage, frequency AC		DC
24V	24–25V	50/60Hz	24V
48V	48–50V	50/60Hz	48V
100V	100–127V	50/60Hz	100–110V
200V	200–250V	50/60Hz	200–220V
300V	265–347V	50/60Hz	–
400V	380–450V	50/60Hz	–
500V	460–575V	50/60Hz	–

Notes: SC-4N to 10N: 24V–575V
SC-11N to 16N: 100V–575V

Operation



Example: Coil voltage 200 volts use with AC circuit 50 or 60Hz

"ORANGE LINE" AC Contactors, AC Operated

■ *NON-REVERSING CONTACTORS* UL File No. E42419, E44592 CSA File No. LR20479

1 Phase HP Ratings		3 Phase HP Ratings				Continuous Ampere Ratings	Qty. of Auxiliary Contacts	Part Number	Fuji Type	Frame Size
120	240	200 208	220 240	440 480	550 600					
1/3	1	2	2	5	5	11	1	4NC0A0#10	SC-03	0A
1/3	1	2	2	5	5	11	1	4NC0A0#10Y	SC-03Y	0A
1/3	1	3	3	5	5	13	1	4NC0F0#10	SC-0	0F
1/3	1	3	3	5	5	13	1	4NC0F0#10Y	SC-0Y	0F
1/3	1	3	3	5	5	13	2	4NC0G0#11	SC-05	0G
1/3	1	3	3	5	5	13	2	4NC0G0#11Y	SC-05Y	0G
1	2	5	5	7 1/2	7 1/2	20	1	4NC0Q0#10	SC-4-0	0Q
1	2	5	5	10	10	20	1	4NC0R0#10	SC-4-1	0R
1	2	5	5	10	10	20	2	4NC0H0#11	SC-5-1	0H
1	2	5	5	10	10	20	2	4NC0H0#11Y	SC-5-1Y	0H

■ *REVERSING CONTACTORS* UL File No. E42419, E44592 CSA File No. LR20479

1 Phase HP Ratings		3 Phase HP Ratings				Continuous Ampere Ratings	Qty. of Auxiliary Contacts	Part Number	Fuji Type	Frame Size
120	240	200 208	220 240	440 480	550 600					
1/3	1	2	2	5	5	11	1	4ND0A0#10	SC-03RM	0A
1/3	1	2	2	5	5	11	1	4ND0A0#10Y	SC-03RMY	0A
1/3	1	3	3	5	5	13	1	4ND0F0#10	SC-0RM	0F
1/3	1	3	3	5	5	13	1	4ND0F0#10Y	SC-0RMY	0F
1/3	1	3	3	5	5	13	2	4ND0G0#11	SC-05RM	0G
1/3	1	3	3	5	5	13	2	4ND0G0#11Y	SC-05RMY	0G
1	2	5	5	7 1/2	7 1/2	20	1	4ND0Q0#10	SC-4-0RM	0Q
1	2	5	5	10	10	20	1	4ND0R0#10	SC-4-1RM	0R
1	2	5	5	10	10	20	2	4ND0H0#11	SC-5-1RM	0H
1	2	5	5	10	10	20	2	4ND0H0#11Y	SC-5-1RMY	0H

Note: The list above indicates the No. of auxiliary contacts provided per contactor.

EXPLANATION OF PART NUMBER SYSTEM

4 N C 0 A 0 # 1 0 Y

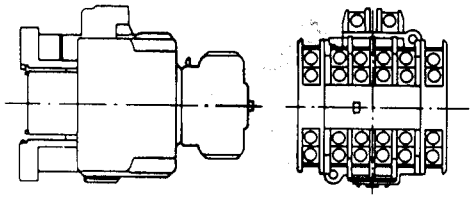
- **APPROVAL**
  4=UL Listed
  JIS Approved
- **OPERATION**
  N=AC Coil
  G=DC Coil
- **DESCRIPTION**
  C=Non-Reversing Contactor
  D=Reversing Contactor
- **FRAME SIZE**
- **FRAME ENCLOSURE**
  0=Open Frame, No Enclosure
- **COIL VOLTAGE**
  Select code from chart on next page
- **QUANTITY OF N.O. AUX. CONTACTS**
- **QUANTITY OF N.C. AUX. CONTACTS**
- **QUICK TERMINALS**
  Y=Provided
  No Mark=Not Provided
  See page 15 for details

ORANGE LINE ACCESSORIES

Description		Type
Auxiliary Contact Block	• Front mounting	
	4NO	SZ-A40†
	3NO+1NC	SZ-A31†
	2NO+2NC	SZ-A22†
	2NO	SZ-A20†
	1NO+1NC	SZ-A11†
	2NC	SZ-A02†
	1NO+1NC (Over lapping)	SZ-A111
	2NO+2NC (Over lapping)	SZ-A222
	• Right side mounting 1NO+1NC	SZ-AR
	• Left side mounting 1NO+1NC	SZ-AL

†Also available with quick terminals (Y). See page 15 for details.

Front mounting type and side mounting type auxiliary contact blocks can not be used simultaneously.



Operating Counter	• Without alarm contact	SZ-J
	• With alarm contact	
	at 1-million operations	SZ-J1
	at 2-million operations	SZ-J2
	at 3-million operations	SZ-J3
	at 4-million operations	SZ-J4
	at 5-million operations	SZ-J5
	at 6-million operations	SZ-J6
	at 7-million operations	SZ-J7
	at 8-million operations	SZ-J8
3-pole Parallel Connection Link	For 4NC0A0, 4NC0F0 4NC0G0 (2 pcs.)	SZ-SP1
	For 4NC0Q0, 4NC0R0, 4NC0H0 (2 pcs.)	SZ-SP2
Coil Drive Unit	24V DC	SZ-CD1*
Off-delay Release Unit	100V AC	SZ-DE100
	110V AC	SZ-DE110
	200V AC	SZ-DE200
	220V AC	SZ-DE220
Mechanical Latch Unit*	24V AC	SZ-V24*
	48V AC	SZ-V48*
	100V AC	SZ-V100*
	200V AC	SZ-V200*

* Not UL listed/CSA certified

Description		Type
Terminal Cover	• Contactor	
	For 4NC0A0, 4NC0F0	SZ-T1
	For 4NC0G0	SZ-T2
	For 4NC0Q0, 4NC0R0	SZ-T3
	For 4NC0H0	SZ-T4
	• Auxiliary contact block	
	For 4-pole, front mounting	SZ-T5
	For 2-pole, front mounting	SZ-T6
	For single-pole, side mounting	SZ-T7
	• Thermal overload relay	
	For 4NK0A	SZ-T12
	For 4NK0H	SZ-T13
	Base unit for separate mounting:	
	For 4NK0A	SZ-T10
	For 4NK0H	SZ-T11
Coil Surge Suppression Unit	Varistor: 24 to 48V AC	SZ-Z1
	100 to 240V AC	SZ-Z2
	380 to 440V AC	SZ-Z3
	24 to 48V AC with LED	SZ-Z6
	100 to 240V AC with LED	SZ-Z7
	CR: 24 to 48V AC	SZ-Z4
	100 to 240V AC	SZ-Z5
	24 to 48V AC with LED	SZ-Z8
	100 to 240V AC with LED	SZ-Z9
Main Circuit Surge Suppression Unit	With delta-connected CR, 100 to 240V AC	
	• Front mounting	SZ-ZM1
	• Side mounting	SZ-ZM2
Base Unit for Separate Mounting	For 4NK0A	SZ-HB
	For 4NK0H	SZ-HC
Case Cover	Non-reversing (Plastic)	SZ-JC1
	Non-reversing, with pushbuttons (Plastic)	SZ-JC2
	Reversing (Steel)	SZ-JC3
Dial Cover		SZ-DA
Trip Indicator	100 to 110V AC	SZ-L100
	200 to 220V AC	SZ-L200
Reset Release Button	Lead length: 300mm	SZ-R1
	500mm	SZ-R2
	700mm	SZ-R3
Mechanical Interlock Unit		SZ-RM
Power Connection Kit for Reversing	For 4NC0A0, 4NC0F0	SZ-RW1
	For 4NC0G0	SZ-RW2
	For 4NC0Q0, 4NC0R0	SZ-RW3
	For 4NC0H0	SZ-RW4

ORANGE LINE REPLACEMENT PARTS

■ MAIN CONTACTS

Size	Contacts	Kit Each	U.S. Catalog No.
0A	Movable	3	4NC0A-CK
	Stationary	6	
0F, 0G	Movable	3	4NC0G-CK
	Stationary	6	
0Q	Movable	3	4NC0Q-CK
	Stationary	6	
0R, 0H	Movable	3	4NC0H-CK
	Stationary	6	

■ COIL

ALL ORANGE LINE devices use the same coils.

-AC coils: 4NC0H-#MC, Replace the # with the correct coil code found on page 6

-DC coils: 4GC0H-#MC, Replace the # with the correct coil code found on page 8

Type T and TF Features

6988K

Type T and TF control transformers are manufactured in

manufacturing facility. Our .

facility has been registered to ISO 9001 by Underwriters Laboratories in the united States. This major accomplishment is just the first step in demonstrating our total commitment to quality.

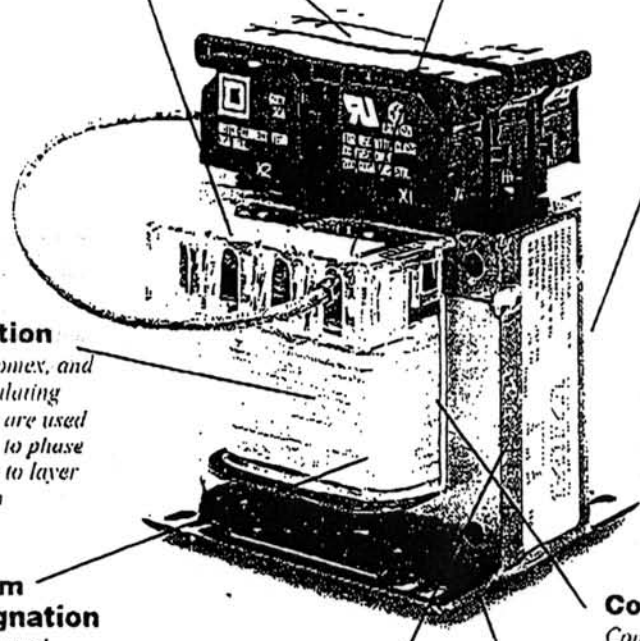
ISO 9000 is a series of standards recognized by nearly 100 countries and is used for global quality recognition. The ISO standards describe elements of quality systems that are designed to ensure that a product or service meets all requirements before it is delivered to the customer. T achieve registration, facilities must document every process they follow – from building a transformer to taking corrective action– and go through an intensive audit of these processes by an independent third party.

A2231 UL REGISTERED FIRM ISO 9001

Fingersafe covers for terminals and fuse blocks
Provide protection against electric shock and meet IEC requirements

Terminal Points
Transformers up to 1000 VA are constructed with rugged terminals and excellent isolation between primary and secondary windings.

Testing
All Type T transformers are fully tested in accordance with IEC, UL, CSA and NOM requirements.



Insulation
Mylar, Nomex, and other insulating materials are used for phase to phase and layer to layer insulation

Tri-lingual marking
Easy to read nameplates/ instructions in English, French and Spanish.

Vacuum Impregnation
Type T control transformers are vacuum impregnated with varnish, guaranteeing quiet operation, providing additional insulation turn to turn, and creating a unitized body for greater mechanical strength. They are then oven cured to seal the coils against moisture and contaminants.

Coils
Copper magnet wire coils are wound with computer controlled winding equipment to ensure pinpoint accuracy, excellent voltage regulation, and high reliability

Core
50 VA to 1000 VA transformers are uniformly welded to create a one piece transformer with low noise.

Sturdy Mounting Plates
Type T transformers can be mounted in any position and are interchangeable with many other transformers.

Type T and TF Selection

6988K

Type T

Type & Voltage Code[1]	UL VA Rating	IEC VA Rating	Dim. Acces. Code*
T50D1	50	50	T1
T75D1	75	75	T2
T100D1	100	100	T3
T150D1	150	150	T4
T200D1	200	200	T5
T250D1	250	160	T6
T300D1	300	200	T7
T350D1	350	250	T8
T500D1	500	300	T9
T750D1	750	500	T10
T1000D1	1000	630	T11

[1]Note:
The following voltage codes will have the same dimensions as their respective VA sizes from the D1 codes: D1, D2. D3, D4, D5. D12, D13. D14, D15, D23. D31, D33.

*See page six for dimensions.

Type T

Type & Voltage Code (D18,20,32)	UL VA Rating	IEC VA Rating	Dim./ Acces Code*
T50	50	50	T2
T75	75	75	T4
T100	100	100	T4
T150	150	150	T5
T200	200	200	T7
T250	250	160	T8
T300	300	200	T8
T350	350	250	T9
T500	500	300	T10
T750	750	500	T11
T1000	1000	630	N/A

Type T Field Installable Accessories

Part No.	Description	Comment
FSC-1	Finger-protected covers kit (50-200VA)	(2covers/kit, 10 kit minimum)
FSC-2	Finger-protected covers kit (250-1000VA)	(2covers/kit, 10 kit minimum)
FP-1	Fuse puller kit	(3 pullers/kit, 10 kit minimum)
SF25A*	Secondary fuse block kit (50-200VA)	Accommodates 1¼" x ¼" size fuse
SF25B*	Secondary fuse block kit (250-1000VA)	Accommodates 1¼" x ¼" size fuse
SF41A*	Secondary fuse clip kit (50-200VA)	Accommodates a midget 1½" x 13/32" size fuse
SF41B*	Secondary fuse clip kit (250-1000VA)	Accommodates a midget 1½" x 13/32" size fuse

* Can not be used when EN 60-742 must be met. Use Type TF control power transformer.

Type TF (with top mounted fuse block)

Type & Voltage Code[1]	UL VA Rating	IEC VA Rating	Dim./ Acces Code*
TF50D1	50	50	TF1
TF75D1	75	75	TF2
TF100D1	100	100	TF3
TF150D1	150	150	TF4
TF200D1	200	200	TF5
TF250D1	250	160	TF6
TF300D1	300	200	TF7
TF350D1	350	250	TF8
TF500D1	500	300	TF9
TF750D1	750	500	TF10
TF1000D1	1000	630	TF11

[1]Note:
The following voltage codes will have the same dimensions as their respective VA sizes from the D1 codes: D1, D2. D3, D4, D5. D12, D13. D14, D15, D23. D31, D33.

*See page six for dimensions.

Type TF (with top mounted fuse block)

Type & Voltage Code (D18,20,32)	UL VA Rating	IEC VA Rating	Dim./ Acces Code*
TF50	50	50	TF2
TF75	75	75	TF4
TF100	100	100	TF4
TF150	150	150	TF5
TF200	200	200	TF7
TF250	250	160	TF8
TF300	300	200	TF8
TF350	350	250	TF9
TF500	500	300	TF10
TF750	750	500	TF11
TF1000	1000	630	N/A

6988K

Type T and TF Fuse Selection

Recommended Fuse Sizes for The Primary (Use class CC time delay fuses)

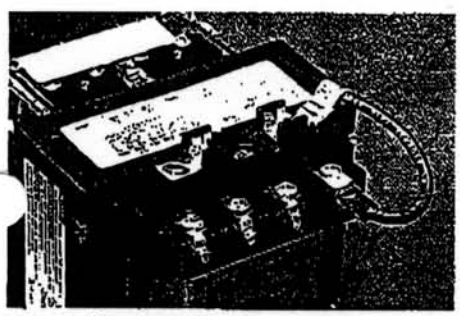
VA	120 Volts Primary Current (Amps)	120 Volts Fuse Rating	240 Volts Primary Current (Amps)	240 Volts Fuse Rating	480Volts Primary Current (Amps)	480Volts Fuse Rating	600 Volts Primary Current (Amps)	600 Volts Fuse Rating
50VA	.41	1	.21	1/2	.10	3/10	.08	3/10
75VA	.63	1 1/2	.31	6/10	.16	3/10	.13	3/10
100VA	.83	2	.42	1	.21	1/2	.17	4/10
150VA	1.25	3	.63	1 1/2	.31	6/10	.25	6/10
200VA	1.67	4	.83	2	.42	1	.33	8/10
250VA	2.08	3 3/10	1.04	2 1/2	.52	1 1/4	.42	1
300VA	2.50	6 1/4	1.25	3	.63	1 1/2	.50	1 1/8
350VA	2.92	7	1.46	3 1/2	.73	1 8/10	.58	1 4/10
500VA	4.17	10	2.08	3 3/10	1.04	2 1/2	.83	2
750VA	–	–	3.13	5	1.56	3 1/2	1.25	3
1000VA	–	–	4.17	6 1/4	2.08	3 3/10	1.67	4

Note:1) Fuse sizing in tables satisfies NEC requirements (Art. 450-3) for primary and secondary control circuit protection. 2) For motor control (MCCs) applications with primary current rated 2 anps or less, NEC article 430-72 (b) allows primary fuses to be sized at or less than 500% of rated primary current.

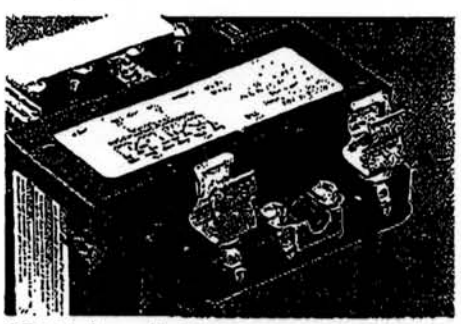
Recommended Fuse Sizes for The Secondary (Use 1 1/2" x 13/32" fuses)

VA	24 Volts Fuse Amps	24 Volts Secondary Current Rating	120 Volts Fuse Amps	120 Volts Secondary Current Rating	240Volts Fuse Amps	240Volts Secondary Current Rating
50VA	2.08	3	.42	6/10	.21	3/10
75VA	3.13	5	.63	1	.31	1/2
100VA	4.17	6	.83	1 1/4	.42	6/10
150VA	6.25	10	1.25	2	.63	1
200VA	8.33	12	1.67	2 1/2	.83	1 1/4
250VA	10.42	15	2.08	3	1.04	1 3/4
300VA	12.50	20	2.50	4	1.25	2
350VA	14.58	20	2.92	5	1.46	2 1/2
500VA	20.83	30	4.17	7	2.08	3
750VA	–	–	6.25	10	3.13	5
1000VA	–	–	8.33	12	4.17	7

Note:Fuse sizing in tables satisfies NEC requirements (Art.450-3) for primary and secondary circuit protection



SF25A fuse block kit to accomodate 1 1/4" x 1/4" fuse.



SF41A fuse clip kit to accomodate 1 1/2" x 13/32" fuse

6988K

Type T and TF Selection

Voltage Code	Primary-Secondary Voltage
D1	220/440-110
	230/460-115
	240/480-120
D2	240/480-24
D3	208-120
D4	277-120
D5	550-110
	575-115
	600-120
D6	380-110
D8*	220-110
	230-115
	240-120
D9*	440-110
	460-115
	480-120
D12	440-220
	460-230
	480-240
D13	120-12/24
D14	208-24
D15	240/480-24/120
D16	600-24
D17	415-110
D18	208/277/380-95/115
D19	208/240/277/380/480-24
D20	208/230/460-115
D22	480-277
D23	120/240-24
D24	110-110
	115-115
	120-120
D25	277-24
D26	208/240/416/480-120
D27	208/240/480-120
D31	220/440-110/220
	230/460-115/230
	240/480-120/240
D32	220/440/550-90/110
	230/460575-95/115
	240/480/600-100/120
D33	380/400/415-115/230
D34	208/480/575-120
D35	208/230/380/440/460-110/115
D36	600-12/24
D37	600-120/240
D38	240/480-12
D39	208/380/416-95/115
D40	208/240/380/416/480-120
D41	208/230/400/440/460-110/115

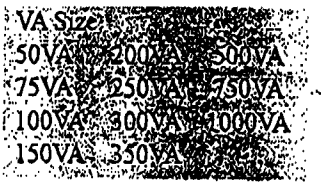
*Use codes D8 and D9 on transformers with leads only. On other requests with these voltages, please use the stocked code D1.

Ordering Information

Example: Class 9070, Type T, F, 50, D1

Type T Control Transformer

With top mounted fuse block



Regulation

Class 9070 transformers are designed with low impedance windings for excellent voltage regulation. This allows Class 9070 transformers to accommodate the high momentary inrush current caused when electromechanical devices such as contactors, relays and solenoids are energized. The secondary voltage drop between no load and momentary overload is low, helping to assure satisfactory operation of magnetic components.

Selection Guide

1. Determine inrush and sealed VA of each coil in the control circuit
2. Total the sealed VA of all coils
3. Total the inrush VA of all coils at 100% secondary voltage. Add this value to the total sealed VA present (if any) when inrush occurs.
4. If the supply voltage is stable and varies no more than ±5%, refer to the 90% secondary voltage column. If the voltage varies as much as ±10%, use the 95% voltage column.
5. Using the regulation chart, select a transformer.

(A) With a continuous VA rating equal to or greater than the value obtained in step 2

(B) With a maximum inrush VA equal to or greater than the value obtained in step 3

Regulation Chart

Inrush VA @ 30% power factor

	95% SECONDARY VOLTAGE			90% SECONDARY VOLTAGE			85% SECONDARY VOLTAGE		
VA	TYPE E	TYPE K	TYPE T	TYPE E	TYPE K	TYPE T	TYPE E	TYPE K	TYPE T
25	72	N/A	N/A	109	N/A	N/A	131	N/A	N/A
50	171	161	161	235	221	221	299	281	281
75	327	244	244	390	337	337	554	437	437
100	382	307	307	553	440	440	722	575	575
150	468	521	521	735	765	765	997	1014	1014
200	1065	1065	759	1538	1538	1060	2163	2163	1369
250	1290	1290	1190	1949	1949	1660	2680	2680	2120
300	1700	1237	1335	2489	1775	1845	3384	2299	2350
350	2500	1480	1610	4115	2104	2270	5393	2712	2910
500	3600	1836	2650	4836	2651	3500	6900	3441	4340
750	6250	3482	3270	8583	5042	4895	13183	6564	6530
1000	8750	4244	5350	13275	6345	7675	19462	8388	9935
1500	16500	10023	N/A	22863	14735	N/A	35378	19304	N/A
2000	24300	12744	N/A	36688	19202	N/A	54737	25450	N/A
3000	28900	18176	N/A	44789	28096	N/A	98007	37797	N/A
5000	78500	29868	N/A	116406	48349	N/A	187579	66541	N/A

* NEMA standards require magnetic devices to operate at 85% of rated voltage. Regulation data calculated at the maximum rated temperature conditions.

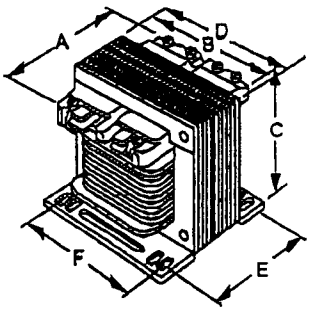
Type T and TF Dimensions

6988K

Type T

Type & Voltage Code	A	B	C	D*	E	F	Terminal covers	Slot	Wt. (lbs)
T1	3.09	3.00	2.58	3.84	2.00	2.50	FSC-1	.20 x .38	2.6
T2	3.34	3.38	2.89	4.09	2.38	2.81	FSC-1	.20 x .48	3.6
T3	3.34	3.38	2.89	4.09	2.38	2.81	FSC-1	.20 x .48	3.6
T4	3.59	3.75	3.20	4.34	2.88	3.13	FSC-1	.20 x .38	5.1
T5	3.59	3.75	3.20	4.34	2.88	3.13	FSC-1	.20 x .38	5.1
T6	5.25	3.75	3.25	6.05	2.88	3.13	FSC-2	.20 x .38	7.3
T7	4.70	4.50	3.80	5.50	2.56	3.75	FSC-2	.20 x .38	8.6
T8	5.09	4.50	3.80	5.89	3.00	3.75	FSC-2	.20 x .38	9.9
T9	5.46	4.50	3.80	6.26	3.56	3.75	FSC-2	.20 x .38	11.5
T10	5.66	5.25	4.43	6.46	3.43	4.38	FSC-2	.28 x .56	16.9
T11	6.04	5.25	4.43	6.84	4.31	4.38	FSC-2	.28 x .56	19.3

*Width dimensions with fingersafe covers on.



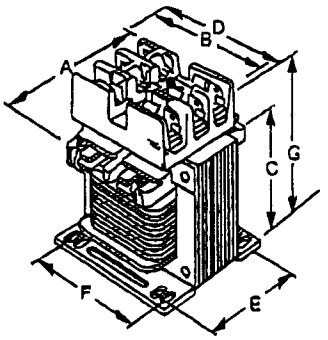
Type TF

Type Voltage Code	A	B	C	D*	E	F	G**	Terminal covers	Slot	Wt. (lbs)
TF1	3.09	3.00	4.00	3.84	2.00	2.50	4.20	FSC-1	.20 x .38	2.9
TF2	3.34	3.38	4.25	4.09	2.38	2.81	4.45	FSC-1	.20 x .48	3.9
TF3	3.34	3.38	4.25	4.09	2.38	2.81	4.45	FSC-1	.20 x .48	3.9
TF4	3.59	3.75	4.55	4.34	2.88	3.13	4.75	FSC-1	.20 x .38	5.4
TF5	3.59	3.75	4.55	4.34	2.88	3.13	4.75	FSC-1	.20 x .38	5.4
TF6	5.25	3.75	4.55	6.05	2.88	3.13	4.75	FSC-2	.20 x .38	7.6
TF7	4.70	4.50	5.10	5.50	2.56	3.75	5.30	FSC-2	.20 x .38	8.9
TF8	5.09	4.50	5.10	5.89	3.00	3.75	5.30	FSC-2	.20 x .38	10.2
TF9	5.46	4.50	5.10	6.26	3.56	3.75	5.30	FSC-2	.20 x .38	11.8
TF10	5.66	5.25	5.73	6.46	3.43	4.38	5.93	FSC-2	.28 x .56	17.2
TF11	6.04	5.25	5.73	6.84	4.31	4.38	5.93	FSC-2	.28 x .56	19.6

*Width dimensions with fingersafe covers on.

**Height dimensions with Fingersafe covers on.

K-54

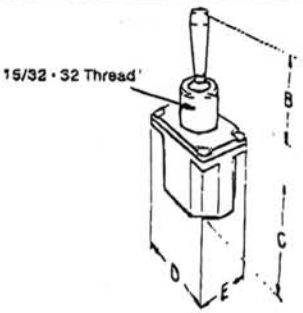


SWITCH SEALED TOGGLE AND ROC

8002K

TABLE II. TOGGLE SERIES DIMENSIONS

No. of Poles	APPROXIMATE DIMENSION INCHES A	C Screw Terminals	C Solder Terminals	C Spade Terminals	D	E
1	.468	1.30	1.28	1.43	1.25	.6
2	.468	1.34	1.32	1.47	1.32	.9
3	.468	1.34	1.32	1.47	1.32	1.6



TOGGLE SWITCH SELECTION TABLE

STANDARD LEVER	LEVER LOCK	DESIGNER LINE

Lever Style

Shape	"B" In.	Color
	0.859	
	0.893	
	0.893	

Color: White, Red, Black

ONE POLE

8530 One Pole

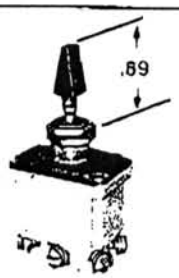
8536 One Pole

8533 One Pole

TWO POLE

8531 Two Pole

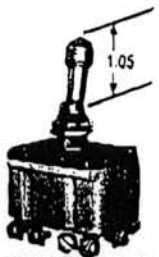
8537 Two Pole



8534 Two Pole

FOUR POLE

8532 Four Pole



8538 Four Pole

8535 Four Pole

TABLE V. LEVER LOCKING CONFIGURATION CODES

STYLE A	STYLE B	STYLE D	STYLE E	STYLE F	STYLE G	STYLE H
Locked In Three Positions	Locked In Center and In Keyway Side	Locked Out of Center Position	Locked In Center Position	Locked In Side Opposite Keyway	Locked In Keyway Side	Locked Out Center and Keyway Sid
STYLE J	STYLE K	STYLE L	STYLE M	STYLE N	STYLE P	
Locked Out of	Locked In Center		Locked Out of			Figures A th P do not repre details of constructio They schemati

CLIPPER FOOT SWITCH

IP20

The rugged, long life Clipper switch models have proved themselves in the field over many years of usage. All maintained models offer "Push On-Push Off" action through a molded nylon actuating cam mechanism that insures long trouble-free performance. The wide treadle models offer a large seven inch target for the operator's foot. Cast iron housing. Nonskid base pad. Complete with adjustable strain relief connector. Black finish.

Size: 4½" x 3⅛" x 1½" Weight: 2¼ lbs.

The Clipper Twin consists of two SPDT or two DPDT switches mounted on a heavy steel base plate with nonskid pad. Divider bar between pedals helps prevent accidental operation of both pedals at one time. A tube between the two switches conceals all internal wiring between them. A conduit opening with strain relief connector is provided in the right switch.

Size: 8⅜" x 4½" x 1½" Weight: 5 lbs.

NOTE: VDC Rated Magnetic Blowout Models – For maximum life use polarized connections. Connect common terminal to negative polarity and N.O. or N.C. or both to positive polarity.

Model 638-S features a cast aluminum housing painted Alert Orange with a splash resistant interior switch.

WIDE TREADLE

TWIN with DIVIDER BAR

FULL GUARD 522-B14 (4 lbs.) (supplied separately)

FULL TWIN GUARD 522-B12 (7 lbs.) (supplied separately)

SEE PAGE 2 BOLD COPY INDICATES STOCK ITEM

SPECIFICATIONS (Special variations are available to the O.E.M. on special order on the models listed below)

REGULAR	WIDE TREADLE	DESCRIPTION	CIRCUIT	ELECTRICAL RATINGS
632-S	642-S	Momentary	SPDT	20 A 125-250 VAC 1 H.P. 125-250 VAC
632-SC3*		Momentary	SPST Wired N.O.	15 A 125 VAC ¾ H.P. 125 VAC
633-S	643-S	Momentary	SPDT DBT	20 A 125-250 VAC ¾ H.P. 125 VAC 1 H.P. 250 VAC
635-S	645-S	Momentary	DPDT	15 A 125 VAC 10 A 250 VAC ½ H.P. 125-250 VAC
636-S	646-S	Two Stage Momentary	Each Stage SPDT	15 A 125 VAC 10 A 250 VAC ½ H.P. 125-250 VAC
632-D	642-D	Maintained	SPDT	20 A 125-250 VAC 1 H.P. 125-250 VAC
634-DA		Maintained	DPDT	10 A 125-250 VAC ½ H.P. 125 VAC ¼ H.P. 250 VAC
TWIN 632-S		Momentary	Each Side SPDT	20 A 125-250 VAC 1 H.P. 125-250 VAC
TWIN 635-S		Momentary	Each Side DPDT	15 A 125 VAC 10 A 250 VAC ½ H.P. 125-250 VAC
638-S		Momentary	SPDT	10 A 125-250 VAC ½ H.P. 125-250 VAC
CE 638-SC38** (IP21)		Momentary	SPST Wired N.O.	

CE MARKING – see note on page 2.

*Supplied with 8 ft. 14/3 cord and 3 prong series plug. Green lead grounded. **Supplied with 8 ft. 16/3 cord , wired N.O. with green lead grounded.

TDB Double Break models must be wired to equal voltage sources and the same polarity. The loads should be on the same sides of the line.

Hydraulic Parts List

Item	Part Number	Description
1	AP100/3.5D	Gear Pump
2	½" x ⅛" x 1⅛" x ¼	Mechanical Coupling Set
3	2-42-2AA-S	Pump/Motor Adapter Bracket
4	LM13667	Electrical Motor
5	PBRWA003500-N	Adjustable Relief Valve
6	CB2.5-901-3000	Liquid Filled Pressure Gauge
7	CBV30060001M	Diverter Valve
8	FFG2002T	Speed Control Valve
9	OCP-G01-W-E21	Pilot Operated Check Valve
10	OTH-01-85-E10	Bolt Kit
11	SS-G01-C7Y-R-C115-E30	Directional Control Valve
12	10052	Two Station Series Manifold
13	MPS-100-P10A	Return Line 10Micron Filter
14	Rhi-3	3 Gallon Reservoir

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WWW.ROYALHYDRAULICS.COM INFO@ROYALHYDRAULICS.COM

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"PRACTICAL MOTION CONTROL TECHNOLOGIES"

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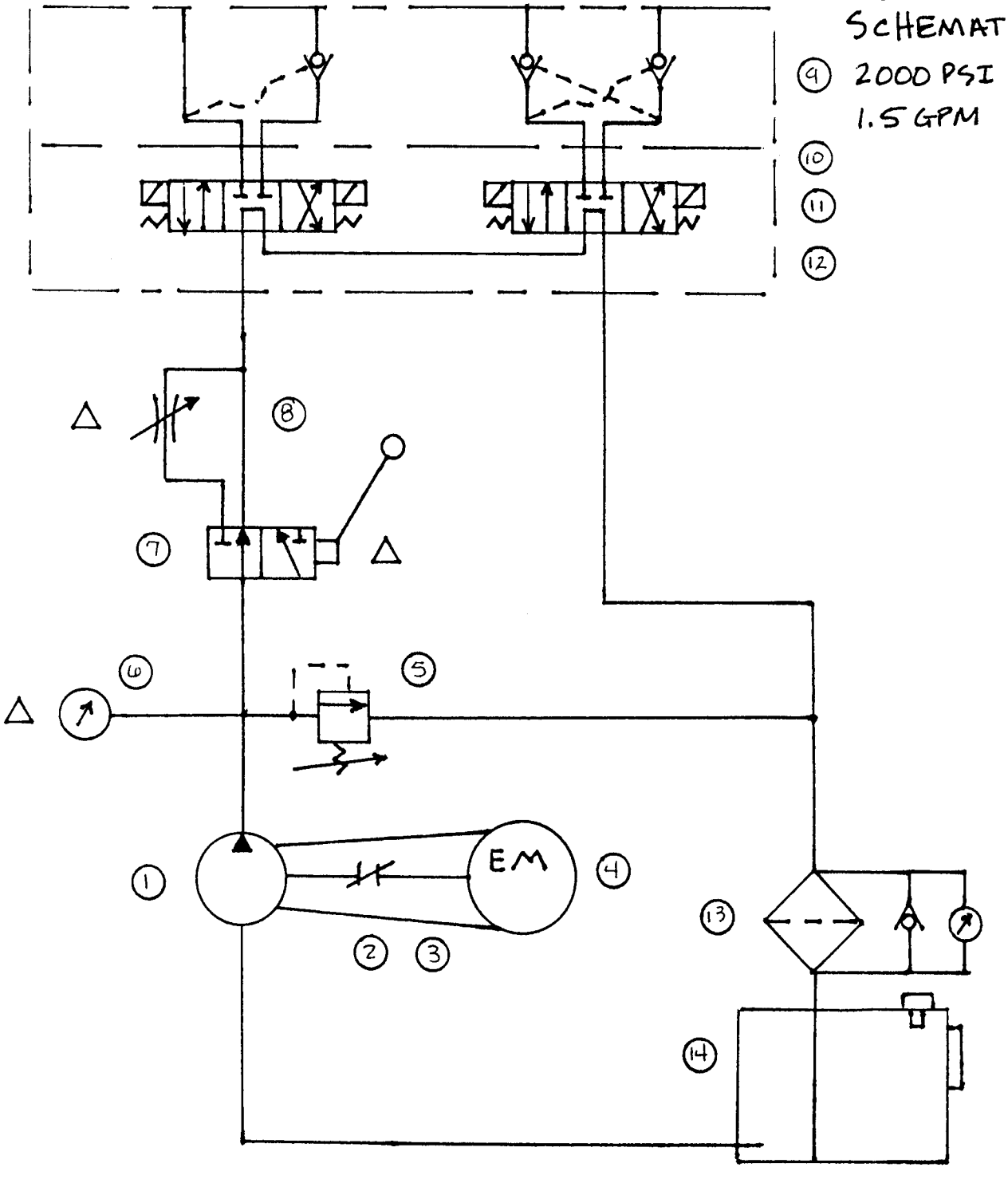
2000 PSI
1.5 GPM



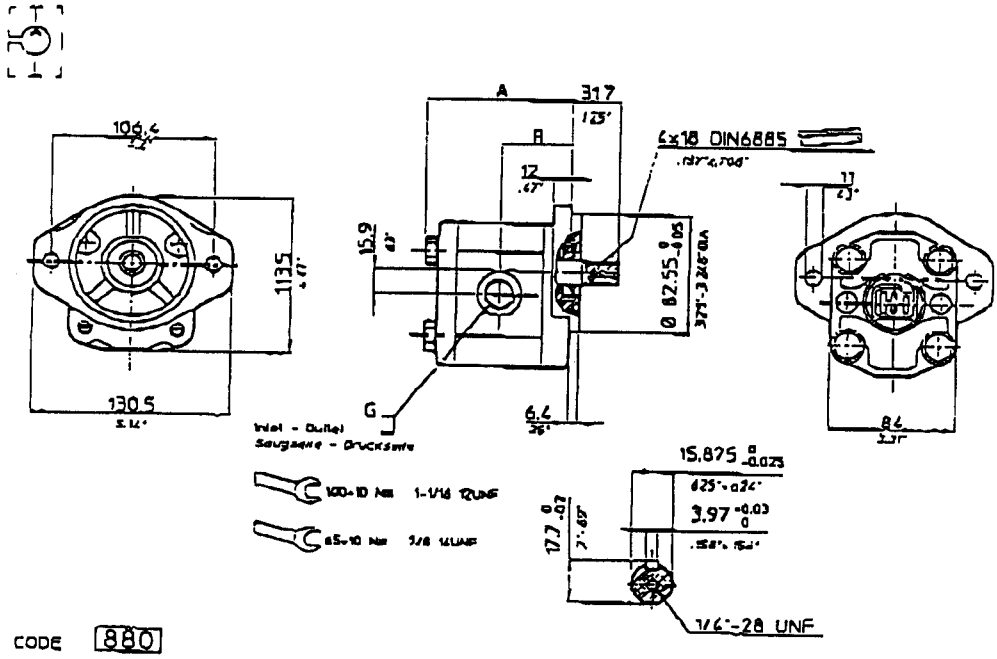
NACHI AMERICA INC.
HYDRAULIC DIVISION

NEW PRODUCT RELEASE BULLETIN

EXTERNAL GEAR PUMPS

Features:

- **93% volumetric efficiency**
- **90% mechanical efficiency**
- **Clockwise rotation**
- **SAE "A" mounting**



CODE 880

PART #	DISPLACEMENT CI/REV	FLOW @ 0 PSI 1740 RPM	INLET	OUTLET	A	B	PRESSURE RATING
AP200/6.5D	0.39	2.93	#12 SAE	#10 SAE	3.23"	1.55"	3150 PSI
AP200/11D	0.67	5.04	#12 SAE	#10 SAE	3.9"	1.87"	3000 PSI
AP200/15D	0.91	6.85	#12 SAE	#10 SAE	3.9"	1.87"	3000 PSI
AP200/19D	1.16	8.73	#12 SAE	#10 SAE	4.35"	2.11"	3000 PSI
AP200/22D	1.34	10.09	#12 SAE	#10 SAE	4.53"	2.18"	2900 PSI
AP200/26D	1.59	11.97	#12 SAE	#10 SAE	4.53"	2.18"	2700 PSI

Model PM 90 - Standard Bore - Keyway Sizes (Per AGMA Class 1, Clearance Fit)

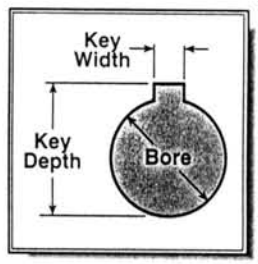
Part Number	Bore & Keyway Combinations	Bore Size**	Key Width	Key Depth	Set Screw	
					Size	Quantity
P090014N	7/16 x No.Key	.4375 / .4385	No Keyway	-	1/4 - 20 UNC	1
P09001403	7/16 x 3/32	.4375 / .4385	.0938 / .0958	.484 / .495	1/4 - 20 UNC	1
P09001404	7/16 x 1/8	.4375 / .4385	.125 / .127	.496 / .507	1/4 - 20 UNC	2
P09001604	1/2 x 1/8	.500 / .501	.125 / .127	.560 / .571	1/4 - 20 UNC	2
P09001804	9/16 x 1/8	.5625 / .5635	.125 / .127	.623 / .634	1/4 - 20 UNC	2
P09002005	5/8 x 5/32	.625 / .626	.1562 / .1582	.698 / .709	1/4 - 20 UNC	2
P09002006	5/8 x 3/16	.625 / .626	.1875 / .1895	.709 / .720	1/4 - 20 UNC	2
P09002206	11/16 x 3/16	.6875 / .6885	.1875 / .1895	.773 / .784	1/4 - 20 UNC	2
P09002404	3/4 x 1/8	.750 / .751	.125 / .127	.812 / .823	1/4 - 20 UNC	2
P09002406	3/4 x 3/16	.750 / .751	.1875 / .1895	.837 / .848	1/4 - 20 UNC	2
P09002806	7/8 x 3/16	.875 / .876	.1875 / .1895	.964 / .975	1/4 - 20 UNC	2
P09002808	7/8 x 1/4	.875 / .876	.250 / .252	.982 / .993	1/4 - 20 UNC	2
P090010006	1 x 3/16	1.000 / 1.001	.1875 / .1895	1.090 / 1.101	1/4 - 20 UNC	2
P090010008	1 x 1/4	1.000 / 1.001	.250 / .252	1.114 / 1.125	1/4 - 20 UNC	2
P090010408	1 1/8 x 1/4	1.125 / 1.126	.250 / .252	1.241 / 1.252	1/4 - 20 UNC	2

*Shaded combinations are Semi-special - See price sheet

**Other Bore/Keyway combinations available. Consult factory for quotation.

Model PM 90 Bore Tolerances

Features	Tolerance
Bore	-.000 / +.001
Key Width	-.000 / +.002
Key Depth	+.005 / +.016



As with Magnaloy's standard line of couplings, insert elastomer selection allows variable performance characteristics. Insert design eliminates metal-to-metal contact and assures electrical isolation of shafts.

Nitrile, 70A Durometer.....
Standard elastomer material offering excellent resistance to petroleum products and superior compression set characteristics.

Urethane, 90A Durometer....
Excellent mechanical and physical properties. Note: Urethane material tends to soften when exposed to elevated temperatures or humid conditions

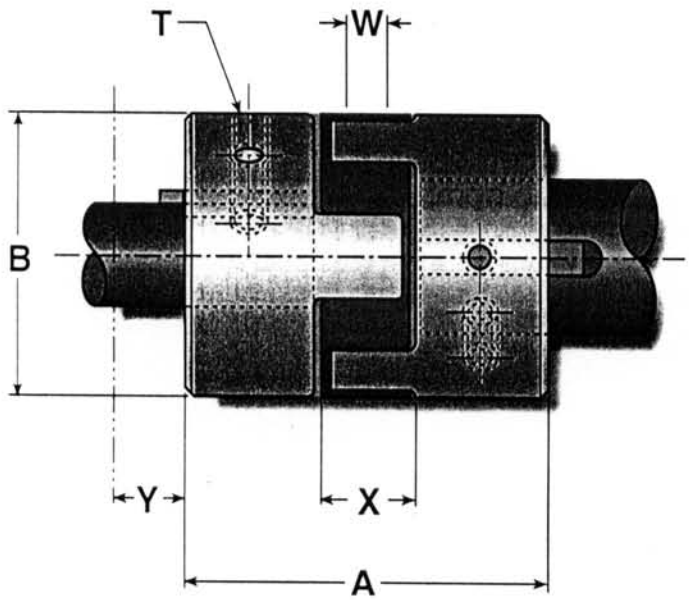
Hytrel, 50D Durometer....
Superior mechanical and physical properties and offer excellent fluid compatibility and high temperature characteristics.

Additional insert materials available upon request from factory.
See page 8 for additional information on insert selection.

Model PM 90 Performance Specifications

Maximum Bore	Minimum Bore	Insert Number	Torque Rating (in.lb.)	HP Rating Per 100 RPM	Torsional Rigidity (in.lb./deg.)	Complete Coupling Approx. Weight (lb)		Wr^2 (lb. Ft.^{2}) (Solid)
						Solid	Max. Bore	
1-1/8	7/16	P097N7	224	0.36	38.3	1.8	1.3	0.946
		P090U9	336	0.54	69.9			
		P090H5	672	1.08	158.7			

Model PM 90 Dimensional Specifications



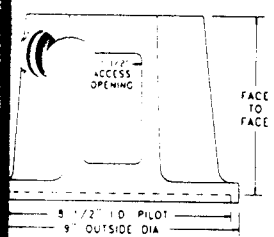
A - Over all length (Assembled) - 2.78
B - Outside Diameter - 2.125
T - Set Screw 1/4 -20 UNC, 2 places
W - Distance between shaft ends 3/16 min.
X - Distance between shaft ends 3/4 max.
Y - Hub movement required for insert removal (1.20 total)

Notes

magnaloy coupling company P.O. Box 455 Alpena, MI 49707 517-356-2186
A Division of Douville Johnston Corporation Fax: 517-354-4190 http://www.magnaloy.com

ADAPTERS FOR ELECTRIC C-FACE MOTORS

n adapter cover for
e access opening is
vailable for these
odels at a list price of
3.50. To order a
over use part# AC-13

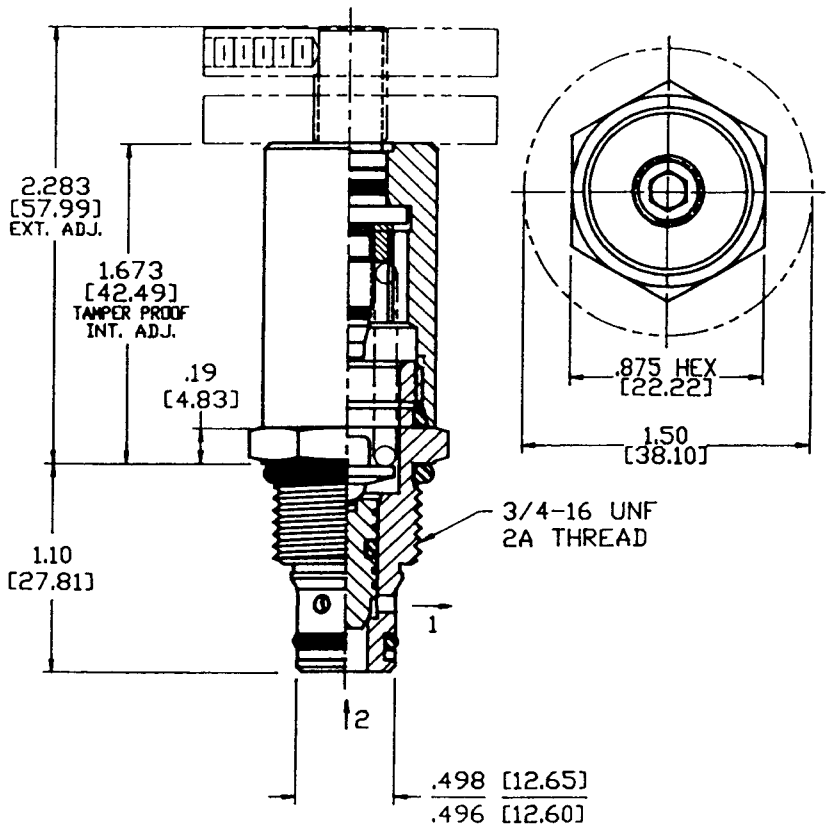


Electric Motor Data NEMA C-Face Motor Shaft Frame No.	Length	Adapter Inside Clearance	Face to Face Length *	Pump Designation From Pg.	Model Number	List Price**
		3 5/8"	3 3/4"	SAE-AA-2 BOLT SAE-AA-4 BOLT SAE-A-2 BOLT	2-36-2AA-S 2-36-4AA-S 2-36-2A-S	$76.96
			4 1/4"	SAE-AA-2 BOLT SAE-AA-4 BOLT SAE-A-2 BOLT	2-42-2AA-S 2-42-4AA-S 2-42-2A-S	
			4 5/8"	SAE-AA-2 BOLT SAE-AA-4 BOLT SAE-A-2 BOLT	2-45-2AA-S 2-45-4AA-S 2-45-2A-S	
			5 1/4"	SAE-AA-2 BOLT SAE-AA-4 BOLT SAE-A-2 BOLT	2-52-2AA-S 2-52-4AA-S 2-52-2A-S	
			5 13/16"	SAE-A-2 BOLT	2-57-2A-S	
			6 5/8"	SAE-A-2 BOLT	2-65-2A-S	$80.36
182 - 184 TC 213 - 215 TC 254 - 256 TC	2 5/8" 3 1/8" 3 3/4"	5"	5 13/16"	SAE-B-2 BOLT SAE-C-2 BOLT SAE-A-4 BOLT SAE-B-4 BOLT	2-57-2B-S 2-57-2C-S 2-57-4A-S 2-57-4B-S	$87.72
			6 5/8"	SAE-B-2 BOLT SAE-C-2 BOLT SAE-A-4 BOLT SAE-B-4 BOLT	2-65-2B-S 2-65-2C-S 2-65-4A-S 2-65-4B-S	$92.62
			7 1/8"	SAE-A-2 BOLT SAE-B-2 BOLT SAE-C-2 BOLT SAE-A-4 BOLT SAE-B-4 BOLT	2-71-2A-S 2-71-2B-S 2-71-2C-S 2-71-4A-S 2-71-4B-S	$99.96
			7 5/8"	SAE-A-2 BOLT SAE-B-2 BOLT SAE-C-2 BOLT SAE-A-4 BOLT SAE-B-4 BOLT	2-75-2A-S 2-75-2B-S 2-75-2C-S 2-75-4A-S 2-75-4B-S	$101.96
		4 3/4"	5 1/4"	SAE-A-4 BOLT SAE-B-4 BOLT SAE-C-4 BOLT SPECIAL	2-52-M4A-S 2-52-M4B-S 2-52-M4C-S 2-52**-S	$106.34
			6 5/8"	SAE-B-4 BOLT SAE-C-4 BOLT SPECIAL	2-65-M4B-S 2-65-M4C-S 2-65**-S	$112.22
			7 5/8"	SAE-B-4 BOLT SAE-C-4 BOLT	2-75-M4B-S 2-75-M4C-S	$114.66

*** Note: Motor shaft length plus coupling spider width plus pump shaft length equals Face to Face length.**

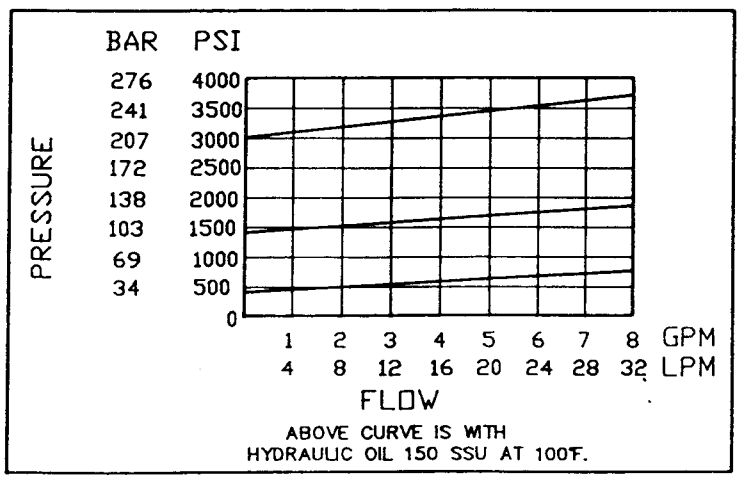
OTE: Due to product
nprovement, specifications
nd price are subject to
hange without notice.

*All List Prices are in US
urrency and all shipments are
OB from factory.



VALVE SPECIFICATIONS

Nominal Flow	8 GPM (30 LTR/M)
Max. Operating Pressure	3500 PSI (240 bar)
Viscosity Range	36 SSU (3CSC) to 3000 SSU (647CSC)
Filtration	30 micron nominal
Media Operating Temp. Range	−35°F (−37.2°C) to 200°F (93.3°C)
Seals	Buna-N O-rings, standard
Cavity Form Tool No.	40500005
Options	See Option Data
Valve Body Data	See Body Data
Weight	4.80 oz. (.136 kg)
Design	Direct Acting Poppet Valve
Operating Fluid Media	All General Purpose Hydraulic Fluid
Cartridge torque requirements	30 Ft. Lbs. at 3000 psi



NOTE: DIMENSIONS IN BRACKETS ARE MILLIMETERS

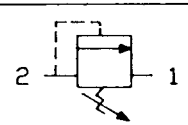
MODEL NUMBER: PB-RWA-00

PAGE 2.152

DELTA POWER COMPANY
ROCKFORD, ILLINOIS

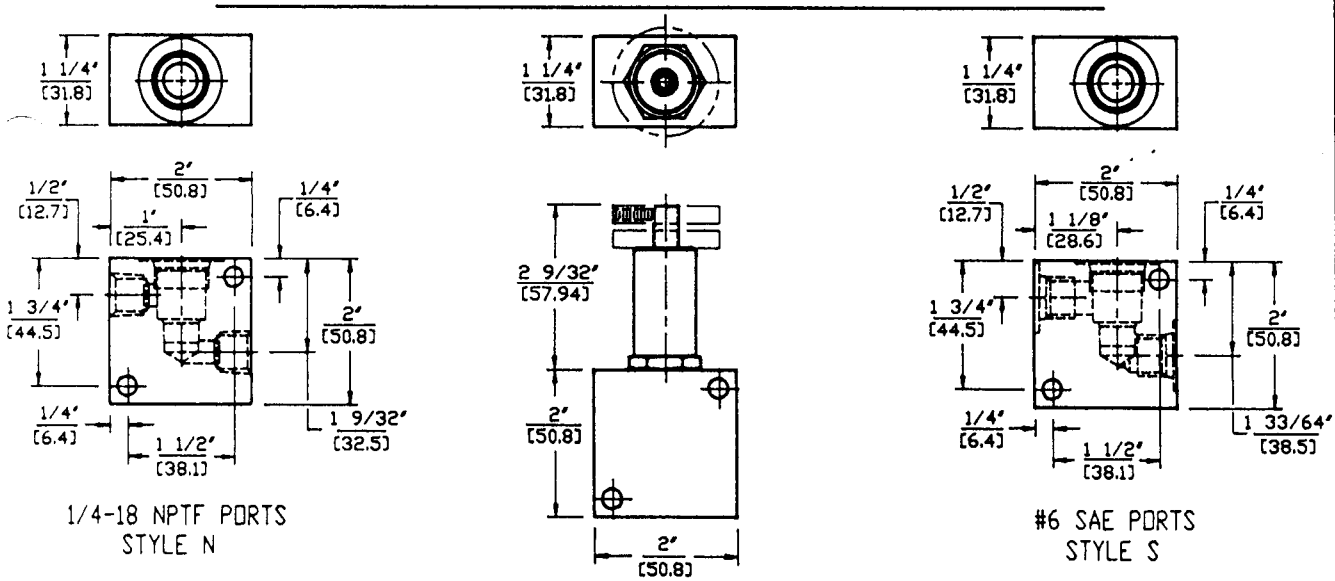
DESCRIPTION: POWER SERIES DIRECT ACTING RELIEF VALVE

RELEASE DATE: DECEMBER 1995 REV D



SYMBOL

STANDARD VALVE BODY DATA: B SERIES



1/4-18 NPTF PORTS
STYLE N

#6 SAE PORTS
STYLE S

NOTE: ALL MOUNTING HOLES .281 DIA.

FOR DETAILED CAVITY INFORMATION USE DRAWING 40200005

BODY WEIGHT: .40 lbs./.18 Kg.

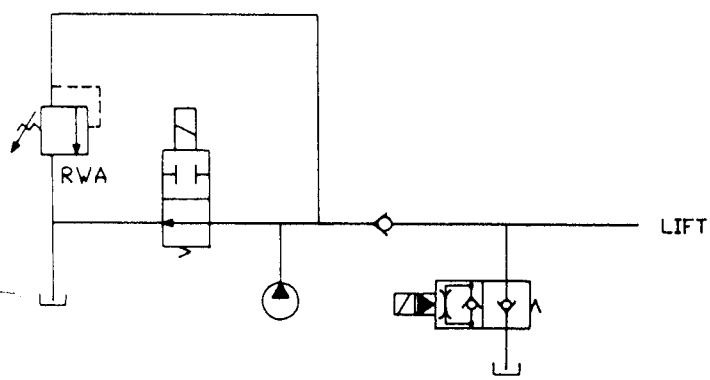
WHEN ORDERING
FILL IN ALL BOXES

ORDERING INFORMATION

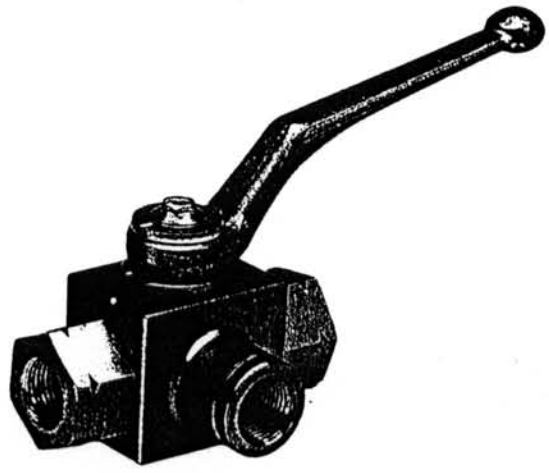
PB-RWA-**-****-*
1 2 3 4

1: BASIC MODEL NO.	2: OPTIONS	3: Pressure Range/Setting	4: BODY
3/4 - 16 Thd., Direct Acting Relief Valve.	00 -External Adj. W/Locknut Buna V0 -External Adj. W/Locknut Viton 0K -Buna & Knob VK -Viton & Knob 0I -Internally Adj. Buna VI -Internally Adj. Viton 0T -Tamper Proof Buna VT -Tamper Proof Viton	**Ext./Int. Adjustable** 1000 - 100-1000 psi 3000 - 500-3500 psi **Tamper Proof** Fill In 4 Digit Pressure Setting Example: 0500 = 500 psi	* = WITHOUT BODY N =1/4" NPT S =#6 SAE

TYPICAL SCHEMATIC



TYPICAL APPLICATION FOR THIS VALVE IS TO PROTECT PUMP AND SYSTEM.



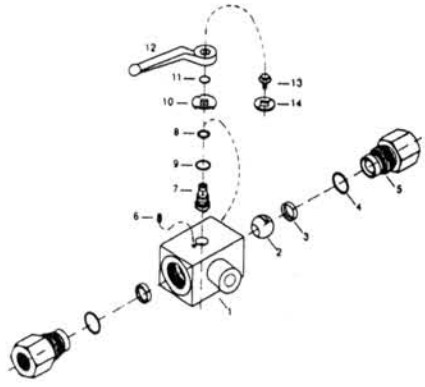
SPECIFICATIONS

- 1/8"– 2" NPT and SAE Connections
- Delrin +MoS_2 Ball Seats
- Viton O-Rings
- Pressure Range: Up to 4500 PSI (300 bar)
- Carbon Steel Construction
- Yellow Chromated Zinc Plating Finish
- Temperature Range: –30°F to 212°F (–34°C to 100°C)

OPTIONS

- Stainless Steel Construction

TECHNICAL INFORMATION



Item Number	Quantity	Description
1	1	Body
2	1	Ball
3*	2	Seat
4*	2	Connector O-Ring
5	2	Connector
6	1	Stop Pin
7	1	Stem
8*	1	Thrust Ring
9*	1	Stem O-Ring
10	1	Cam Plate
11	1	Snap Ring
12	1	Handle
13	1	Stem Screw
14	1	Flow Indicator

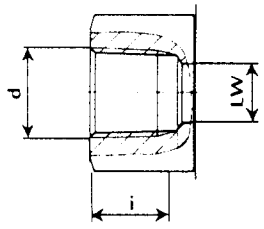
*Included in Seal Kit

SIZE		PART NUMBER	MAXIMUM WORKING PRESSURE	*ACTUATOR CODE	
				EDA	ESA
1/8"	NPT	CBV30020001R	4500 PSI	A	B
	SAE	**			
1/4"	NPT	CBV30040001M	4500 PSI	A	B
	SAE	**			
3/8"	NPT	CBV30060001M	4500 PSI	A	B
	SAE	**			
1/2"	NPT	CBV30080001M	4500 PSI	A	B
	SAE	CBV31080001M	4500 PSI	A	B
3/4"	NPT	CBV30120001M	3600 PSI	C	C
	SAE	CBV31120001M	3600 PSI	C	C
1"	NPT	CBV30160001M	3600 PSI	C	C
	SAE	CBV31160001M	3600 PSI	C	C
1 1/4"	NPT	CBV30200001M	2300 PSI	C	C
	SAE	**			
1 1/2"	NPT	CBV30240001M	2300 PSI	C	C
	SAE	**			
2"	NPT	CBV30320001M	2300 PSI	C	C
	SAE	**			

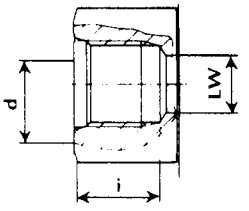
* See Actuator Code on Page 204.
** Contact Factory for Availability

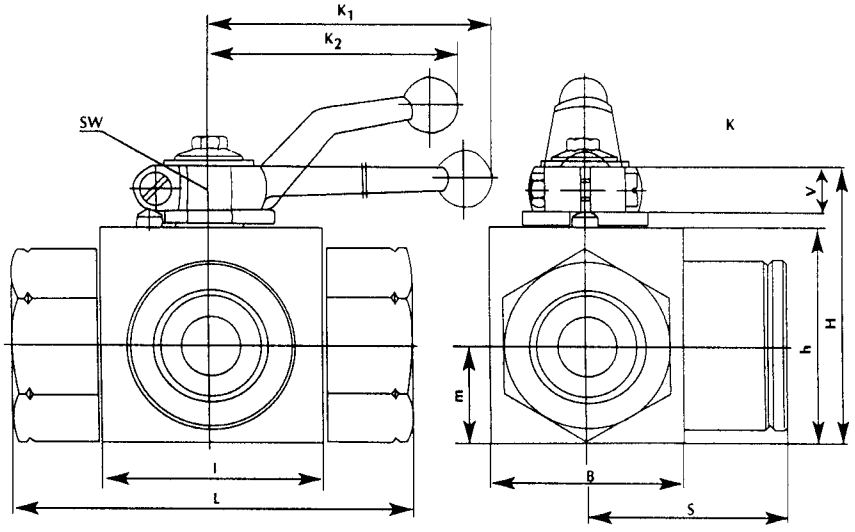
DIMENSIONAL INFORMATION

NPT



SAE





SIZE	d NPT	d SAE	i NPT	i SAE	L NPT	L SAE	LW NPT	LW SAE	l	B	H	h	m	V	S	SW	K1	K2	Wt
			in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	in / mm	lb / kg
⅛"	¼-28	-	0.51 / 12.95		2.72 / 69.09		0.24 / 6.10		1.57 / 39.88	1.02 / 25.91	1.85 / 46.99	1.80 / 44	0.53 / 13.46	0.43 / 10.95	1.86 / 47.24	0.35 / 9	5.91 / 150.11	4.33 / 110.00	0.001 / 0.0
¼"	¼-18	¼-20	0.67 / 17.03	0.55 / 13.97	2.72 / 69.09	2.72 / 69.09	0.24 / 6.10	0.20 / 5.08	1.57 / 39.88	1.02 / 25.91	1.85 / 46.99	1.80 / 44	0.53 / 13.46	0.43 / 10.95	1.86 / 47.24	0.35 / 9	5.91 / 150.11	4.33 / 110.00	0.001 / 0.0
⅜"	⅜-18	⅜-18	0.69 / 17.54	0.61 / 15.49	3.07 / 77.98	2.81 / 71.80	0.39 / 9.91	0.39 / 9.91	1.69 / 42.93	1.26 / 32.00	2.05 / 52.07	1.50 / 38	0.69 / 17.53	0.43 / 10.95	1.42 / 36.07	0.35 / 9	5.91 / 150.11	4.33 / 110.00	0.001 / 0.0
½"	½-14	½-16	0.98 / 24.89	0.69 / 17.54	4.09 / 103.89	3.27 / 83.06	0.51 / 12.95	0.51 / 12.95	1.89 / 48.01	1.38 / 35.05	2.16 / 54.11	1.57 / 40	0.75 / 19.07	0.43 / 10.95	1.61 / 40.90	0.35 / 9	5.91 / 150.11	4.33 / 110.00	0.001 / 0.0
¾"	¾-14	¾-12	0.91 / 23.11	0.91 / 23.11	4.02 / 102.18	3.74 / 95.00	0.79 / 20.07	0.79 / 20.07	2.44 / 61.98	1.93 / 49.03	2.95 / 74.91	2.24 / 57	0.96 / 24.38	0.55 / 13.95	1.85 / 47.50	0.55 / 14	7.87 / 199.90	6.30 / 160.01	0.002 / 0.1
1"	1-11½	1-12	1.09 / 27.69	0.91 / 23.11	4.69 / 119.13	4.45 / 113.04	0.98 / 24.89	0.83 / 21.08	2.60 / 66.04	2.28 / 57.91	3.27 / 83.06	2.56 / 65	1.16 / 29.46	0.55 / 13.95	2.22 / 56.39	0.55 / 14	7.87 / 199.90	6.30 / 160.01	0.004 / 0.2
1¼"	1¼-11½	1¼-12	1.11 / 28.19	0.91 / 23.11	4.72 / 119.89	4.33 / 109.98	1.26 / 32.00	1.06 / 26.92	4.19 / 81.03	3.15 / 80.01	3.98 / 101.09	3.15 / 8	1.86 / 14.53	0.65 / 16.51	4.03 / 76.96	0.67 / 17		11.81 / 300.0	0.004 / 0.2
1½"	1½-11½	1½-12	1.10 / 27.94	0.91 / 23.11	5.12 / 130.05	5.12 / 130.05	1.50 / 38.10	1.30 / 33.03	3.39 / 86.11	3.94 / 100.08	4.76 / 120.90	3.94 / 100	1.85 / 46.99	0.65 / 16.51	3.15 / 80.01	0.67 / 17		11.81 / 300.0	0.004 / 0.2
2"	2-11½	2-12	1.19 / 30.23	0.91 / 23.11	5.51 / 139.95	5.51 / 139.95	1.89 / 48.01	1.77 / 44.96	3.98 / 101.09	4.33 / 109.98	5.16 / 131.06	4.33 / 110	2.05 / 52.07	0.65 / 16.51	3.54 / 89.95	0.67 / 17		11.81 / 300.0	0.004 / 0.2

ORDERING INFORMATION

CBV 3 0 12 0 0 0 1 M LD

PRODUCT TYPE
CBV – Compact Body 3 Way Diverter Valve

NO. OF PORTS

CONNECTOR STYLE
0 – NPT
1 – SAE

CONNECTOR SIZE
02 – 1/8"
04 – 1/4"
06 – 3/8"
08 – 1/2"
12 – 3/4"
16 – 1"
20 – 1¼"
24 – 1½"
32 – 2"

BODY MATERIAL
0 – Carbon Steel
1 – 316 Stainless Steel
6 – Zinc Plated Carbon Steel

BALL & STEM MATERIAL
0 – Carbon Steel
1 – 316 Stainless Steel

BALL SEAT MATERIAL
0 – Delrin

O RING MATERIAL
1 – Viton

MANUFACTURING CODE

LOCKING KIT
LD – Locking Device
OSD – Screwdriver Operated

STAUFF

NEEDLE VALVES

2000 SERIES

For Fine Metering and Shut-Off

FEATURES

NOW WITH BLACK CHROMATE FINISH*

*Carbon steel valves only

Durable

- Heavy-duty threaded **and** brazed construction for added strength and safety up to 10,000 psi.
- Carbon steel valves are zinc-plated **and** sealed with black chromate for double corrosion protection.

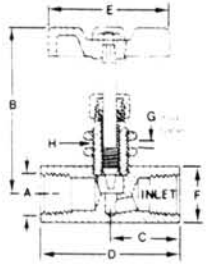
Reliable

- Precision-machined stems and valve bodies provide perfect seat alignment for leak-free shut-off.

Versatile

- Designed for use with air, oil, water, steam, liquid fuels and most chemicals.
- Machined from carbon, 303 or 316 stainless steels.
- Available in globe and angle configurations; in-line or panel mounted.

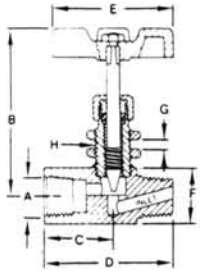
ORDERING INFORMATION



FFG

PART NUMBER Standard	A (NPT) Female	B (In.) Max.	C (In.)	D (In.)	E (In.)	F (In.) Square	G (In.)	H (In.) Diam.	Orifice Diam. (In.)	C_V
CARBON STEEL										
FFG2001T	1/8	3 1/2	31/32	1 15/16	2 1/2	7/8	3/8	5/8	7/32	0.66
FFG2002T	1/4	3 1/2	1 1/32	2 1/16	2 1/2	7/8	3/8	5/8	7/32	0.66
FFG2003T	3/8	3 5/8	1 7/16	2 3/4	2 1/2	1 1/8	3/8	3/4	7/32	0.70
FFG2004T	1/2	3 5/8	1 7/16	2 3/4	2 1/2	1 1/8	3/8	3/4	7/32	0.70
FFG2005TA	3/4	5 3/16	1 13/16	3 5/8	4 1/4	1 1/2	7/8	1 1/2	9/16	3.90
FFG2006TA	1	5 5/16	2 1/32	4 1/16	4 1/4	2	7/8	1 1/2	9/16	5.22
303 STAINLESS STEEL										
FFG2001SST	1/8	3 1/2	31/32	1 15/16	2 1/2	7/8	3/8	5/8	7/32	0.66
FFG2002SST	1/4	3 1/2	1 1/32	2 1/16	2 1/2	7/8	3/8	5/8	7/32	0.66
FFG2003SST	3/8	3 5/8	1 7/16	2 3/4	2 1/2	1 1/8	3/8	3/4	7/32	0.70
FFG2004SST	1/2	3 5/8	1 7/16	2 3/4	2 1/2	1 1/8	3/8	3/4	7/32	0.70
FFG2005SSTA	3/4	5 3/16	1 13/16	3 5/8	4 1/4	1 1/2	7/8	1 1/2	9/16	3.90
FFG2006SSTA	1	5 5/16	2 1/32	4 1/16	4 1/4	2	7/8	1 1/2	9/16	5.22
316 STAINLESS STEEL										
FFG2002SS6T	1/4	3 1/2	1 1/32	2 1/16	2 1/2	7/8	3/8	5/8	7/32	0.66
FFG2004SS6T	1/2	3 5/8	1 7/16	2 3/4	2 1/2	1 1/8	3/8	3/4	7/32	0.70

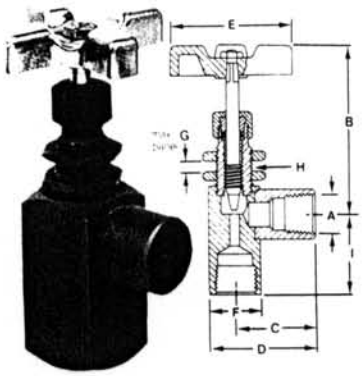
MFG



PART NUMBER Standard	A (NPT) Male X Female	B (In.) Max.	C (In.)	D (In.)	E (In.)	F (In.) Square	G (In.)	H (In.) Diam.	Orifice Diam. (In.)	C_V
CARBON STEEL										
MFG2002T	1/4	3 1/2	1 1/32	2 11/32	2 1/2	7/8	3/8	5/8	.218	0.92
MFG2003T	3/8	3 5/8	1 3/8	2 3/4	2 1/2	1 1/8	3/8	3/4	.218	1.1
MFG2004T	1/2	3 5/8	1 3/8	2 5/8	2 1/2	1 1/8	3/8	3/4	.218	1.1
303 STAINLESS STEEL										
MFG2002SST	1/4	3 1/2	1 1/32	2 11/32	2 1/2	7/8	3/8	5/8	.218	0.92
MFG2004SST	1/2	3 5/8	1 3/8	2 5/8	2 1/2	1 1/8	3/8	3/4	.218	1.1
316 STAINLESS STEEL										
MFG2002SS6T	1/4	3 1/2	1 1/32	2 11/32	2 1/2	7/8	3/8	5/8	.218	0.92
MFG2004SS6T	1/2	3 5/8	1 3/8	2 5/8	2 1/2	1 1/8	3/8	3/4	.218	1.1

ORDERING INFORMATION

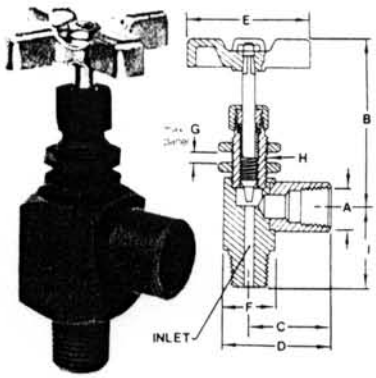
FFA



PART NUMBER Standard	A (NPT) Female	B (In.) Max.	C (In.)	D (In.)	E (In.)	F (In.) Square	G (In.)	H (In.) Diam.	I (In.)	Orifice Diam. (In.)	C_V
CARBON STEEL											
FFA2001T (1)	1/8	3 1/2	1	1 1/2	2 1/2	1	3/8	5/8	1 1/16	1/32	92
FFA2002T (1)	1/4	3 1/2	1 9/32	1 25/32	2 1/2	1	3/8	5/8	1 1/16	1/32	92
FFA2003T	3/8	3 5/8	1 17/32	2 5/32	2 1/2	1 1/4	3/8	3/4	1 19/32	1/32	1 10
FFA2004T	1/2	3 5/8	1 17/32	2 5/32	2 1/2	1 1/4	3/8	3/4	1 19/32	1/32	1 10
FFA2005TA	3/4	5 3/16	1 27/32	2 23/32	4 1/4	1 3/4	7/8	1 1/2	1 15/16	9/16	4 43
FFA2006TA	1	5 3/16	2 3/16	3 1/16	4 1/4	1 3/4	7/8	1 1/2	2 5/8	9/16	6 40
303 STAINLESS STEEL											
FFA2002SST	1/4	3 1/2	1 9/32	1 25/32	2 1/2	1	3/8	5/8	1 1/16	1/32	92
FFA2004SST	1/2	3 5/8	1 17/32	2 5/32	2 1/2	1 1/4	3/8	3/4	1 19/32	1/32	1 10
FFA2005SSTA	3/4	5 3/16	1 27/32	2 23/32	4 1/4	1 3/4	7/8	1 1/2	1 15/16	9/16	3 90
FFA2006SSTA	1	5 3/16	2 3/16	3 1/16	4 1/4	1 3/4	7/8	1 1/2	2 5/8	9/16	5 22

(1) 1/8" and 1/4" values now made from a steel forging

MFA



PART NUMBER Standard	A (NPT) Male X Female	B (In.) Max.	C (In.)	D (In.)	E (In.)	F (In.) Square	G (In.)	H (In.) Diam.	I (In.)	Orifice Diam. (In.)	C_V
CARBON STEEL											
MFA2002T	1/4	3 1/2	1 9/32	1 25/32	2 1/2	1	3/8	5/8	1 1/16	1/32	92
MFA2003T	3/8	3 5/8	1 17/32	2 5/32	2 1/2	1 1/4	3/8	3/4	1 3/4	1/32	1 1
MFA2004T	1/2	3 5/8	1 17/32	2 5/32	2 1/2	1 1/4	3/8	3/4	1 3/4	1/32	1 1
303 STAINLESS STEEL											
MFA2002SST	1/4	3 1/2	1 9/32	1 25/32	2 1/2	1	3/8	5/8	1 1/16	1/32	92

SPECIFICATIONS

Maximum Operating Pressure ..... 10,000 psig hydraulic
2,000 psig air

Minimum Burst Pressure ..... 20,000 psig

Temperature Range ..... -40°F to +500°F

Materials:	"T" and "TA" Models	"SST" and "SSTA" Models	"SS6T" Models
Body	12L14 Carbon Steel	303 Stainless	316 Stainless
Stem	303 Stainless	303 Stainless	17-4 PH
Bonnet Nut	Carbon Steel	303 Stainless	316 Stainless
Handle	Aluminum	Aluminum	Chrome-plated aluminum
Stem Packing	"Teflon"	"Teflon"	"Teflon"

Stem Taper

10 1/2° On 1/8, 1/4, 3/8 and 1/2" sizes
15° On 3/4 and 1" sizes

Stem Pitch

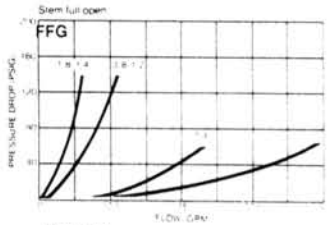
16 Threads/Inch on 1/8, 1/4, 3/8 and 1/2" sizes
14 Threads/Inch on 3/4 and 1" sizes

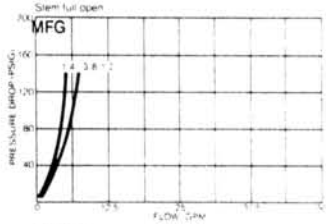
C_V Factor ..... See Ordering Information

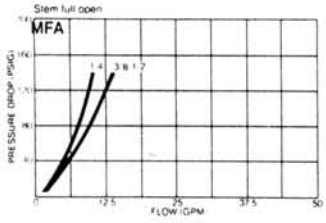
PANEL MOUNTING KITS

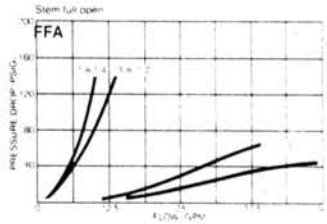
VALVE SIZE	KIT NUMBER
1/8 TO 1/4	KIT 2002S
3/8 TO 1/2	KIT 2004S
3/4 TO 1"	KIT 2005S

PERFORMANCE CURVES









REGO

OCP Series

PILOT OPERATED CHECK MODULAR VALVE

●50~200ℓ/min (13.2~52.9 gpm)
210, 250 kgf/cm² (3000, 3571 psi)

Features

1. Holds actuator in place when directional valve is centered. Prevents drifting of loads.
2. The maximum operating pressure of this is 210, 250 kgf/cm² (3000, 3571 psi.

Specification

Model	Valve size	Max. Operating Pressure kgf/cm² (psi)	Max Flow ℓ/min (gpm)	Cracking Pressure kgf/cm² (psi)	Section Area Ratio			Weight kgf(lbs)
					Pilot Piston	Seat Area of Check	Seat Area of Needle	
OCP-G01-W1-21 W2	1/8	250 (3571)	50 (13.2)	2 (29) 5 (71)	1	0.37	–	1.2 (2.6)
OCP-G01-A1-21 A2				2 (29) 5 (71)				
OCP-G01-B1-21 B2				2 (29) 5 (71)				
OCP-G01-W1-F-21 W2				2 (29) 5 (71)	1	0.51	0.06	1.2 (2.6)
OCP-G01-A1-F-21 A2				2 (29) 5 (71)				
OCP-G01-B1-F-21 B2				2 (29) 5 (71)				
OCP-G03-W1-J50 A1 B1	3/8	250 (3571)	100 (26.5)	2 (29)	1	0.49	0.07	3.6 (7.9)
OCP-G06-W1-11 A1 B1	3/4	210 (3000)	200 (52.9)	2 (29)	1	0.47	0.07	12.6 (28) 12.2 (27)

Note 1 OCP-G03-※2-J50 (cracking pressure 71 psi) is also available.
2 As for size 03 and 06, with shock prevent mechanism is standard. However, without shock prevent mechanism is also available.

Model Code

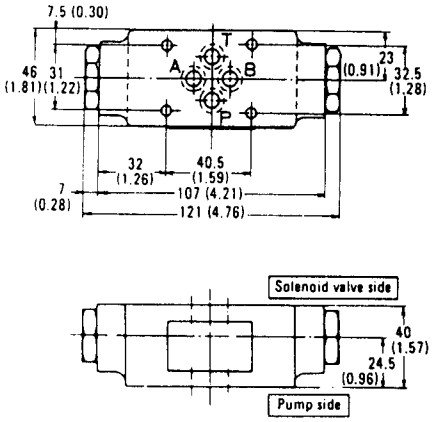
OCP-G03-W1-(F)-J50

- Design code
- Auxiliary code F : With shock prevent mechanism (size 01)
- Cracking pressure 1 : 2 kgf/cm² (28.6 psi) 2 : 5 kgf/cm²1 (71 psi)
- Control port W : A, B port A : A port B : B port
- Valve size
- Mounting G : Gasket mounting
- Pilot operated check modular valve

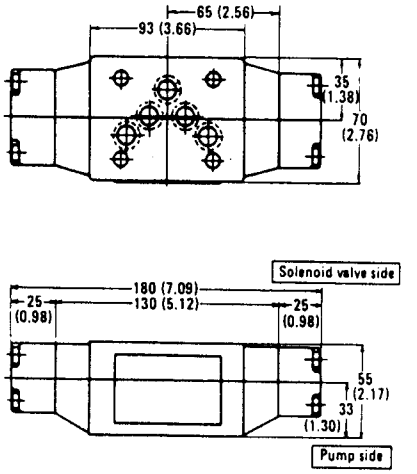
OCP Series

Installation Dimensions mm (inch)

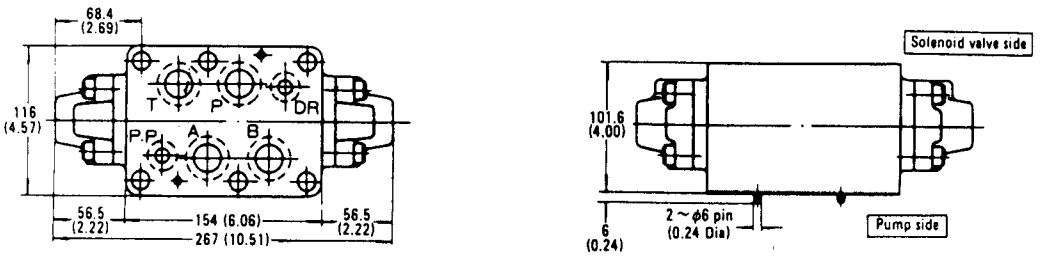
OCP-G01- ※ ※ -(F)-21



OCP-G03- ※ 1-J50



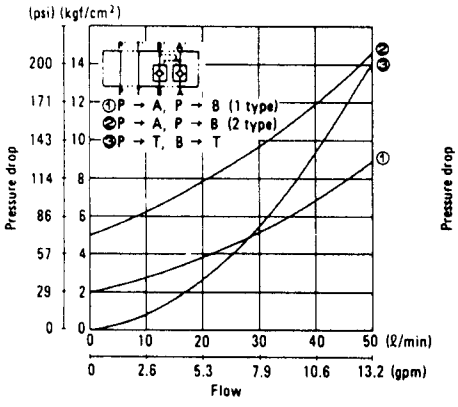
OCP-G06- ※ 1-11



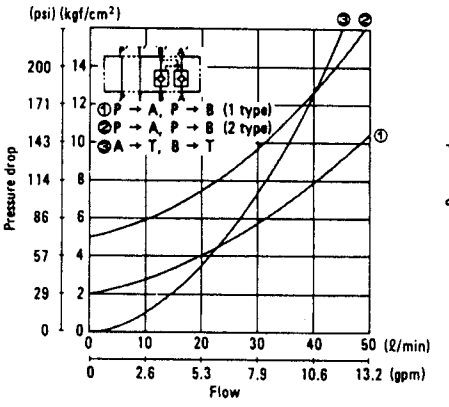
Performance Curve

Pressure Drop Characteristics

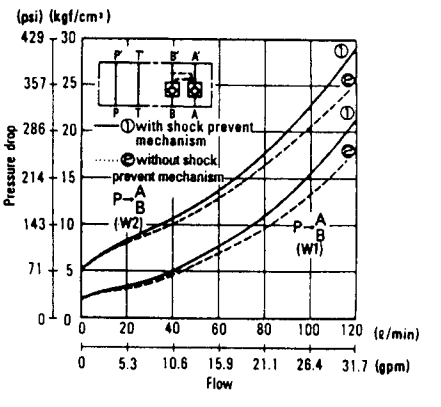
OCP-G01-W ※ -21



OCP-G01-W※-F-21

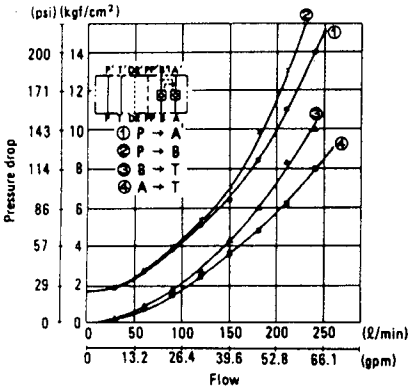


OCP-G03-W1-J50

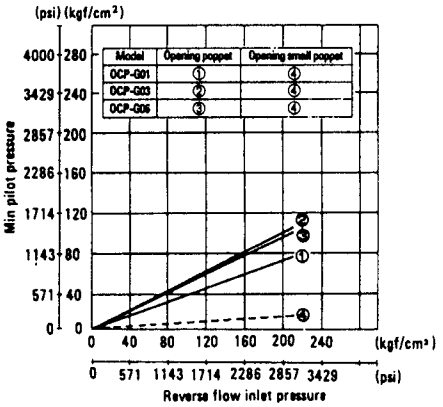


OCP Series

OCP-G06-W1-11



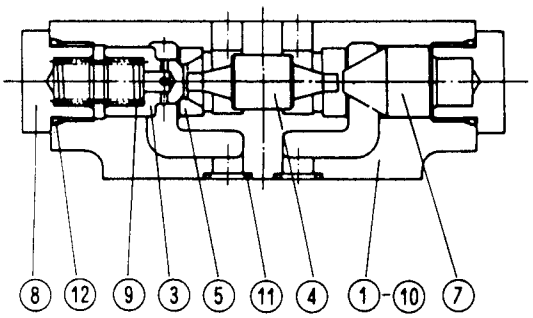
Min. Pilot Pressure Characteristics



Cross Section Drawing

Viscosity of hydraulic fluid 32cSt.

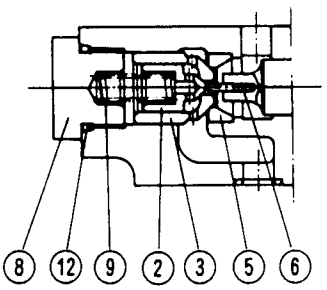
OCP-G01-A※-21



List of Seals

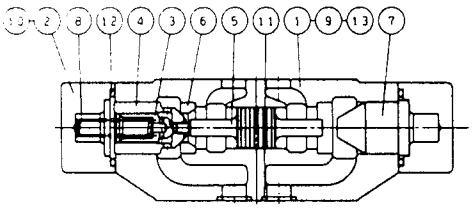
No.	Name of part	Number of part	Q'ty
11	O-ring	RO-P9-90	4
12	O-ring	RO-P18-90	2

OCP-G01-A※-F-21



No.	Name of part
1	Body
2	Poppet
3	Poppet
4	Piston
5	Seat
6	Rod
7	Bushing
8	Guide
9	Spring
10	Plate
11	O-ring
12	O-ring

OCP-G03-A※-J50

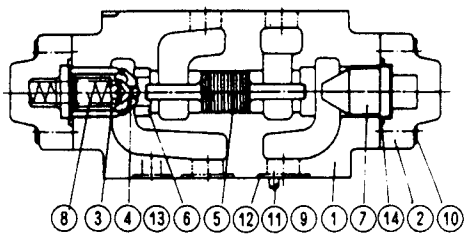


No.	Name of part
1	Body
2	Cover
3	Poppet
4	Poppet
5	Piston
6	Seat
7	Bushing
8	Spring
9	Plate
10	Screw
11	O-ring
12	O-ring
13	Pin

List of Seals

No.	Name of part	Number of part	Q'ty
11	O-ring	ROA-014-90	5
12	O-ring	RO-P29-90	2

OCP-G06-A1-11



No.	Name of part
1	Body
2	Cover
3	Poppet
4	Poppet
5	Piston
6	Seat
7	Bushing
8	Spring
9	Plate
10	Screw
11	Pin
12	O-ring
13	O-ring
14	O-ring

List of Seals

No.	Name of part	Number of part	Q'ty
12	O-ring	RO-P28-90	4
13	O-ring	RO-P20-90	2
14	O-ring	RO-G35-90	2

SS Series/ WET TYPE SOLENOID (OIL IMMERSED SOLENOID) OPERATED DIRECTIONAL CONTROL VALVE.

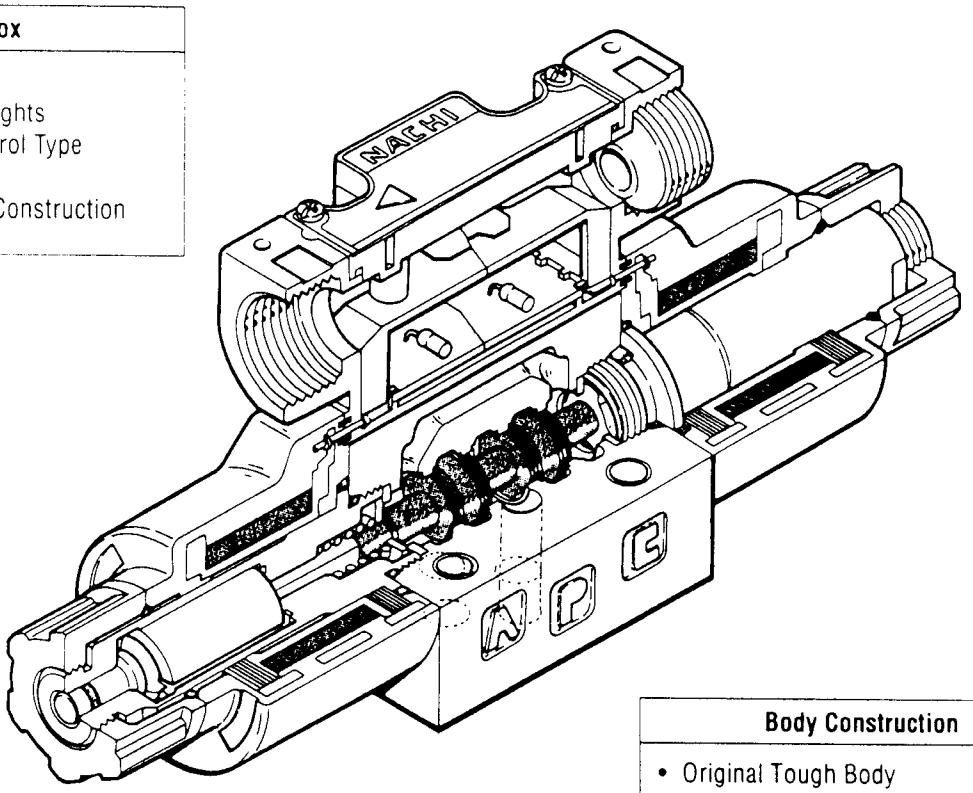
350 kgf/cm² {5000 psi}, 100ℓ/min {26.4gpm}

Wet Type (Oil Immersed) Solenoid

- Smooth, Long Life Wet Type
- High Guide Back Pressure
- Welded type guide
- Compact and Powerful Solenoid

Wiring Box

- Large Wiring Space
- Standard Indicator Lights
- Electrical Surge Control Type (Option G)
- Simple Water Proof Construction



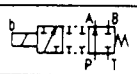
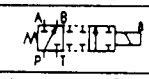
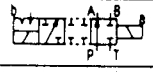
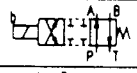
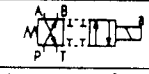
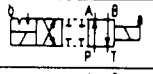
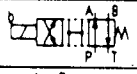
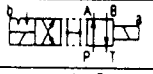
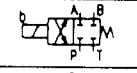
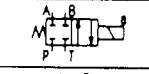
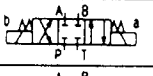
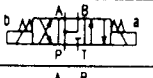
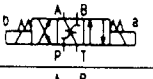
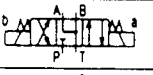
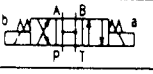
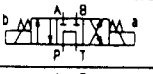
Body Construction

- Original Tough Body
- Low Pressure Loss by Ideal Flow Pass Design
- Stability Operation by Hydraulic Shockless Type (Option F)

Features

1. **Oil immersed solenoid design**
   The moving iron core operates in hydraulic oil for smooth operation and longer life.
2. **Low noise and quiet operation**
   Because the armature is oil immersed there is very little noise during change over.
3. **Shockless hydraulic operation**
   Hydraulic shock caused by abrupt change in the flow condition at flow cut off is minimized by a specially machined spool. (option F)
4. **High pressure, High flow capacity**
   Fluid reaction force compensation and low pressure loss design allows opeating pressures of 350 kgf/cm² (5000 psi) and flows to 100 l/min (264 gpm)
5. **Electrical surge control**
   The sparks at the contract and surge voltage, which occur when the solenoid is energized, are minimized (option G)
6. **Easy wiring**
   The wide space makes it easy to wire, check and maintain.
7. **Easy coil changes**
   The plug-in coil can be changed in a single step
8. The combination with modular valves allows for compact systems.

Specifications

Model		Standard type SA-G01-※※-※※-※30 SS-G01-※※-R-※※-※30		Shockless type SA-G01-※※-F-※※-※30 SS-G01-※※-FR-※※-※30		Standard, Shockless type SS-G03-※10	
Symbol	Valve spool type	Max. operating pressure kgf/cm² {psi}	Max. flow ℓ/min {gpm}	Max. operating pressure kgf/cm² {psi}	Max. flow ℓ/min {gpm}	Max. operating pressure kgf/cm² {psi}	Max. flow ℓ/min {gpm}
	– A2X –	350 {5000}	30 {7.9}	250 {3571}	30 {7.9}	250 {3571}	15 {4.0}
	– H2X –						
	– E2X –						50 {13.2}
	– A3X –		80 {21.1}		50 {13.2}		80 {21.1}
	– H3X –						
	– E3X –		100 {26.4}				
	– A3Z –		65 {17.1}				
	– H3Z –						
	– E3Z –						
	– A5 –		100 {26.4}				
	– H5 –						
	– C2 –						
	– C5 –						
	– C9 –						
	– C1S –						
	– C6S –						
	– C1 –		AC:65 {17.1} DC:80 {21.1}				
	– C6 –						
	– C4 –		50 {13.2}		40 {10.6}		50 {13.2}
	– C7Y –						
	– C8 –						

Note) The max. flow of each valve differs depending on the pressure. For details, refer to page 7.

		SA·SS-G01			SS-G03		
		AC solenoid	DC solenoid Built-in rectifier		AC solenoid	DC solenoid Built-in rectifier	
		C※	E※	D※	C※	E※	D※
Max. operating pressure	P, A, B port	350 kgf/cm² {5000 psi}			250 kgf/cm² {3571 psi}		
Max. permissible back pressure	T port	210 kgf/cm² {3000 psi}			70 kgf/cm² {1000 psi}		
Changeover frequency (times/min)		300	120	300	240	120	240
Standard	Indicator light	R (Note 1)			R		
Options	Shockless	—	F		—	F	
	Electrical surge control	G (Note 2)	—	G	—		G
	Push button	N			—		
	Quick return function	—	Q	—	—	Q	—
Weight kg (lbs)	Double solenoids	1.8 {4.0}	2.0 {4.4}		3.5 {7.7}	5.1 {11.2}	
	Single solenoid	1.4 {3.1}	1.5 {3.3}		3.1 {6.8}	4.0 {8.8}	
Recommended operating conditions	Operating temperature range	-20 ~ 70°C {-4 ~ 158°F}			5 ~ 60°C {41 ~ 140°F}		
	Operating viscosity	15 ~ 300 cSt {80 ~ 1400 SUS}					
	Viscosity index	90 or above					
	Filtration	25 μm or less					

Note 1) SA: "R" is not standard.
2) SA: "G" is not available.

Notes

1. Pipe system so that tank line is always filled with oil.
2. Surge pressure should be kept below maximum tank line back pressure rating.
3. When using a 4-way valve as a 2-way or 3-way and blocking unused ports lowers the maximum flow.
4. Keep hydraulic oil clean. (Degree of contamination: NAS grade 12 or better). When petroleum hydaulic oil is used, it should conform to ISO VG32, 46.
5. Do not exceed permissible voltage range of the coil used.
6. Do not supply electric power to the AC solenoid unless the coil is mounted to the valve.
7. Provide drain piping from the T port, when valve spool types are A2X, H2X, E2X.
8. The size 03 rectified solenoid coil can be used for both 50 Hz and 60 Hz. Connect to the COM and 50Hz terminals.
9. If the changeover position is kept under high pressure for an extended period, malfunctions may occur due to hydraulic lock. Please consult us when you have such application.
10. When the detent-type (E2X, E3X, E3Z) is used, we recommend that the electric power supply be continuous in order that the changeover position may be firmly maintained.
11. Resistance force against the manual override pin changes, depending on the back pressure of the tank line.

Solenoid specifications

Solenoid classification			AC solenoid											
Power source			C1			C115			C2			C230		
Voltage (V)			AC100		AC110	AC110		AC115	AC200		AC220	AC220		AC230
Frequency (Hz)			50	60	60	50	60	60	50	60	60	50	60	60
Size 01	Solenoid coil type	SS type	EDC64-C1			EDC64-C115			EDC64-C2			EDC64-C230		
		SA type	EAC64-C1			EAC64-C115			EAC64-C2			EAC64-C230		
	Starting current (A)		2.2	2.0	2.2	2.0	1.8	2.0	1.1	1.0	1.1	1.0	0.91	1.0
	Holding current (A)		0.52	0.38	0.46	0.47	0.35	0.42	0.26	0.19	0.23	0.24	0.17	0.21
	Holding electric power (W)		25	22	28	25	22	28	25	22	28	25	22	28
	Permissible voltage range (V)		80 ~ 110	90 ~ 120		90 ~ 120	100 ~ 130		160 ~ 220	180 ~ 240		180 ~ 240	200 ~ 260	
	Insulation resistance (MΩ)		100 or above (500V)											
Size 03	Solenoid coil type		EC64-C1			EC64-C115			EC64-C2			EC64-C230		
	Starting current (A)		3.6	3.7	3.5	3.0	—	3.3	1.8	1.8	1.7	1.5	—	1.6
	Holding current (A)		0.90	0.86	0.80	0.69	—	0.75	0.45	0.43	0.40	0.35	—	0.38
	Holding electric power (W)		37	37	37	30	—	37	37	37	37	30	—	37
	Permissible voltage range (V)		90 ~ 110		100 ~ 120	100 ~ 130		100 ~ 130	180 ~ 220		200 ~ 240	200 ~ 260		200 ~ 260
	Insulation resistance (MΩ)		100 or above (500V)											

NACHI

SS/SA Series

Solenoid classification			DC solenoid							
			Built-in rectifier							
Power source			E1	E115		E2	E230		D1	D2
Voltage (V)			AC100	AC110	AC115	AC200	AC220	AC230	DC12	DC24
Frequency (Hz)			50/60	50/60		50/60	50/60		—	—
Size 01	Solenoid coil type	SS type	EDC64-E1	EDC64-E115		EDC64-E2	EDC64-E230		EDC64-D1	EDC64-D2
		SA type	EAC64-E1	EAC64-E115		EAC64-E2	EAC64-E230		EAC64-D1	EAC64-D2
	current (A)		0.37	0.31	0.32	0.18	0.15	0.16	2.5	1.25
	Holding electric power (W)		32	30	32	32	30	32	30	30
	Permissible voltage range (V)		90 ~ 100	100 ~ 125		180 ~ 220	200 ~ 250		10.8 ~ 13.2	21.6 ~ 26.4
	Insulation resistance (MΩ)		100 or above (500V)							
Size 03	Solenoid coil type		EC64-E1	EC64-E115		EC64-E2	EC64-E230		EC64-D1	EC64-D2
	current (A)		0.40	0.32	0.33	0.20	0.17	0.18	2.9	1.45
	Holding electric power (W)		35	30	33	35	32	35	35	35
	Permissible voltage range (V)		90 ~ 110	100 ~ 125		180 ~ 220	200 ~ 250		10.8 ~ 13.2	21.6 ~ 26.4
	Insulation resistance (MΩ)		100 or above (500V)							

Model Code

S A
S S - G 0 1 - A 3 Z - ※ R - C 2 3 0 - (J) 3 0

- Design No.
  - 30: Valve size 01
  - 10: SS-G03
- Mounting bolt
  - No code : Metric thread (Valve size 01)
  - J : Metric thread (Valve size 03)
  - E : Unified thread
- Electric power source indication
  - C: AC C1 = AC100V50/60 Hz, C2 = AC200V50/60 Hz
    - C115 = AC110V50 Hz/AC115V60 Hz
    - C230 = AC220V50 Hz/AC230V60 Hz
  - D: DC D1 = DC12V, D2 = DC24V
  - E: Rectifier built-in type, common to 50/60 Hz
    - E1 = AC100V, E2 = AC200V, E115 = AC115V, E230 = AC230V
- R: Indicator light (Standard for SS series)
- Optional function (can be combined in the alphabetical order)
  - F: Hydraulic shockless type (Electric power D※ or E※)
  - G: Electrical surge contorol (Electric power D※ for 01/03, C※ for G01)
  - N: With push button for manual operation (size 01) See page DV-7
  - Q: Quick return type (Electric power E※)
- Flow passage condition during transition

X	Y	Z
Closed	Semi-open	Open

- Position type at neutral

0	1	2	3	4	5
6	7	8	9	1S	6S

Note: P pressure port, A and B cylinder ports, T(R) tank port.

- Spring arragement

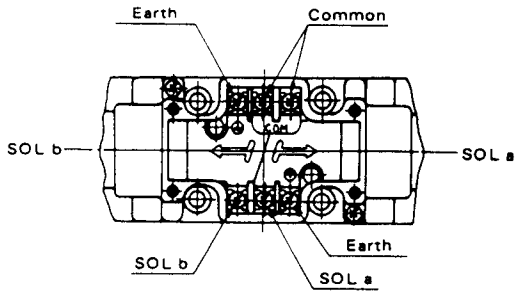
A	H	C	E
Spring offset	Spring offset	Spring center	Detent

- Valve size 01: Size 01 03: Size 03
- Gasket mounting
- SA series: DIN connector type
  SS series: Terminal box type

SS/SA Series

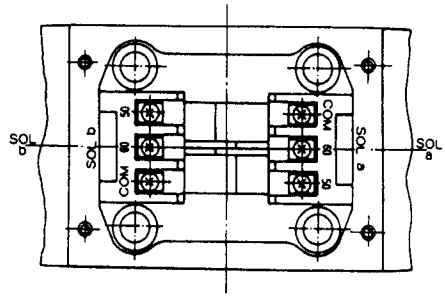
Wiring

SS-G01



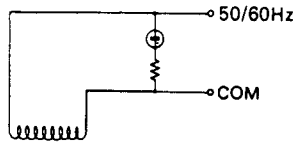
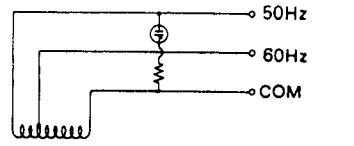
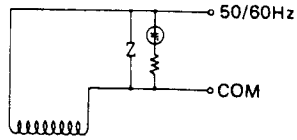
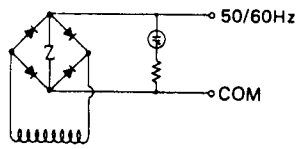
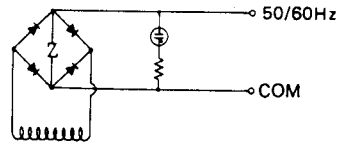
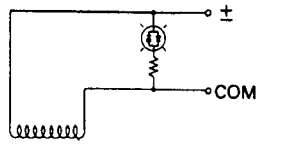
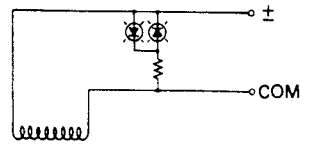
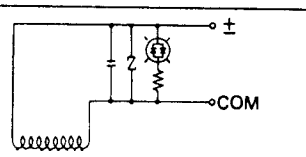
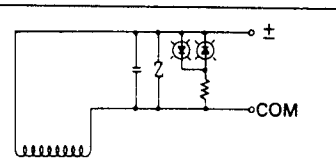
Note) 1. COM terminal is provided in double solenoid valve for ease of wiring. Please remove by loosing machine screw, if unnecessary.
2. Use an earth terminal when ground wiring is necessary.
3. Use a compressed termnal for M3.
4. Fasten the screw of the terminal with 0.5 ~ 0.7N-m {4.3 ~ 6.1 lbs. - inch} torque.

SS-G03



Note) 1. The rectifier built-in type solenoid E1, E2, E115, E230 can be used for both 50Hz and 60Hz. Connect the COM and the 50Hz terminal.
2. Use a compressed terminal for M3.
3. Fasten the screw of the terminal with 0.5 ~ 0.7N·m {4.3 ~ 6.1 lbs · inch} torque.

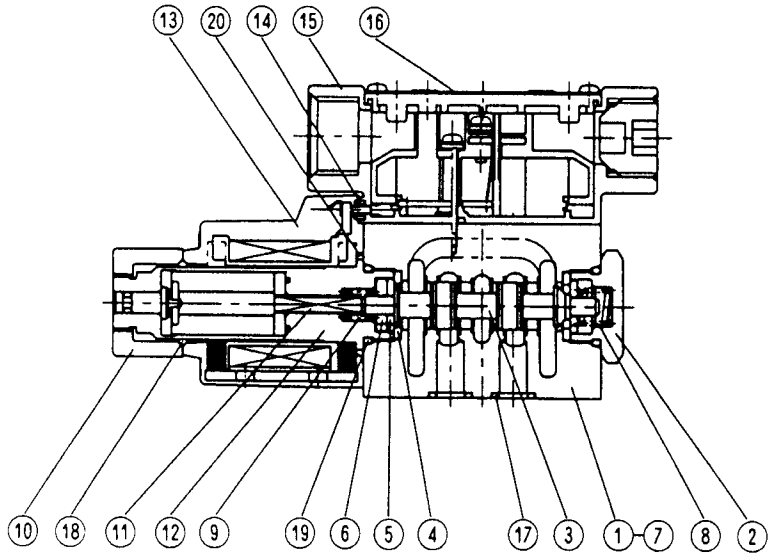
Electric circuit diagram

Mode \ Size	SS-G01	SS-G03
SS-G01/G03-***-R-C*-*30/10		
SS-G01-***-GR-C*-*30		
SS-G01/G03-***-R-E*-*30/10		
SS-G01/G03-***-R-D*-*30/10		
SS-G01/G03-***-GR-D*-*30/10		

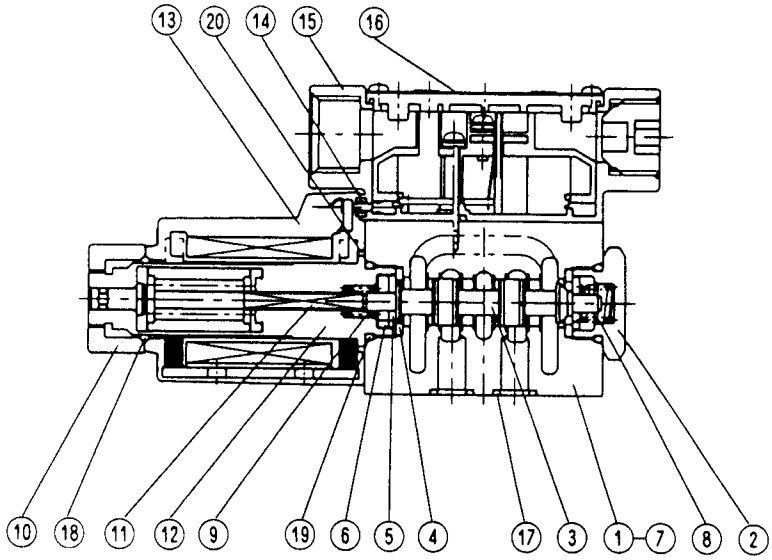
SS/SA Series

Cross Section Drawing

SS-G01-A3X-R-C※-※30
(SA-G01-A3X-※-C※-※30)



SS-G01-A3X-R-D/E※-※30
(SA-G01-A3X-※-D/E※-※30)



No.	Name of parts
1	Body
2	Plug
3	Spool
4	Retainer A
5	Retainer B
6	Retainer C
7	Spacer
8	Spring A
9	Spring C
10	Nut
11	Rod
12	Solenoid guide
13	Solenoid coil
14	Packing
15	Terminal
16	Name plate
17	O-ring
18	O-ring
19	O-ring
20	O-ring

List of seals for SA/SS-G01

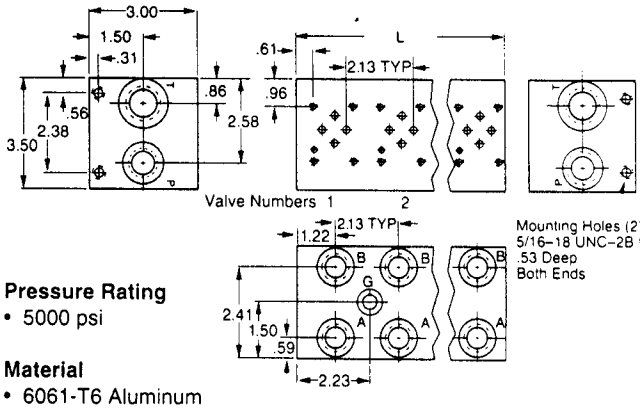
No.	Name or Part	Part No.	Quantity	
			Single SOL	Double SOL
17	O-ring	ROA-012-90	4	4
18	O-ring	RO-P20	1	2
19	O-ring	RO-P18-90	2	2
20	O-ring	S-25	1	2

Seal Kit = EDCS-A (Single Solenoid), EDCS-C (Double Solenoid)

SOURCE
FLUID POWER

D03 (OLD D01) Manifolds

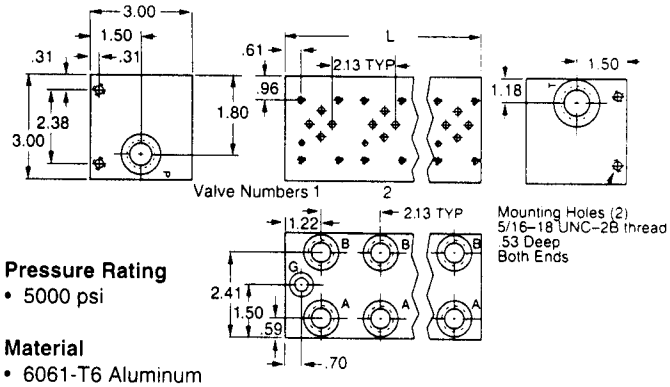
PARALLEL — 2.13 SPACING



Pressure Rating
- 5000 psi

Material
- 6061-T6 Aluminum

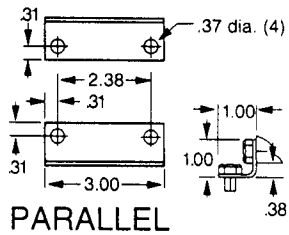
SERIES — 2.13 SPACING



Pressure Rating
- 5000 psi

Material
- 6061-T6 Aluminum

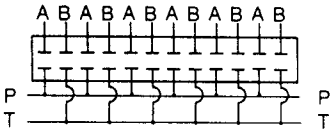
*BRACKETS (Optional)



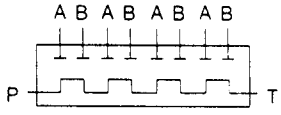
PORTS

- T
  1 1/16-12 O-ring port (SAE -12)
- A & B
  3/4-16 O-ring port (SAE -8)
- G Gauge with plug
  7/16-20 O-ring port (SAE -4)
- P
  7/8-14 O-ring port (SAE -10)

PARALLEL



SERIES



TYPE	NO. OF VALVES	PART NUMBER	"L" INCHES	APPROX WT LBS.
Parallel	2	10002	4.57	4.1
	3	10003	6.70	6.1
	4	10004	8.83	8.1
	5	10005	10.96	10.1
	6	10006	13.09	12.0
	7	10007	15.22	14.0
	8	10008	17.35	16.0
	9	10009	19.48	18.0
	10	10010	21.61	20.0
Series	2	10052	4.57	3.5
	3	10053	6.70	5.2
	4	10054	8.83	6.9
	5	10055	10.96	10.0
	6	10056	13.09	12.0

* Optional Mounting Bracket Kit Part Number 10081