

NACHI

Standard Hydraulic Equipment

Using the NACHI Standard Hydraulic Equipment Catalog

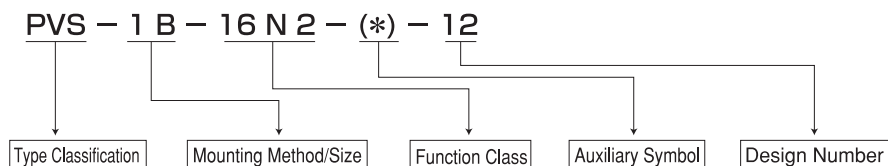
As a comprehensive manufacturer of a full range of hydraulic equipment, Nachi-Fujikoshi manufactures, markets, and provides a wide range of other services for a full lineup of outstanding products.

This general catalog introduces standard hydraulic equipment that has been carefully selected from the wide range of products manufactured by Nachi-Fujikoshi. We hope that this catalog will be of assistance in planning your hydraulic system and for providing some guidelines for your inquiries about Nachi-Fujikoshi products.

■ Interpreting Model Numbers

Model numbers are assigned in accordance with Nachi-Fujikoshi standards as described below.

Example: PVS Series Variable Volume Piston Pump



A change in the right digit of the design number indicates there is no component compatibility. However, installation method compatibility still exists. This is subject to change without notice.

■ Using the Model Number Index

The Model Number Index at the back of this catalog lists the model numbers for NACHI standard hydraulic equipment. Use the index when looking up equipment details.

Hydraulic Equipment and Device Safety Precautions

■ Before using any Nachi-Fujikoshi hydraulic equipment or device, carefully read the precautions and the "Handling" section for each of the standard hydraulic equipment products.

■ Precautions are classified according to the three types described below. All three indicate important information that you need to know to ensure safety. Be sure to read all precautions and carefully follow the advice that they provide.

 Danger	This type of precaution indicates a condition in which incorrect handling creates the immediate risk of death or serious personal injury.
 Warning	This type of precaution indicates a condition in which incorrect handling creates the risk of death or serious personal injury.
 Caution	This type of precaution indicates a condition in which incorrect handling creates the risk of personal injury or material damage.

*Danger, Warning, and Caution precautions are not comprehensive. Other risks may exist, even though they are not specifically mentioned. Before actually using any Nachi-Fujikoshi product, be sure to read its user documentation. You should use the product or device only after you thoroughly understand its user documentation, always keeping safety first and foremost in your mind.

*Be sure that you always comply with the following laws in order to ensure safe operation of a product.

- High Pressure Gas Safety Law
- Occupational Safety and Health Law
- Fire Codes

■ Hydraulic Operating Fluid Precautions

- Use of improper hydraulic operating fluid creates the risk of malfunction and breakdown.

 Danger	Many hydraulic operating fluids are flammable, so do not use open flame and do not perform welding in the vicinity of hydraulic devices and equipment. Failure to follow this precaution creates the risk of fire.
 Caution	Use only anti-wear type hydraulic operating fluid that is ISO3448 viscosity grade VG32 to VG68. Never use any other type of hydraulic operating fluid or fluid that is contaminated with foreign matter. Always check your user documentation for information before using non-mineral type hydraulic operating fluid (water based, synthetic, etc.)
 Caution	Use the proper type of hydraulic operating fluid, ensuring that fluid temperature, viscosity, contaminant level, and other factors are all within their prescribed ranges. Using hydraulic operating fluid outside of its prescribed ranges creates the risk of fire due to operational problems, mechanical damage, and fluid leaks.
 Caution	Configure circuits and operate the system to ensure that the contamination level of the hydraulic operating fluid being used is always within the manufacturer's recommended values. Check the contamination level and the condition of the filter at regular intervals. Also periodically check hydraulic operating fluid for oxidation, deterioration, and moisture, and replace the hydraulic operating fluid whenever these levels exceed the recommended values of the fluid manufacturer.
 Caution	Whenever changing to another type of hydraulic operating fluid, be sure to thoroughly flush out the interior of the circuit. Never mix hydraulic operating fluids of different types. Continued use creates the risk of malfunction of and damage to the equipment.
 Caution	Make sure to avoid splashing hydraulic operating fluid on you and others. Should fluid get on your skin, wash the area thoroughly with soap and water. Allowing hydraulic operating fluid to remain on the skin creates the risk of skin irritation.
 Caution	Before replacing the hydraulic operating fluid, allow the fluid in the system to cool sufficiently. Hot fluid creates the risk of burn injury.
 Caution	Allowing the hydraulic operating fluid level in the tank to become too low creates the risk of malfunction and breakdown.

■ Precautions when Preparing for a Test Run

 Warning	Always leave product installation, removal, piping, wiring, and other work up to specialists.
 Warning	Never attempt any unauthorized modification of the hydraulic system or control circuit.
 Warning	Never attempt any unauthorized modification of the setting values of the pressure and flow rate adjusting devices.
 Caution	Always check new hydraulic devices for looseness of internal components that may have occurred during shipment and check to make sure that all components are fitted securely.
 Caution	Whenever suspending a product, make sure that you use all of the attached eye plates or eye bolts. Using any other method (such as using a single eye plate) to suspend the product creates the risk of it falling.

1. Checking the Product Model Number

 Danger	In any atmosphere where there is the danger of explosion or fire, be sure to use only products that are designed for operation in such atmospheres.
 Caution	Whenever installing a valve, pump, or motor, check its plate and engravings to confirm that it is the proper type. In many cases you cannot tell the difference between different hydraulic equipment types by their outward appearance only.

2. Product Handling

 Caution	Never climb onto, strike, tip over, or apply excessive force to a product. Doing so creates the risk of malfunction, damage, fluid leaks, etc.
 Caution	Wipe up any hydraulic operating fluid that gets on the product or floor. Failure to do so creates the risk of personal injury due to the product slipping out of your hand and falling, and due to someone slipping on the fluid left on the floor.

3. External Piping

 Caution	• Be sure to perform sufficient flushing. • Anchor pipe supports to a secure surface. • Use pipe that has sufficient pressure rating. The rated pressure of the pipe should be double the pressure that you plan to be using. • The finish of the O-ring seal surface should be within the equivalent of 6.3S. Make sure there are no cracks, etc.

4. Electrical

 Warning	Leave all electrical work up to a qualified professional. Be sure to turn off power before performing electrical work. Failure to do so creates the risk of electric shock.
 Warning	Failure to check the condition of the gate valve and relief valve when checking the rotation direction of a hydraulic pump creates the risk of accident, malfunction, and breakdown.

5. Coupling Alignment

 Caution	Though motor and pump shaft alignment is checked at the factory prior to shipment, they may go out of alignment during shipping or due to installation conditions. Because of this, you should always check for proper alignment during the test run.

6. Valve, Pump, and Motor Installation

 Caution	Make sure installation holes and surfaces are clean. Insufficient bolt tightening torque can allow fluid to leak, creating the risk of fire.
 Caution	Whenever installing a product, always use bolts of the specified strength and specified number, and tighten them to the specified torque. Failure to observe proper specified values during installation creates the risk of fire due to malfunction, mechanical damage, and hydraulic fluid leaks.
 Caution	During installation and removal, never strike the pump shaft or motor shaft with a hammer or otherwise subject them to impact. Doing so can damage the product.
 Caution	In the case of a pump or motor that requires a drain pipe, the drain pipe that is used should not allow the pressure inside the casing to exceed the specified value. In the case of a pump or motor structure where operating fluid needs to be filled within the casing during operation, use a drain pipe that constantly replenishes operating fluid but does not allow air to collect inside of the casing. The drain pipe also should not let the level of operating fluid inside of the case to drop (does not allow fluid to return to the tank) during long periods of non-operation.

7. High-pressure Restrictions

 Warning	When using a pump that does not have a pressure compensation function (with maximum pressure adjustment), be sure to install a hydraulic circuit maximum pressure regulating relief valve near the pump discharge side.

8. Using an Accumulator

 Warning	When using an accumulator, use only nitrogen gas. Be sure to read and understand all pertinent user documentation before using an accumulator.
 Warning	Never attempt to modify an accumulator by mechanical processing or welding.

9. Fluid Supply

 Caution	Supply fluid up to the standard quantity through the prescribed oil supply port. Take care to ensure that no foreign matter or moisture contaminates the fluid. Also, check to make sure that the standard oil quantity is maintained even when the actuator is operated.

■ Precautions During a Test Run

 Warning	Authorized personnel only should be allowed in the vicinity of hydraulic devices during operation. Never touch devices during operation.
 Warning	Never remove covers of rotating parts or operate hydraulic devices with covers open.
 Warning	Before turning on the power supply, first check to make sure that all operation switches are off.
 Caution	Start up a pump while it is in the no-load state, and check to make sure that the rotation direction is correct.
 Caution	Valves, pumps, and motor casings can become very hot during operation. Do not touch them.
 Caution	Should you ever notice abnormal noise, abnormal heat, abnormal vibration, leaking oil, smoke, abnormal odor, or any other abnormal operation in a valve, pump, or motor, immediately shut down operation and take the necessary steps to correct the condition. Installation of sensors designed to detect abnormalities is recommended. Continued use under the above conditions creates the risk of damage, fire, and personal injury.

1. Hydraulic Pump Operation

 Warning	Before starting operation, check to make sure that all stop valves are correctly open or closed as required. Particular attention is required in the case of the suction line and return line.
 Caution	Though there is some vibration during normal operation, extreme vibration may indicate a defective fitting. Continued use creates the risk of accident or breakdown.
 Caution	Use a current meter to check for abnormally high loads on the motor. A large load can indicate a defective fitting, sticking, etc. Correct the abnormality before operating the pump.

2. Priming (Air Bleeding)

 Warning	Set the pressure to a value that does not operate the actuator (normally 72 to 200 psi). Perform operation carefully while monitoring the pressure with a pressure gauge.
 Warning	When bleeding air while the actuator is being operated, be careful about the movement of the machinery. Shut down the machinery immediately whenever there is the danger of accident.
 Caution	Performing work while operating fluid is below the prescribed level or using a mixture of different types of operating fluid creates the risk of malfunction or breakdown of the pump or other devices.

3. Actuator Operation

 Warning	Operate the actuator manually at low speed for initial operation. While carefully observing the operation of the machine, perform continuous operation and automatic operation. Trying to perform continuous operation and automatic operation for the initial operation creates the risk of unexpected accident and breakdown.

4. Cleaning the Filter

 Caution	The filter can become clogged right from the first test run. Be sure to watch the filter indicator for signs of clogging. Continued use of a clogged filter creates the risk of unexpected accident and breakdown.

5. Valve Control

All Valves

 Warning	Use valves within their prescribed maximum operating pressures (including surge pressure).
 Warning	Sudden operation of the handle (screw) is dangerous. Be sure to unload the valve before gradually increasing pressure. Never keep a valve at a pressure that is greater than its design specification pressure value.
 Warning	Make sure you understand the hydraulic circuit diagram and switching valve structure, and check the electrical operation circuit and solenoid valve before performing any operation. An incorrect switching direction can cause reverse operation of the actuator and create the risk of unexpected accident and breakdown.
 Warning	Make sure you understand the hydraulic circuit diagram and flow control valve structure before performing any operations. Sudden operation can change the operating speed of the actuator and create the risk of unexpected accident or breakdown.

Solenoid Valves, Proportional Valves, Servo Valves

 Warning	Use valves within their prescribed maximum operating pressures (including surge pressure).
 Warning	Never charge both coils of a double solenoid valve at the same time.
 Caution	The pump casing and solenoid coil surface can become very hot. Never touch them.
 Caution	Be sure to use the appropriate model in environments that require water resistance.

■ Maintenance Precautions During Normal Daily Operation

1. Operating Fluid

 Caution	In order to ensure proper performance of hydraulic devices, check the fluid temperature, fluid level, and fluid color (for discoloration and deterioration) everyday. Any abnormalities create the risk of malfunction and breakdown.
 Caution	Whiteish fluid indicates that water has contaminated the fluid, and blackish fluid indicates that the fluid has been subjected to high temperatures. Replace the operating fluid whenever these symptoms are noticed.
 Caution	Operating fluid that is below the prescribed level can cause improper pump suction. Keep fluid filled to prescribed level.
 Caution	As it is used for normal operations, operating fluid deteriorates and gradually loses its rust inhibiting, lubrication, and foam inhibiting characteristics. Deteriorated operating fluid creates the risk of malfunction and breakdown. As a general rule, replace operating fluid at least once a year.

2. Hydraulic Pumps

 Caution	A very hot hydraulic pump surface indicates the possibility of malfunction and breakdown. Immediately shut down the pump and take steps to correct the problem.

3. Fluid Leaks

 Warning	Fluid leaking from welded pipe seams, from a hydraulic pump, from hydraulic machinery, or from other sources creates the risk of serious accident. Always be on the lookout for possible leaks.

4. Filters

 Caution	Continued use of a clogged filter creates the risk of unexpected accident and breakdown. Replace a filter as soon as possible after it shows signs of clogging. Never operate devices with filter elements removed.

5. Pressure Gauges

 Caution	Always be sure to tighten the gauge cock whenever you do not need to view the pressure gauge. Deflection of the needle can damage the pressure gauge.

6. Tank Interior

 Caution	Actual tank inspection needs depend on the contamination level of the operating fluid. As a general rule, the tank should be emptied of fluid and its interior inspected and cleaned once a year.

7. Hydraulic Devices

 Caution	Never allow cutting oil, grinding oil, clippings, water, or other similar matter to get on hydraulic devices.

8. Coolers

 Caution	For a water cooler, adjust the temperature adjusting valve to keep the water temperature below 140° F. Provide a fan cooler to allow proper intake, outflow, and flow of cooling air.

■ Handling Precautions During Non-use

 Caution	If the system will not be operated for long periods, be sure to take proper anti-rust measures. • Not operating the system for long periods without taking anti-rust measures creates the risk of malfunction and breakdown due to rust. • Be sure to flush the system before using it again after a long period of non-use. Failure to flush out rust inhibitors creates the risk of malfunction and breakdown.

■ Disassembly and Inspection Work Precautions

 Warning	Never attempt to modify or reconfigure valves, pumps, or motors. Doing so can cause them to operate at levels that are lower than for which they are designed, and creates the risk of malfunction and breakdown.
 Warning	All disassembly and inspection work should be left up to persons who possess the required special knowledge for such work. Attempting disassembly without the required knowledge creates the risk of unexpected accident. Incorrectly performed disassembly and inspection work creates the risk of malfunction and breakdown.
 Warning	Before starting disassembly or maintenance work, make sure that all electrical breakers are cut off, and use an electroscope to check for the presence of electricity. Failure to do so creates the risk of unexpected accident to actuator free running, electric shock, etc.
 Warning	Performing work while the electrical circuitry is charged creates the risk of unexpected accident due to electric shock.
 Warning	Always make sure to release all residual pressure before starting disassembly work. Performing disassembly work without releasing residual pressure creates the risk of accident due to spurting fluid, actuator free running, or dropping, and also creates the risk of malfunction and breakdown.
 Caution	Always place valves, pumps, and motors on a secure surface, and never place them on top of hydraulic machinery. Doing so creates the risk of damage to the hydraulic machinery.
 Caution	Never strike or drop valves, pumps, or motors, and never subject hydraulic equipment to strong external force.
 Caution	During reassembly, failure to tighten to proper torques and contaminants getting into piping creates the risk of malfunction and breakdown. • Take care to ensure that the tightening torques of hydraulic equipment are uniform and at prescribed levels. • Take care that sealing materials, welding scales, and other contaminants do not get inside of piping.
 Caution	After disassembly and reassembly, double check to make sure that you did not forget to open stopper valves, and that you have properly tightened all bolts, stopper plugs, couplings, and other required parts before performing the first operation.

■ Storage Precautions

 Caution	Seals may need to be replaced before using a product for the first time after long storage.

Standard Hydraulic Equipment ~ Index

NACHI Hydraulic Pumps

General Information.....A1-A2

A Piston Pumps

PVS	PVS Series Variable Volume Piston Pumps.....	A3
	PVS Series Uni-Pump.....	A19
PZS	PZS Series Variable Volume Piston Pump.....	A22
PZ	PZ Series Load Sensitive Variable Piston Pump.....	A36

B Vane Pumps

VDS	VDS Series Small Variable Volume Vane Pump.....	B1
	VDS Uni-Pump.....	B4
VDR22	VDR22 Design Series Variable Volume Vane Pump.....	B6
	VDR Uni-Pump.....	B12
VDR13	VDR13 Design Series Variable Volume Vane Pump.....	B15
	VDR Uni-Pump.....	B22
VDC	VDC Series High-Pressure Type Variable Volume Vane Pump.....	B25
	VDC Series High-Pressure Type Variable Volume Double Vane Pump	
	VDC Uni-Pump.....	B37
UVN	UVN Series Variable Volume Vane Uni-Pump (NSP Uni-Pump).....	B39

C Gear Pumps

IPH	IPH Series IP Pump.....	C1
	IPH Series Double Pump.....	C14

NACHI Hydraulic Valves

General Information.....D1-D3

D Solenoid Valves

SS	SS Series (Wiring System: Central Terminal Box) Wet Type Solenoid Valve.....	D4
SA	SA Series (Wiring System: DIN Connector Type) Wet Type Solenoid Valve.....	D16
SE	SE Series Pilot Operated Lower Power Solenoid Valve.....	D28
SL	SL Series (Wiring System: Central Terminal Box) Wet Type Solenoid Valve.....	D34
DSS	DSS (DSA) 21 Design Series Solenoid Control Valve.....	D41
SF	SF Series Fine Solenoid Valve.....	D49
SNH	SNH Series Non-Leak Type Solenoid Valve.....	D53
SAW	SAW Series Solenoid Valve with Monitoring Switch.....	D62
SCW	SCW Series Poppet Type Solenoid Valve with Monitoring Switch.....	D71
SK	SK-G01 Series Wet Type Solenoid Valve.....	D76

E Manual Valves

DMA	DMA Type Manual Valve.....	E1

F Modular Valves

	General Information.....	F1
G01	G01 Modular Valve Series.....	F4
G03	G03 Modular Valve Series.....	F6
G04	G04 Modular Valve Series.....	F9
OR	OR Relief Modular Valve.....	F10
ORO	ORO Brake Modular Valve.....	F16
ORD	ORD Direct Relief Modular Valve.....	F20
OG	OG Pressure Reducing Modular Valve.....	F25
OGB	OGB Balanced Piston Type Pressure Reducing Modular Valve.....	F32
OG	OG Pressure Reducing Modular Valve.....	F34
OGS	OGS Two-Pressure Reducing Modular Valve.....	F41

OQ	OQ Sequence Modular Valve.....	F44	Piston Pumps	A
OCQ	OCQ Counter Balance Modular Valve.....	F47		
OW	OW Pressure Switch Modular Valve.....	F52		
OY, OCY	OY, OCY Flow Regulator Modular Valve.....	F55	Vane Pumps	B
OF, OCF	OF, OCF Flow Control Modular Valve (Pressure and temperature compensated).....	F63		
OC, OCV	OC, OCV Check Modular Valve.....	F69		
OCF	OCF Pilot Operated Check Modular Valve.....	F76		
OK	OK Gauge Modular Block.....	F81	Gear Pumps	C
OB	OB High-Low System Block.....	F83		
MOB	MOB End Plate, Free Flow Plate, 03/01 Change Plate.....	F85		
OTH, OTD	OTH, OTD Valve Installation Bolt List.....	F87		
MOB	MOB 01, 03 Base Block.....	F90	Solenoid Valves	D
M35	M35 High Pressure Modules.....	F92		
G Proportional Valves				
	General Information.....	G1	Manual Valves	E
EPR	EPR Electro-Hydraulic Proportional Pilot Relief Valve.....	G2		
ER	ER Electro-Hydraulic Proportional Relief Valve.....	G4		
EGB	EGB Electro-Hydraulic Proportional Relief and Reducing Valve.....	G6	Modular Valves	F
ES	ES Electro-Hydraulic Proportional Flow Control Valve.....	G8		
ESR	ESR Load Response Electro-Hydraulic Proportional Relief and Flow Control Valve.....	G11		
ESD	ESD Electro-Hydraulic Proportional Relief and Flow Control Valve.....	G14	Proportional Valves	G
	ESD Pressure Compensation Valve Kit			
EOG	EOG Modular Type Electro-Hydraulic Proportional Reducing Valve.....	G22		
EOF	EOF Modular Type Electro-Hydraulic Proportional Flow Control Valve.....	G24		
EMA, EMC	EMA, EMC Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive.....	G26		
EDA, EDC	EDA, EDC Small Type Multi-Function Power Amplifier.....	G30	Subplates	H
ESH	ESH G01 High-Response Proportional Flow Control Valve.....	G38		
	ESH G03, 04, 06 High-Response Proportional Flow Control Valve.....	G40		
EHA	EHA High-Speed Response Proportional Control Valve	G42	Pressure Control Valves	I
EA	EA Electro-Hydraulic Servo Valve Driver Servo Amplifier.....	G44		
H Subplates Part Number Index				
	Subplates Part Number Index.....	H1	Flow Control Valves	J
I Pressure Control Valves				
R	R Series Relief Valve.....	I1		
RI	RI Series Relief Valve (ISO Mounting, Balanced Piston Type).....	I5	Check Valves	K
RC	RC Series Remote Control Relief Valve.....	I8		
RSS	RSS Series Solenoid Controlled Relief Valve.....	I10		
RIS	RIS Series Solenoid Controlled Relief Valve.....	I15		
CG	(C) CG Series Pressure Reducing (and Check) Valve.....	I18	Hydraulic Units	L
GR	GR Series Balancing Valve (Pressure Reducing and Relief Valve).....	I23		
CQ	(C) CQ Series Pressure Control (and Check) Valve.....	I25		
J Flow Control Valves				
FR	(C) FR Series Throttle (and Check) Valve.....	J1	Wheel Motors	M
FT	(C) FT Series Type Flow Control (and Check) Valve with Pressure and Temperature Compensation.....	J4		
F	(C) F Series Type Flow control (and Check) Valve with Pressure Compensation.....	J8	Technical Data	N
TN	(C) TN Series Type Flow Control (and Check) Valve.....	J11		
	Fine Adjustment Type with Pressure and Temperature Compensation			
TS	(C) TS Series Type Flow Control (and Check) Valve.....	J14		
	Fine Adjustment Type with Pressure and Temperature Compensation			
TL, TLT	TL, TLT Series Type Feed Control Valve.....	J16	Model Index	O
	Fine Control Type with Pressure Compensation			

K Check Valves

CA, CN	CA, CN Series Right Angle Check Valve In-Line Check Valve.....	K1
CP	CP Series Pilot Check Valves.....	K4
K2	K2 Gauge Cock.....	K7
CA	Flange Type Check Valve.....	K8

NACHI Hydraulic Power Units

L Power Units

NV	NV Vertical Units.....	L1
NH	NH Horizontal Units.....	L5
NCP	NCP Series Standard Variable Pump Unit.....	L9
NSP	NSP Series Compact Variable Pump Unit.....	L26
NSP-L	NSP-L Series Compact Variable Pump Unit.....	L32
NSP-I	NSP-I Series Energy-Saving Variable Pump Unit with Inverter Drive.....	L34
NN	NN Pack High-Pressure Standard Variable Pump Unit.....	L38
NCP/NNP	NCP/NNP Series Energy-Saving Variable Pump Unit with Inverter Drive.....	L43
	Power Meister.....	L45
	Powerfit.....	L49

NACHI Wheel Motors

M Wheel Motors

PHV-1	PHV-1.....	M1
PHV-2	PHV-2.....	M4
PHV-3	PHV-3.....	M7
PHV-4	PHV-4.....	M9
PHV-5	PHV-5.....	M12

N Technical Data

	Operating Fluid.....	N1
	Water-Glycol Type Operating Fluid Hydraulic Devices.....	N3
	SI Units and Conversion Formulas.....	N7

O Model No. Index

	Model Number Index.....	O1

NACHI Hydraulic Pumps

A

NACHI Hydraulic Pumps

Features

- 1 Nachi Fujikoshi hydraulic pumps are finished by high-grade, precision machining technology unique to the comprehensive manufacturer Nachi Fujikoshi using carefully selected materials and traditional heat treatment technology. High performance and quality are assured with all models of Nachi Fujikoshi hydraulic pumps.
- 2 Noise has been thoroughly reduced on hydraulic pumps, a general source of noise on machinery and equipment. All models such as the low-noise type IP series can be operated quietly with little noise.
- 3 Attention has been paid to surface treatment and selection of materials in NACHI hydraulic pumps so that they can be applied extensively with fire-resistant hydraulic operating fluid.

Installation and Maintenance

- 1 Limit the eccentricity between the drive shaft and hydraulic pump shaft to .001 in., keep the angle error within 1° and use flexible couplings for connections.
- 2 When operating hydraulic pumps with belts, gears and chains, prevent a radial or thrust load exceeding the allowable value from being applied on the pump shaft. Also, if necessary, install a device that prevents a load (bending force) from being applied at right angles on the shaft. Mount hydraulic pumps so that the pump shaft is horizontal.
- 3 Use a rigid pump mounting base.
- 4 The direction of rotation is determined on each hydraulic pump. Operate the hydraulic pump in the correct direction of rotation after checking the indicated model No. on the nameplate or the arrow indicating the direction of rotation on the body. The direction of rotation is clockwise when viewed from the shaft end.
- 5 Limit the suction pressure to within the range 4.3 psi.
- 6 With external drain type hydraulic pumps, directly connect the drain to the tank, insert the drain pipe under the oil level, and limit the drain back pressure to 4.3 psi.
- 7 When connecting steel pipes to the suction and discharge sides, prevent force pressure from being applied on the hydraulic pump by the piping.
- 8 Set the clamping length of couplings and hydraulic pump shafts so that it is within at least 2/3 or more of the coupling width. Also, use a size of coupling that matches the shaft diameter.

- 9 When inserting couplings into shafts, insert them gently. When removing couplings from shafts, be sure to use a pulley extractor. Avoid hitting the shaft when attaching or removing couplings.
- 10 Connect to the suction port above the horizontal to keep oil inside hydraulic pumps.
- 11 Provide an air bleed valve in circuits where it is difficult to release air at startup.
- 12 Be sure to use only specified bolts on hydraulic pumps. Use grade 8 or equivalent.

Uni-pumps

Uni-pumps are compact pump/motor units which have a motor directly coupled to the hydraulic pump. Variable discharge volume type vane pumps and piston pumps are available. As each of these pumps are ideally integrated with the motor, they can be easily installed, and more compact equipment configurations can be achieved economically.

- Standard Motor:
 - totally-enclosed splashproof housing surface flange
 - cooled self-actuating type (totally enclosed fan-cooled type)
 - 5 hp to 4P or less: Class E insulation
 - 7 hp to 4P or more: Class B insulation
 - Voltage 200V··50/60 Hz
 - 220V··60 Hz

Management of Hydraulic Operating Fluid

- 1 Use mineral oil-based hydraulic operating fluid.
- 2 Provide a suction filter of about 100 to 150 mesh on the suction port.
- 3 When operating hydraulic pumps at a high pressure or when using fire-resistant hydraulic operating fluid, oil contamination greatly affect pump service life. So, use a filter of 10 µm or less.
- 4 Consult your agent when using fire-resistant hydraulic operating fluid. When using water- or glycol-based hydraulic operating fluid, refer to page N-3 for details on applicable models of hydraulic pumps.
- 5 For details on the viscosity of hydraulic operating fluid, refer to the separate item "Hydraulic Operating Fluid."

Terms Used in This Catalog

The following describes the meanings of the terms used in this catalog:

- Rated Pressure:
The maximum pressure at which a hydraulic pump can be used continuously.
- Maximum Operating Pressure:
The maximum pressure (including surge pressure) at which a hydraulic pump can be used within six seconds at most within 1/10 of the cycle time.
- Allowable Peak Pressure:
The maximum pressure (set pressure + surge pressure) that can be momentarily allowed.

The following shows the standards in Lists of Sealing Parts:

JIS standard B2401 (O-ring)
JIS standard B2407 (backup ring)
SAE standard AS568 (O-ring)

Pipe apertures mentioned in this catalog that are indicated as "G*/*" comply with JIS B2351 O-ring seal systems. Note, however, that G3/4 adopts dimensions before JIS revisions were made in 1990. Nachi Fujikoshi adopts P24 as the O-ring size whereas P22.4 is stated in current JIS standards.

Calculation Formula Required when Selecting Hydraulic Pumps and Motors

1. Pump Discharge Flow Rate

$$Q_p = \left(\frac{q \cdot N \cdot \eta_v}{231} \right) \text{ gal / min}$$

q = discharge volume per rotation
(cu in/rev)

N = revolution speed (min⁻¹)

η_v = volume efficiency

2. Power Required for Pump Drive

$$W_{p1} = \frac{P \cdot Q_p}{1714} \text{ (hp)}$$

p = discharge pressure (psi)

η = overall efficiency

3. Motor Revolution Speed

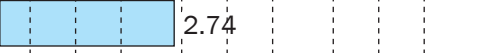
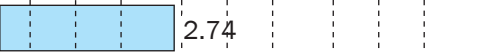
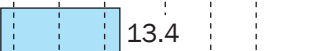
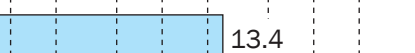
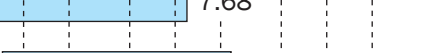
$$N = \left(\frac{120 \cdot f}{P} \right) \cdot (1 - S) \text{ (min}^{-1}\text{)}$$

f = frequency (50Hz, 60 Hz)

P = number of motor poles

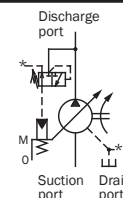
S = slip rate

Hydraulic Pump Selection Table

Pump Type	Name	Type Classification	Rated Pressure psi	Displacement cu in / rev																Page
				.12	.30	.61	1.2	3.0	6.1	12.2	30.5	61.0	122.0	305						
Variable piston pumps	PVS series variable piston pump	PVS	3000	.21												A-3				
	Uni-pump	UPV	3000	.21												A-19				
	PZS series variable piston pump	PZS	3000				2.56									A-22				
	PZ load-sensitive variable piston pump	PZ	3000	.48												A-35				
Variable discharge volume vane pumps	VDS series compact variable vane pump	VDS	1015	.18												B-1				
	Uni-pump	USV	1015	.18												B-4				
	VDR22 design series variable vane pump	VDR	2030	.3												B-6				
	Uni-pump	UVD	1015	.3												B-12				
	VDR13 design series variable vane pump	VDR	870	.24												B-15				
	Uni-pump	UVD	870	.24												B-22				
	VDC series high-pressure variable vane pump	VDC	2030	.3												B-25				
	Uni-pump	UVC	1015	.3												B-37				
	UVN series variable vane uni-pump	UVN	1160	.49												B-39				
Internal gear pump	IPH series IP pump	IPH	3625	.21												C-1				
	IPH series double IP pump	IPH	3045	.43												C-14				

PVS Series Variable Volume Piston Pumps

.48 to 2.74 cu in/rev
3045 psi



- ⚠ Design No. 30 is applied on PVS-0B to make the pump more compact and lighter, and reduce noise.
- ⚠ Production of PVS-3B has been discontinued. Use PZS-3B.
- ⚠ Pressure adjustment 3 type has been added to PVS-1B-22 and PVS-2B-45. (Design No. 20 is applied only on PVS-2B-45*3)

Features

Energy-saving Type with Drastically Reduced Loss

A NACHI-proprietary semi-circular barrel swash plate that receives pressure on its surface ensures a stable discharge volume at all times. This eliminates excess discharge volume, and enables the

effective use of power corresponding to the load cycle. This "energy-saving type" conserves energy, reduces power loss, and helps to reduce hydraulic costs.

Silent Type That Demonstrates Its Power Quietly

Proprietary low-noise mechanisms are incorporated on the shoe, swash plate, valve plate, and other locations to ensure silent operation. In particular, a semi-circular barrel swash plate stabilizes operation characteristics to ensure silent operation.

Specifications

Model No.	Volume in ³ /rev (cm ³ /rev)	Discharge volume at no-load gpm				Pressure adjustment range psi	Permitted peak pressure psi	Rotating speed min ⁻¹		Mass lbs
		1000min ⁻¹	1200min ⁻¹	1500min ⁻¹	1800min ⁻¹			Min.	Max.	
PVS-0B-8*0-E30 1 2 3	.18 - .48 (8.0)	2.1	2.5	3.2	3.8	290 to 507 290 to 1015 435 to 2030 435 to 3045	3625	500	2000	17
PVS-1B-16*0-(*)-E13 1 2 3	.3 - 1.0 (16.5)	4.4	5.2	6.5	7.8	290 to 507 290 to 1015 435 to 2030 435 to 3045	3625	500	2000	23
PVS-1B-22*0-(*)-E13 1 2 3	.42 - 1.34 (22.0)	5.8	7.0	8.7	10.5	290 to 507 290 to 1015 435 to 2030 435 to 3045	3625	500	2000	23
PVS-2B-35*0-(*)-E13 1 2 3	.48 - 2.1 (35.0)	9.2	11.1	13.9	16.6	290 to 507 290 to 1015 435 to 2030 435 to 3045	3625	500	2000	51
PVS-2B-45*0-(*)-E13 1 2 3 3-(*)-E20	.67 - 2.74 (45.0)	11.9	14.3	17.9	21.5	290 to 507 290 to 1015 435 to 2030 435 to 3045	3625	500	2000	51

Note: Direction of rotation is clockwise when viewed from the shaft end.

- Handling
 - Cautions during Pump Installation and Piping
- 1 Use flexible couplings for connecting the pump shaft to the drive shaft, and prevent a radial or thrust load from being applied on the pump shaft.
 - 2 For centering of the pump shaft, limit the eccentricity between the drive shaft and hydraulic pump shaft to .002 in, and keep the angle error within 1°.
 - 3 Set the clamping length of couplings and hydraulic pump shafts so that it is within at least 2/3 or more of the coupling width.
 - 4 Use a sufficiently rigid pump mounting base.
 - 5 Set the pressure on the pump suction side to 4.3 or more (suction port flow velocity within 6 ft/sec).
 - 6 Raise part of the drain piping to above the topmost part of the pump body, and

insert the return section of the drain piping into the hydraulic operating fluid. Also, observe the values in the following table to limit the drain back pressure to 14 psi.

Item	Model No.	PVS-0B PVS-1B	PVS-2B
Pipe joint size		3/8" or more	1/2" or more
Pipe I.D		3/8"	1/2"
Pipe length		39"	39"

• Management of Hydraulic Operating Fluid

- 1 Use good-quality hydraulic operating fluid, and use within a kinematic viscosity range of 20 to 200 centistokes during operation. Use an R&O type and antiwear hydraulic fluid of ISO-VG32 to 68. The optimum kinematic viscosity during

operation is 20 to 50 centistokes.

- 2 The operating temperature range is 40 to 190° F. When the oil temperature at startup is 40° F or less, warm up the hydraulic pump by low-pressure, low-operation speed operation until the oil temperature reaches 40° F.
- 3 Provide a suction strainer with a filtering grade of about 100µm (150 mesh). Be sure to provide a return line filter of grade 10µm or less on the return line to the tank. (When the hydraulic pump is used at a high pressure of 2000 psi or more, we recommend providing a filter of 10µm or less.
- 4 Manage the hydraulic operating fluid so that contamination is maintained at class NAS10 or lower.
- 5 Use hydraulic operating fluid within an operating ambient temperature of 32 to 140° F.

(continued on following page)

- Caution at Startup NACHI-proprietary

- Before you start pump operation, fill the pump body with clean hydraulic operating fluid via the lubrication port.

Model No.	Injection amount cu in
PVS-0B-8	13
PVS-1B-16, 22	18
PVS-2B-35, 45	39

- An unload is required when the motor is started under condition WYE.Delta Start. Consult your agent regarding the circuit.
- Make sure that the pump operates in the direction of rotation the same as that indicated by the arrow on the pump body.

- Air entering the pump or pipes may cause noise or vibration. At startup, set the pump discharge side to a no-load state, and operate the pump in the inching mode to release any air in the pump or pipes.

- Provide an air bleed valve in circuits where it is difficult to release air at startup.

- How to Set Pressure and Discharge Volume

The default pump discharge volume is set to "maximum" and default discharge pressure is set to "minimum". Change the discharge volume and discharge pressure settings according to your particular operating conditions.

[Pressure adjustment]
Turning the pressure adjusting screw CW increases the pressure.

[Discharge volume adjustment]
Turning the flow rate adjusting screw CW decreases the discharge volume.

Note:

- For details regarding the relationship between flow rate adjustment length l and pump capacity q , see the tables provided in the installation dimension drawings for each of the pumps.

- Firmly tighten the lock nuts after you have finished adjustments.

Note:

- Variable control mechanism

Standard Type

N* Pressure compensation type (manual mode)

Option type

P* Pressure compensation type (remote control mode)

R Load Sense

N*Q* 2-pressure, 2-flow rate control

R* $\text{A} \oplus$ Solenoid cutoff control

W* $\text{A} \oplus$ 2-pressure control

RQ* $\text{A} \oplus$ 2-pressure, 2-flow rate control w/ solenoid cutoff

C* $\text{A} \oplus$ 2-cutoff control

- * : Pressure adjustment range

0 : 286 - 500

1 : 286 - 1000

2 : 429 - 2000

3 : 429 - 3000

- $\oplus$: Applicable to solenoid specifications A, S

A $\oplus$: SA-G01

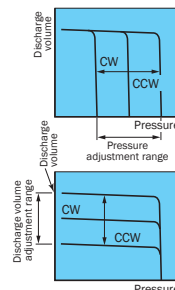
S $\oplus$: SS-G01

1 : 100V 50/60Hz

2 : 200V 50/60Hz

3 : DC12V

4 : DC24V



Explanation of Model No.

PVS - 1 B - 16 N 2 - (*) - 12

Design No. 30: PVS-0B
12: PVS-1B, PVS-2B (BSPT piping)
E13: PVS-1B, PVS-2B (SAE piping)
E20: PVS-2B -45N3

Auxiliary Symbol None: Side port type
Z: Axial port type

Pressure Adjustment Range [Note] Reference

Variable Control Mechanism [Note] Reference

Max. Pump Capacity (cm³/rev)
Nominal 8, 16, 22, 35, 45

Mounting Method

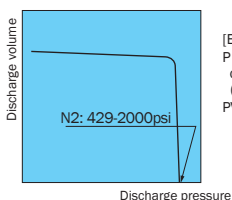
B: Mounting flange type

A: Mounting foot type

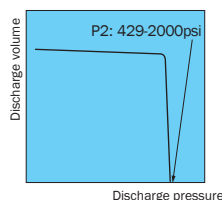
Pump Size 0,1,2

PVS Series Variable Piston Pump

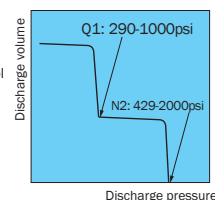
[Example 1]
N* Pressure compensation type (manual mode)
PVS-1B-16N2



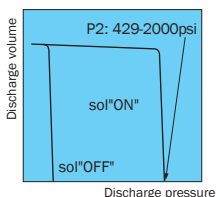
[Example 2]
P* Pressure compensation type (remote control mode)
PVS-1B-16P2



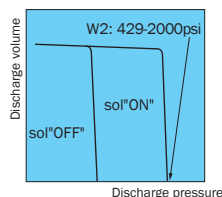
[Example 3]
N*Q* 2-pressure, 2-flow rate control
PVS-1B-16N2Q1



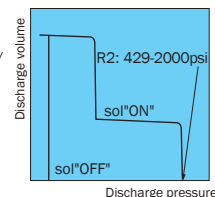
[Example 4]
R*S* Solenoid cutoff control
PVS-1B-16R2S2
Solenoid specifications
120V 50/60Hz
SS-G01



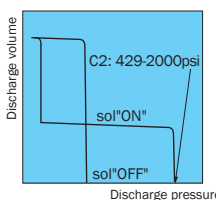
[Example 5]
W*S* 2-pressure control
PVS-1B-16W2S1
Solenoid specifications
120V 50/60Hz
SS-G01



[Example 6]
RQ*S* 2-pressure, 2-flow rate control w/ solenoid cutoff
PVS-1B-16RQ2S1
Solenoid specifications
120V 50/60Hz
SS-G01



[Example 7]
C*S* 2-cutoff control
PVS-1B-16C2S2
Solenoid specifications
120V 50/60Hz
SS-G01



- R, load sense available for all PVS models.

- NQ, RS, WS, RQS and CS types are not available for the PVS-0B-8.

- NQ, RQS and CS types are not available for the PVS-1B-16-22-Z and PVS-2B-35-45-Z.

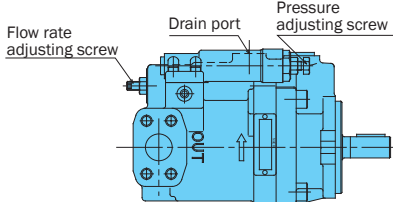
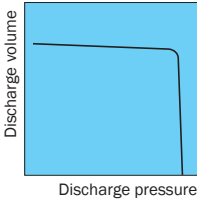
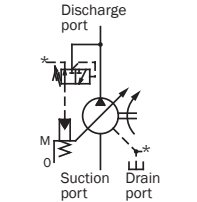
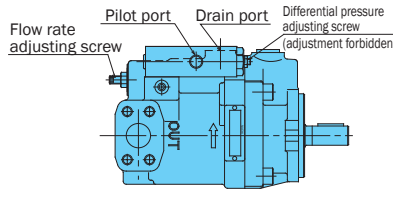
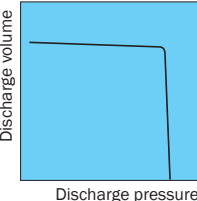
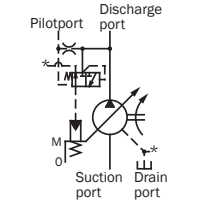
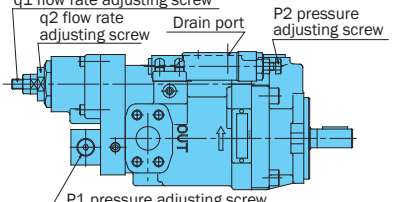
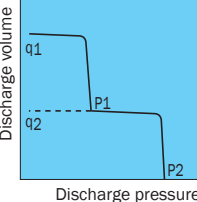
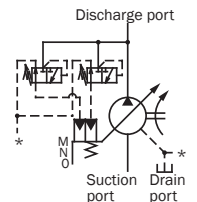
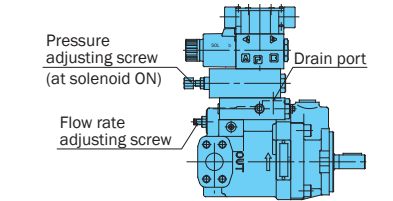
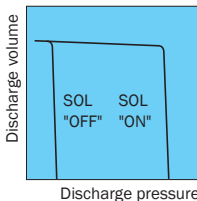
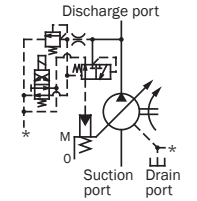
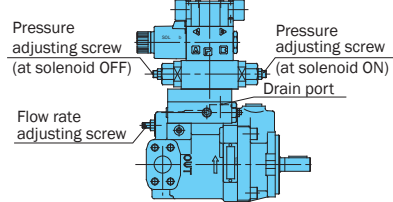
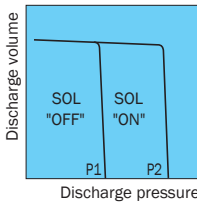
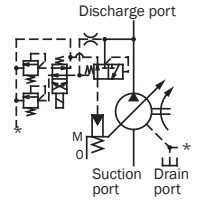
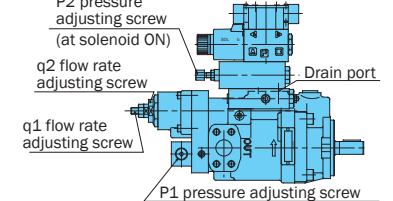
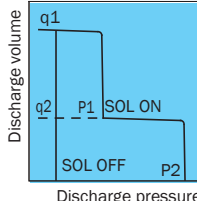
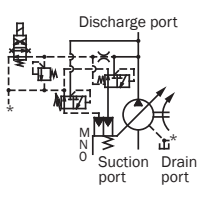
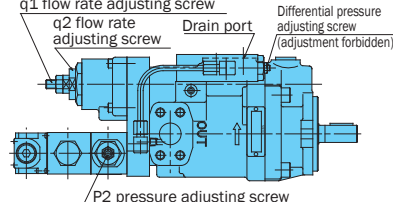
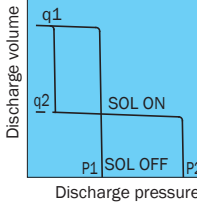
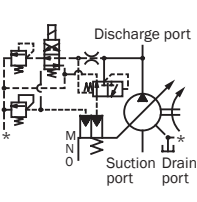
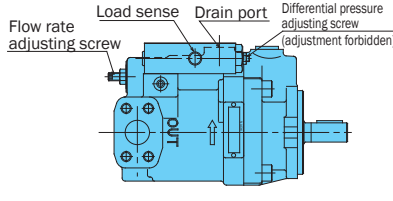
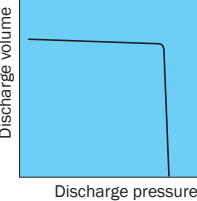
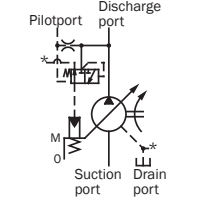
Variable Control Mechanisms

A

Piston Pumps

Standard type

Option type

Symbol	External View	Characteristics	Hydraulic Circuit	Explanation
N				Pressure compensation type (manual system) When the discharge pressure reaches the preset volume set by the pressure compensator, the discharge volume is automatically reduced to hold the pressure at the set pressure.
P				Pressure compensation type (remote control mode) This mode demonstrates the same characteristics as the manual mode. The discharge pressure can be adjusted by external pilot pressure. The discharge volume can be adjusted manually.
NQ				2-pressure, 2-flow rate control type The discharge volume changes in two stages by the pump's built-in sequence valve. This allows conventional high/ low pressure control to be performed on a single pump unit, and save energy in the hydraulic circuit.
RS (RA)				Solenoid cutoff control type A solenoid valve for unload is integrated into the pressure compensation type to minimize energy loss when pump output is not required. Only a slight amount of heat is generated.
WS (WA)				2-pressure control type Two pressure compensation types can be obtained by switching the solenoid valve ON/OFF. Two types of output control are possible with the actuator set to a constant speed.
RQS (RQA)				2-pressure, 2-flow rate control type w/ solenoid cutoff The discharge volume can be changed in two stages by the sequencer valve and solenoid valve for unload mounted on the pump, and unloading is possible when pressure oil is not required.
CS (CA)				2-cutoff control type Two types of pressure - flow rate characteristics can be obtained by the solenoid valve and cylinder mounted on the pump.
R				Load sense type This mode demonstrates the same characteristics as the manual mode. The discharge pressure can be adjusted by external pilot pressure. The discharge volume can be adjusted manually. (Note 2)

Note 1: Many other variable control mechanism are also available in addition to those in the above table. Please consult your agent for details.

Note 2: We recommend ZR-T02-5895* as the remote control valve. For details, consult your agent. Prevent the pipe volume up to the remote control valve from falling below 10 cu in.

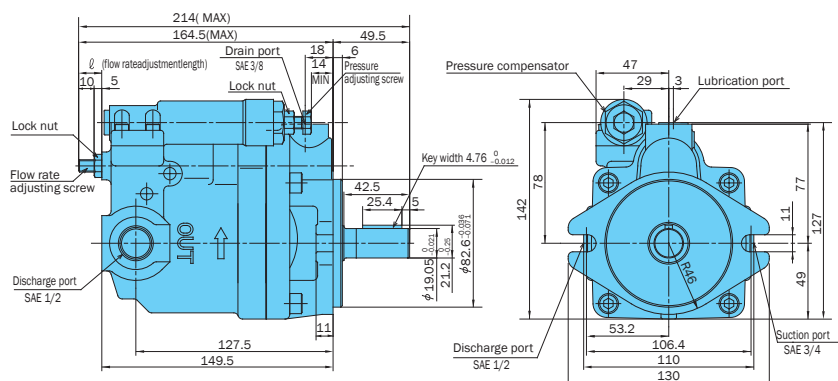
Pressure Compensation Type

PVS-0B-8N*-30

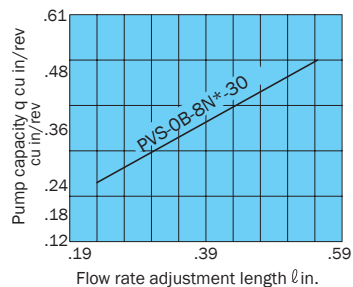
Manual Mode: Standard Type

2 Bolt SAE A Mount

Installation Dimension Drawing

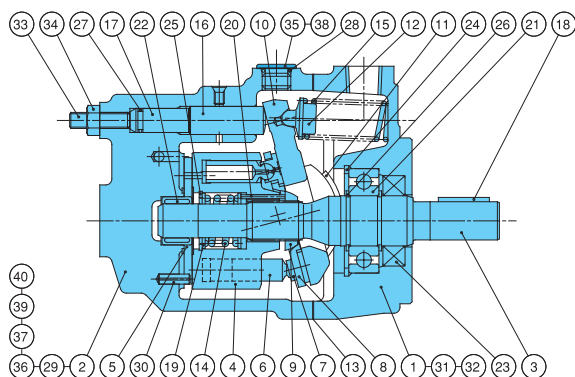


PVS-0B-8N*-30

Flow rate adjustment length l in.

Set a flow rate adjustment length within the above range. Oil will leak if the pump is operated below the adjustment range lower limit.

Cross-Sectional Drawing



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	15	Spring S	29	Parallel pin
2	Case	16	Control piston	30	Spring pin
3	Shaft	17	Guide pin	31	Hexagon socket head bolt
4	Cylinder barrel	18	Parallel key	32	Cross-recessed countersunk head screw
5	Valve plate	19	Retainer	33	Hexagon socket set screw
6	Piston	20	Needle	34	Hexagon nut
7	Shoe	21	Ball bearing	35	Hexagon plug
8	Shoe holder	22	Needle bearing	36	Metal plug
9	Barrel holder	23	Oil seal	37	Nameplate
10	Swash plate	24	Snap ring	38	Lubrication port plate
11	Thrust bush	25	Snap ring	39	CAUTION plate
12	Spring holder	26	Snap ring	40	Rivet
13	Gasket	27	O-ring		
14	Spring C	28	O-ring		

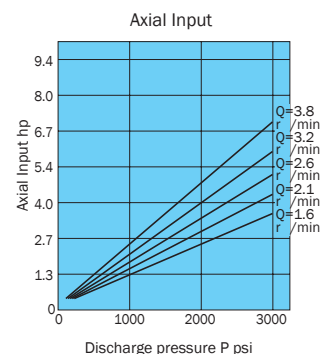
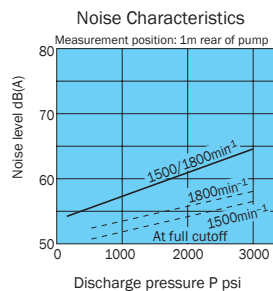
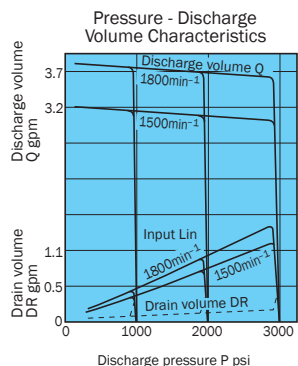
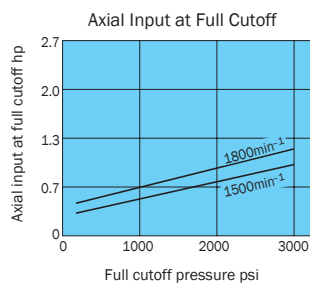
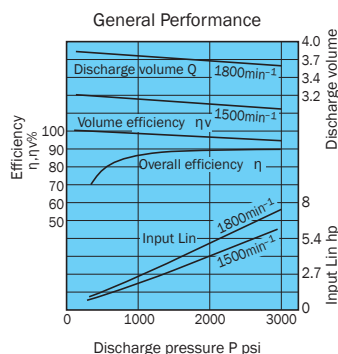
Seal Kit Part No. PSS-100000

Part No.	Part Name	Q'ty	Size	Remarks
* 13	Packing	1	PSC46-100000	3 Bond
23	Oil seal	1	TCV-254511	N.O.K
27	O-ring	1	1B-P9	JIS B 2401
28	O-ring	1	1B-P11	JIS B 2401

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

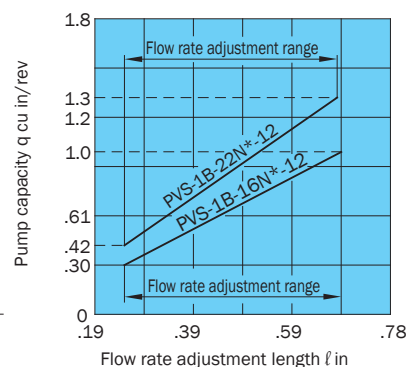
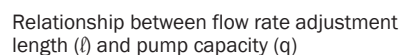
Pressure Compensation Type

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes



Piston Pumps

**SAE A Mount
(side port type)**



Set a flow rate adjustment length within the above range. Oil will leak if the pump is operated below the adjustment range lower limit.

Technical drawing of the 61 series pump showing three views: front, side, and rear. The front view shows a square flange with four mounting holes (4-M10X16) and two ports labeled "Code 61 - 1 (suction port 24 mm dia.)" and "Code 61 - 3/4 (discharge port 24 mm dia.)". The side view shows the pump body with a "Drain port SAE 3/8", "Pressure adjusting screw", and "Flow rate adjusting length". The rear view shows the "Pressure compensator" and "Lubrication port". Dimensions are provided in millimeters with tolerances.

Fig. 1.1 is a detailed technical cross-section drawing of a mechanical assembly, likely a pump or valve. The drawing is rendered in blue lines on a white background. It features a central horizontal shaft with various components mounted on it. A large, complex housing surrounds the central assembly. Numerous numbered callouts (1 through 41) are distributed around the drawing, each with a leader line pointing to a specific part. The callouts are arranged as follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41. The drawing shows internal features like threads, seals, and structural reinforcements.

Part No.	Part Name	Part No.	Part Name
1	Body	22	Ball bearing
2	Case	23	Needle bearing
3	Shaft	24	Oil seal
4	Cylinder barrel	25	Snap ring
5	Valve plate	26	Snap ring
6	Piston	27	Snap ring
7	Shoe	28	O-ring
8	Shoe holder	29	O-ring
9	Barrel holder	30	O-ring
10	Swash plate	31	Pin
11	Thrust bush	32	Hexagon socket head bolt
12	Seal holder	33	Cross-recessed countersunk head screw
13	Gasket		
14	Spring C	34	Hexagon socket set screw
15	Spring S	35	Metal plug
16	Control piston	36	Nameplate
17	Needle	37	CAUTION plate
18	Key	38	Spring holder
19	Nut	39	Lubrication port plate
20	Retainer	40	Rivet
21	Plug	41	Guide pin

List of Sealing Parts (Kit Model Number PSS-101000-2A)

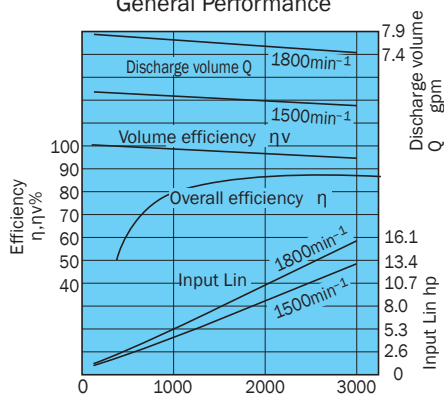
Part No.	Name	Q'ty	Size	Remarks
13	Gasket	1	PS46-101000	Nihon Gasket
24	Oil seal	1	TCN-254511	N.O.K
28	O-ring	1	1B-G55	JIS B 2401
29	O-ring	1	1B-P9	JIS B 2401
30	O-ring	1	1B-P14	JIS B 2401

Parts marked by an asterisk "*" are not available on the market.
Consult your agent.

Performance Curves

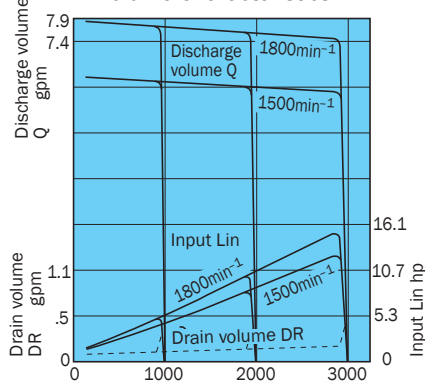
PVS-1B-16N*-(Z)-E13

General Performance



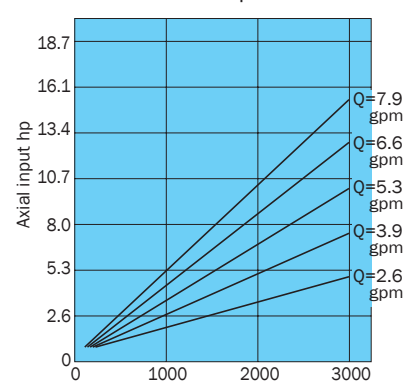
Discharge pressure P psi

Pressure - Discharge Volume Characteristics



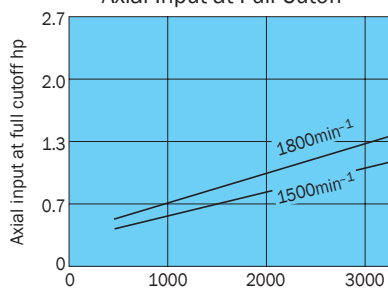
Discharge pressure P psi

Axial Input



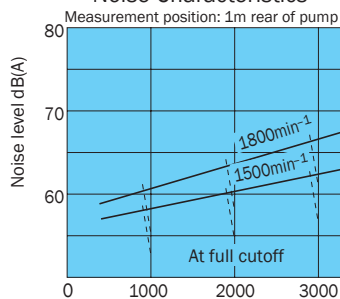
Discharge pressure P psi

Axial Input at Full Cutoff



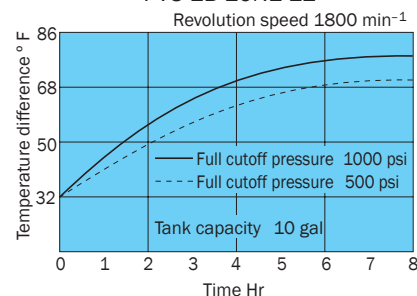
Full cutoff pressure psi

Noise Characteristics



Discharge pressure P psi

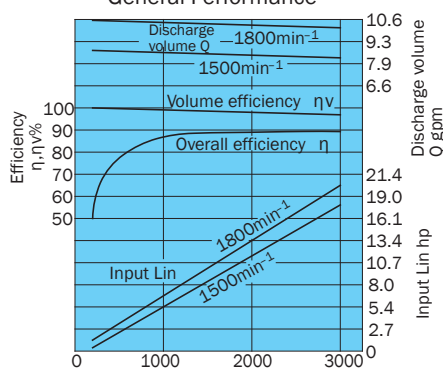
Oil Temperature Rise Characteristics PVS-1B-16N1-12



Performance Curves

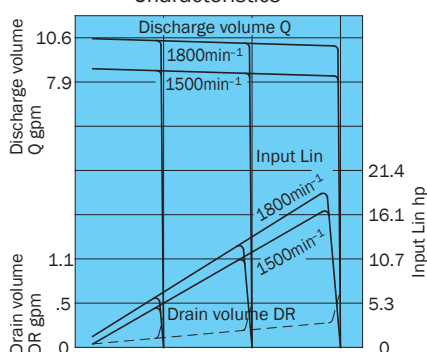
PVS-1B-22N*-(Z)-E13

General Performance



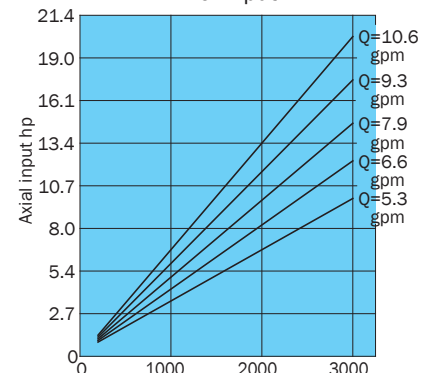
Discharge pressure P psi

Pressure - Flow Rate Characteristics



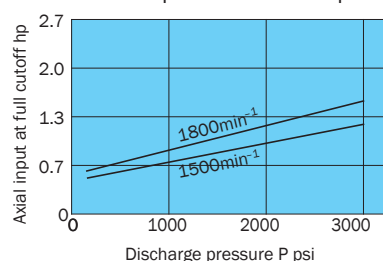
Discharge pressure P psi

Axial Input



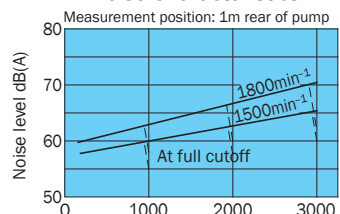
Discharge pressure P psi

Axial input at full cutoff hp

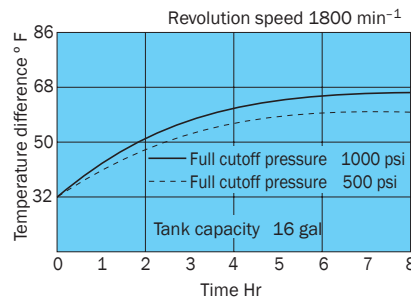


Discharge pressure P psi

Noise Characteristics

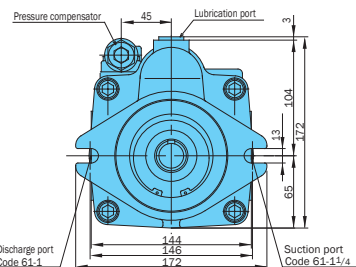


Discharge pressure P psi

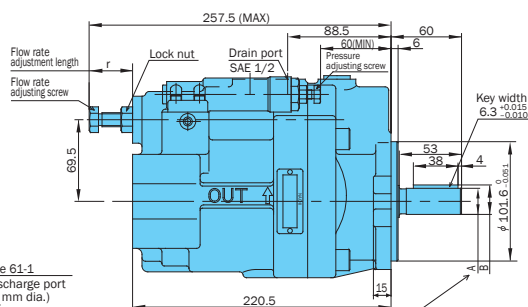


Piston Pumps

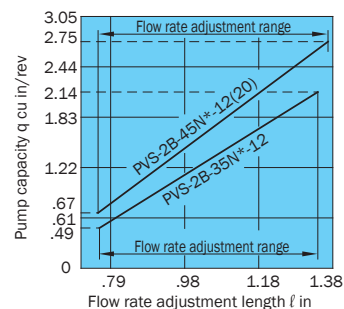
**SAE B Mount
(side port type)**



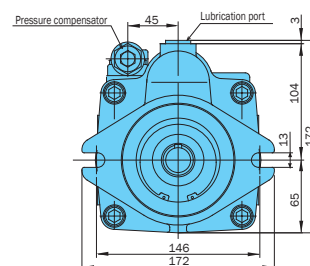
(axial port type)



Relationship between flow rate adjustment length (l) and pump capacity (q)

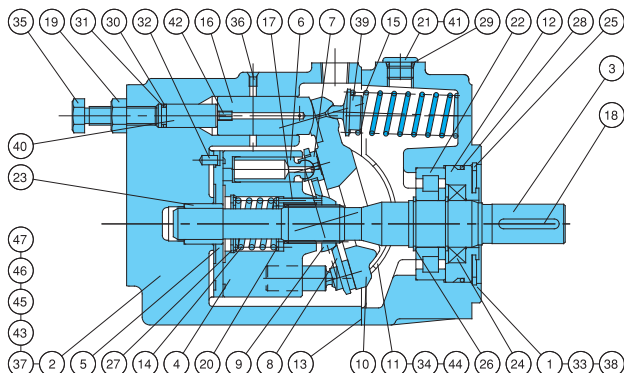


Set a flow rate adjustment length within the above range. Oil will leak if the pump is operated below the adjustment range lower limit.



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body ¹⁴⁶	16	Control piston	31	Backup ring
2	Case ¹⁷²	17	Needle	32	Pin
3	Shaft	18	Key	33	Hexagon socket
4	Cylinder barrel	19	Nut		head bolt
5	Valve plate	20	Retainer	34	Cross-recessed countersunk head screw
6	Piston	21	Plug		Flow rate adjusting screw
7	Shoe	22	Ball bearing	35	Metal plug
8	Shoe holder	23	Needle bearing		Nameplate
9	Barrel holder	24	Oil seal	36	CAUTION plate
10	Swash plate	25	Snap ring	37	Spring holder
11	Thrust bush	26	Snap ring	38	Guide
12	Seal holder	27	Snap ring	39	Lubrication port plate
13	Gasket	28	O-ring	40	Orifice
14	Spring C	29	O-ring	41	Rivet
15	Spring S	30	O-ring	42	
				43	

SAE B Mount



List of Sealing Parts (Kit Model Number PSS-102000-2A)

Part No.	Part Name	Q'ty	PVS-2B-35/45	
			Size	Remarks
* 13	Gasket	1	PS46-102000-0A	Nihon Gasket
* 24	Oil seal	1	TCN-305011Z	N.O.K
28	O-ring	1	1B-G70	JIS B 2401
29	O-ring	1	1B-P14	JIS B 2401
30	O-ring	1	1B-P11	JIS B 2401
31	Backup ring	1	T2-P11	JIS B 2407

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	17	Needle	33	Hexagon socket
2	Case	18	Key		head bolt
3	Shaft	19	Nut	34	Cross-recessed countersunk head screw
4	Cylinder barrel	20	Retainer		Flow rate adjusting screw
5	Valve plate	21	Plug	35	Flow rate adjusting screw
6	Piston	22	Roller bearing		CAUTION plate
7	Shoe	23	Needle bearing	36	Spring holder
8	Shoe holder	24	Oil seal	37	Guide
9	Barrel holder	25	Snap ring	38	Lubrication port plate
10	Swash plate	26	Snap ring	39	Orifice
11	Thrust bush	27	Snap ring	40	Rivet
12	Seal holder	28	O-ring	41	Orifice
13	Gasket	29	O-ring	42	Pin
14	Spring C	30	O-ring	43	O-ring
15	Spring S	31	Backup ring	44	Plug
16	Control piston	32	Pin	45	
				46	
				47	

List of Sealing Parts (Kit Model Number PSBS-102220)

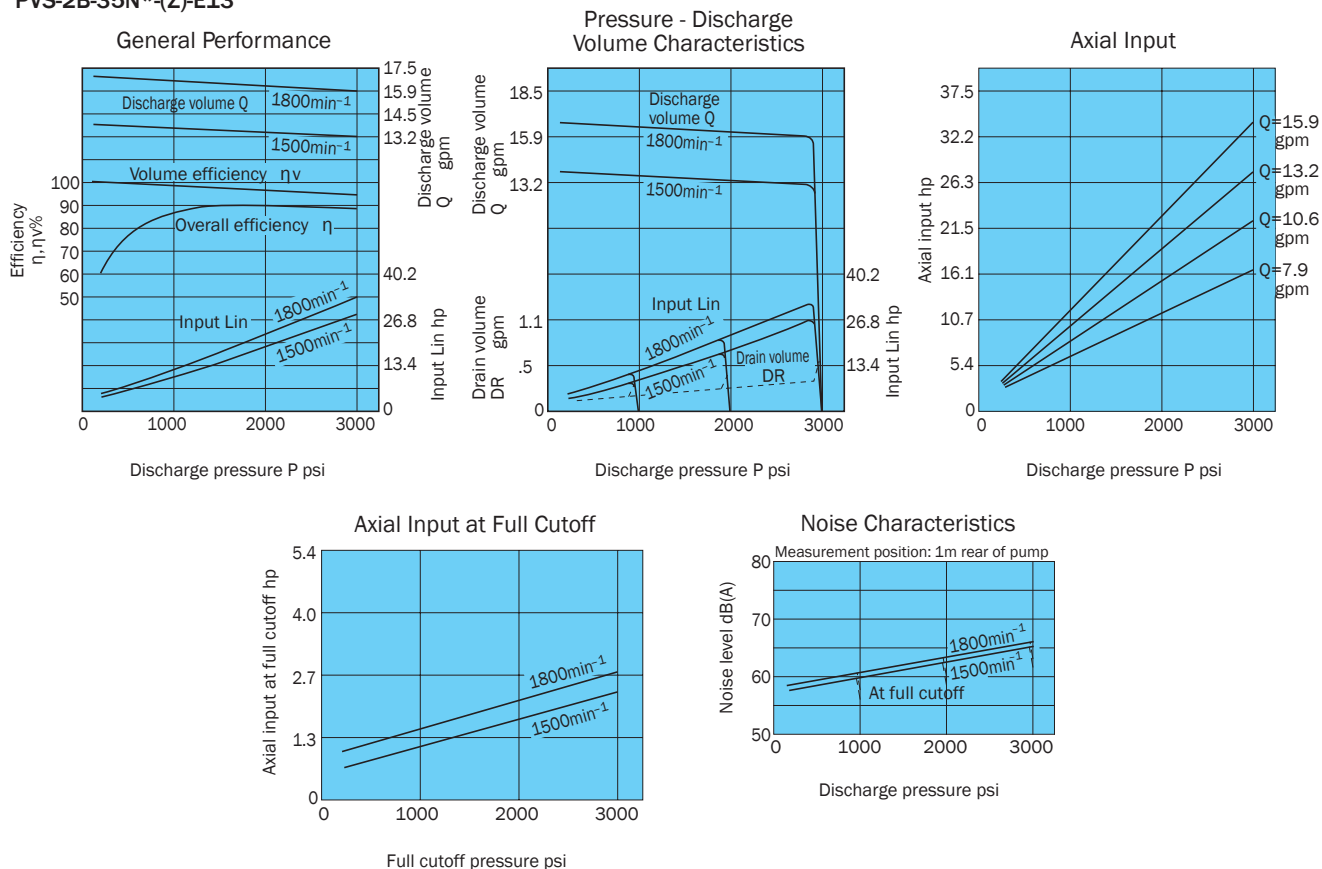
Part No.	Part Name	Q'ty	PVS-2B-45N3	
			Size	Remarks
* 13	Gasket	1	PS46-102000-OA	Nihon Gasket
* 24	Oil seal	1	TCN305011Z	N.O.K
28	O-ring	1	1B-G70	JIS B 2401
29	O-ring	1	1B-P14	JIS B 2401
30	O-ring	1	1B-P11	JIS B 2401
46	O-ring	2	1B-P5	JIS B 2401
31	Backup ring	1	T2-P11	JIS B 2407

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes

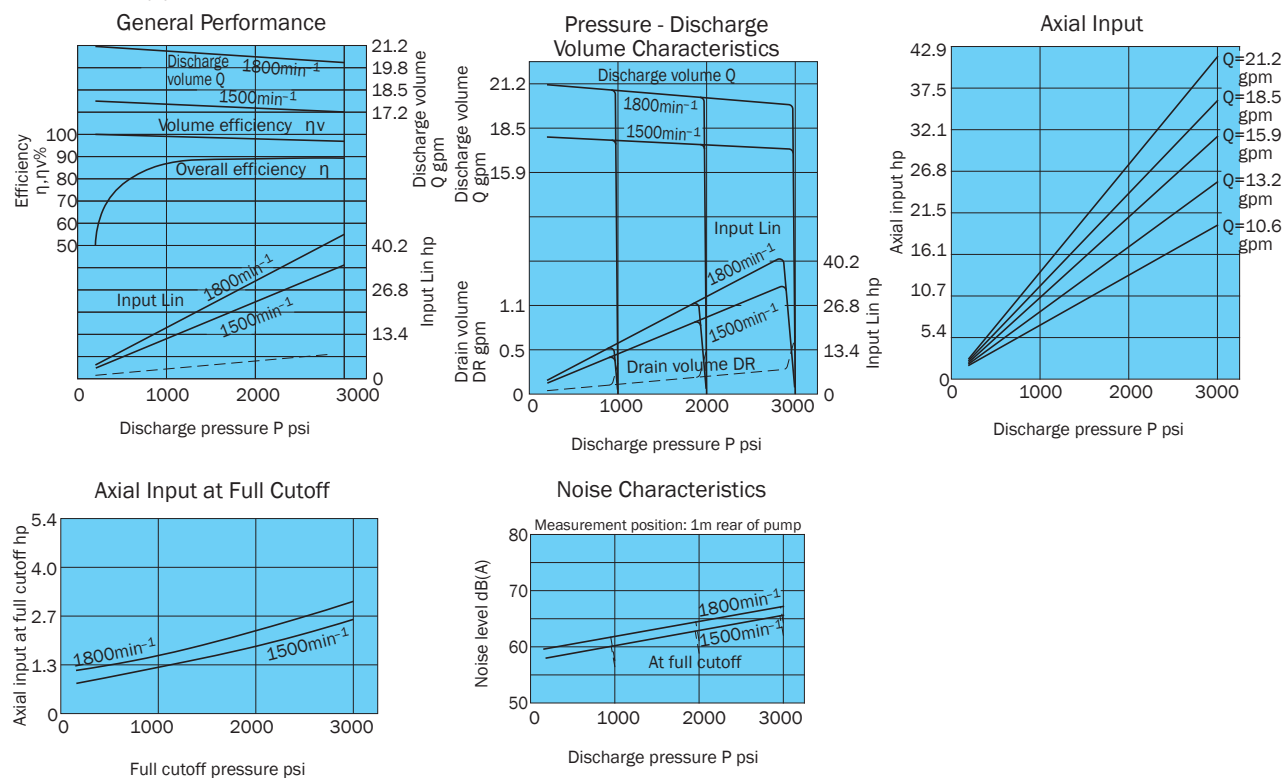
PVS-2B-35N*-(Z)-E13



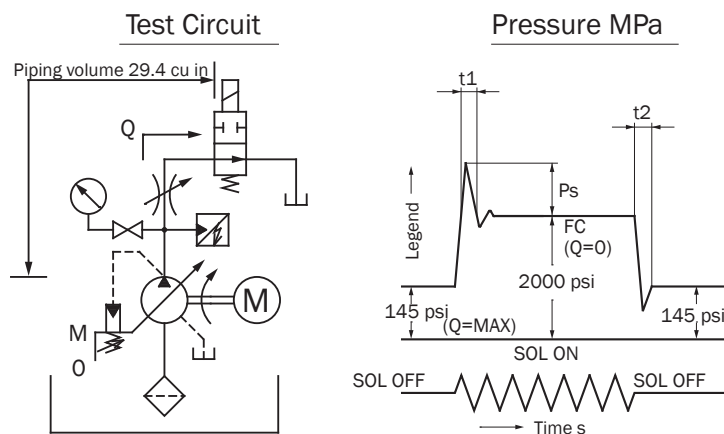
Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes

PVS-2B-45N*-(Z)-E13



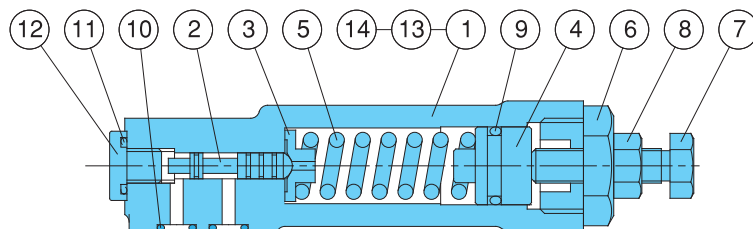
Response Performance



Model No.	Response Time (s)		Surge Pressure psi
	t ₁	t ₂	P _s
PVS-0B-8	0.03 to 0.04	0.04 to 0.06	290 to 580
PVS-1B-16	0.05 to 0.06	0.07 to 0.08	580 to 1000
PVS-1B-22	0.05 to 0.06	0.07 to 0.08	725 to 1160
PVS-2B-35	0.05 to 0.06	0.05 to 0.07	870 to 1300
PVS-2B-45	0.05 to 0.06	0.05 to 0.07	870 to 1300

Response performance changes according to pipe volume and size.
Use a surgeless valve to prevent surge pressure.

Pressure Compensator



Part No.	Part Name	Part No.	Part Name
1	Body	8	Nut
2	Spool	9	O-ring
3	Holder	10	O-ring
4	Plunger	11	O-ring
5	Spring	12	Plug
6	Retainer	13	Plug
7	Pressure adjusting bolt	14	Mounting bolt

List of Sealing Parts

Part No.	Name	Q'ty	Size
			For 0B, 1B, 2B
9	O-ring	1	1A-P14
10	O-ring	3	1B-P6
11	O-ring	1	1B-P10

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Replacement Items

PVS Rotating Group

PVS-0B-8*E30	PSCG-100000-0F
PVS-1B-16*E13	PSG-101100-0A
PVS-1B-22*E13	PSG-101200-1E
PVS-2B-35*E13	PSG-102100-0A
PVS-2B-45*E13	PSG-102200-0A
PVS-2B-45N3*E20	

Includes Items 4,5,6 & 7

PVS Thrust Plate Item 11

PVS-0B-8*E30	PSC69-100000
PVS-1B-16*E13	PS69-101000
PVS-1B-22*E13	PS69-101000
PVS-2B-35*E13	PS69-102000
PVS-2B-45*E13	PS69-102000

Compensator Part Numbers

N0 - PSN-101000	P - ZR-G01-P-E2405C
N1 - PSN-101010	R - ZR-G01-R3-E2171B
N2 - PSN-101020	
N3 - PSN-101030	

Pressure Compensation Type

Explanation of Model No.: **PVS – 0 B – 8 P * – E30**

- Design No.
E30: PVS-0*
E12: PVS-1*, PVS-2 *
E20: PVS-2*45P3 only

- Pressure adjustment range

1: 286 - 1000

2: 429 - 2000

3: 429 - 3000

ssure compensat

- P: Pressure compensation type (remote control mode)

Max. pump capacity (cm³/rev)

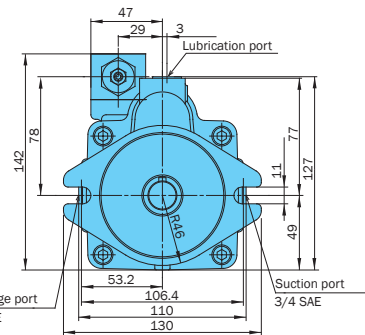
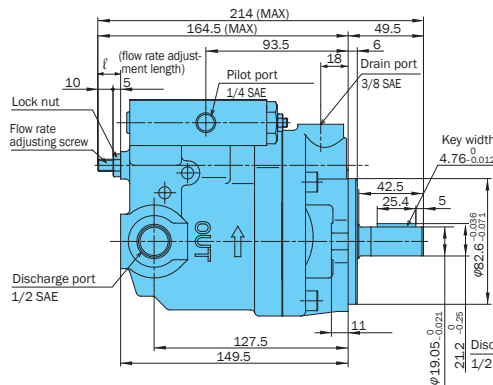
Nominal 8, 16, 22, 35, 45

- Pump size 0, 1, 2

Installation Dimension Drawing

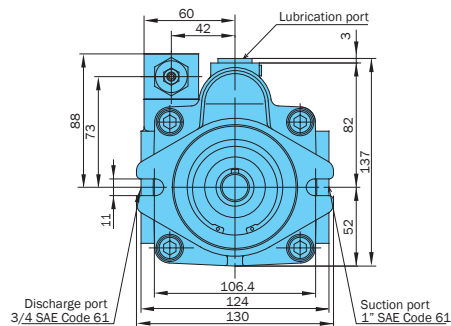
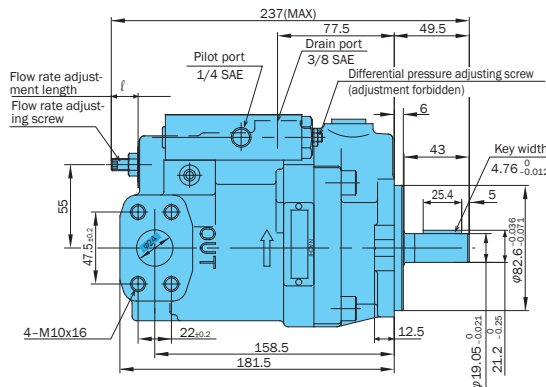
The ZR-T02-*-5895* is the recommended remote control valve. Provide piping to the remote control valve at a pipe volume of 9 cu in or less.

PVS-0B-8P*-E30



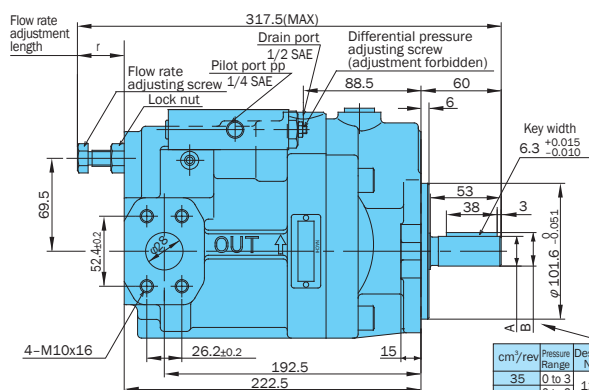
SAE A Mount

PVS-1B- $\frac{16}{22}$ P*-E13

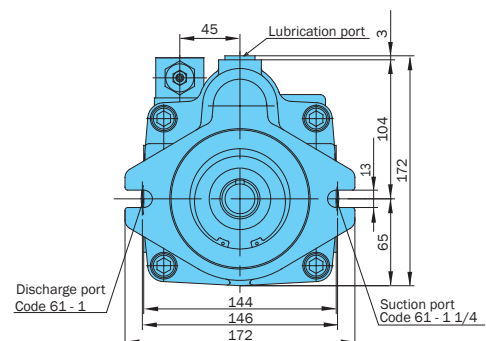


SAE A Mount

PVS-2B-³⁵₄₅P*-E13



cm ³ /rev	Pressure Range	Design No.	A	B
35	0 to 3	12D	0.875	0.987
45	0 to 2		0.874	0.978
	3	20D	0.999	1.096
			0.998	1.087



SAE B Mount

A Piston Pumps

Design No.
E13: PVS-1 *, PVS-2 *
E20: PVS-2 *-45N3Q*

Pressure adjustment range

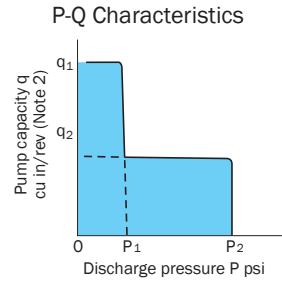
- N*: High-pressure adjustment range,
P2 (Set to lowest pressure before shipping)
- Q*: Low-pressure adjustment range,
P1 (Set to 3.5 MPa before shipping)

0: 286 - 500 psi
1: 286 - 1000 psi
2: 429 - 2000 psi
3: 429 - 3000 psi

- NQ: 2-pressure, 2-flow rate control

- Max. pump capacity (cm³/rev) Nominal 16, 22, 35, 45

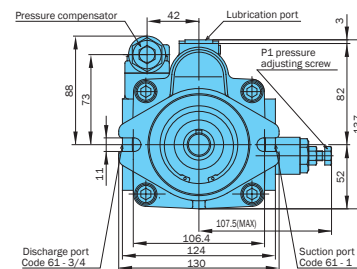
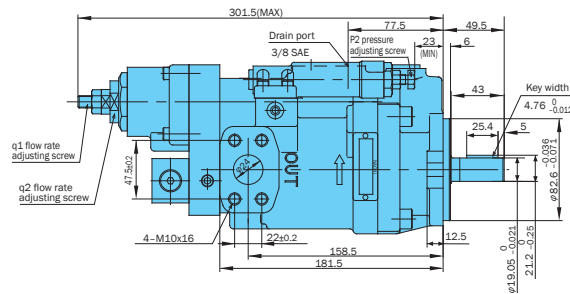
- Pump size 1, 2



Installation Dimension Drawing

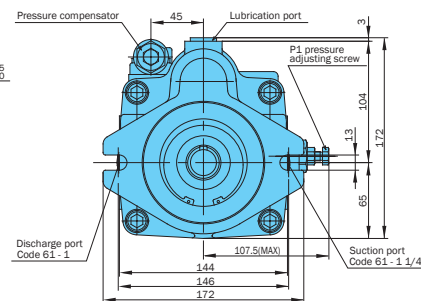
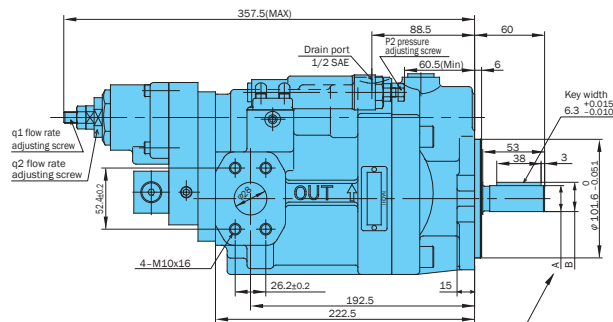
PVS-1B- $\frac{16}{22}$ N*Q*-E13

SAE A Mount



PVS-2B- $\frac{35}{45}$ N*Q*-E13(E20)

SAE B Mount

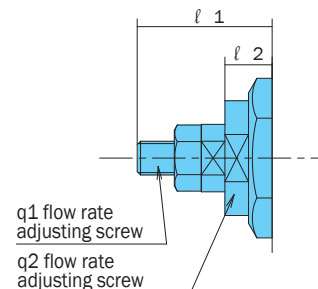


cm ³ /rev	Pressure Range	Design No.	A	B
35	0 to 3	12D	0.875	0.987
	0 to 2		0.874	0.978
45	3	20D	0.999	1.096
			0.998	1.087

Pump Model No.	q ₂ Adjustment Range (in ³ /rev)	Default q ₂ (Setting in ³ /rev)
PVS-1B-16	.12 to 0.6	.2
PVS-1B-22	.12 to .79	.26
PVS-2B-35	.12 to 1.16	.42
PVS-2B-45	.18 to 1.46	.54

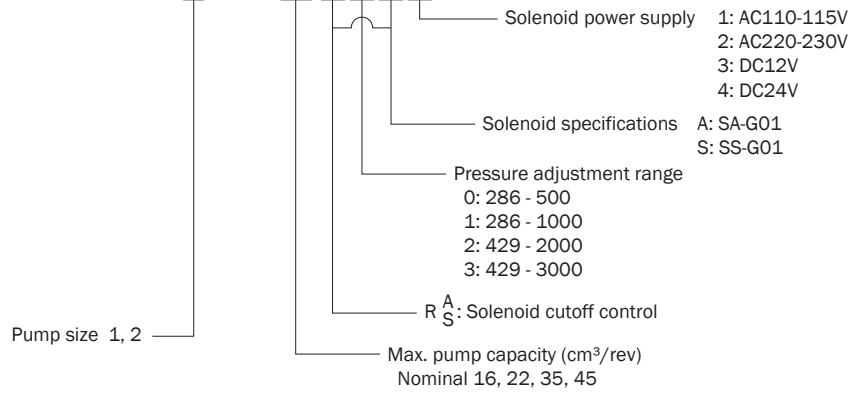
Note 1: The setting range of maximum pump capacity q_1 varies according to the setting of q_2 .

Note 2: Overall efficiency at a low flow rate is worse than at the maximum flow rate. Pay attention to this when selecting the motor capacity for the drive.

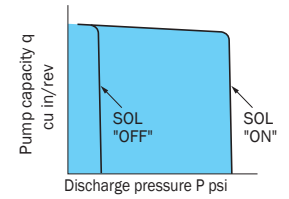


Solenoid Cutoff Control Type

Explanation of Model No.: **PVS - 1 B - 16 R 2 S 1 - E13**

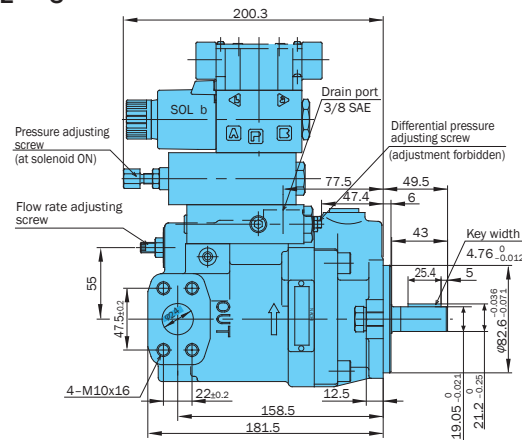


P-Q Characteristics

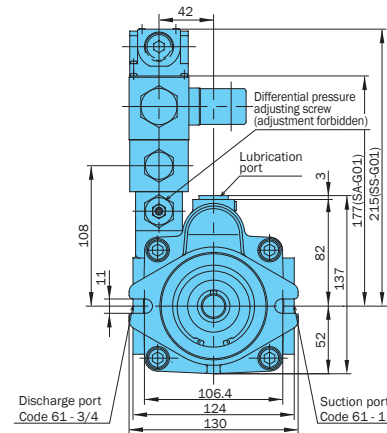


Installation Dimension Drawing

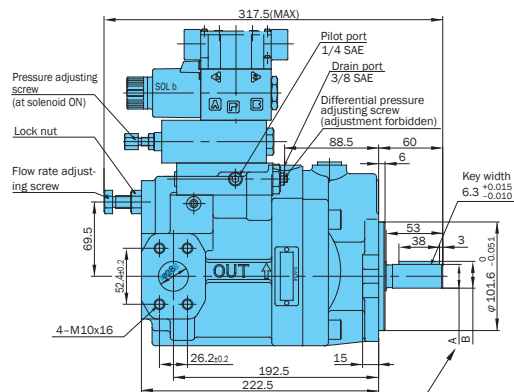
PVS-1B-¹⁶/₂₂R^A/_S*-E13



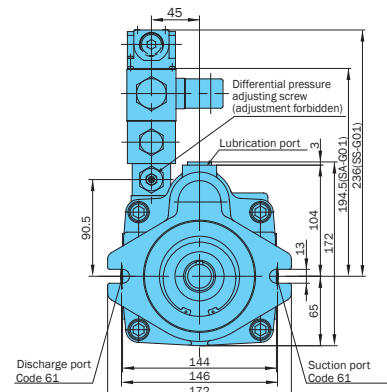
SAE A Mount



PVS-2B-³⁵/₄₅R^A/_S*-E13



SAE B Mount



cm ³ /rev	Pressure Range	Design No.	A	B
35	0 to 3	12D	0.875	0.987
	0.10 to 2		0.874	0.978
45	3	20D	0.999	1.096
			0.998	1.087

- The coil surface temperature increases if this pump is kept continuously energized.
Do not touch the surface of the coil directly with your hands.

A Piston Pumps

The graph shows pump capacity q (cu in/rev) on the y-axis and discharge pressure P (psi) on the x-axis. The curve starts at a high capacity at low pressure, remains relatively flat until pressure P_1 , then drops sharply to a lower capacity level, and remains flat until pressure P_2 , where it drops again. The region between the first flat section and the first sharp drop is labeled "SOL 'OFF'", and the region between the first sharp drop and the second sharp drop is labeled "SOL 'ON'".

A 15

2-Pressure, 2-Flow Rate Control Type w/Solenoid Cutoff

Explanation of Model No.: **PVS -- 1 B -- 16 RQ 2 S 1 -- E13**

Solenoid power supply 1: AC110-115V
2: AC220-230V
3: DC12V
4: DC24V

Solenoid specifications A: SA-G01
S: SS-G01

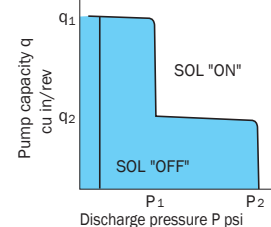
Pressure adjustment range
0: 286 - 500
1: 286 - 1000
2: 429 - 2000
3: 429 - 3000

RQ ^A_S: 2-pressure, 2-flow rate control w/solenoid cutoff

Pump size 1, 2

Max. pump capacity (cm³/rev)
Nominal 16, 22, 35, 45

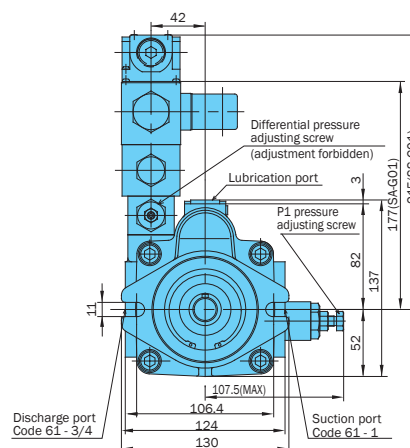
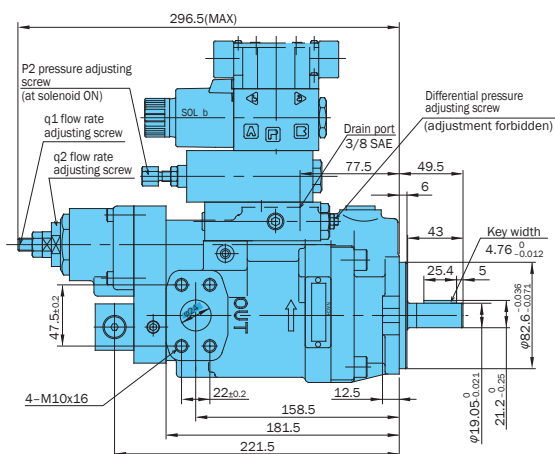
P-Q Characteristics



Installation Dimension Drawing

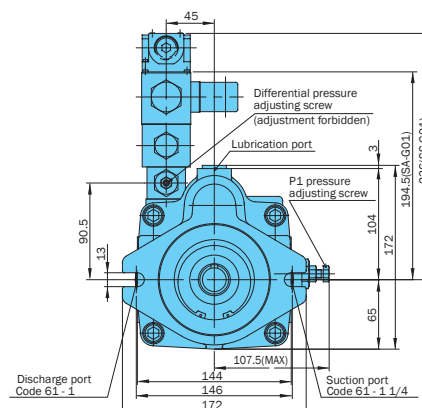
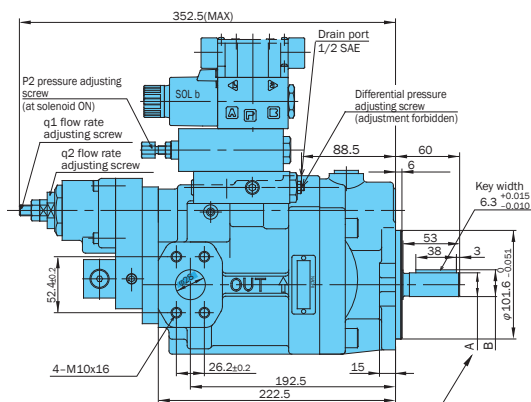
PVS-1B-¹⁶₂₂RQ*^A_S*-E13

SAE A Mount



PVS-2B-³⁵₄₅RQ*^A_S*-E20

SAE B Mount



cm ³ /rev	Pressure Range	Design No.	A	B
35	0 to 3	12D	0.875	0.987
	0 to 2		0.874	0.978
45	3	20D	0.999	1.096
			0.998	1.087

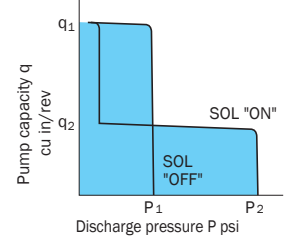
■ The coil surface temperature increases if this pump is kept continuously energized.
Do not touch the surface of the coil directly with your hands.

2-Cutoff Control Type

Explanation of Model No.: **PVS - 1 B - 16 C 2 S 1 - E13**

- Solenoid power supply 1: AC110-115V
2: AC220-230V
3: DC12V
4: DC24V
- Solenoid specifications A: SA-G01
S: SS-G01
- Pressure adjustment range
0: 286 - 500
1: 286 - 1000
2: 429 - 2000
3: 429 - 3000
- C^A_S: 2-cutoff control
- Pump size 1, 2
- Max. pump capacity (cm³/rev)
Nominal 16, 22, 35, 45

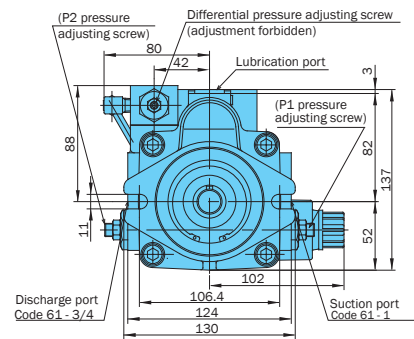
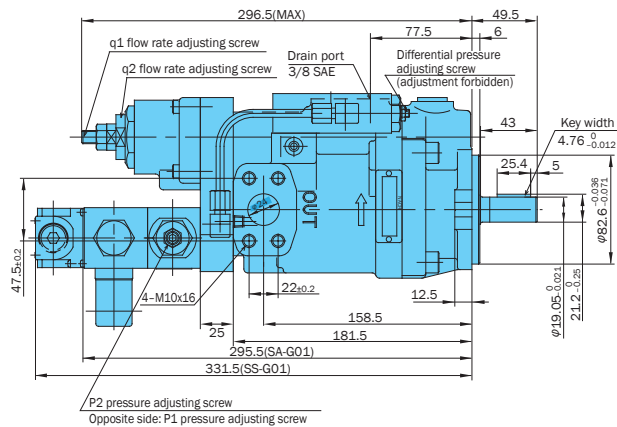
P-Q Characteristics



Installation Dimension Drawing

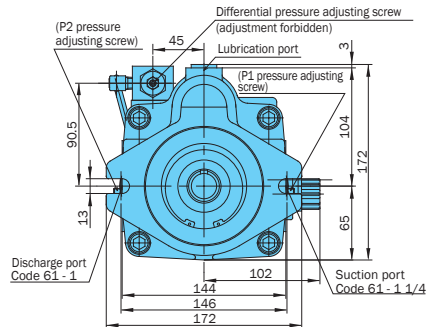
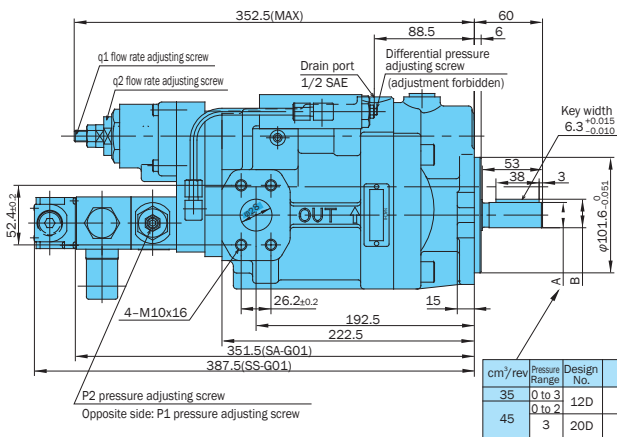
PVS-1B-16 C* A*-E13
22 S

SAE A Mount



PVS-2B-35 C* A*-E20
45 S

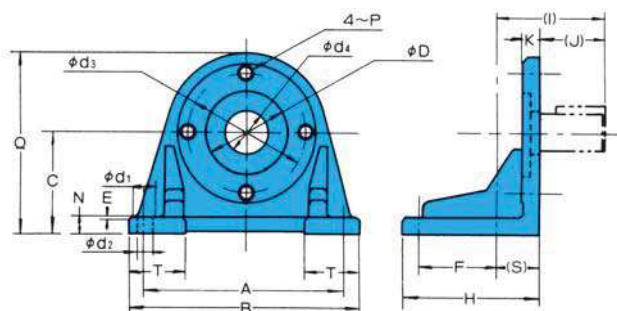
SAE B Mount



cm ³ /rev	Pressure Range	Design No.	A	B
35	0 to 3	12D	0.875	0.987
45	0 to 2	12D	0.874	0.978
	3	20D	0.999	1.096
			0.998	1.087

- The coil surface temperature increases if this pump is kept continuously energized.
Do not touch the surface of the coil directly with your hands.

Foot Mounting Kit



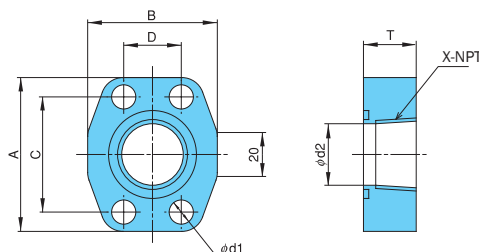
Kit Model No.	Applicable Pump Model No.	Accessories				Dimensions				
		Bolt	Q'ty	Washer	Q'ty	A	B	C	E	F
IHM-2-10	PVS-0B PVS-1B	TB-10 ×30	2	WP-10	2	127	152.5	69.8	1	50.8
IHM-4-10	PVS-2B	TB-12 ×30	2	WP-12	2	220.7	246	107.95	1	114.3

Kit Model No.	Dimensions														Weight kg
	H	(I)	(J)	K	N	P	Q	(S)	T	φD	φd ₁	φd ₂	φd ₃	φd ₄	
IHM-2-10	96	64.5	32	17.5	13	M10	135	32.5	36.5	82.6	22	11	106.4	50	2.0
IHM-4-10	140	56.7	44	16	16	M12	195.5	12.7	53	101.6	22	11	146	40	5.5

When only the mounting feet are required, the pump mounting bolts, washers and other parts are sold together as the Foot Mounting Kit.

Piping Flange Kit

For PVS-1B, 2B



Applicable Pump Model No.	PVS-1B-16/22		PVS-2B-35/45	
Plunger Kit model No.	PSF-101000		PSF-102000	
	Suction port	Discharge port	Suction port	Discharge port
A	70	65	79	70
B	59	52	73	59
C	52.4	47.5	58.7	52.4
D	26.2	22.0	30.2	26.2
T	24	24	28	24
φd ₁	φ11	φ11	φ11	φ11
φd ₂	φ28	φ22	φ37	φ28
X	1	3/4	1-1/4	1
Mounting bolt	TH-10 ×40	TH-10 ×40	TH-10 ×45	TH-10 ×40
Washer	WS-B-10	WS-B-10	WS-B-10	WS-B-10
O-ring	1B-G35	1B-G30	1B-G45	1B-G35
Weight lbs	1.3	1.1	1.6	1.3

Notes: 1. The piping flange is on sale in the Flange Kit which includes mounting bolts, washers and O-rings.

2. O-ring 1B/B-** refers to JIS B2401-1B.

3. For details on tightening torque, see page C-11.

Uni-Pump Specifications

Explanation of Model No.:

UPV -- 1 A -- 16 N 1 -- 1.5 * -- 4 * * -- *20(40)

Design No. 20: PVS-1B 0.75 - 5.5kW; 1 hp - 7 hp
PVS-2B 3.7 - 7.5kW; 5 hp - 10 hp
40: PVS-0B 0.75 - 3.7kW; 1 hp - 5 hp
*E: Unified Thread

Auxiliary symbol None: Side port type; Z: Axial port type (PVS-1B, 2B)

M: 230 Volt

G: 460 Volt

Symbol None: 200 Volt

Number of motor poles 4: 4 poles

Motor terminal None: Right side viewed from pump side
A: Left side viewed from pump side

Motor output 0.7: 0.75 kW (1hp) 3.7: 3.7kW; (5hp) Note: UPV-^{OA}_{1A} is 0.75-5.5kW; (1 hp - 7 hp)
1.5: 1.5 kW (2hp) 5.5: 5.5kW; (7hp) UPV-2A is 3.7-7.5kW; (5 hp - 10 hp)
2.2: 2.2 kW (3hp) 7.5: 7.5kW; (10hp)

Pressure adjustment range

0: 286-500 psi

1: 286-1000 psi

2: 429-2000 psi

3: 429-3000 psi

Note: Not available at 45 cm³/rev

Variable control mechanism

N: pressure compensation type

(Note) Control option is also standard on the PVS pump.

Max. pump capacity (cm³/rev)

Nominal 8, 16, 22, 35, 45

Motor mounting method

Mounting foot type

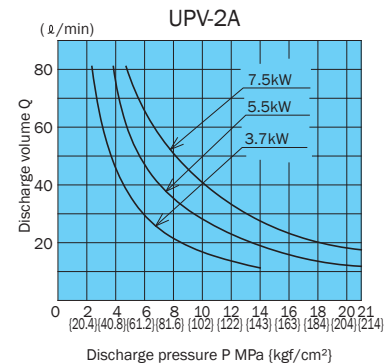
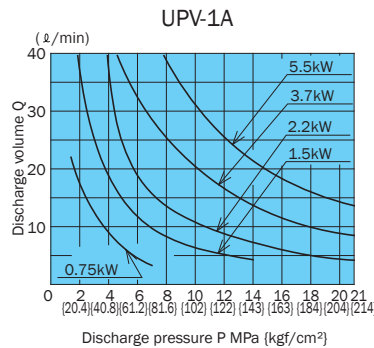
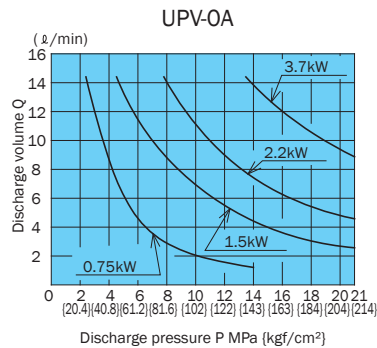
Pump size 0: PVS-0B, 1: PVS-1B, 2: PVS-2B

PVS series uni-pump

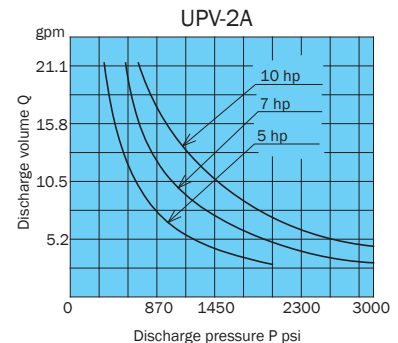
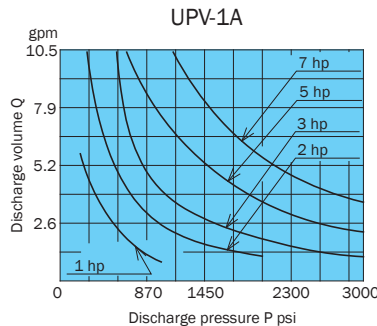
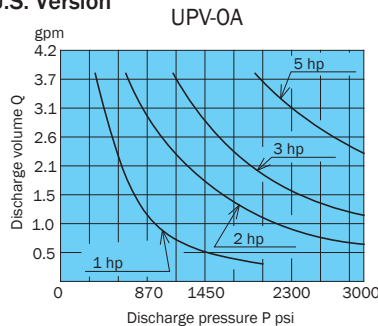
*This Uni-Pump is the metric version from Japan

Motor selection curves

Metric Version



U.S. Version



• How to select the motor

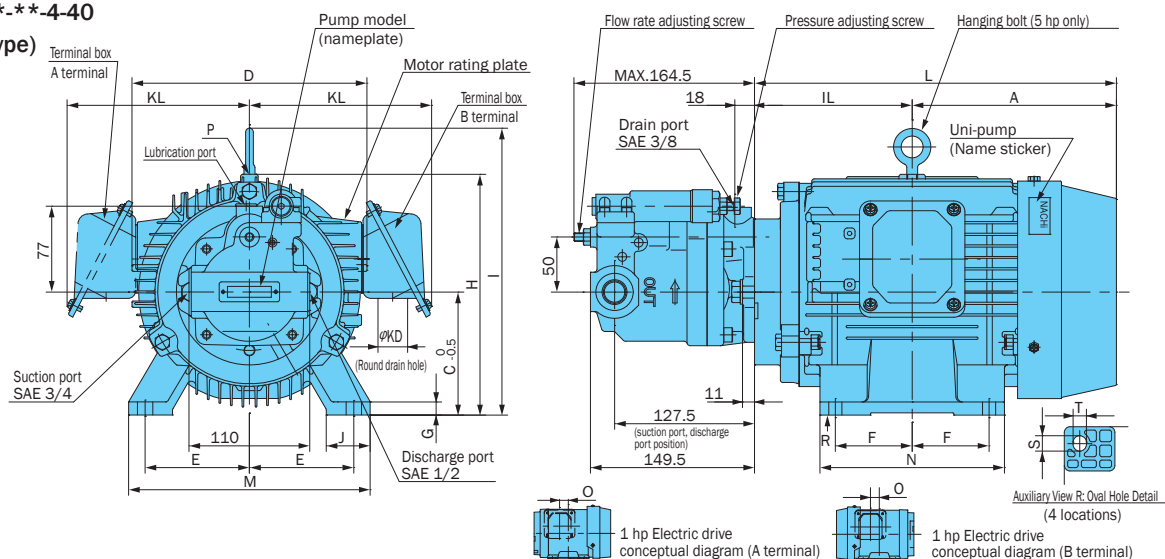
The lower side of the output curves for each of the motors shown above indicates the operating range under rated output for that motor.

* Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload

Installation Dimension Drawings

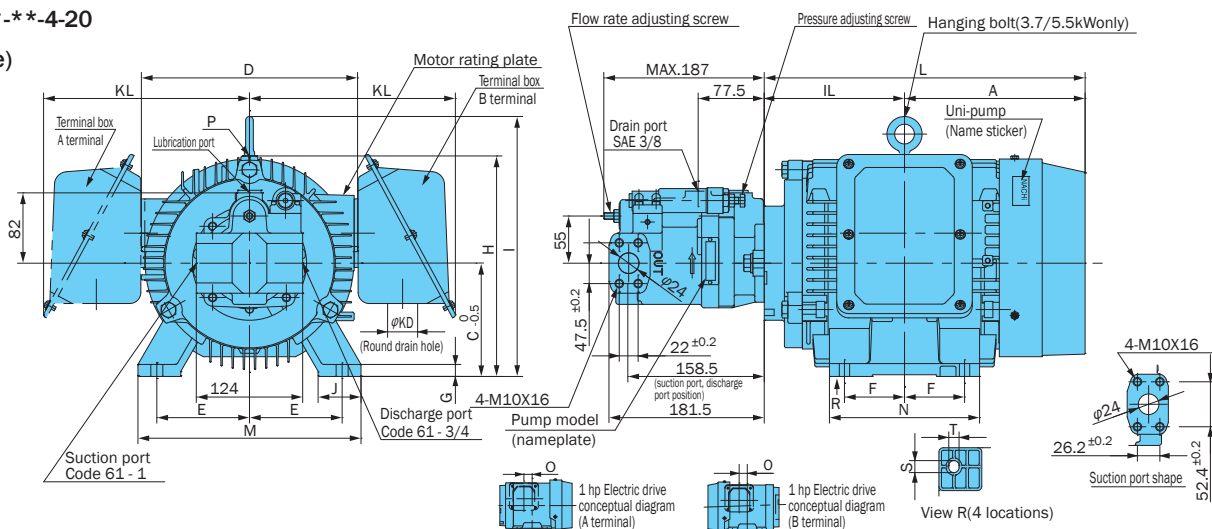
UPV-0A-8***-4-40

(side port type)



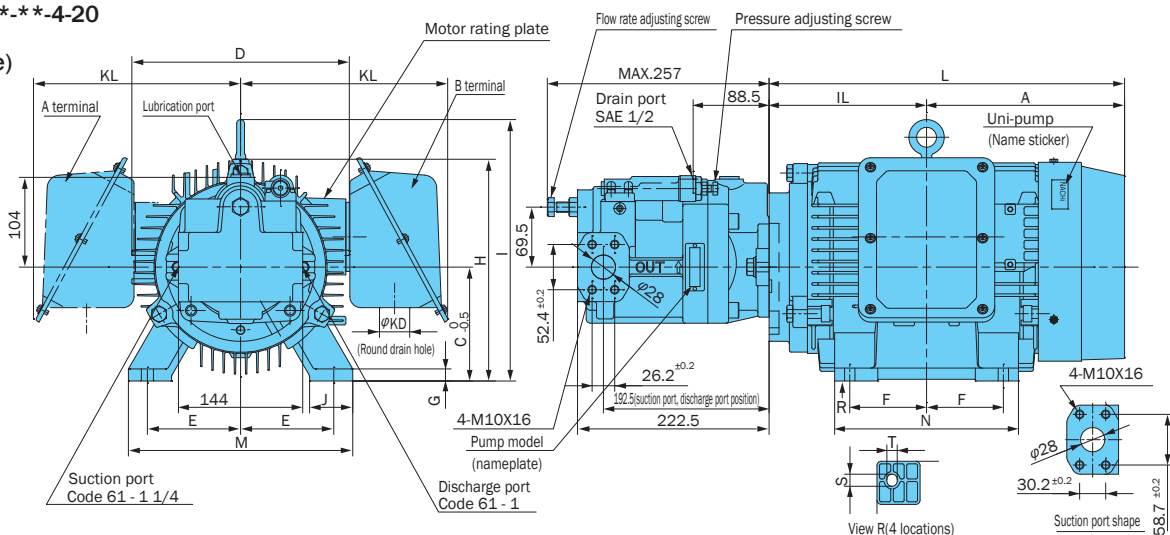
UPV-1A-16***-4-20

(side port type)



UPV-2A-35***-4-20

(side port type)



*These Pumps are Metric Versions from Japan

1. Drive motor is fully enclosed fan cooled, 1 to 5 hp is E type, and 7 to 10 hp is B type.

2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz; EM - 230 VAC, EG - 460 VAC

3. Viewed from the pump side, suction port is on the left and discharge port is on the right.

4. Broken lines indicate instances for the A terminal. Broken lines pass through to the other side of the pump along its center.

Note: A terminal measurements are in parentheses ().

Motor Specifications

Output hp	Motor Dimensions																	Frame No.	Weight lbs
	A	IL	C	D	E	F	G	H	I	J	L	M	N	S×T	KD	KL	O		
1	133	107.5	80	170	62.5	50	4.5	165	–	35	240.5	165	130	18×10	φ27	157	27.5	80M	14.5
2	143	118.5	90	198	70	62.5	10	190	–	40	261	176	150	12×10	φ27	159	–	90L	16
3	157.5	133	100	198	80	70	12	200	–	40	290.5	200	168	14×12	φ27	159	–	100L	21
5	186	143.5	112	214	95	70	12	–	261	40	329.5	220	168	14×12	φ27	166	–	112M	27
7	210.5	163.5	132	252	108	70	15	–	303	50	374	260	175	14×12	φ85	240	–	132S	42
10	229.5	182.5	132	252	108	89	15	–	303	50	412	260	213	14×12	φ85	240	–	132M	48

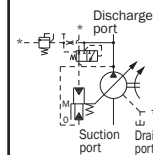
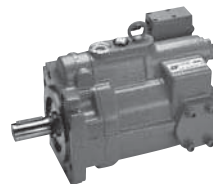
Characteristics of drive motor for unipump (domestic standard 3 rating)

Output hp	Poles	(Note1) Model Number TYPE (N)	Voltage [V]	Frequency [Hz]	Current rating [A]	RPM rating [min ⁻¹]	Heat resistance
.5	4	VBDA (VDS series only)	200	50	2.2	1400	B
			200	60	2.0	1680	
			230-460	60	2.0	1710	
1	4	V*DA-*A4*07	200	50	3.8	1410	B
			200	60	3.4	1690	
			230-460	60	3.4	1720	
2	4	V*DA-*A4*15	200	50	7.0	1410	B
			200	60	6.2	1690	
			230-460	60	6.0	1710	
3	4	V*DA-*A4*22	200	50	9.8	1400	B
			200	60	8.9	1680	
			230-460	60	8.5	1710	
5	4	V*DA-*A4*37	200	50	16.0	1410	B
			200	60	14.8	1690	
			230-460	60	14.0	1710	
7	4	V*DA-*A4*55	200	50	23.8	1430	B
			200	60	21.0	1730	
			230-460	60	20.0	1740	
10	4	V*DA-*A4*75	200	50	31.8	1435	B
			200	60	28.2	1730	
			230-460	60	27.0	1740	

- The asterisks * indicate variations in the hydraulic pump series, size, and position of terminal box.
Check the ratings sticker on the top of the drive motor.
- Contact us for variations in voltage.

PZS Series Variable Volume Piston Pumps

4.27 to 13.47 cu in/rev
4.27 to 6.10 cu in/rev 4085 psi
7.93 to 13.42/rev 3642 psi



Features

- High pressure, high reliability**
These pumps deliver the perfect combination of high pressure (4085 psi maximum) and high reliability. Hydraulic device energy efficiency is ensured because variable volume capabilities provide the means to keep the discharge rate to the desired level.
- Low noise, low vibration operation**
The semi-cylindrical swash plate of the PVS series provides high support and rigidity, making it possible to increase the number of pistons (from nine to 11) and equip optimal valve plates, all of which make low-noise operation possible.
- High reliability, long life**
O-ring seals used for mating surfaces eliminate worries about oil leaks. A spherical valve plate maintains optimal hydraulic pressure balance, for stable operation across a wide range and better contamination resistance characteristics.
- A wide range of possible applications
In addition to use as a stand-alone pump, a PZS Series pump can be combined with another IP pump in a wide range of possible applications with an adapter kit.

Specifications

Model No.	Pump Capacity in ³ /rev (cm ³ /rev)	Rated Pressure psi	Maximum Working Pressure psi	Pressure Adjustment Range psi	Revolution Speed min ⁻¹		Weight (lbs)	Fixed Discharge Pump (Note 1)		GPM
					Min.	Max.		Capacity cu in/rev	Pressure psi	
PZS-3B- 70* 1-E4481A 3-E4481A 4-E10	2.74 - 4.27 (70)	3000	4085	291 - 1000 291 - 3000 291 - 4085	500	1800	81	3.6 to 15.8 (IPH- 2.3 type)	21 {214}	32
PZS-4B- 100* 1-E4481A 3-E4481A 4-E10	2.44 - 6.10 (100)	3000	4085	291 - 1000 291 - 3000 291 - 4085	500	1800	128	3.6 to 15.8 (IPH- 2.3 type)	21 {214}	46
PZS-5B- 130* 1-E10 3-E5533A 4	3.11 - 7.93 (130)	3000	3642	291 - 1000 291 - 3000 291 - 3642	500	1800	189	3.6 to 32.3 (IPH- 2.3.4 type)	21 {214}	60
PZS-6B- 180* 1-E10 3 4	6.16 - 10.98 (180)	3000	3642	291 - 1000 291 - 3000 291 - 3642	500	1800	271	3.6 to 63.9 (IPH- 2.3.4.5 type)	21 {214}	83
PZS-6B- 220* 1-E10 3 4	7.56 - 13.42 (220)	3000	3642	291 - 1000 291 - 3000 291 - 3642	500	1500	278	3.6 to 63.9 (IPH- 2.3.4.5 type)	21 {214}	87

- Note
- Fixed discharge pump can be configured by combining with an IP pump.
 - Pump capacity adjustment ranges are for control codes N, RS, and WS. For information about control code NQ, see page A-27.
 - Direction of rotation is clockwise when viewed from the shaft end.

- Handling
 - Cautions during Pump Installation and Piping
- Use flexible couplings for connecting the pump shaft to the drive shaft, and prevent a radial or thrust load from being applied to the pump shaft.
 - Eccentricity between the drive shaft and pump shaft should be no greater than .001 in, with an eccentric angle error of 1° or less.
 - Set the clamping length of couplings and pump shafts at least 2/3 the length of the coupling width.
 - Use a sufficiently rigid pump mounting base.
 - Set the pressure on the pump suction side to -5 psi or more (suction port flow velocity within 6 ft/sec).
 - Raise part of the drain piping to above the topmost part of the pump body, and

insert the return section of the drain piping into the hydraulic operating fluid. Also, observe the values in the following table to limit the drain back pressure to 14.5 psi.

Model No.	3B, 4B, 5B	6B
Pipe joint size	at least 3/4"	at least 1"
Pipe I.D.	5/8	7/8
Pipe length	1m or less	1m or less

- Mount the pump so the pump shaft is oriented horizontally.
- Use of rubber hose is recommended in order to minimize noise and vibration.
- Check valve is located on the discharge side of the pump. (To prevent reverse rotation and damage to the pump when it is off)

Management of Hydraulic Operating Fluid

- Use only good-quality hydraulic operating fluid with a kinematic viscosity during operation within the range of 20 to 200 centistokes. Normally, you should use an R&O type and wear-resistant type of ISOVG32 to 68 or equivalent. The optimum kinematic viscosity during operation is 20 to 50 centistokes.
- The operating temperature range is 40 to 140 °F. When the oil temperature at startup is 5 °C or less, run the pump at low pressure and low speed until the oil temperature reaches 40 °F.
- Provide a suction strainer with a filtering grade of about 100μ (150 mesh).

(continued on following page)

- 4 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower.
- 5 Use hydraulic operating fluid when the operating ambient temperature is in the range of 32 to 140°F.
 - Startup Precautions
- 1 Before starting up the pump, fill the pump body with clean hydraulic operating fluid through the lubrication port.

Model No.	Oil Amount cu in
PZS-3B	61
PZS-4B	110
PZS-5B	134
PZS-6B	183

- 2 An unload circuit is required when the motor is started under condition WYE Delta . Contact your agent about the unload circuit.
- 3 Check to make sure that the rotation

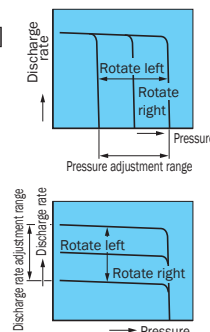
direction of the pump is the same as the rotation direction indicated by the arrow on the pump body.

- 4 Air entering the pump or pipes can cause noise or vibration. At startup, set the pump discharge side to a no-load state, and operate the pump in the inching mode to remove any air that might be in the pump or pipes.
- 5 Equip an air bleed valve in circuits where it is difficult to release air before startup. (See "IP Pumps" on page C-13.)
- 6 Install a check valve on the discharge side to protect the pump if the load is large or if there is an accumulator in the circuit on the discharge side of the pump.
- 7 Do not release the pressure in the hydraulic circuit by switching the solenoid valve (RS/WS type) on the pump.
- 8 Provide a return filter of 10µm or less

- Configuring Pressure and Discharge Rate Settings
- The factory default pump discharge rate setting is the setting's maximum value, while the default discharge pressure is the settings minimum value. Change the discharge rate and discharge pressure settings in accordance with your particular operating conditions.

[Pressure Adjustment]
Rotating the pressure adjusting screw clockwise increases pressure.

[Discharge Volume Adjustment]
Rotating the flow rate adjusting screw clockwise decreases the discharge rate.

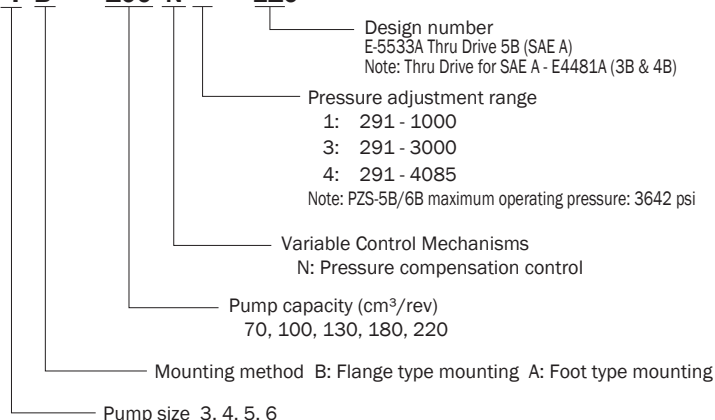


Note:
Securely tighten the lock nut after making adjustments.

Understanding Model Numbers

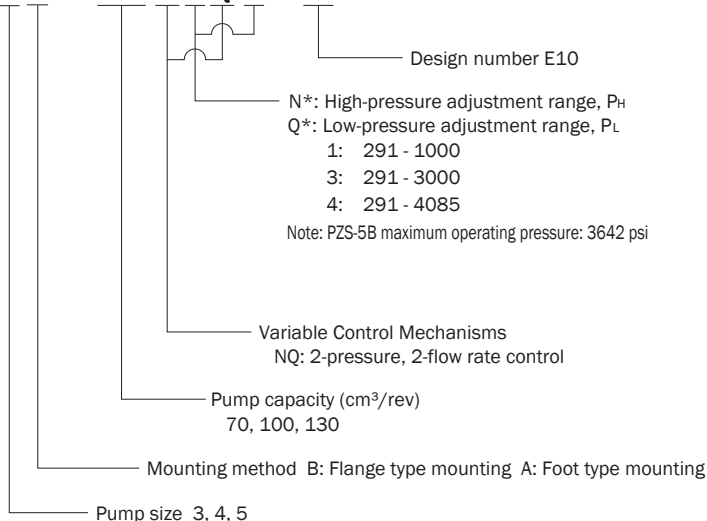
Standard Type, Pressure compensation(N)

PZS - 4 B - 100 N * - E10

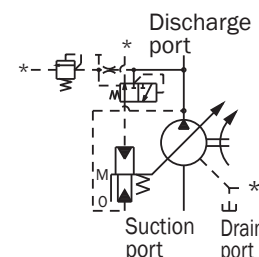
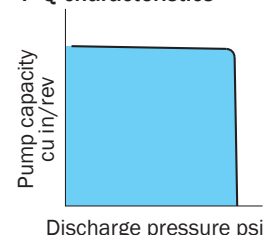


Option type, 2-Pressure, 2-Flow Rate Control Type (NQ)

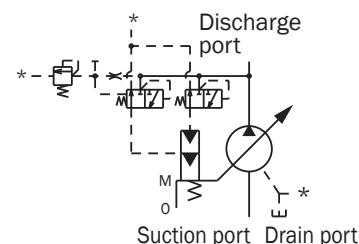
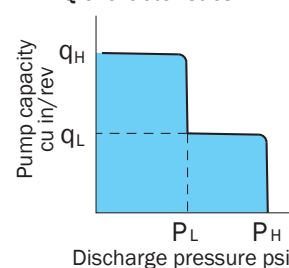
PZS - 4 B - 100 N * Q * - E10



P-Q characteristics



P-Q characteristics



Solenoid Cutoff Control Type (RS)**PZS - 4 B - 100 R * S * - E10**

Design Number
E-5533A Thru Drive 5B
Note: Thru Drive for SAE A - E4481A (3B-4B)

Pressure adjustment range

- 1: 291 - 1000
- 3: 291 - 3000
- 4: 291 - 4085

Note: PZS-5B/6B maximum operating pressure: 3625 psi

Variable Control Mechanisms

RS: Solenoid cutoff control (S: SS-G01)

Pump capacity (cu in/rev)

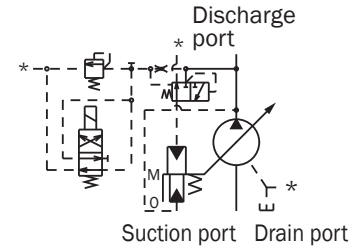
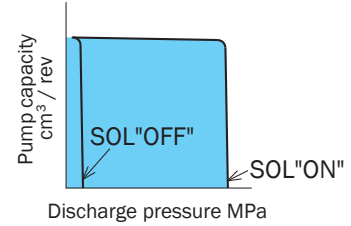
70, 100, 130, 180, 220

Mounting method B: Flange type mounting A: Foot type mounting

Pump size 3, 4, 5, 6

Solenoid power supply

- 1: AC100-115V
- 2: AC200-230V
- 3: DC12V
- 4: DC24V

P-Q characteristics

■ Do not use the solenoid valve to release the pressure in the hydraulic circuit.

2-Pressure Control System (WS)**PZS - 4 B - 100 W * S * - E10**

Design Number
E-5533A Thru Drive 5B
Note: Thru Drive for SAE A - E4481A (3B-4B)

Pressure adjustment range

- 1: 2 to 7MPa
- 3: 2 to 21MPa
- 4: 2 to 28MPa

Note: PZS-5B/6B maximum operating pressure: 3625 psi

Variable Control Mechanisms

WS: 2-pressure control type (S: SS-G01)

Pump capacity (cm³/rev)

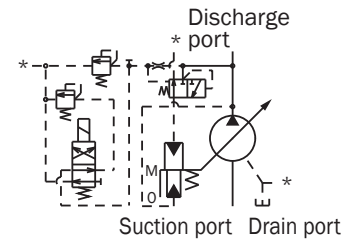
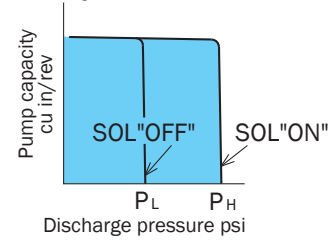
70, 100, 130, 180, 220

Mounting method B: Flange type mounting A: Foot type mounting

Pump size 3, 4, 5, 6

Solenoid power supply

- 1: AC100-115V
- 2: AC200-230V
- 3: DC12V
- 4: DC24V

P-Q characteristics**Installation Dimension Drawings**

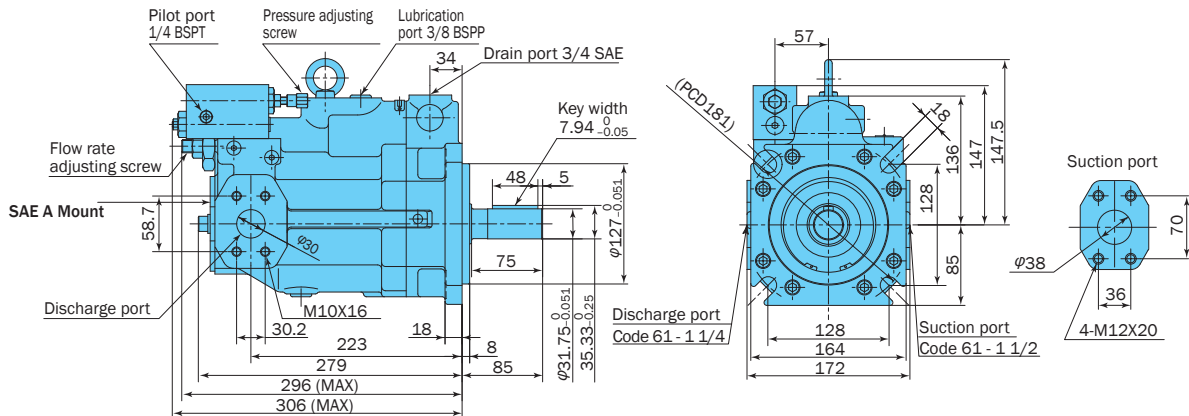
The ZR-T02-*5895* is the recommended remote control valve. Provide piping to the remote control valve at a pipe volume of 9 cu in or less.

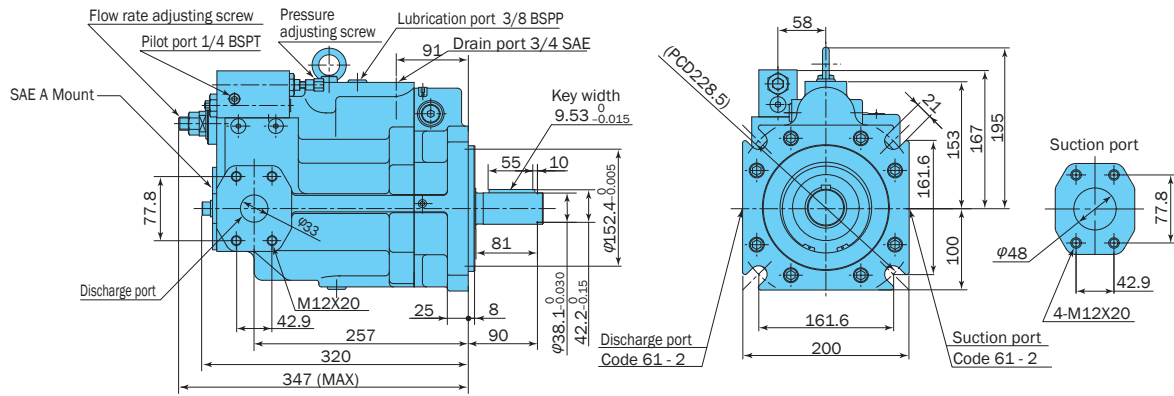
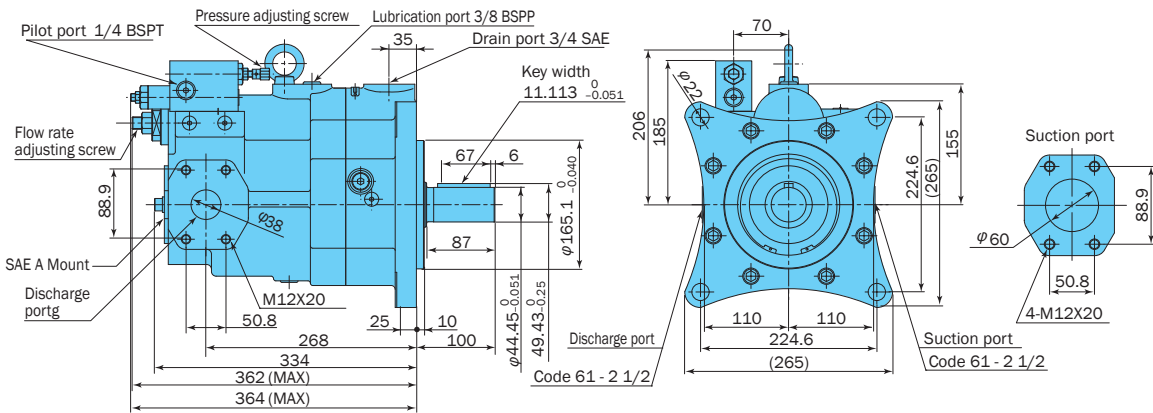
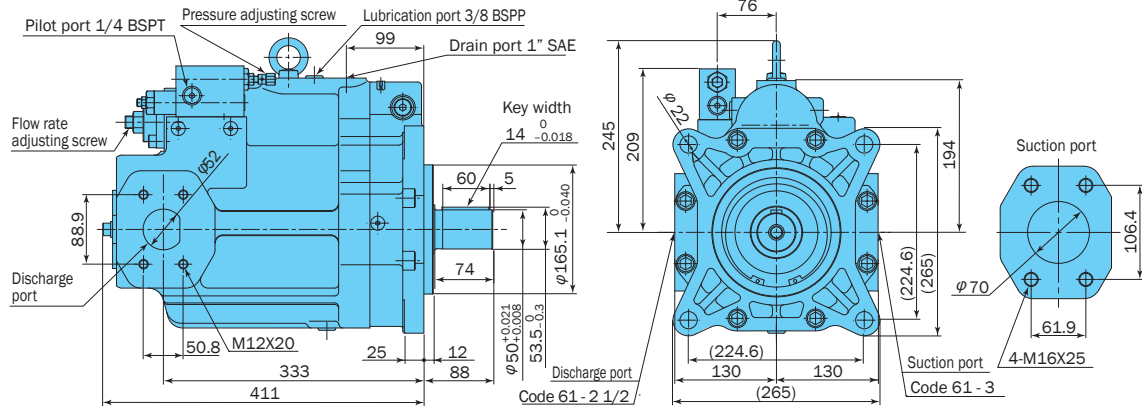
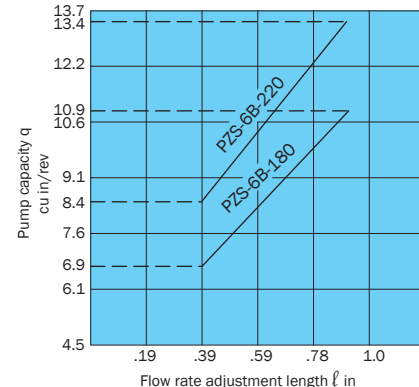
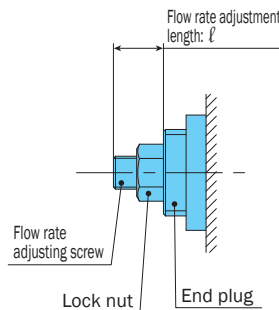
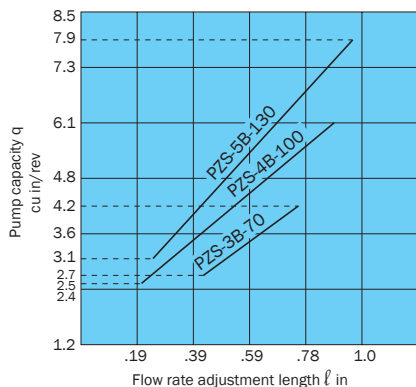
Pressure Compensation Type

Installing a remote control relieve valve to the pilot port provides remote control of pressure compensation. (PZS series "P type")

PZS-3B-70N*-E10 (E4481A Thru Drive)

SAE C 2 Bolt Mount (will fit)

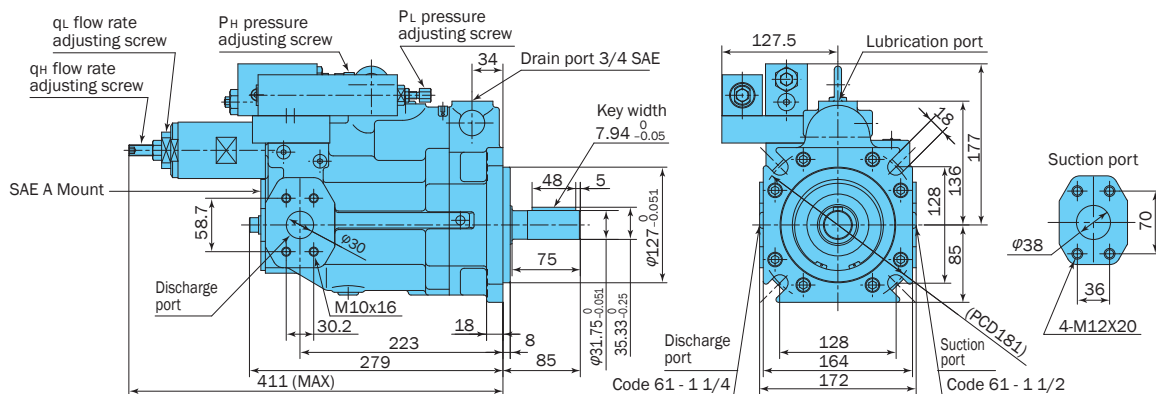


PZS-4B-100N*-10 (E4481A Thru Drive)**4 Bolt SAE D Mount****PZS-5B-130N*-E10 (E5533A Thru Drive)****4 Bolt SAE E Mount****PZS-6B-180N*-E10****4 Bolt SAE E Mount****PZS-6B-220N*-E10****Flow Adjustment Rotation Angle (θ) and Pump Capacity (q)**

Use a flow adjustment length that is within the range noted in the above chart. Using a length that is outside the lower limit adjustment range can lead to oil leaks.

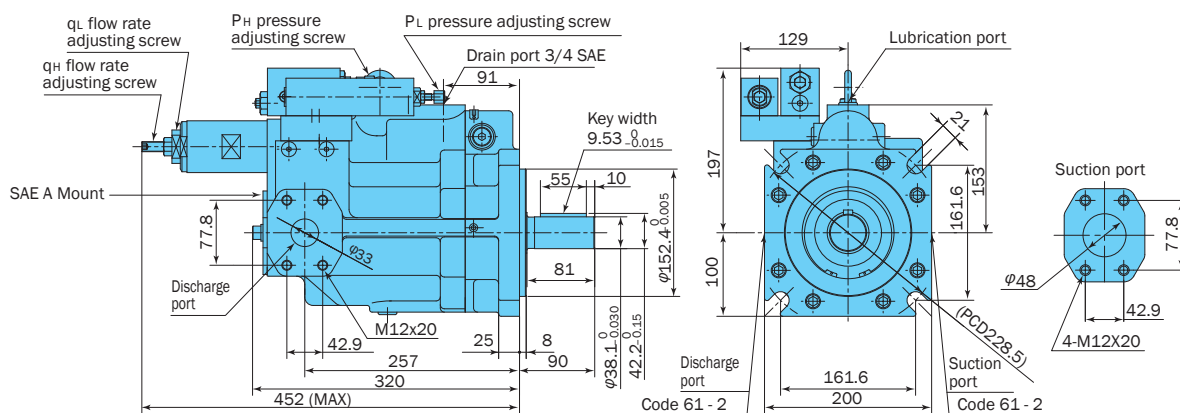
2-Pressure, 2-Flow Rate Control Type
PZS-3B-70N*Q*-10 (E4481A Thru Drive)

(will fit) 2 Bolt SAE C Mount



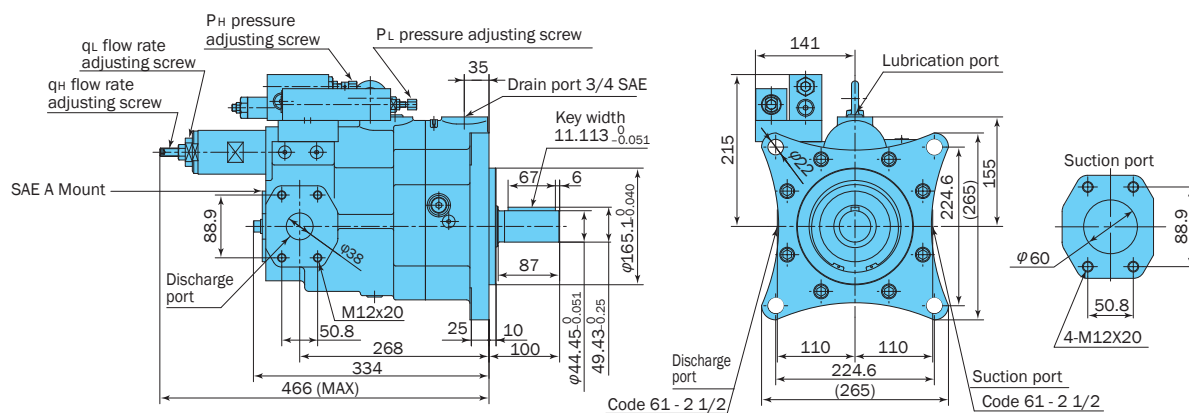
PZS-4B-100N*Q*-10 (E4481A Thru Drive)

4 Bolt SAE D Mount



PZS-5B-130N*Q*-10 (E5533A Thru Drive)

4 Bolt SAE E Mount

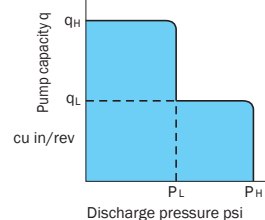


Pump Volume Adjustable Range

Pump Model No.	Volume Adjustment Range cu in/rev		Factory Default q. Setting (cu in/rev)
	q_H Note 1	q_L Note 2	
PZS-3B-70N*Q*-10	.3 to 4.2	.3 to 2.4	.85
PZS-4B-100N*Q*-10	.9 to 6.1	.4 to 3.6	1.2
PZS-5B-130N*Q*-10	1.0 to 7.9	.48 to 4.2	1.5

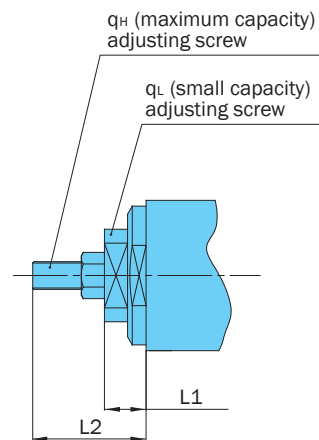
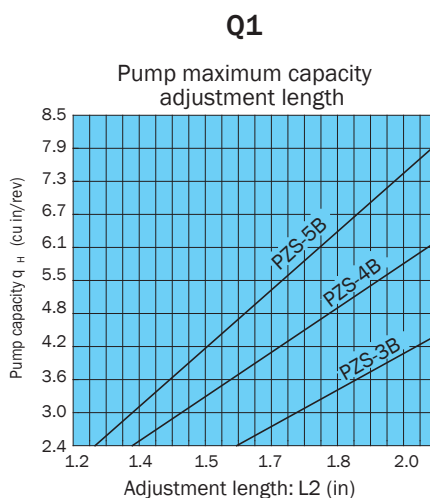
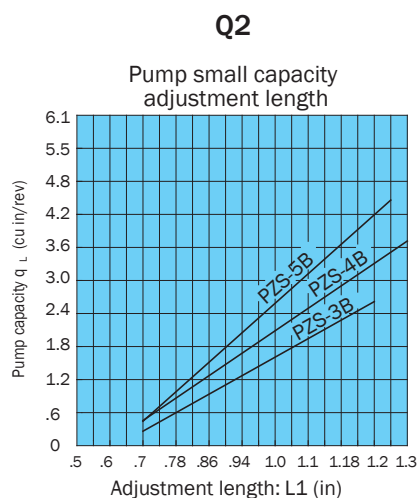
- Note 1: The setting range for pump maximum capacity q_H depends on the q_L setting.
 Note 2: Overall efficiency at a low flow rate is worse than at the maximum flow rate. Keep this in mind when deciding on the drive motor capacity.
 Note 3: P_L is set to 500 psi before shipping. (P_H is the lowest pressure)

P-Q characteristics



PZS Pump 2-Pressure 2-Flow Rate Control Flow Rate Adjustment Graph

- Be sure to adjust the low flow rate first, and then adjust the maximum flow rate.
- Remember that the maximum flow rate adjustment range (lower limit) changes in accordance with the low flow rate adjustment. The maximum flow rate adjustment lower limit is equivalent to the low flow rate adjustment length (L1) plus .43".
- Pump efficiency at a low flow rate is worse than at the maximum flow rate. Keep this in mind when deciding on the drive motor capacity.



Adapter with coupling for Thru Drive E4481A & E5533A

E4481A - PZMK SAE A (with 3/4" coupling)

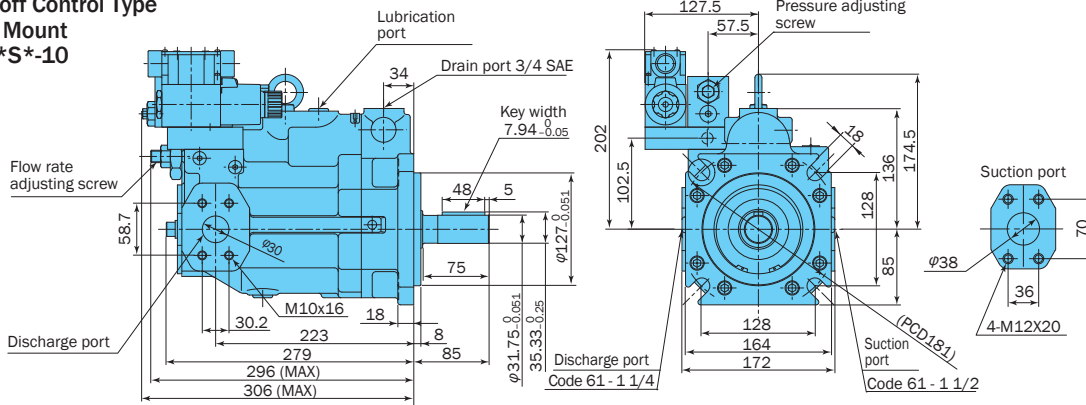
E4481A - PZMK SAE A 5/8 (with 5/8" coupling)

E5533A - JWF-SUB-0187-15-A (SAE A with 7/8" coupling)

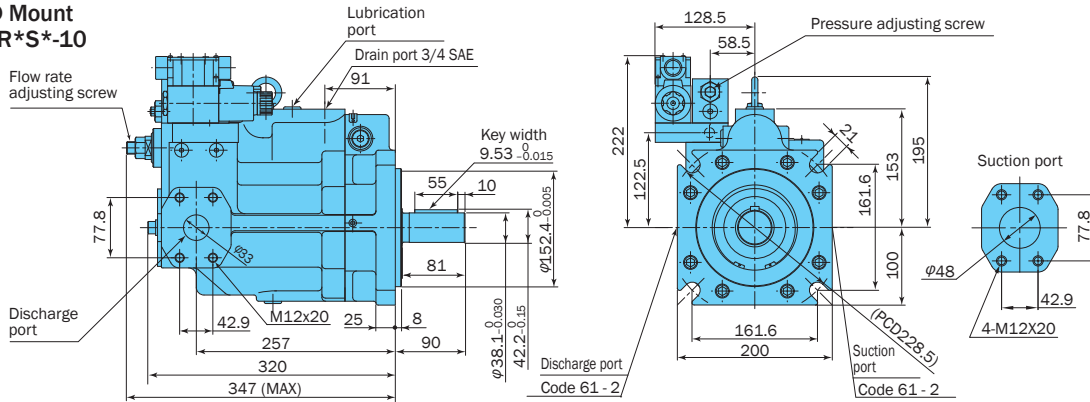
E5533A - JWF-SUB-0186-15-A (SAE A with 3/4" coupling)

E5533A - JWF-SUB-0188-15-A (SAE B with 1" coupling)

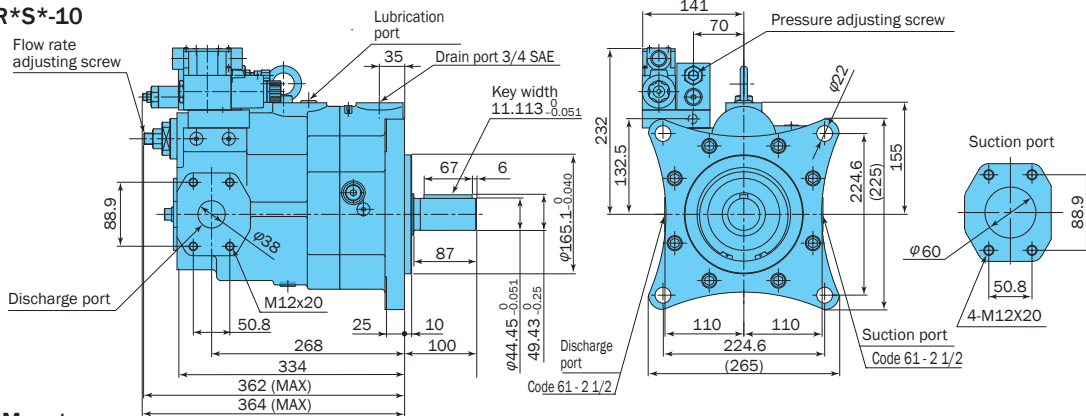
Solenoid Cutoff Control Type
2 Bolt SAE C Mount
PZS-3B-70R*S*-10



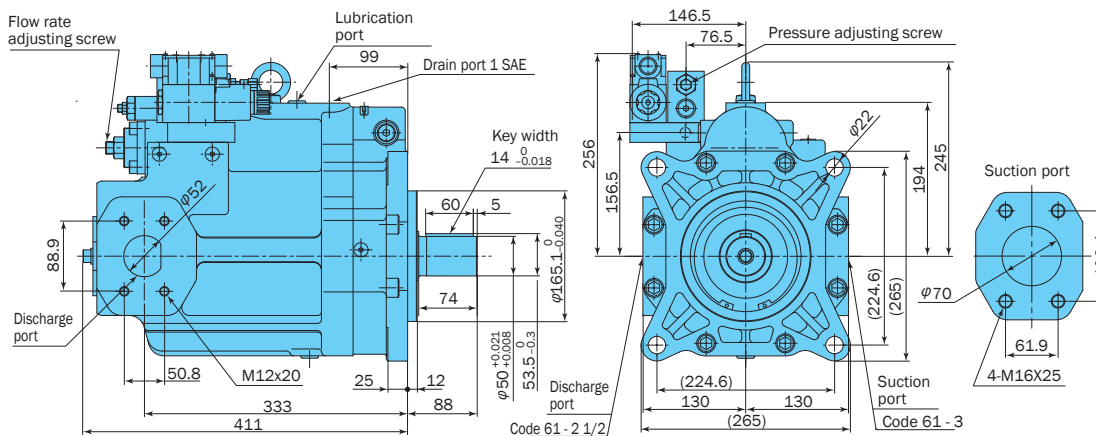
4 Bolt SAE D Mount
PZS-4B-100R*S*-10



4 Bolt SAE E Mount
PZS-5B-130R*S*-10



4 Bolt SAE E Mount
PZS-6B-180R*S*-10
PZS-6B-220R*S*-10



- Using the installed solenoid valve so it is continuously conducting current can cause the coil surface to become hot. Do not touch the surface of the coil directly with your hands.
- Do not use the solenoid valve to release the pressure in the hydraulic circuit

[illegible][illegible]

Technical drawing of the 61-2 1/2 hydraulic pump, showing three views: front view, top view, and suction port view.

Front View Dimensions and Labels:

- Flow rate adjusting screw
- Discharge port
- Lubrication port
- Drain port 3/4 SAE
- Key width $11.113^{+0.051}_{-0.051}$
- Dimensions: 88.9, 50.8, 268, 334, 362 (MAX), 364 (MAX), 25, 10, 100, 67, 6, 87, 165.1 $^{+0.040}_{-0.040}$, $\phi 44.45^{+0.051}_{-0.051}$, $49.43^{+0.25}_{-0.25}$, $\phi 38$, M12x20

Top View Dimensions and Labels:

- PL pressure adjusting screw
- PH pressure adjusting screw
- Dimensions: 141, 71, 272, 132.5, 155, 224.6 (265), 110, 224.6 (265)

Suction Port View Dimensions and Labels:

- Suction port
- Dimensions: 88.9, 50.8, 4-M12X20

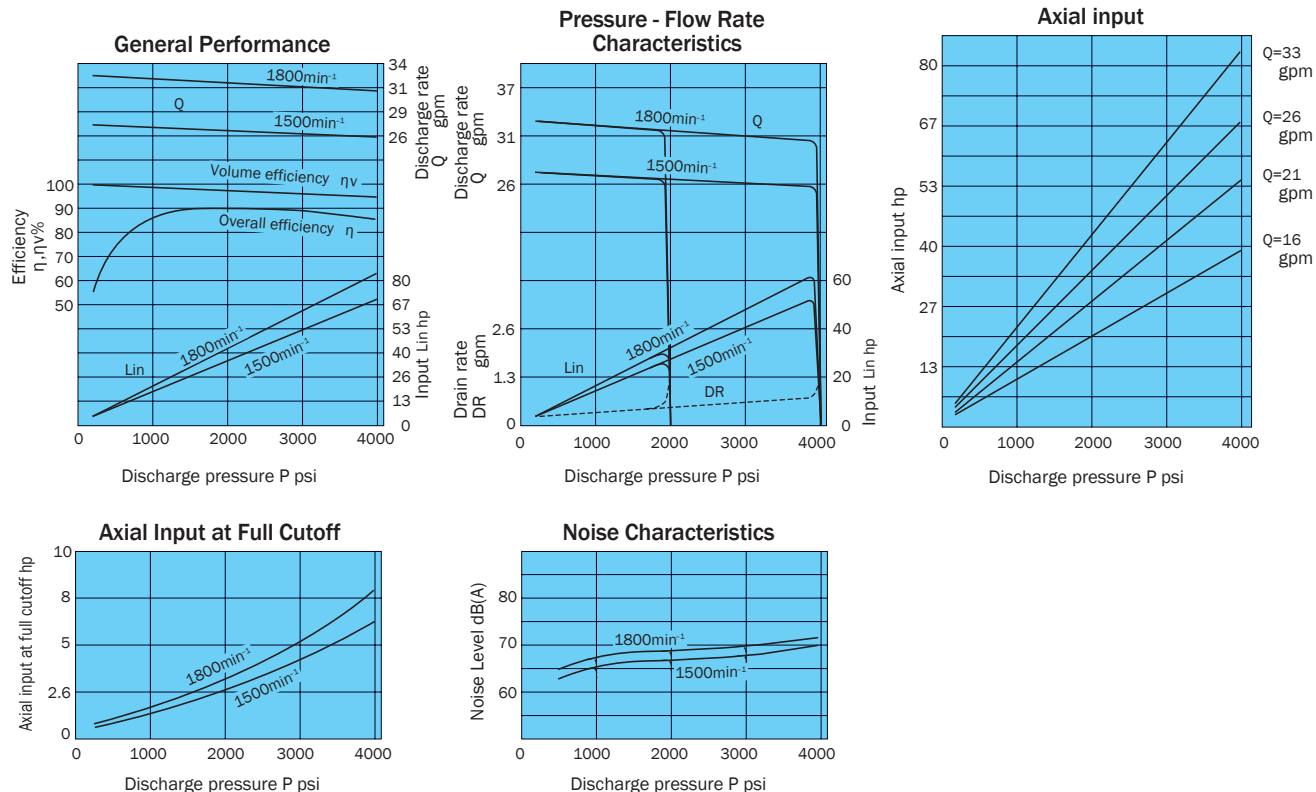
Code 61 - 2 1/2

- A 29

Performance Curves

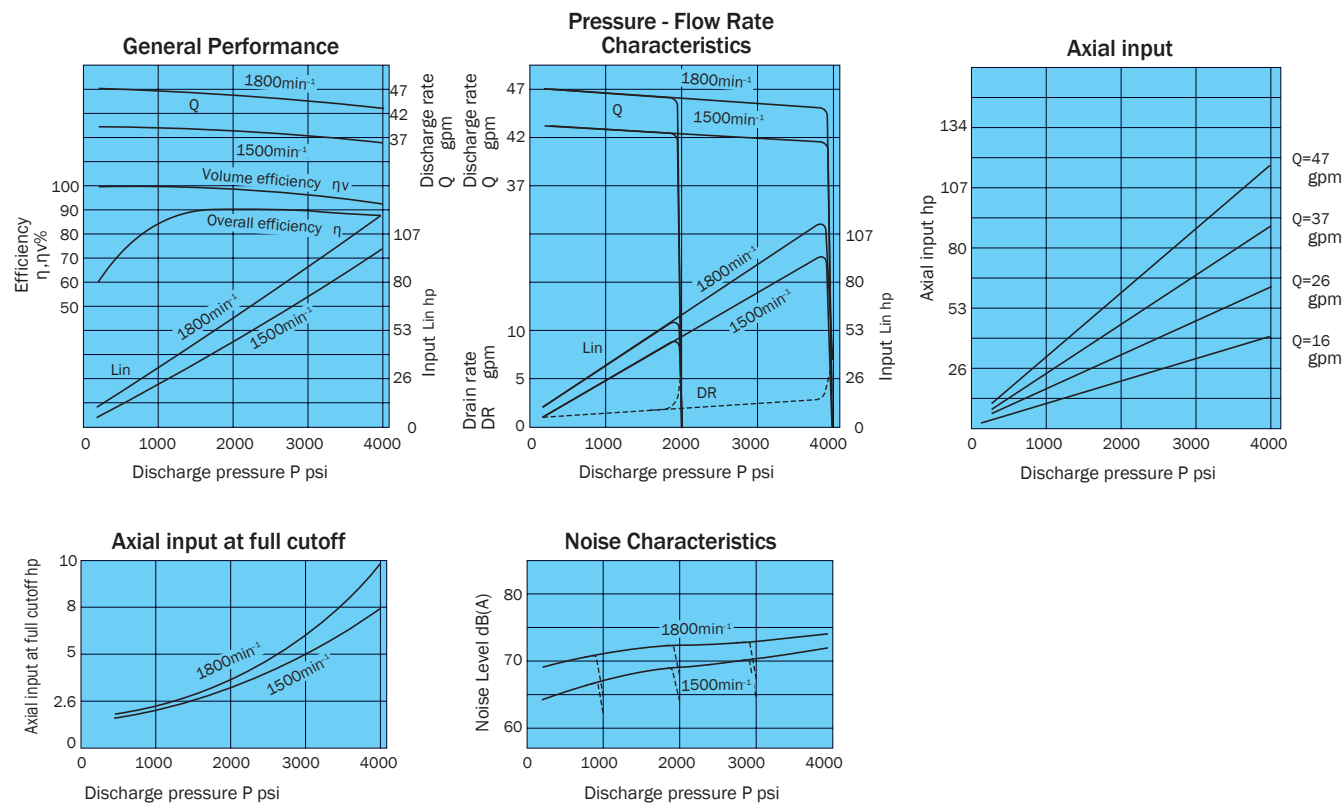
Typical Characteristics at a Hydraulic Operating Fluid Kinematic Viscosity of 46 centistokes

PZS-3B-70N*-10



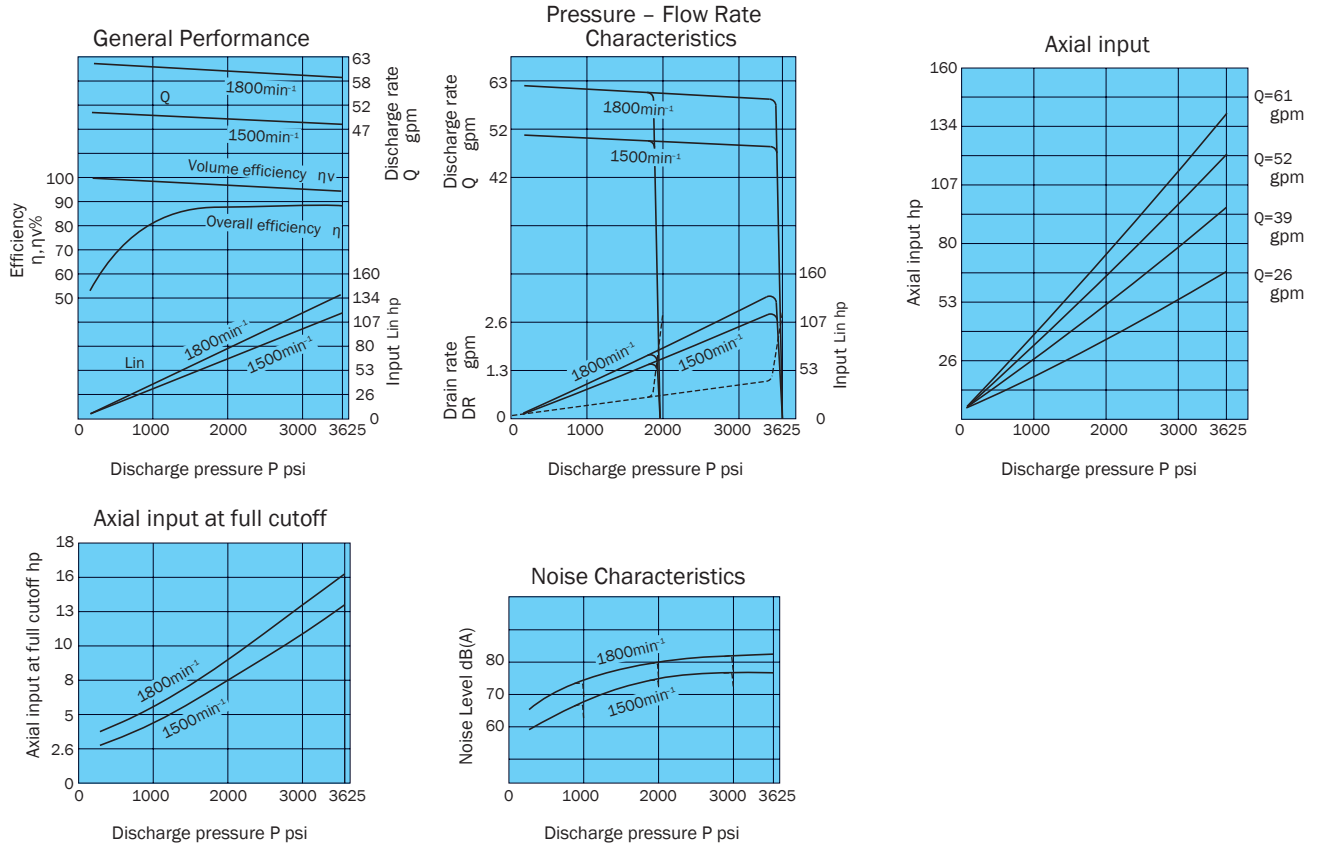
PZS-4B-100N*-10

Typical Characteristics at a Hydraulic Operating Fluid Kinematic Viscosity of 46 centistokes



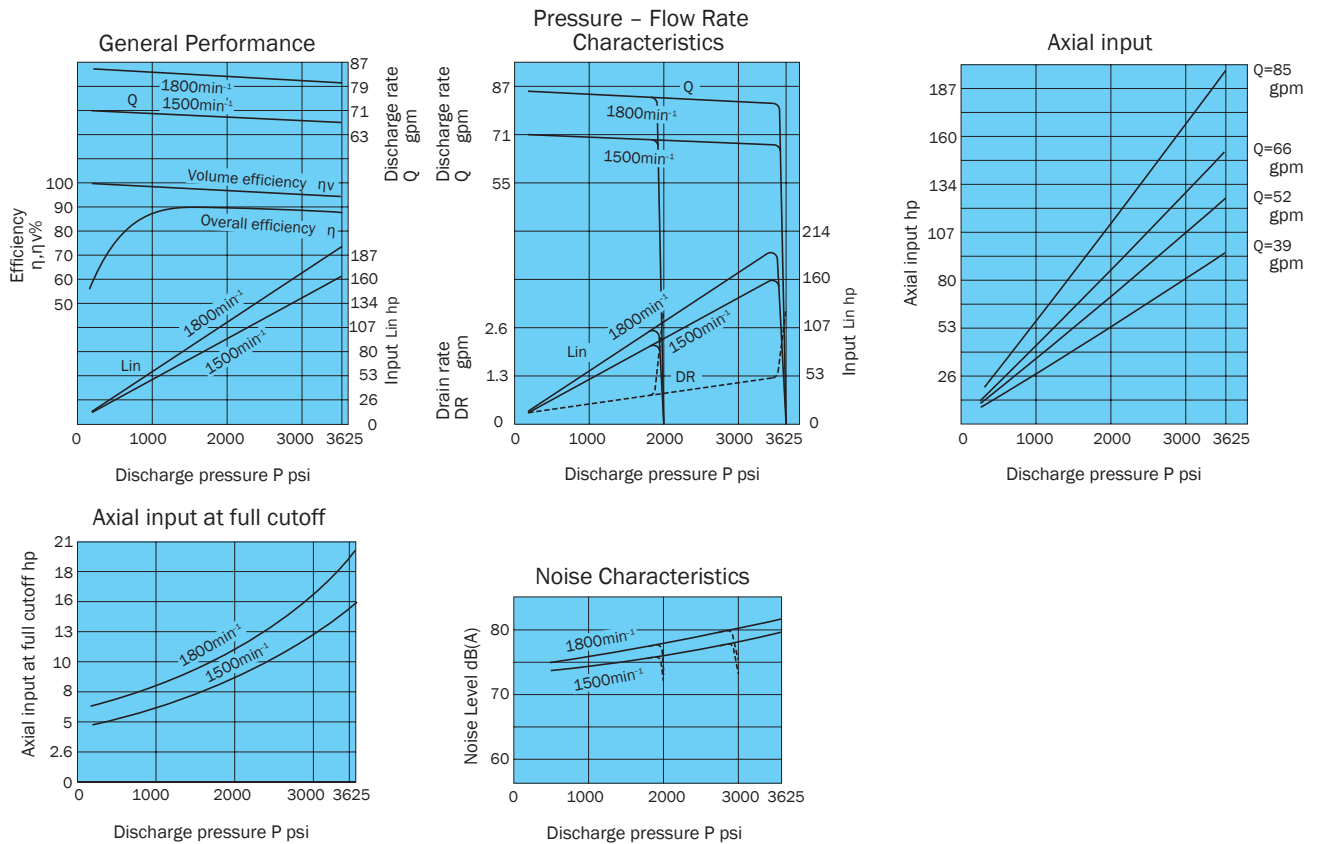
PZS-5B-130N*-10

Typical Characteristics at a Hydraulic Operating Fluid Kinematic Viscosity of 46 centistokes



PZS-6B-180N*-10

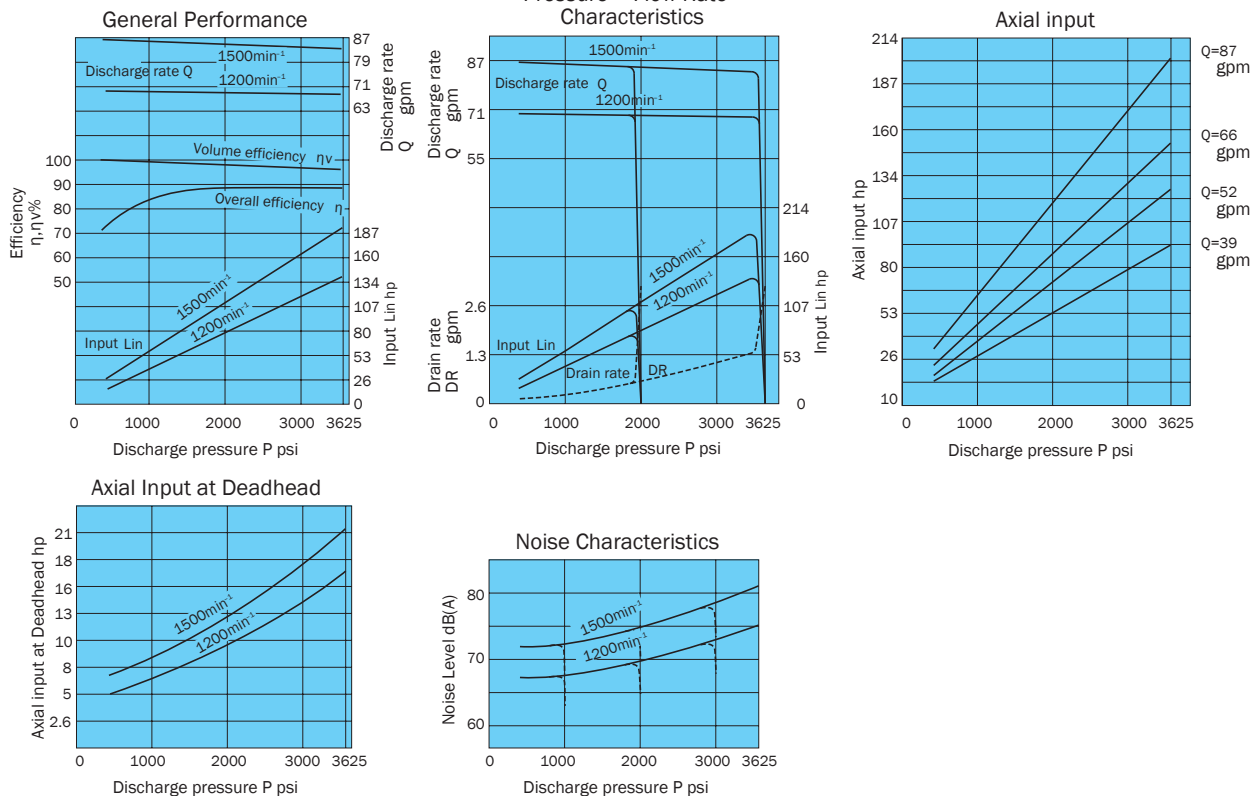
Typical Characteristics at a Hydraulic Operating Fluid Kinematic Viscosity of 46 centistokes



PZS-6B-220N*-10

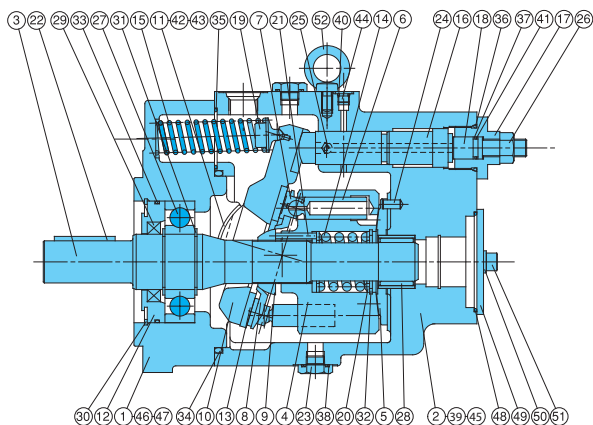
Typical Characteristics at a Hydraulic Operating Fluid Kinematic Viscosity of 46 centistokes

Pressure - Flow Rate



Performance Curves

PZS-3B-70N*-10 PZS-4B-100N*-10 PZS-6B-**N*-10



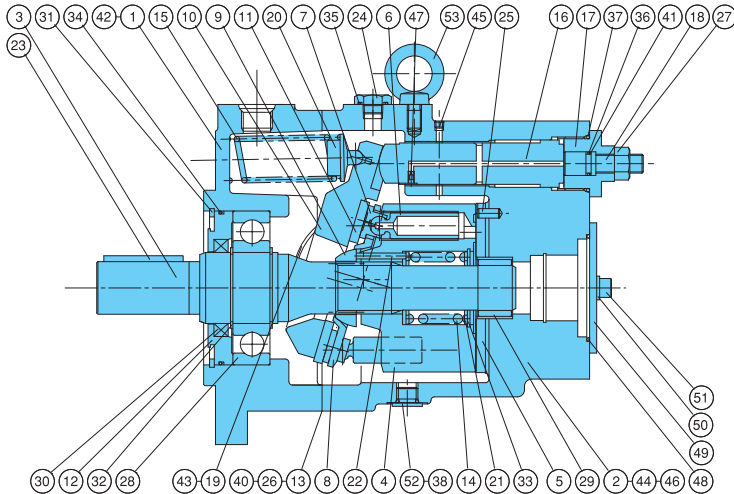
Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	19	Spring holder	37	O-ring
2	Case	20	Retainer	38	O-ring
3	Shaft	21	Needle	39	O-ring
4	Cylinder barrel	22	Key	40	O-ring
5	Valve plate	23	Plug	41	Backup ring
6	Piston	24	Pin	42	Orifice
7	Shoe	25	Orifice	43	Flat philips head screw
8	Shoe holder	26	Nut	44	Plug
9	Barrel holder	27	Ball bearing	45	Pin
10	Swash plate	28	Needle bearing	46	Bolt
11	Thrust bush	29	Oil seal	47	Plug
12	Seal holder	30	Snap ring	48	O-ring
13	Thrust plate	31	Snap ring	49	Plate
14	Spring C	32	Snap ring	50	Washer
15	Spring S	33	O-ring	51	Bolt
16	Control piston	34	O-ring	52	Eye bolt
17	End plug	35	O-ring		
18	Guide screw	36	O-ring		

List of Sealing Parts (Kit Model Number 3B : PZBS-103000, 4B : PZAS-104100, 5B: PZAS-104000, 6B : PZBS-106000)

Part No.	Name	Product Number						Remarks
		PZS-3B	Q'ty	PZS-4B	Q'ty	PZS-6B	Q'ty	
29	Oil seal	TCN-456812	1	TCN-507212	1	TCN-659013	1	NOK
33	O-ring	1B-G95	1	1B-G105	1	1B-G135	1	JIS B 2401
34	O-ring	1B-G130	1	1B-G155	1	1B-G200	1	"
35	O-ring	1B-G50	1	1B-G50	1	1B-G65	1	"
36	O-ring	1B-P34	1	1B-P36	1	1B-P41	1	"
37	O-ring	1B-P12	1	1B-P16	1	1B-P16	1	"
* 38	O-ring	1B-P14	2	1B-P14	3	1B-P14	3	"
39	O-ring	Note 1	1	1B-P9	1	1B-P10	1	"
40	O-ring	1B-P8	5	1B-P8	5	1B-P8	8	"
41	Backup ring	T2-P12	1	T2-P16	1	T2-P16	1	JIS B 2407
48	O-ring	Note 1	1	1B-G85	1	1B-G85	1	JIS B 2401

Note 1: Contact your agent about this type of O-ring.

PZS-5B-130N*-10



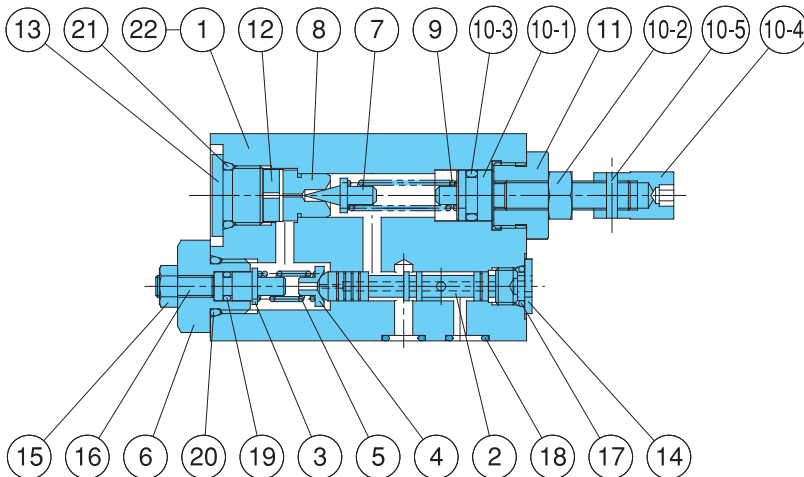
Part No.	Part Name	Part No.	Part Name
1	Body	28	Ball bearing
2	Case	29	Needle bearing
3	Shaft	30	Oil seal
4	Cylinder barrel	31	Snap ring
5	Valve plate	32	Snap ring
6	Piston	33	Snap ring
7	Shoe	34	O-ring
8	Shoe holder	35	O-ring
9	Barrel holder	36	O-ring
10	Swash plate	37	O-ring
11	Thrust plate	38	O-ring
12	Seal holder	39	O-ring
13	Gasket	40	O-ring
14	Spring C	41	Backup ring
15	Spring S	42	Bolt
16	Control piston	43	Flat philips head screw
17	End plug	44	Plug
18	Guide screw	45	Plug
19	Thrust bush	46	Plug
20	Spring holder	47	Orifice
21	Retainer	48	O-ring
22	Needle	49	Plate
23	Key	50	Washer
24	Plug	51	Bolt
25	Pin	52	Plug
26	Connector	53	Eye bolt
27	Nut		

PZS-5B (Kit Model Number 5B : PZAS-104000)

Part No.	Name	Q'ty	Size	Remarks
13	Gasket	1	*	3 Bond
30	Oil seal	1	TCN-608212	N. O. K
34	O-ring	1	1B-G125	JIS B 2401
35	O-ring	2	1B-P21	JIS B 2401
36	O-ring	1	1B-P16	JIS B 2401
37	O-ring	1	1B-P42	JIS B 2401
38	O-ring	1	1B-P14	JIS B 2401
39	O-ring	5	1B-P8	JIS B 2401
40	O-ring	2	1B-P7	JIS B 2401
41	Backup ring	1	T2-P16	JIS B 2407
48	O-ring	1	1B-G85	JIS B 2401

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

Pressure Compensator



Part No.	Part Name	Part No.	Part Name
1	Valve body	12	Collar
2	Spool	13	Plug
3	Spring guide	14	Plug
4	Spring bearing	15	Nut
5	Spring	16	Socket head screw
6	Retainer	17	O-ring
7	Needle valve	18	O-ring
8	Valve seat	19	O-ring
9	Spring	20	O-ring
10	Adjustment screw kit	21	O-ring
10-1	Adjustment screw	22	Plug
10-2	Nut		
10-3	O-ring		
10-4	Nut		
10-5	Spring pin		
11	Retainer		

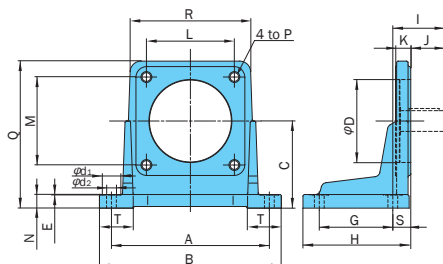
List of Sealing Parts

Part No.	Name	Part Number				Remarks
		PZS-3B, 4B	Q'ty	PZS-5B, 6B	Q'ty	
10-3	O-ring	1B-P10A	1	1B-P10A	1	JIS B 2401
17	O-ring	1B-P8	1	1B-P11	2	"
18	O-ring	1B-P9	4	1B-P9	5	"
19	O-ring	1B-P5	1	1B-P14	1	"
20	O-ring	1B-P12	1	1B-P22	1	"
21	O-ring	1B-P14	1	1B-P14	1	"

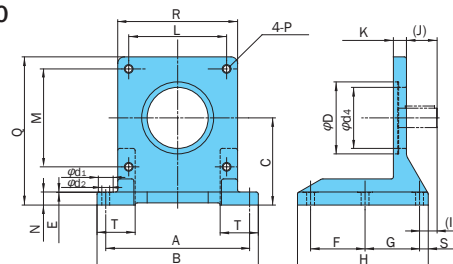
Foot Mounting Kit

Foot Mounting Installation Measurement Chart

PZM *-10



IHM -55-10



Foot Mounting Kit Model No.	Applicable Pump Model No.	Accessories				Measurements (mm)							
		Bolt	Q'ty	Washer	Q'ty	A	B	C	E	F	G	H	(I)
PZM-3-10	PZS-3B	TH-16 ×40	4	WP-16	4	295.3	334	152.4	1	—	139.7	203	104.5
PZM-4-10	PZS-4B	TH-20 ×45	4	WP-20	4	290	334	160	1	—	135	198	95
IHM-55-10	PZS-5B, 6B	TH-20 ×50	4	WS-B-20	4	330	370	200	1	125	125	300	40

Foot Mounting Kit Model No.	Measurements (mm)														Weight
	(J)	K	L	M	N	P	Q	R	(S)	T	φD	φd ₁	φd ₂	φd ₄	kg
PZM-3-10	60	25	128	128	25	M16	259	-	44.5	61	127	35	18	86	13.5
PZM-4-10	62	28	161.6	161.6	25	M20	270	220	33	62	152.4	34	18	φ152.4	18.0
IHM-55-10	70 (Note)	30	224.6	224.6	30	M20	340	275	20	90	165.1	34	18	140	32.0

Note: The IHM-55-10 (J) dimension (70) is the value for the PZS-5B. This dimension becomes 58 in the case of the PZS-6B.
 The IHM-55-10 (I) dimension (40) is the value for the PZS-5B. This dimension becomes 28 in the case of the PZS-6B.
 See the IHM-45-10 on pages B-36 and C-12 to see what the PZM-3-10 looks like.

Piping Flange Kit

Screw In Type

Screw In Type Flange Kit model No.	Applicable Pump Model No.	IN Flange							
		Flange Part No.		Bolt		Washer		O-ring	
PJFE-10300T	PZS-3B	IH03J-100120	1	TH-12 ×55	4	WS-B-12	4	1B-G50	1
PJFE-10400T	PZS-4B	IH03J-100160	1	TH-12 ×60	4	WS-B-12	4	1B-G60	1
PJFE-10500T	PZS-5B	IH03J-100200	1	TH-12 ×65	4	WS-B-12	4	1B-G75	1
PJFE-10600T	PZS-6B	IH03J-100240	1	TH-16 ×75	4	WS-B-16	4	1B-G85	1

OUT Flange							
Flange Part No.		Bolt		Washer		O-ring	
IH03J-100100	1	TH-10 ×55	4	WS-B-10	4	1B-G40	1
IH03J-100160	1	TH-12 ×60	4	WS-B-12	4	1B-G60	1
IH03J-100200	1	TH-12 ×65	4	WS-B-12	4	1B-G75	1
IH03J-100200	1	TH-12 ×65	4	WS-B-12	4	1B-G75	1

Welded Type

Welded Type Flange Kit model No.	Applicable Pump Model No.	IN Flange							
		Flange Part No.		Bolt		Washer		O-ring	
PJF-10300E	PZS-3B	IH03J-200120	1	TH-12 ×55	4	WS-B-12	4	1B-G50	1
PJF-10400E	PZS-4B	IH03J-200160	1	TH-12 ×60	4	WS-B-12	4	1B-G60	1
PJF-10500E	PZS-5B	IH03J-200200	1	TH-12 ×75	4	WS-B-12	4	1B-G75	1
PJF-10600E	PZS-6B	IH03J-200240	1	TH-16 ×75	4	WS-B-16	4	1B-G85	1

OUT Flange							
Flange Part No.		Bolt		Washer		O-ring	
IH03J-200100	1	TH-10 ×55	4	WS-B-10	4	1B-G40	1
IH03J-200160	1	TH-12 ×60	4	WS-B-12	4	1B-G60	1
IH03J-200200	1	TH-12 ×65	4	WS-B-12	4	1B-G75	1
IH03J-200200	1	TH-12 ×65	4	WS-B-12	4	1B-G75	1

See page C-11 for dimensions.
 O-ring 1B-** refers to JIS B2401-1B-**. See page C-11 for details on tightening torque.

Replacement Items

PZS Rotating Group

PZS-3B-70N*10	PZBG-103000
PZS-4B-100N*10	PZG-104100
PZS-5B-130N*10	PZG-104000
PZS-6B-220N*10	PZBG-106000
PZS-6B-180N*10	PZBG-106100

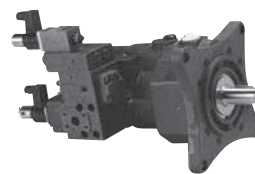
Includes Items 4,5,6 & 7

PZS Thrust Plate Item 11 (2 required per pump)

PZS-3B-70N*E30	PZB69-103000
PZS-4B-100N*E13	PZ69-104100
PZS-5B-130N*E13	PZ69-104000
PZS-6B-220N*E13	PZB69-106000
PZS-6B-180N*E13	PZB69-106000

PZS Compensator Kit

	N1	N3	N4
PZS-3B-70N*10	ZR-G01-RI-2089C	ZR-G01-R3-2089C	ZR-G01-R4-2089C
PZS-4B-100N*10	ZR-G01-RI-2089C	ZR-G01-R3-2089C	ZR-G01-R4-2089C
PZS-5B-130N*10	ZR-G01-RI-4049B	ZR-G01-R3-4049B	ZR-G01-R4-4049B
PZS-6B-220N*10	ZR-G01-RI-4049B	ZR-G01-R3-4049B	ZR-G01-R4-4049B
PZS-6B-180N*10	ZR-G01-RI-4049B	ZR-G01-R3-4049B	ZR-G01-R4-4049B



PZ Series Load Sensitive Variable Piston Pump

2.13 to 13.42 cu in/rev
3045 psi

Features

- 1 The PZ Series load sensitive variable piston pump employs the semi-cylindrical swash plate that is part of the basic technology used by the PVS series variable piston pump. To this it adds a hydrostatic bearing mechanism, valve plate, and other noise reducing mechanisms for operation that is even quieter than that of PVS Series pumps.
- 2 The pump body houses an electro-hydraulic proportional control valve, compensator, and surge cutoff valve, which eliminates the need for superfluous piping.
- 3 The electro-hydraulic proportional control valve uses the proven force feedback system for improved hysteresis, repeatability, and response.
- 4 The ability to create a double pump configuration with an IP pump further expands the range of possible applications.

Specifications

Pump System Specifications

Model No.	Pump Capacity cu in/rev	Maximum Working Pressure psi	Pressure Adjustment Range psi	Flow Control Limit Range gpm Note 3	Revolution Speed min ⁻¹		Weight lbs	Fixed Discharge Pump Note 1	
					Min.	Max.		Capacity cu in/rev	Pressure psi
PZ-2B-* 35E1A-11 2 3	2.13	3045	290 to 1000 290 to 2000 290 to 3000	.26 to 16.6	600	2000	79	3.6 to 8.18	3000
PZ-2B-* 45E1A-11 2	2.74	2030	290 to 2000 290 to 3000	.26 to 21	600	2000	79	3.6 to 8.18	3000
PZ-3B-* 70E1A-10 2 3	4.27	3045	290 to 1000 290 to 2000 290 to 3000	.26 to 33	600	1800	132	3.6 to 15.8	3000
PZ-4B-*100E1A-10 2 3	6.10	3045	290 to 1000 290 to 2000 290 to 3000	.26 to 47.5	600	1800	167	3.6 to 15.8	3000
PZ-5B-*130E1A-10 2 3 (Note 2)	7.93	3045	290 to 1000 290 to 2000 290 to 3000	.79 to 61.8	600	1800	220	3.6 to 32.3	3000
PZ-6B-*180E1A-20 2 3	10.98	3045	290 to 1000 290 to 2000 290 to 3000	.79 to 85.6	600	1800	353	3.6 to 63.9	3000
PZ-6B-*220E1A-20 2 3	13.42	3045	290 to 1000 290 to 2000 290 to 3000	.79 to 87.1	600	1500	357	3.6 to 63.9	3000

Note 1: Can be used in combination with an IP pump to configure a fixed discharge pump.

Note 2: The PZ-4B-130 model number was changed to PZ-5B-130.

Note 3: Maximum flow rate depends on the revolution speed. Values in the above table are for a speed of 1800min⁻¹ for the PZ-2B to PZ-6B-180, and 1500min⁻¹ for the PZ-6B-220.

Pressure/Flow Rate Control System Specifications Pressure Control System

Pressure Control Range psi	.26 to 1000 .26 to 2000 .26 to 3000
Rated Current mA	800
Coil Resistance Ω	20 (20° C)
Hysteresis %	3% max. Note 1

Flow Rate Control System

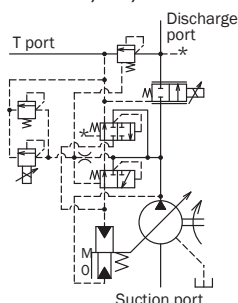
Valve Differential Pressure	145 Note 2
Rated Current mA	800
Coil Resistance Ω	20 (20° C)
Hysteresis %	3% max. Note 1

Note 1. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

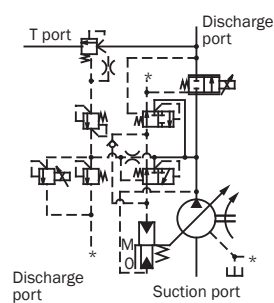
Note 2. Pressure differential of pump discharge pressure (valve IN side) and load pressure (valve OUT side).

Note 3. For information about power amplifiers, see pages G-26 through G-37.

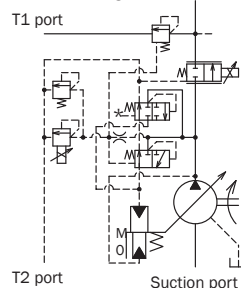
PZ-2B/3B/5B



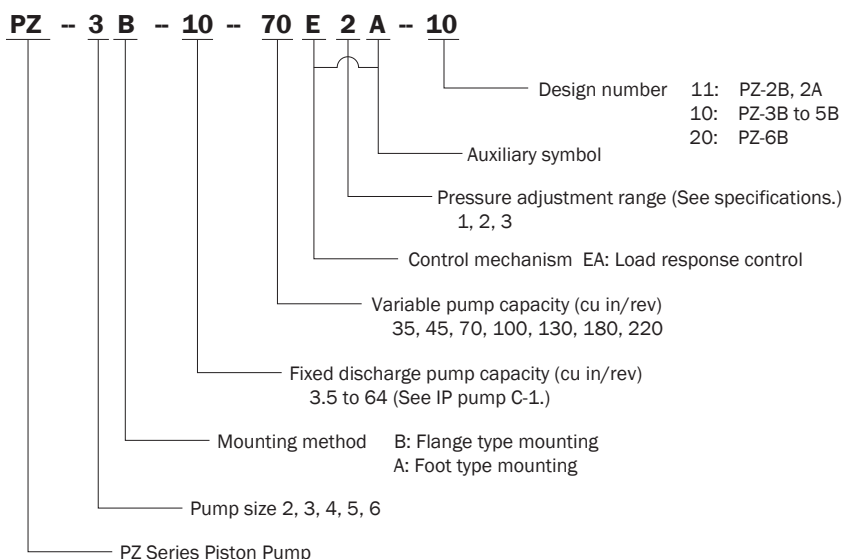
PZ-4B-100



PZ-6B



Understanding Model Numbers



- Handling
- Pump Installation and Piping Precautions

- Use flexible couplings for connecting the pump shaft to the drive shaft, and prevent radial or thrust load from being applied to the pump shaft.
- Eccentricity between the drive shaft and pump shaft should be no greater than 0.01 in, with an eccentric angle error of 1° or less.
- Keep the clamping length of couplings and pump shafts at least 2/3 the length of the coupling width.
- Use a sufficiently rigid pump mounting base.
- Set pump suction side pressure to -4 psi or more (suction port flow velocity less than 6 ft/sec).
- Raise part of the drain piping so it is above the topmost part of the pump body, and insert the return section of the drain piping into the hydraulic operating fluid. Also, observe the values in the following table in order to limit the drain back pressure to 14.5 psi.

Item Model No.	PZ-2B	3B PZ-4B 5B	PZ-6B
Pipe Joint Size	At least 1/2"	At least 3/4"	At least 1"
Pipe I.D.	1/2"	5/8"	7/8"
Pipe Length	1 m or less	1 m or less	1 m or less

- Mount the pump so the pump shaft is oriented horizontally.
- Use of rubber hose is recommended in order to minimize noise and vibration.

- Management of Hydraulic Operating Fluid

- Use only good-quality hydraulic operating fluid with a kinematic viscosity during operation within the range of 20 to 200 centistokes.
Normally, you should use an R&O type and wear-resistant type of ISOVG32 to 68 or equivalent.
The optimum kinematic viscosity during operation is 20 to 50 centistokes.
- The operating temperature range is 41 to 140°F. When the oil temperature at startup is 41°F or less, run the pump at low pressure until the oil temperature reaches 40°F.
- Provide a suction strainer with a filtering grade of about 100μ (150 mesh). Provide a return line filter of grade 10μm or less on the return line to the tank. (When the pump is used at a high pressure of 2000 psi or greater, a filter of 10μm or less is recommended.)
- Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower.
- Use hydraulic operating fluid when the operating ambient temperature is in the range of 32 to 140°F.

- Startup Precautions

- Before starting up the pump, fill the pump body with clean hydraulic operating fluid through the lubrication port.

Model No.	Oil Amount cu in
PZ-2B	39
PZ-3B	61
PZ-4B	110
PZ-5B	134
PZ-6B	183

- Check to make sure that the rotation direction of the pump is the same as the rotation direction indicated by the arrow on the pump body.
- Air entering the pump or pipes can cause noise or vibration. At startup, set the pump discharge side to a no-load state, and operate the pump in the inching mode to remove any air that might be in the pump or pipes.
- Equip an air bleed valve in circuits where it is difficult to release air before startup. (See "IP Pumps" on page C-13.)
- To enable superior pressure and flow control, loosen the air vent when starting up the pump in order to release any air, and fill the inside of the solenoid with hydraulic operating fluid. You can change the position of the air vent by rotating its cover.
- Before adjusting the manual adjusting screw from the first time or when there is no input current to the valve due to electrical malfunction or some other reason, you can control pump pressure and flow rate by rotating the manual adjusting screw. Normally, the manual adjusting screw should be returned completely to its original position and secured with the lock nut.

2 Bolt SAE B Mount

Technical drawing of the 4M1016 hydraulic valve assembly, showing dimensions and port specifications.

Dimensions:

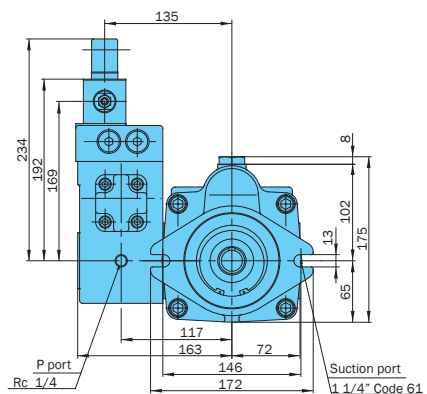
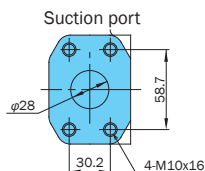
- Connecting cord diameter: $\phi 8$ to 10
- Manual pressure adjusting screw
- Air vent
- T port: $3/8$ BSPT
- Relief valve pressure adjusting screw
- 184
- 88
- 60
- 6
- Lubrication port
- Drain port: $1/2$ BSPT
- Manual flow rate adjusting screw
- Air vent
- 66
- 22
- 47.5
- 4-M10x16
- Discharge port $\phi 23$
- 1" Code 61
- 425
- 222
- (Suction port 15 position dimension)
- 53
- 38
- 3
- Key width: $6.3^{+0.015}_{-0.010}$
- Note: $\phi 10.6^{+0.05}_{-0.05}$
- 58.7
- 4-M10x16

Port Specifications:

- OUT 4

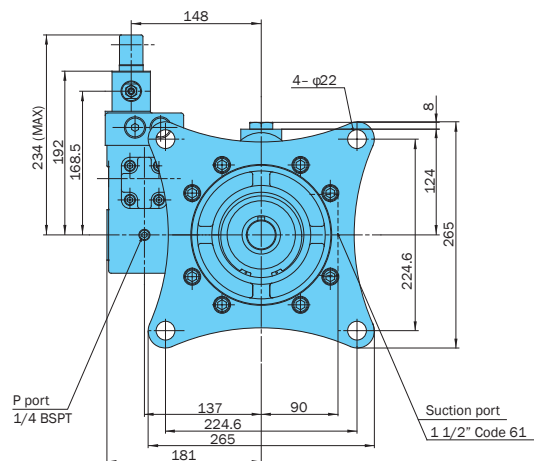
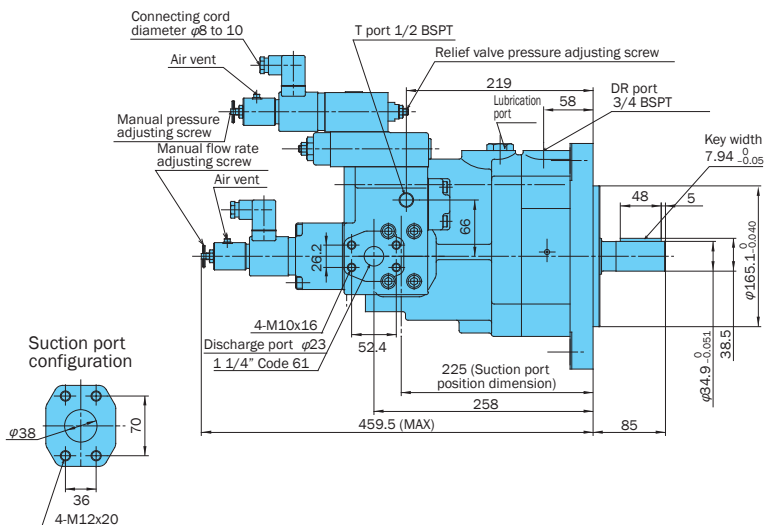
Note:

- Single Port

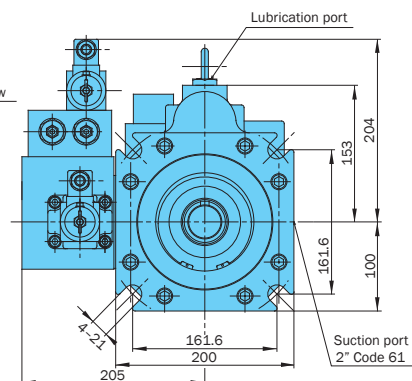
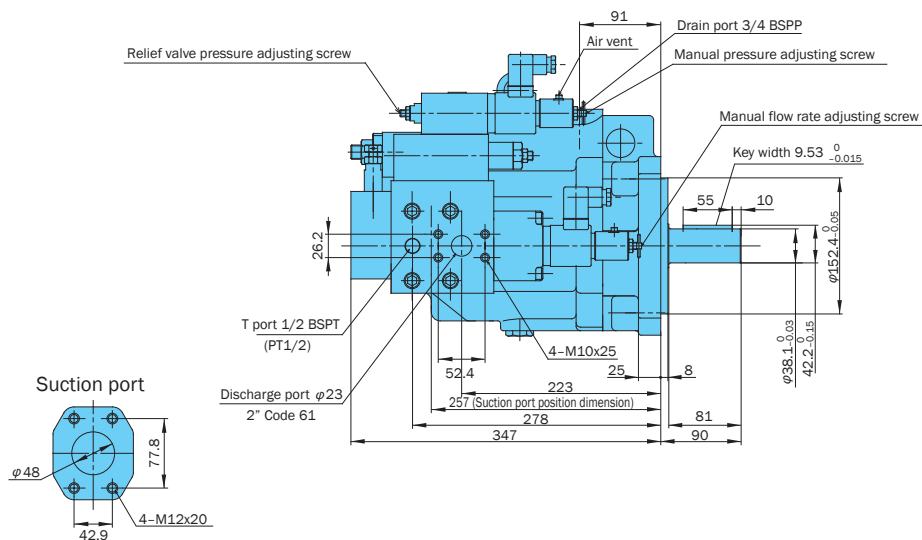


	a	b
Single Pump	$\phi 22.23 \begin{smallmatrix} 0 \\ -0.021 \end{smallmatrix}$	$24.9 \begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix}$
Double Pump with Fixed Flow IP	$\phi 25.385 \begin{smallmatrix} 0 \\ -0.025 \end{smallmatrix}$	$27.85 \begin{smallmatrix} 0 \\ -0.25 \end{smallmatrix}$

4 Bolt SAE E Mount

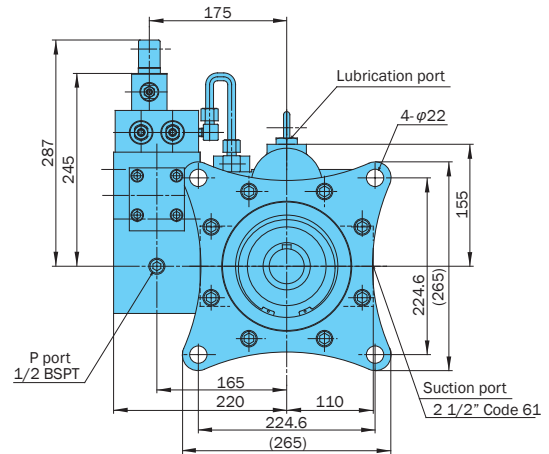
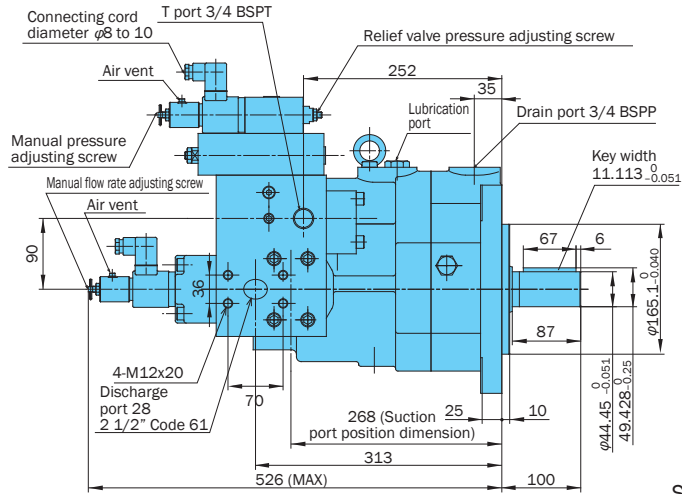


4 Bolt SAE D Mount

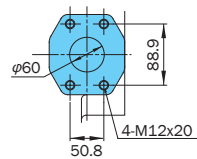


PZ-5B-130

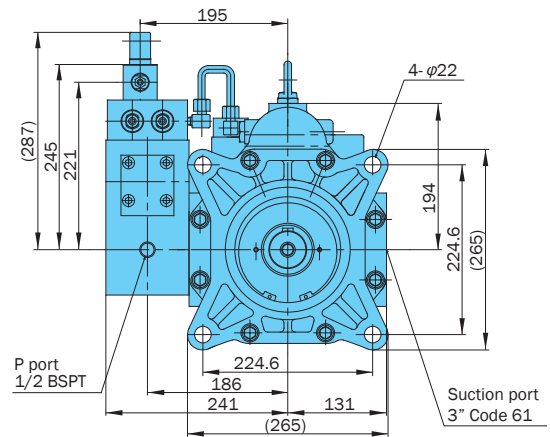
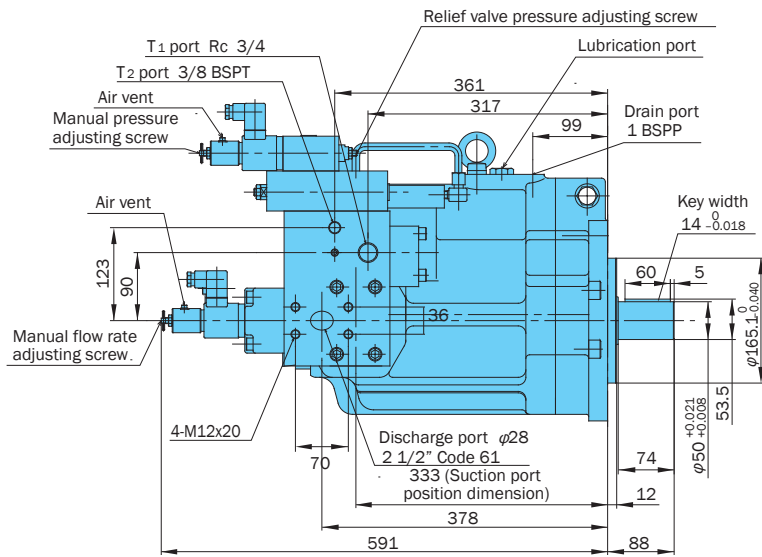
4 Bolt SAE E Mount



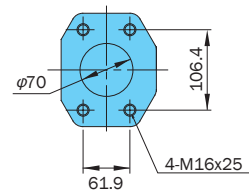
Suction port

PZ-6B-180
220

4 Bolt SAE E Mount



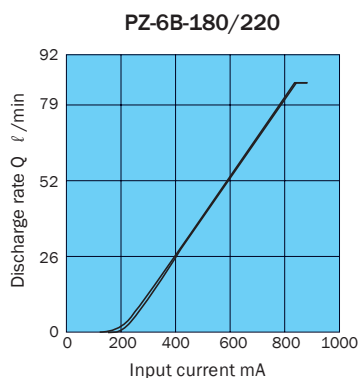
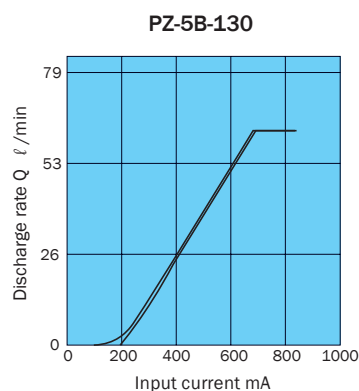
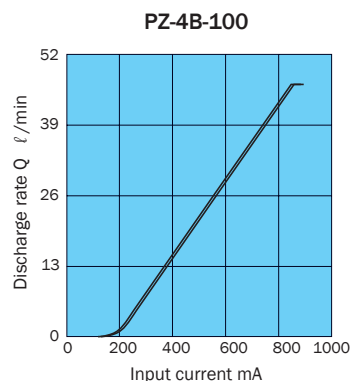
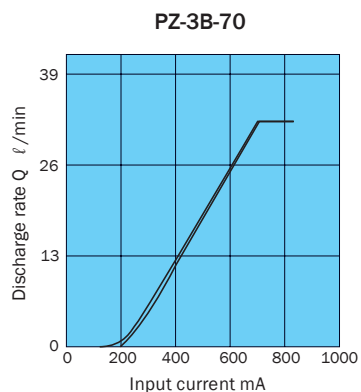
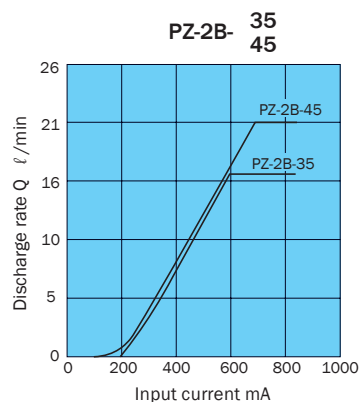
Suction port



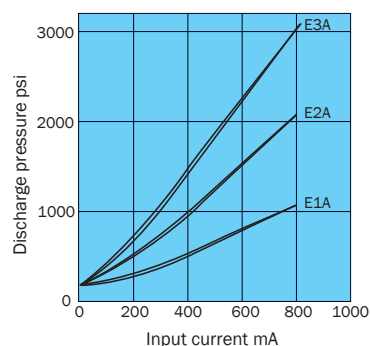
Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes

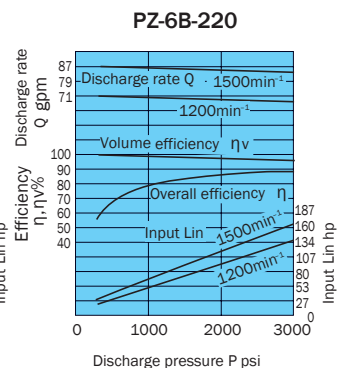
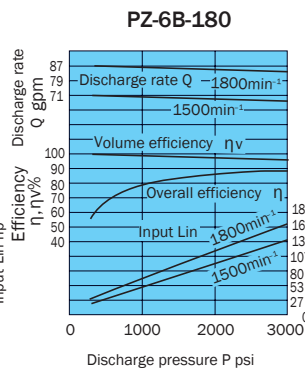
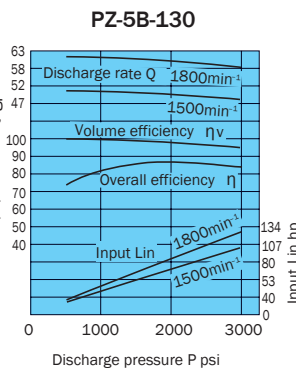
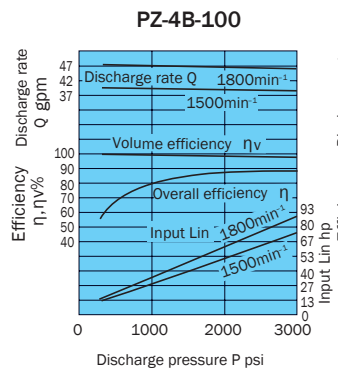
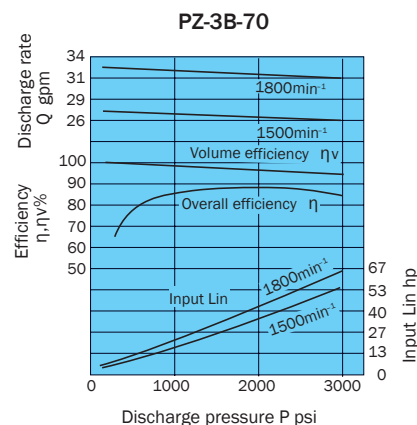
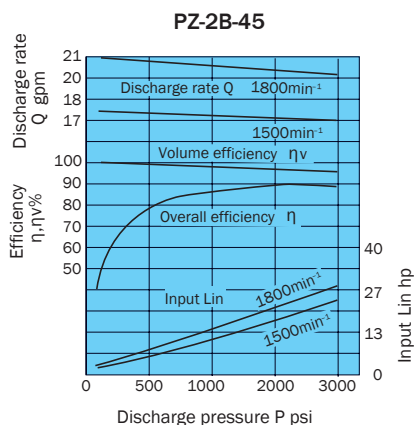
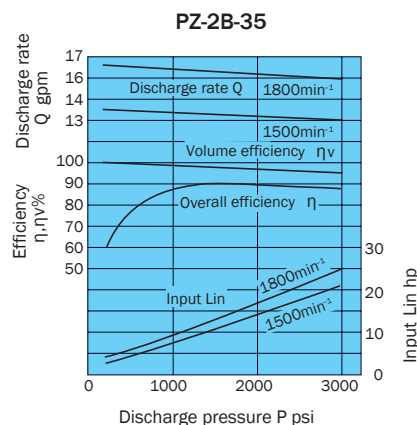
Input Current - Discharge Rate Characteristics



Input Current-Discharge Pressure Characteristics

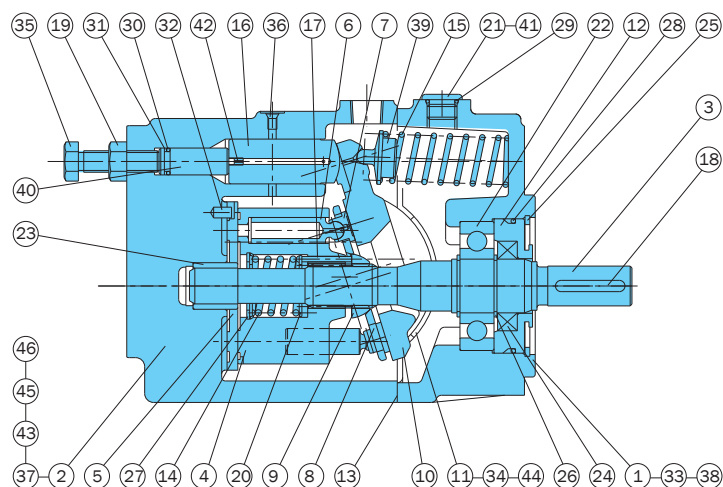


General Performance



Cross-Sectional Drawing

PZ-2B-³⁵₄₅E*A-11



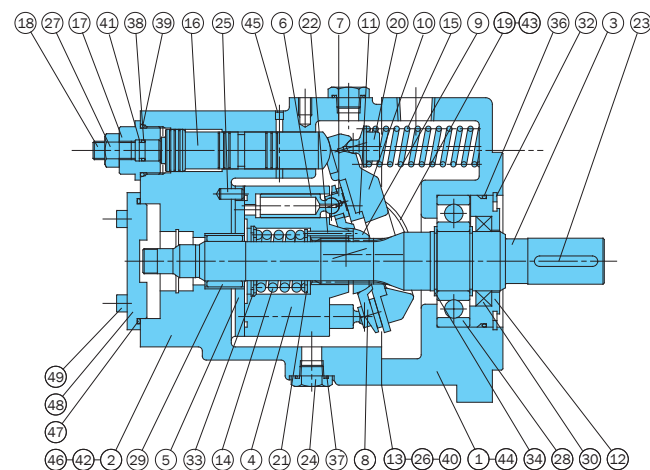
Part No.	Part Name	Part No.	Part Name
1	Body	24	Oil seal
2	Case	25	Snap ring
3	Shaft	26	Snap ring
4	Cylinder barrel	27	Snap ring
5	Valve plate	28	O-ring
6	Piston	29	O-ring
7	Shoe	30	O-ring
8	Shoe holder	31	Backup ring
9	Barrel holder	32	Pin
10	Swash plate	33	Screw
11	Thrust bush	34	Screw
12	Seal holder	35	Screw
13	Gasket	36	Plug
14	Spring C	37	Plug
15	Spring S	38	Plug
16	Control piston	39	Spring holder
17	Needle	40	Guide
18	Key	41	Hydraulic fluid input seal
19	Nut	42	Orifice
20	Retainer	43	Pin
21	Plug	44	Orifice
22	Ball bearing	45	Connector
23	Needle bearing	46	O-ring

List of Sealing Parts (Kit Model Number PSBS-102220)

Part No.	Part Name	Q'ty	Size	Remarks
* 13	Gasket	1	PS46-102000-0A	3 Bond
24	Oil seal	1	TCN-305011	N. O. K
28	O-ring	1	1B-G70	JIS B 2401
29	O-ring	1	1B-P14	JIS B 2401
30	O-ring	1	1B-P11	JIS B 2401
31	Backup ring	1	T2-P11	JIS B 2407
46	O-ring	2	1B-P5	JIS B 2401

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

PZ-3/5B-E*A-10



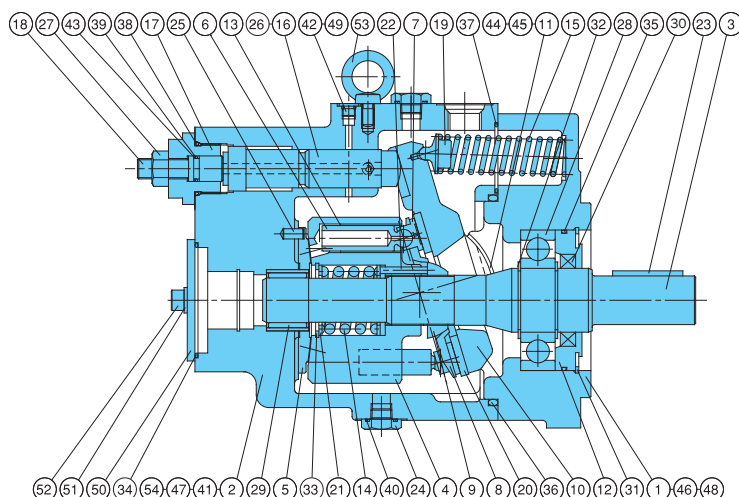
Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	18	Guide screw	37	O-ring
2	Case	19	Thrust bush	38	O-ring
3	Shaft	20	Spring holder	39	O-ring
4	Cylinder barrel	21	Retainer	40	O-ring
5	Valve plate	22	Needle	41	Backup ring
6	Piston	23	Key	42	Bolt
7	Shoe	24	Plug	43	Screw
8	Shoe holder	25	Pin	44	Plug
9	Barrel holder	26	Connector	45	Plug
10	Swash plate	27	Nut	46	Pin
11	Thrust plate	28	Ball bearing	47	O-ring
12	Seal holder	29	Needle bearing	48	Plate
13	Gasket	30	Oil seal	49	Screw
14	Spring C	32	Snap ring		
15	Spring S	33	Snap ring		
16	Control piston	34	Snap ring		
17	End plug	36	O-ring		

List of Sealing Parts (Kit Model Number 3B; PZAS-103200, 5B; PZAS-104000)

Part No.	Part Name	PZ-3B		PZ-5B		Remarks
		Size	Q'ty	Size	Q'ty	
13	Gasket	*	1	*	1	3 Bond
30	Oil seal	TCN-456812	1	TCN-608212	1	N. O. K
36	O-ring	1B-G95	1	1B-G125	1	JIS B 2401
37	O-ring	1B-P21	2	1B-P21	2	JIS B 2401
38	O-ring	1B-P12	1	1B-P16	1	JIS B 2401
39	O-ring	1B-P34	1	1B-P42	1	JIS B 2401
40	O-ring	1B-P7	2	1B-P7	2	JIS B 2401
41	Backup ring	T2-P12	1	T2-P16	1	JIS B 2407
47	O-ring	1B-G90	1	1B-G85	1	JIS B 2401

Parts marked by an asterisk "*" are not available on the market. Consult your agent.

PZ-4/6B-*



Part No.	Part Name	Part No.	Part Name
1	Body	31	Snap ring
2	Case	32	Snap ring
3	Shaft	33	Snap ring
4	Cylinder barrel	34	O-ring
5	Valve plate	35	O-ring
6	Piston	36	O-ring
7	Shoe	37	O-ring
8	Shoe holder	38	O-ring
9	Barrel holder	39	O-ring
10	Swash plate	40	O-ring
11	Thrust bush	41	O-ring
12	Seal holder	42	O-ring
13	Sleeve	43	Backup ring
14	Spring C	44	Orifice
15	Spring S	45	Screw
16	Control piston	46	Plug
17	End plug	47	Pin
18	Guide screw	48	Bolt
19	Spring holder	49	Plug
20	Thrust plate	50	Plate
21	Retainer	51	Washer
22	Needle	52	Bolt
23	Key	53	Eye bolt
24	Plug	54	Electro-hydraulic proportional valve
25	Pin		
26	Orifice		
27	Nut		
28	Ball bearing		
29	Needle bearing		
30	Oil seal		

List of Sealing Parts (Kit Model Number 4B : PZAS-104100, 6B : PZBS-106000)

Part No.	Part Name	PZ-4B		PZ-6B		Remarks
		Size	Q'ty	Size	Q'ty	
30	Oil seal	TCN-507212	1	TCN-659013	1	N. O. K
34	O-ring	1B-G85	1	1B-G85	1	JIS B 2401
35	O-ring	1B-G105	1	1B-G135	1	JIS B 2401
36	O-ring	1B-G155	1	1B-G200	1	JIS B 2401
37	O-ring	1B-G50	1	1B-G65	1	JIS B 2401
38	O-ring	1B-P36	1	1B-P41	1	JIS B 2401
39	O-ring	1B-P16	1	1B-P16	1	JIS B 2401
40	O-ring	1B-P21	3	1B-P21	3	JIS B 2401
41	O-ring	1B-P9	1	1B-P10	1	JIS B 2401
42	O-ring	1B-P8	5	1B-P8	8	JIS B 2401
43	Backup ring	T2-P16	1	T2-P16	1	JIS B 2407

Foot Mounting Kit

Pump Model No.	Mounting Model No.
PZ-2B	IHM-44-10
PZ-3B	
PZ-5B	IHM-55-10
PZ-6B	
PZ-4B	PZM-4-10

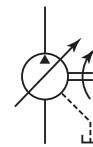
Note: See pages C-12 and A-34 for information about mounting methods.

Piping Flange Kit

Flange Kit model No.	Applicable Pump Model No.	IN Flange							
		Flange Part No.		Bolt		Washer		O-ring	
IHF -4-T-20	PZ-2B-35/45	IH03J-100100	1	TH-10 × 55	4	WS-B-10	4	1B-G40	1
IHF -5-T-20	PZ-3B-70	IH03J-100120	1	TH-12 × 55	4	WS-B-12	4	1B-G50	1
PZF -4-T-10	PZ-4B-100	IH03J-100160	1	TH-12 × 60	4	WS-B-12	4	1B-G60	1
IHF -7-T-10	PZ-5B-130	IH03J-100200	1	TH-12 × 60	4	WS-B-12	4	1B-G75	1
PZF -6-T-10	PZ-6B-180/220	IH03J-100240	1	TH-16 × 75	4	WS-B-16	4	1B-G85	1

	OUT Flange								Plug	
	Flange Part No.		Bolt		Washer		O-ring			
	IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	1B-G30	1	TPHA-1/4	1
	IH03J-100080	1	TH-10 × 50	4	WS-B-10	4	1B-G35	1	TPHA-1/4	2
	IH03J-100080	1	TH-10 × 50	4	WS-B-10	4	1B-G35	1	TPHA-1/4	1
	IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	1B-G50	1	TPHA-1/4	1
	IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	1B-G50	1	TPHA-1/4	1

- Note
1. See page C-11 for dimensions.
 2. O-ring 1B/B-** refers to JIS B2401-1B.
 3. See page C-11 for details on tightening torque.



VDS Series Small Variable Volume Vane Pump

0.5 in³/rev
3.94 gpm
1015 psi

Features

High efficiency operation with minimal power loss

All the performance of the original new VDR series mechanisms combines with precision machining for a pump that minimizes power loss, especially at full cutoff.

Quiet operation

Journal bearings with a proven record on IP pumps plus new suction and discharge port configurations reduce operating noise and deliver quiet

operation with minimal vibration, even in the high-pressure range.

Compact and simple design, easy operation

Compact and quiet, VDS Series variable vane pumps are economical and easy to handle. A simple design allows use in a wide range of hydraulic systems.

Precise characteristics, prompt response

Prompt response at both ON-OFF

and OFF-ON ensures instantaneous, stable, high-precision operation.

Solidly built for high efficiency and long life

VDS Series pumps are built to last, with a design that incorporates years of NACHI experience and know-how. Specially selected materials and skilled workmanship provide outstanding durability along with stable, high-efficiency operation.

Specifications

Model No.	Capacity in ³ /rev	No-load Discharge Rate gpm				Pressure Adjustment Range psi	Allowable Peak Pressure psi	Revolution Speed min min ⁻¹		Weight lbs
		1000min ⁻¹	1200min ⁻¹	1500min ⁻¹	1800min ⁻¹			Min.	Max.	
VDS-0A(B)-1A1-E11						145 ~ 290				
" -1A2-E11	.50	2.1	2.6	3.2	3.94	317 ~ 507	2030	800	1800	A : 14.3 B : 9.9
" -1A3-E11						435 ~ 1015				

• Handling

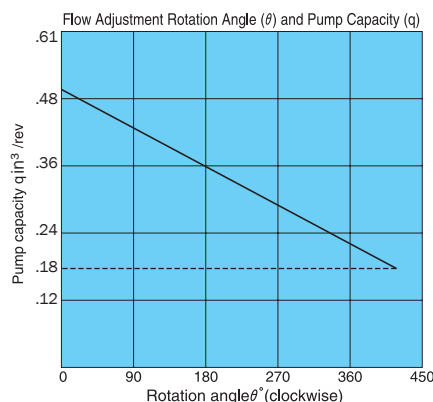
- The direction of rotation for this pump is clockwise (rightward) when viewed from the shaft side.
- Drain piping must be direct piping up to a point that is below the tank fluid level, and back pressure due to pipe resistance should not exceed 4.3 psi.
- When adjusting pressure, pressure is increased by clockwise (rightward) rotation of the adjusting screw and decreased by counterclockwise (leftward) rotation.
- When adjusting the flow rate, the flow rate is decreased by clockwise (rightward) rotation of the adjusting screw and increased by counterclockwise (leftward) rotation. The graph on the right provides general guidelines for the relationship between the rotation angle of the flow rate adjusting screw and the no-load discharge rate.
- Factory Default P-Q Settings (Standard Model)
 - Flow Rate Setting = Maximum flow rate for model as indicated in the catalog.
 - Pressure Setting = Pressure shown in table below.

Factory Default Pressure Settings kgf/cm ² (psi)	
1	20.4 (290)
2	35.7 (507)
3	71.4 (1015)

$$\text{Flow rate gpm} = \frac{\text{in}^3 \times \text{rpm}}{231}$$

Q: No-load Discharge Rate (gpm)

q: Capacity (in³/rev)



The values indicated above are at maximum pump discharge volume with the flow volume adjusting screw at the 0° position. The broken line shows the flow volume adjustment range lower limit value.

6 Thrust Screw

The thrust screw is precision adjusted at the factory during assembly. Never touch the thrust screw.

See callout 9 in the cross-section diagram on page B-4.

7 Initial Operation

Before operating the pump for the first time, put the pump discharge side into the no-load state and then repeatedly start and stop the motor to bleed all air from inside the pump and the suction piping. After confirming that the pump is discharging oil, continue the no-load operation for at least 10 minutes to discharge all the air from the circuit.

- For the hydraulic operating fluid, use an R&O type and wear-resistant type of ISO VG32 to 68 or equivalent (viscosity index of at least 90). Use hydraulic operating fluid that provides kinematic viscosity during operation in the range of 20 to 150 centistokes.

- The operating temperature range is 59 to 140°F. When the oil temperature at startup is 59°F or less, perform a warm-up operation at low pressure until the oil temperature reaches 59°F. Use the pump in an area where the temperature is within the range of 59 to 140°F.

(continued on following page)

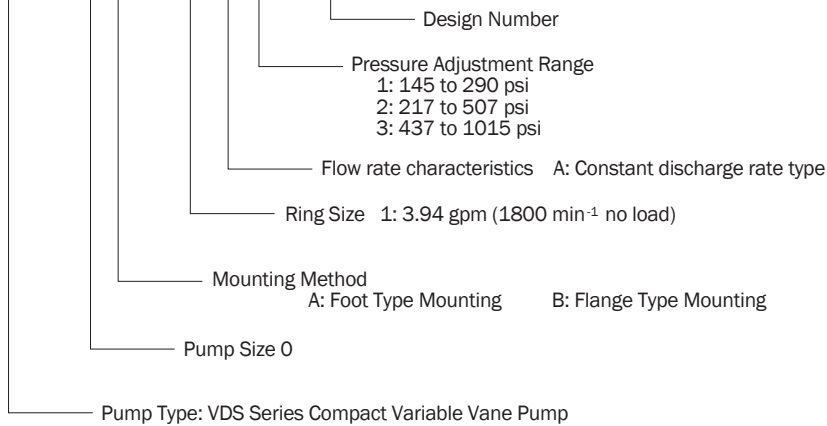
- 10 Suction pressure is 4.35 psi, and the suction port flow rate should be greater than 6 ft/sec.
- 11 Avoid pulley, gear, and other drive systems that impart a radial or thrust load on the end of the pump shaft. Mount the pump so its pump shaft is oriented horizontally.
- 12 Provide a suction strainer with a filtering grade of about 100 μm (150 mesh). For the return line to the tank, use a 10 μm line filter.

- 13 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water or other foreign matter, and watch for discoloration. Whitish fluid indicates that air has contaminated the fluid, and brownish fluid indicates the fluid is dirty.
- 14 Contact your agent about using water- and glycol-based hydraulic operating fluids.
- 15 At startup, repeat the inching operation

- (start-stop) to bleed air from the pump and pipes.
- 16 Equip an air bleed valve in circuits where it is difficult to bleed air before startup. See page C-13 for more information.
- 17 To ensure proper lubrication of the pump's rubbing surfaces, supply oil to the interior of the pump before starting operation.
- 18 When centering the pump shaft, eccentricity with the motor shaft should be no greater than 0.001 in. The angle error should be no greater than 1°.

Understanding Model Numbers

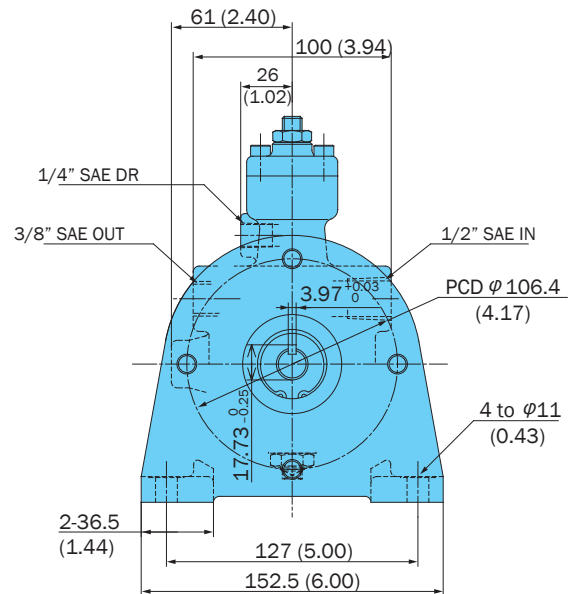
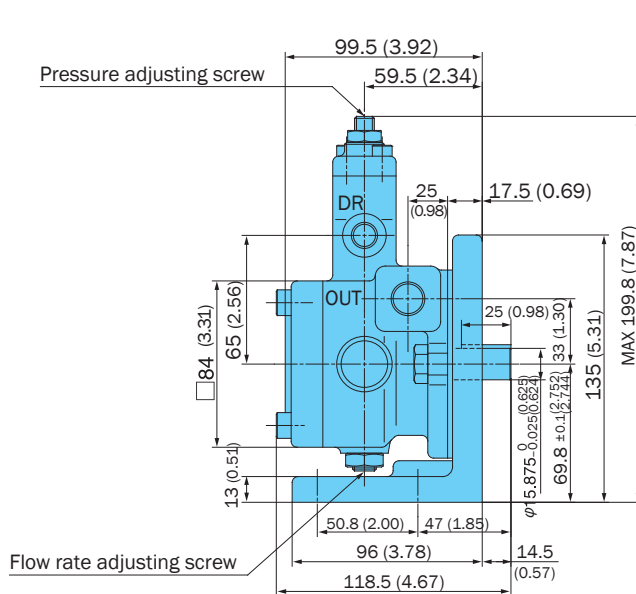
VDS -- 0 * -- 1 A * -- E11



Installation Dimension Drawings

VDS-0A-1A-* -10

Foot Mounting Type mm (inch)

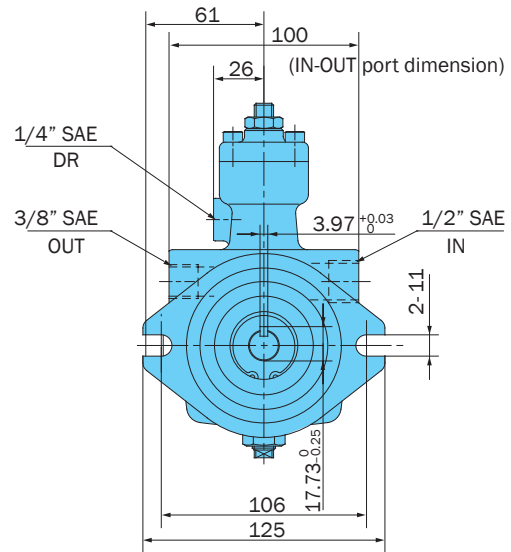
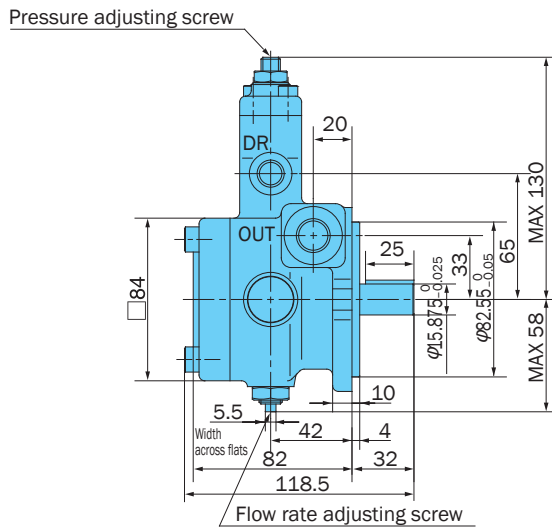


Note: Foot Mounting Kit: IHM-2-10

VDS-0B-1A-*-10

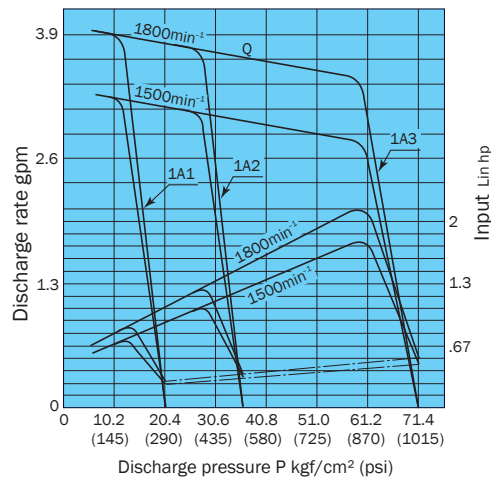
SAE A Mount

Flange Mounting

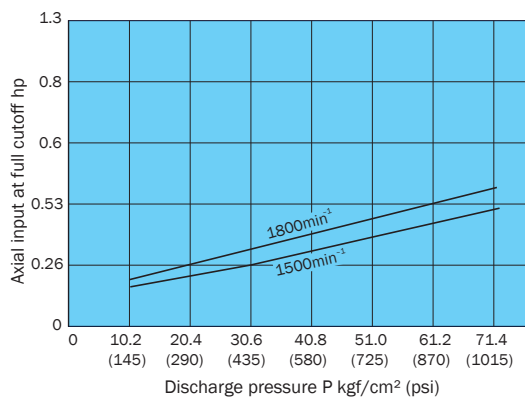


Specifications

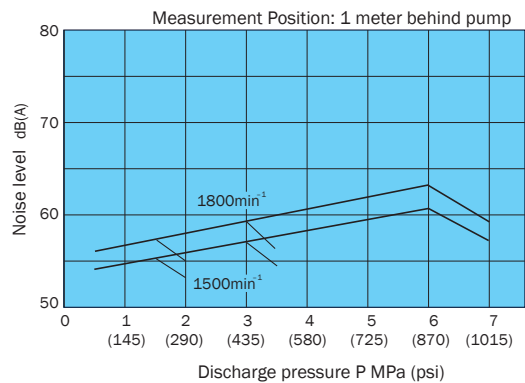
Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes



Axial Input at Full Cutoff

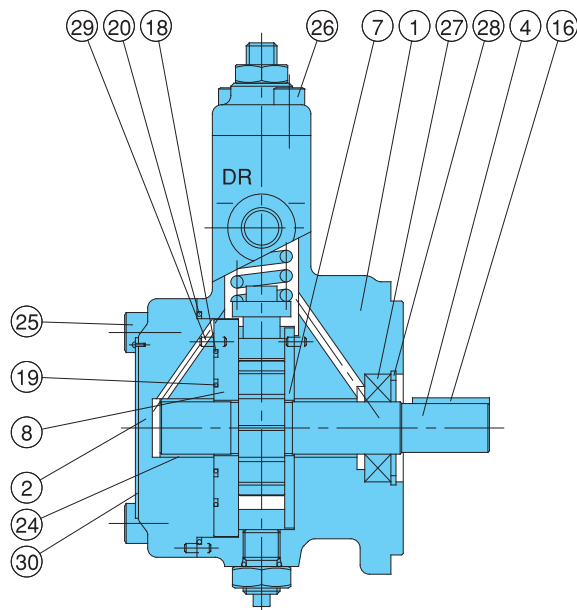
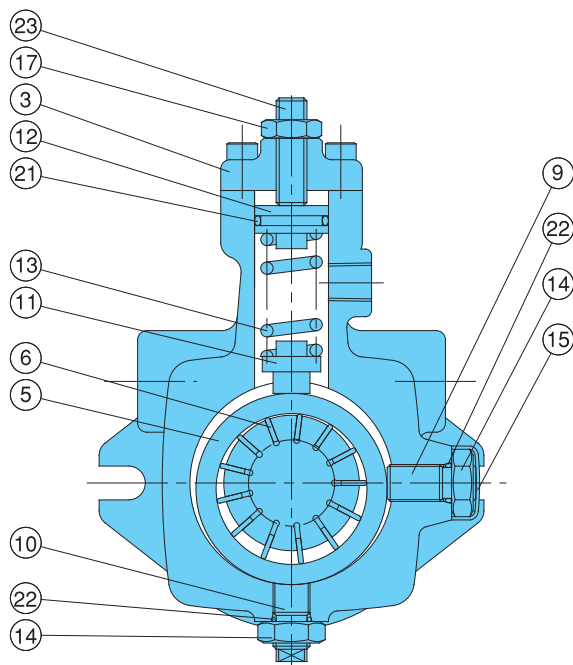


Noise Characteristics



Cross-Sectional Drawing

VDS-0B-1A*-10



List of Sealing Parts

Seal Kit: VBAS-100B00

Applicable Pump Model: VDS-0A/B-1A *10

Part No.	Part Name	Part Number	Q'ty
18	O-ring	AS568-032	1
19	O-ring	AS568-023	1
20	O-ring	S71 (NOK)	1
21	O-ring	1A-P20	1
22	O-ring	1A-P10	2
27	Oil seal	TC-17358	1

Note:

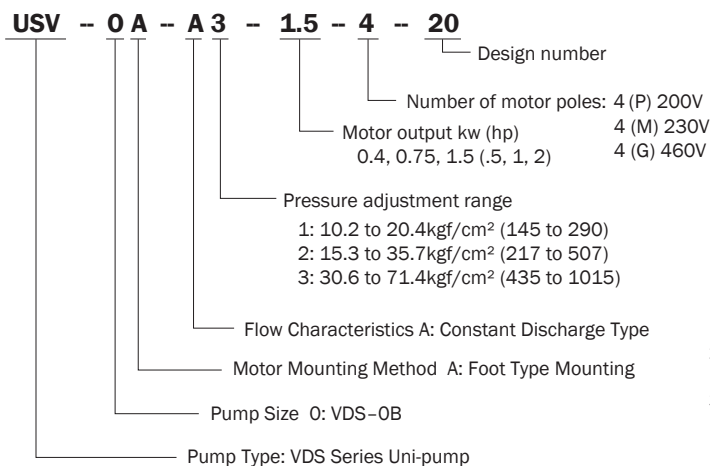
1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
2. O-ring 1A/B-** refers to JIS B2401-1A.

Part No.	Part Name	Part No.	Part Name
1	Body	16	Key
2	Cover (A)	17	Nut
3	Cover (B)	18	O-ring
4	Shaft	19	O-ring
5	Cam ring	20	O-ring
6	Vane	21	O-ring
7	Plate (S)	22	O-ring
8	Plate (H)	23	Screw
9	Thrust screw	24	Bearing
10	Screw	25	Screw
11	Piston	26	Screw
12	Holder	27	Oil seal
13	Spring	28	Snap ring
14	Nut	29	Pin
15	Cap	30	Nameplate

Uni-Pump Specifications

(CE mark standard compliant)

Understanding Model Numbers



Cartridge Kit:

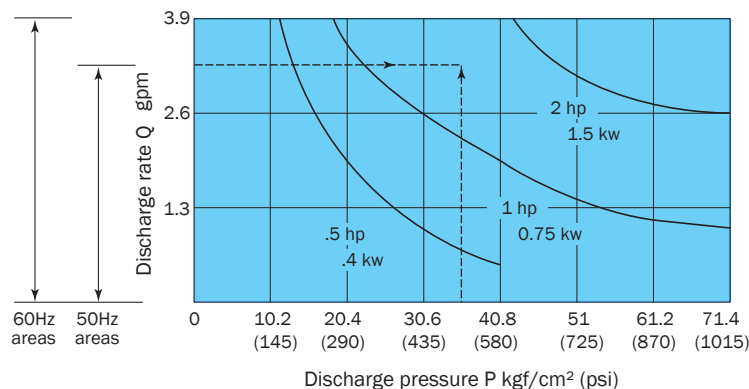
VBAC-100*A*

Includes Items: 4, 5, 6, 7, 8, 16, 29

Maximum Working Pressure kgf/cm (psi)	Maximum Flow Rate gpm	
	50Hz	60Hz
71.4 (1015)	3.30	3.94

1. Standard drive motor is the fully enclosed fan-cooled B type.
2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
3. Standard terminal box is B terminal (right side viewed from pump).

Motor Selection Curves



• How to select a motor

The area under a motor output curve in the graph to the left is the operating range for that motor under the rated output for that motor.

Example:

To find the motor that can produce pressure of 507 psi and a discharge rate of 3.3 gpm.

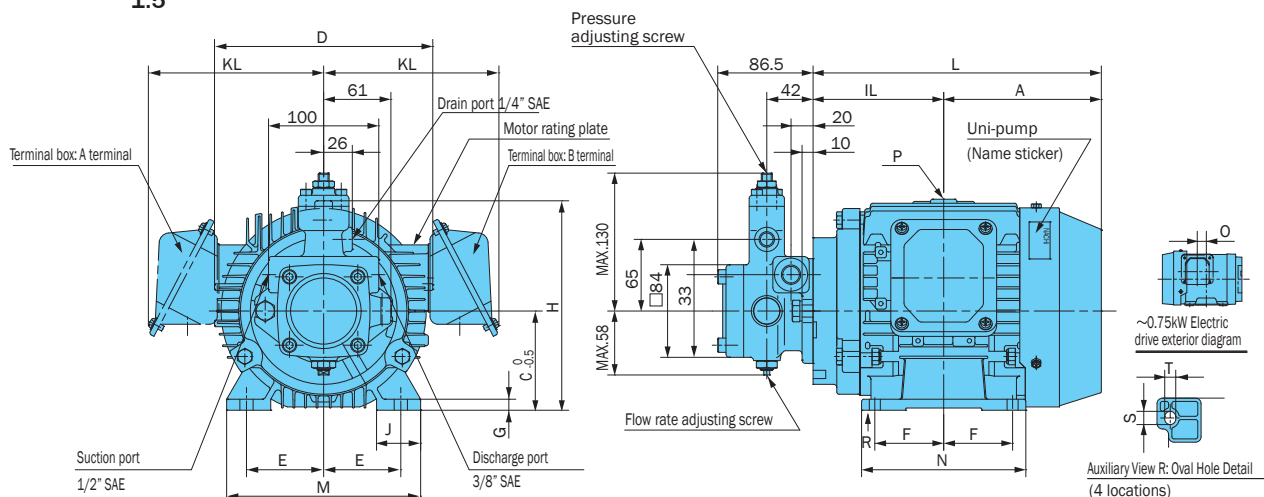
Selection Process:

Since the intersection of the two broken lines from a pressure of 507 psi and discharge rate of 3.3 gpm intersect in the area under the 2 hp curve, it means that a 2 hp motor should be used.

* Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload.

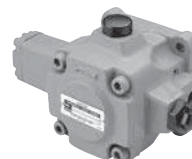
Installation Dimension Drawings

0.4
USV-0A-A* - 0.75-4-20
1.5



Uni-pump	Motor Dimensions mm																Frame No.	Output hp (4 poles)	Weight lbs
	A	IL	C	D	E	F	G	H	J	L	M	N	S × T	KD	KL	O			
USV-0A-A1-0.4-4-20	121	107.5	71	150	56	45	2.3	146	30	228.5	140	110	15 × 7	φ27	151	35	71M	0.5	30
USV-0A-A2-0.4-4-20																			
USV-0A-A3-0.4-4-20																			
USV-0A-A1-0.75-4-20	133	107.5	80	170	62.5	50	4.5	165	35	240.5	165	130	18 × 10	φ27	157	27.5	80M	1.0	42
USV-0A-A2-0.75-4-20																			
USV-0A-A3-0.75-4-20																			
USV-0A-A3-1.5-4-20	143	118.5	90	198	70	62.5	10	190	40	261.5	176	150	12 × 10	φ27	159	—	90L	2	45

* See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).



VDR Design Series Variable Volume Vane Pump

7.9 gpm at 2030 psi
10.5 gpm at 1000 psi

Features

Stable, highly efficient operation up to 2030 psi

A biased piston that minimizes ring vibration and leak-free pressure balance construction enables highly efficient high-pressure operation, and very stable performance up to 2030 psi.

High-precision instantaneous response

Response has been improved by a special bias piston mechanism. Prompt response at both ON-OFF and OFF-ON

ensures instantaneous, stable, high-precision operation.

Silent operation, even in the high pressure range

CQuiet journal bearings, a bias piston that allows a 3-point support system, and new suction and discharge port shapes all contribute to minimize operation noise. Silent, vibration-free operation is ensured, even in the high pressure range.

A combination of NACHI-original mechanical innovations and precision machining create a pump that minimizes power loss, especially at full cutoff.

Solid construction stands up to harsh operating conditions

The tough and rugged construction of this pump is made possible by a long history of quality pump designs. This, in combination with specially selected materials and skilled workmanship, provides outstanding durability.

Reduced power loss

Specifications

Single Pump

Model Type		No-load Discharge Rate l/min (gpm)			Pressure Adjustment Range psi	Allowable Peak Pressure psi	Revolution Speed min ⁻¹		Weight lbs
Foot Mounting	Flange Mounting	1800 rpm	1500 rpm	1200 rpm			Min.	Max.	
VDR-1A-1A2-*22	VDR-1B-1A2-*22	30 (7.9)	25 (6.6)	20 (5.3)	217 ~ 507	500	800	1800	19.9
VDR-1A-1A3-*22	VDR-1B-1A3-*22				435 ~ 1015	1000			
VDR-1A-1A4-*22	VDR-1B-1A4-*22				942 ~ 1522	1500			
VDR-1A-1A5-*22	VDR-1B-1A5-*22				1305 ~ 2030	2000			
VDR-1A-2A2-*22	VDR-1B-2A2-*22	40 (10.6)	33 (8.7)	27 (7.1)	214 ~ 500	500	800	1800	19.9
VDR-1A-2A3-*22	VDR-1B-2A3-*22				429 ~ 1000	1000			

Double Pump

Model No.	Vent Side		Shaft Side		Vent Side	Shaft Side	Revolution Speed min ⁻¹		Weight lbs
Foot Mounting Type (Flange Mounting Type)	Discharge Rate gpm	Pressure Adjustment Range psi	Discharge Rate gpm	Pressure Adjustment Range psi	Allowable Peak Pressure psi		Min.	Max.	
VDR-11A(B)-1A2-1A2-22 VDR-11A(B)-1A2-1A3-22	7.9	217 ~ 507	7.9	435 ~ 1015	2030		800	1800	37
VDR-11A(B)-1A3-1A3-22		435 ~ 1015		435 ~ 1015					
VDR-11A(B)-2A2-2A2-22 VDR-11A(B)-2A2-2A3-22	10.5	217 ~ 507	10.5	435 ~ 1015	2030		800	1800	37
VDR-11A(B)-2A3-2A3-22		435 ~ 1015		435 ~ 1015					

Note: 1. The discharge rate is the value at 1800min⁻¹ no load.

2. The change from design number 21 to design number 22 represents a change in the shaft key width from .125 in to .187 in. This means that when using a .125 in key coupling, you need to use a stepped key (VD31J-302000) or add a new key groove at .187 in.

• Handling

1 Rotation Direction

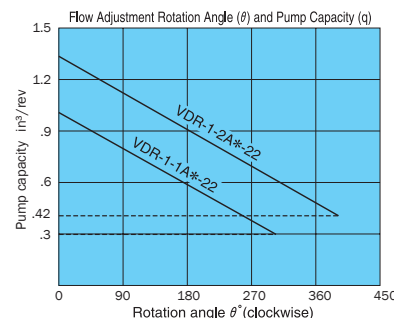
The direction of rotation is always clockwise (rightward) when viewed from the shaft side.

2 Drain

Drain piping must be direct piping up to a point that is below the tank fluid level, and back pressure due to pipe resistance should not exceed 4.35 psi. When using a pump that has drain ports at two locations, use the drain port that is higher after the pump is installed.

3 Discharge Volume Adjustment

The discharge flow rate is decreased by clockwise (rightward) rotation of the discharge rate adjusting screw, and increased by counterclockwise (leftward) rotation. Loosen the lock nut before making adjustments. After adjustment is complete, re-tighten the lock nut. The graph on the right provides general guidelines for the relationship between the rotation angle of the flow rate adjusting screw and the no-load discharge rate.



(continued on following page)

Flow rate gpm: $Q = \frac{\text{in}^3 \times \text{rpm}}{231}$

Q: No-load Discharge Rate Q r/min

q: Volume cm^3/rev

N: Revolution Speed min^{-1}

The broken line shows the flow volume adjustment range lower limit value.

Note:

The values indicated above are at maximum discharge volume with the flow volume adjusting screw at the 0° position.

4 Pressure Adjustment

Pressure is decreased by clockwise (rightward) rotation of the discharge rate

adjusting screw, and increased by counterclockwise (leftward) rotation.

5 Factory Default P-Q Settings (Standard Model)

- Flow Rate Setting = Maximum flow rate for model as indicated in the catalog
- Pressure Setting = Pressure shown in table to the right

6 Thrust Screw

The thrust screw is precision adjusted at the factory during assembly. Never touch the thrust screw. See callout ②1 in the cross-section diagram on page B-11.

Factory Default Pressure Settings
kgf/cm² (psi)

2	: 35.7 (507)
3	: 30.6 (435)
4	: 66.3 (942)
5	: 91.8 (1305)

7 Initial Operation

Before operating the pump for the first time, put the pump discharge side into the no-load state and then repeatedly start and stop the motor to bleed all air from inside the pump and the suction piping. After confirming that the pump is discharging oil, continue the no-load operation for at least 10 minutes to discharge all the air from the circuit.

Provide an air bleed valve in circuits where it is difficult to bleed air before startup.

8 Sub Plate

Use the following table for specification when a sub plate is required.

For detailed dimensions, see pages B-17 through B-19.

- 9 For the hydraulic operating fluid, use type ISO VG32 or equivalent (viscosity index of at least 90) for pressures of 1015 psi or lower, and type ISO VG68 or equivalent (viscosity index of at least 90) for pressures greater than 1015 psi.

Pump Model No.	Sub Plate Number	Motor(hp)
VDR-1A-1A*-22	MVD-1-115-10	1 ~ 2
	MVD-1-135-10	3 ~ 5
VDR-1A-2A*-22	MVD-1-115Y-10	1 ~ 2
	MVD-1-135Y-10	3 ~ 5
VDR-11A-*A* -*A*-22	MVD-11-135-10	2 ~ 5
	MVD-11-135X-10	

- 10 The operating temperature range is 59 to 140 °F. When the oil temperature at startup is 59 °F or less, perform a warm-up operation at low pressure until the oil temperature reaches 59 °F. Use the pump in an area where the temperature is within the range of 32 to 140 °F.

- 11 Suction pressure is 4.35 psi, and the suction port flow rate should be to greater than 6 ft/sec.

Avoid pulley, gear, and other drive systems that impart a radial or thrust load on the end of the pump shaft. Mount the pump so its pump shaft is oriented horizontally.

(Continued on following page)

Understanding Model Numbers

Single Pump

VDR -- 1 A -- 1 A 2 -- *22

Design Number
E: NPT Piping

Pressure Adjustment Range
2: 15 ~ 35 kgf/cm² (217 ~ 507 psi)
3: 30 ~ 70 kgf/cm² (435 ~ 1015 psi)
4: 65 ~ 105 kgf/cm² (942 ~ 1522 psi)
5: 90 ~ 140 kgf/cm² (1305 ~ 2030 psi)
Note: Ring size: in the case of 2, maximum setting pressure is 1015 psi

Flow Rate Characteristics A: Constant discharge rate type

Ring Size 1: 7.9 gpm } at 1800 min⁻¹
2: 10.5 gpm }

Mounting Method

A: Foot Type Mounting B: Flange Type Mounting

Pump Size 1

Pump Type: VDR Series Variable Discharge Rate Vane Pump

Double pump

VDR -- 11 A -- 1 A 2 -- 1 A 3 -- 22

Design Number
E: NPT Piping

Shaft Side Pressure Adjustment Range
2: 15.3 to 35.7kgf/cm² (217 to 507)
3: 30.6 to 71.4kgf/cm² (435 to 1015)

Shaft Side Flow Rate Characteristics
(based on single pump)

Shaft Side Ring Size
(based on single pump)

Head Side Pressure Adjustment Range
2: 15.3 to 35.7kgf/cm² (217 to 507)
3: 30.6 to 71.4kgf/cm² (435 to 1015)

Head Side Flow Rate Characteristics
(based on single pump)

Head Side Ring Size
(based on single pump)

Mounting Method

A: Foot type mounting B: Flange type mounting

Pump Size: 11

Pump Type: VDR Series Variable Discharge Rate Vane Pump

13 Provide a suction strainer with a filtering grade of about 100 μm (150 mesh). For the return line to the tank, use a 10 μm line filter.

14 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water or other foreign matter, and watch out for discoloration. Whitish fluid indicates that air has contaminated the fluid, and brownish

fluid indicates the fluid is dirty.

15 Contact your agent about using water- and glycol-based hydraulic operating fluids.

16 At startup, repeat the inching operation (start-stop) to bleed air from the pump and pipes.

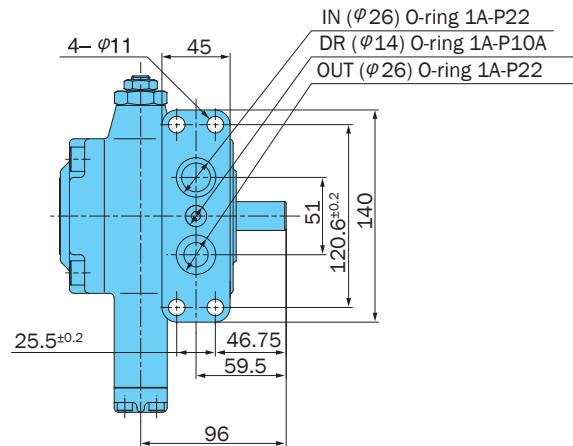
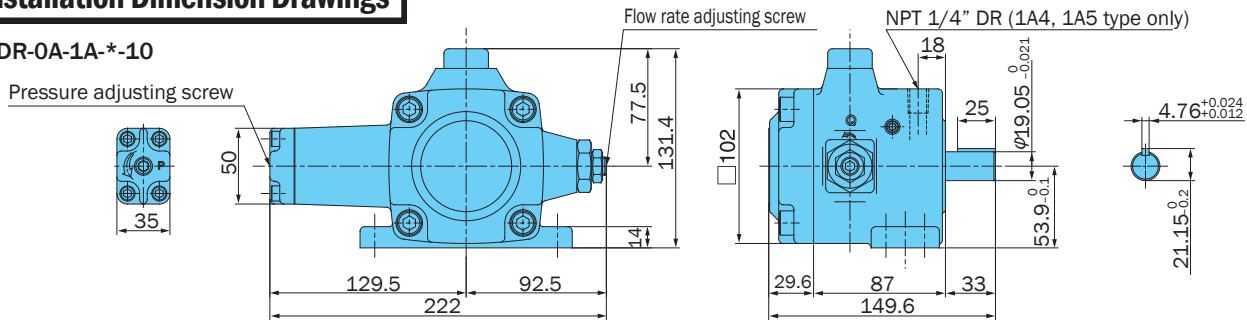
17 Equip an air bleed valve in circuits where it is difficult to bleed air before startup. See page C-13 for more information.

18 To ensure proper lubrication of the pump's rubbing surfaces, supply oil to the interior of the pump before starting operation.

19 When centering the pump shaft, eccentricity with the motor shaft should be no greater than 0.001 in. Use a pump mounting base of sufficient rigidity. The angle error should be no greater than 1°.

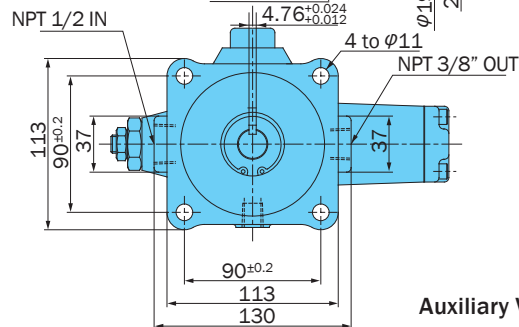
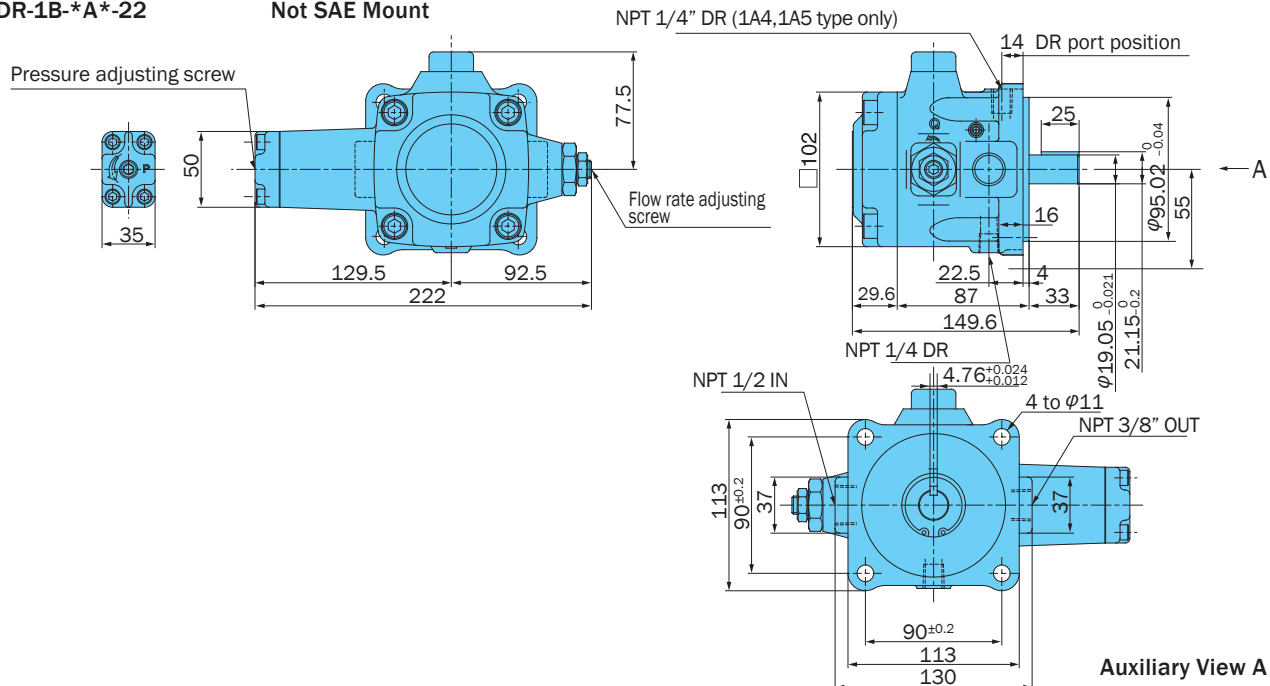
Installation Dimension Drawings

VDR-0A-1A-*-10



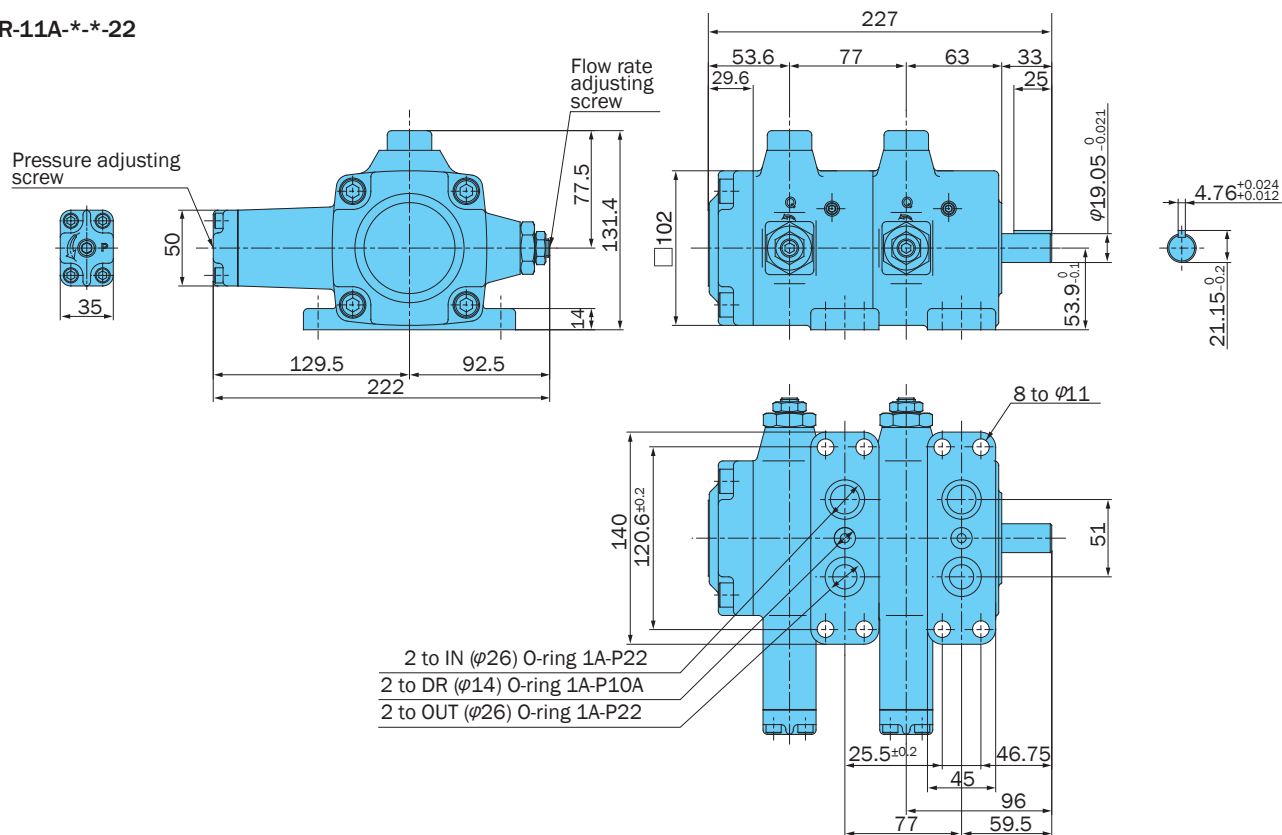
VDR-1B-*A*-22

Not SAE Mount



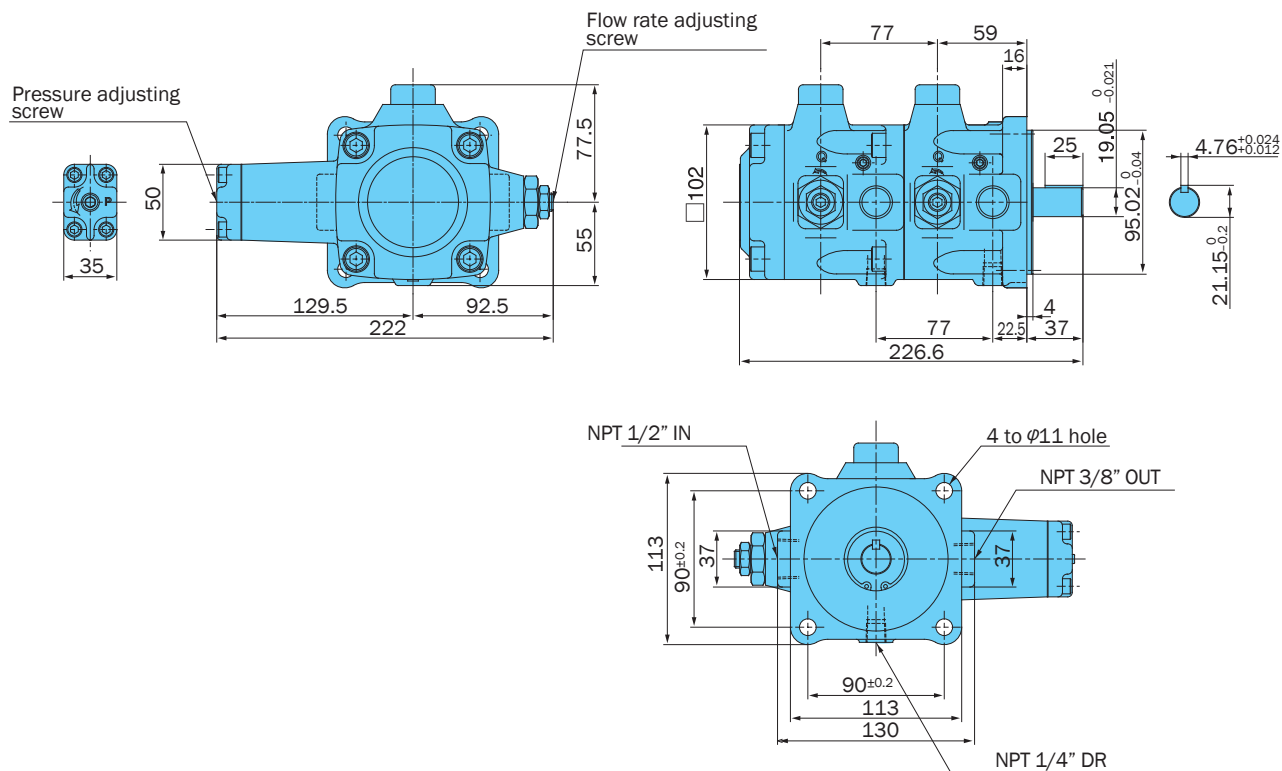
Auxiliary View A

VDR-11A-*. *-22



VDR-11B-*. *-22

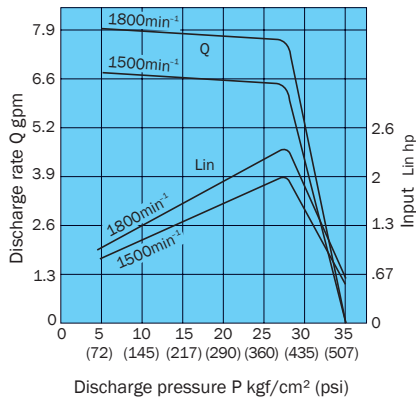
Not SAE Mount



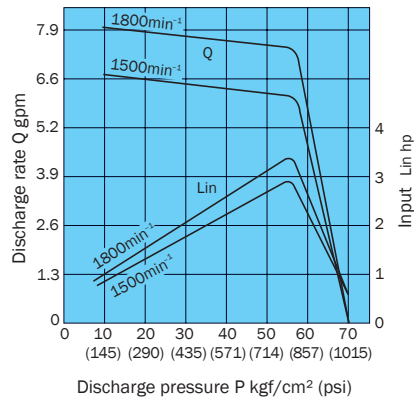
Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes.

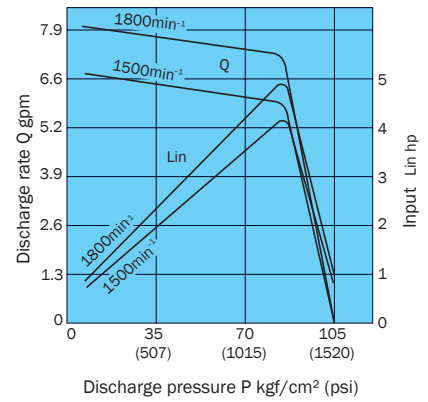
VDR-1*-1A2-22



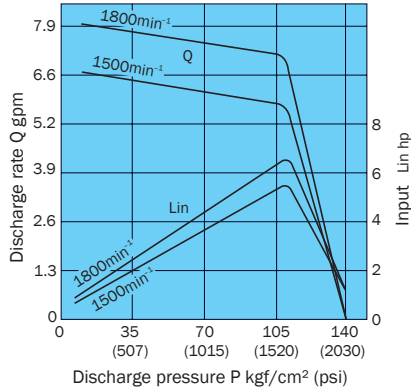
VDR-1*-1A3-22



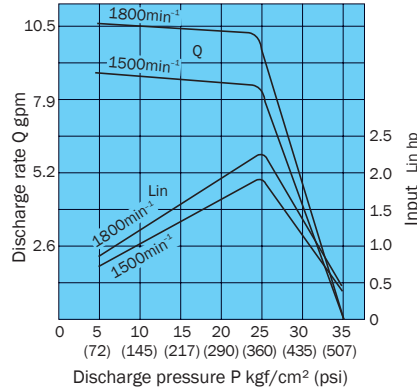
VDR-1*-1A4-22



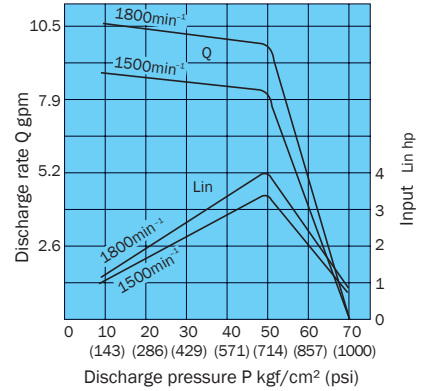
VDR-1*-1A5-22



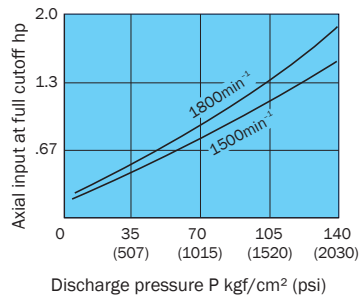
VDR-1*-2A2-22



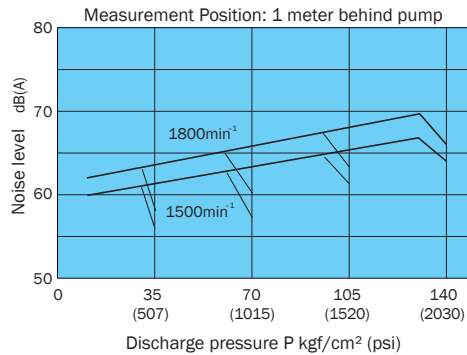
VDR-1*-2A3-22



Axial Input At Full Cutoff

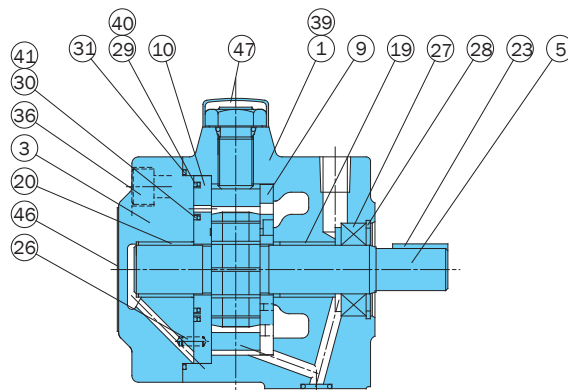
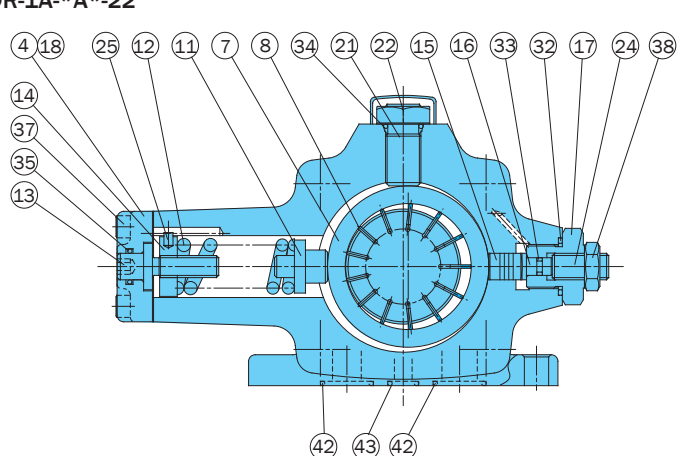


Noise Characteristics



Cross-Sectional Drawing

VDR-1A-*A*-22



List of Sealing Parts

Single Pump

Part No.	Applicable Pump Model No. VDR-1A-*A*-22		
	Seal Kit Number VDBS-101A00		
	Part Name	Part Number	Q'ty
18	Packing	VDB32-101000	1
27	Oil seal	ISRD-224211	1
29	Backup ring	VDB34-101000	1
30	Backup ring	VDB34-201000	1
31	O-ring	S85(NOK)	1
32	O-ring	1A-P22	1
33	O-ring	1A-P5	1
34	O-ring	1A-P14	1
35	O-ring	1A-P12	1
40	O-ring	AS568-036	1
41	O-ring	AS568-029	1
42	O-ring	1A-P22	2
43	O-ring	1A-P10A	1

Note:

- Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
- O-ring 1A-** refers to JIS B2401-1A-**.
- For VDR-1B-*A*-22, the seal kit number becomes VDBS-101B00, without the 42 and 43 O-rings.

Double Pump

Part Name	Applicable Pump Model No. VDR-11A-*A*-22		
	Seal Kit Number VDBS-111A00		
	Part Name	Part Number	Q'ty
18	Packing	VDB32-101000	2
27	Oil seal	ISRD-224211	1
29	Backup ring	VDB34-101000	2
30	Backup ring	VDB34-201000	2
31	O-ring	S85(NOK)	2
32	O-ring	1A-P22	2
33	O-ring	1A-P5	2
34	O-ring	1A-P14	2
35	O-ring	1A-P12	2
40	O-ring	AS568-036	2
41	O-ring	AS568-029	2
42	O-ring	1A-P22	4
43	O-ring	1A-P10A	2

Note:

- Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
- O-ring 1A-** refers to JIS B2401-1A-**.
- For VDR-11B-*A*-22, the seal kit number becomes VDBS-111B00, without the 42 and 43 O-rings.

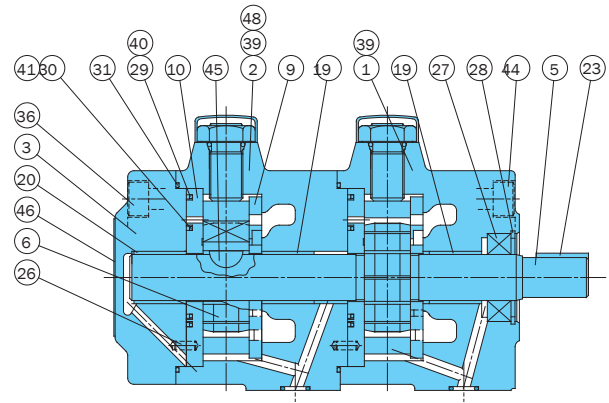
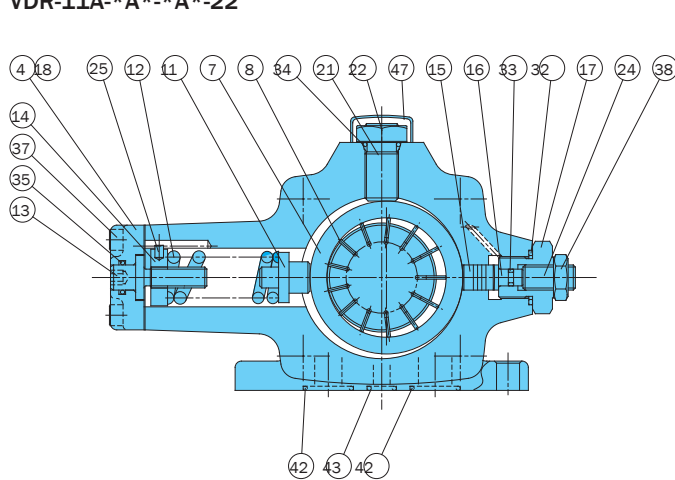
Part No.	Part Name	Part No.	Part Name
1	Body (A)	25	Pin
2	Body (B)	26	Spring pin
3	Cover	27	Oil seal
4	Cover	28	Snap ring
5	Shaft	29	Backup ring
6	Rotor	30	Backup ring
7	Ring	31	O-ring
8	Vane	32	O-ring
9	Plate (S)	33	O-ring
10	Plate (H)	34	O-ring
11	Piston	35	O-ring
12	Spring	36	Screw
13	Screw	37	Screw
14	Nut	38	Nut
15	Piston	39	Plug
16	Holder	40	O-ring
17	Adapter	41	O-ring
18	Packing	42	O-ring
19	Bearing (S)	43	O-ring
20	Bearing (H)	44	Screw
21	Thrust screw	45	Key
22	Nut	46	Nameplate
23	Key	47	Cap
24	Screw	48	Pin

Cartridge Kit:

VDR-1-22; VDBC-101*A*

Includes Items: 5, 7, 8, 9, 10, 23, 25

VDR-11A-*A*-*A*-22



Uni-Pump Specifications

(CE mark standard compliant)

Understanding Model Numbers

Single Pump

UVD - 1 A - 2 A 2 - 1.5 - 4 - 40

- Design Number - E=NPT
- Number of Motor Poles: 4 (P) 200V
4 (G) 230V
4 (M) 460V
- Motor Output kw (hp)
0.75, 1.5, 2.2, 3.7 (1, 2, 3, 5)
- Pressure Adjustment Range
2: 15.3 to 35.7kgf/cm² (217 to 507)
3: 30.6 to 71.4kgf/cm² (435 to 1015)
- Flow Characteristics A: Constant Discharge Type
- Ring Size
None: 7.9 gpm } at 1800min⁻¹
2 : 10.5 gpm }
- A: Foot Type Mounting
- Pump Size 1: VDR-1B (22D)
- Pump Type: VDR (220) Series Uni-Pump

Double Pump

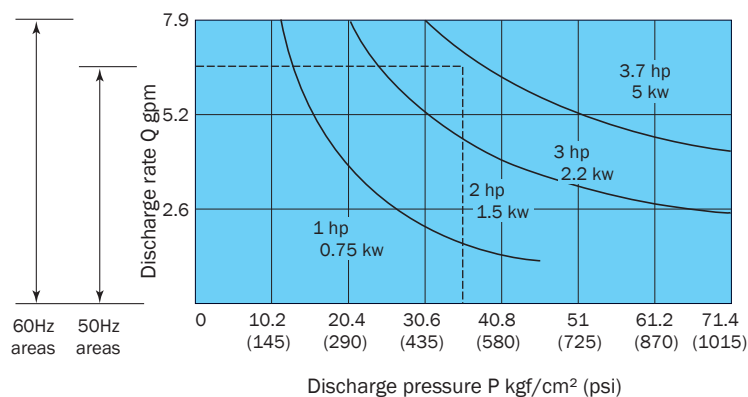
UVD - 11 A - 2 A 2 - 2 A 2 - 3.7 - 4 - 40

- Design Number - E=NPT
- Number of Motor Poles: 4 (P) 200V
4 (G) 230V
4 (M) 460V
- Motor Output kw (hp)
1.5, 2.2, 3.7 (2, 3, 5)
- Shaft Side Pump Pressure Adjustment Range
2: 15.3 to 35.7kgf/cm² (217 to 507)
3: 30.6 to 71.4kgf/cm² (435 to 1015)
- Shaft Side Pump Flow Rate Characteristics
A: Constant Discharge Type
- Shaft Side Pump Ring Size
None: 7.9 gpm } at 1800min⁻¹
2 : 10.5 gpm }
- Head Side Pump Pressure Adjustment Range:
Same as the shaft side pump
- Head Side Pump Flow Rate Characteristics
A: Constant Discharge Type
- Head Side Pump Ring Size
None: 7.9 gpm } at 1800min⁻¹
2 : 10.5 gpm }
- A: Foot Type Mounting
- Pump Size 11: VDR-11B (22D)
- Pump Type: VDR (220) Series Uni-Pump

Specifications

Model No.	Maximum Working Pressure kgf/cm ² (psi)	Maximum Flow Rate gpm (A*)		Maximum Flow Rate gpm (2A*)	
		50Hz	60Hz	50Hz	60Hz
UVD-1A	71.4 (1015)	6.6	7.9	8.7	10.5
UVD-11A	71.4 (1015)				

Motor Selection Curves



* Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload.

• Selecting a motor

The area under a motor output curve in the graph to the left is the operating range for that motor under the rated output for that motor.

Example:

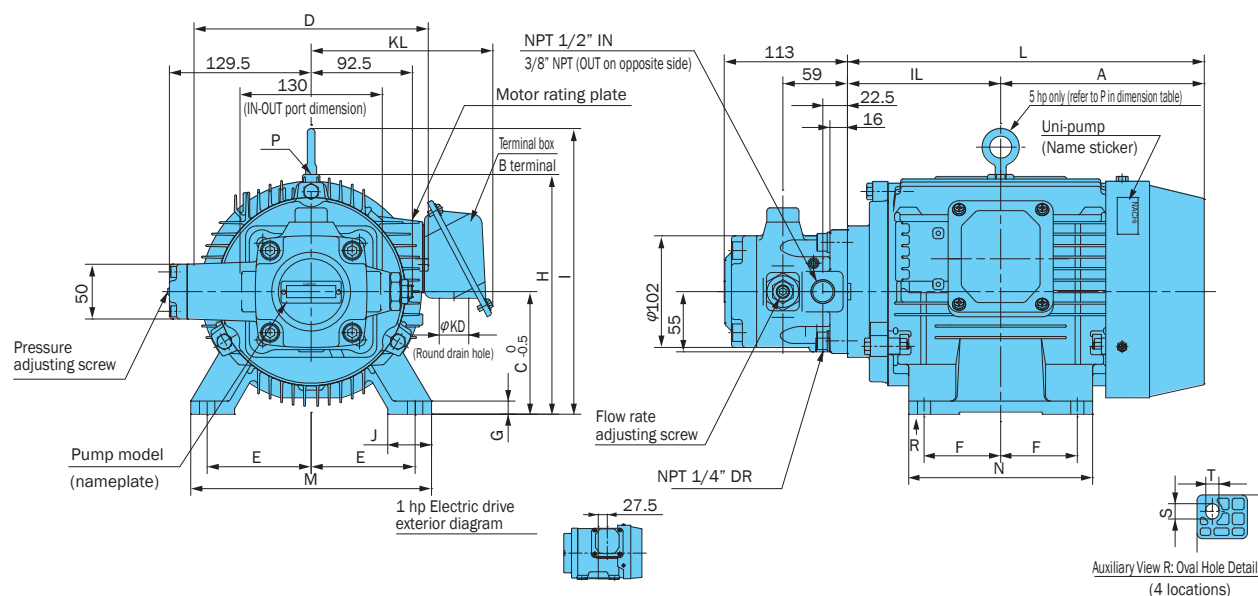
To find the motor that can produce pressure of 435 psi and a discharge rate of 6.6 gpm.

Selection Process:

Since the intersection of the two broken lines from a pressure of 435 psi and discharge rate of 6.6 gpm intersect in the area under the 3 hp curve, it means that a 3 hp motor should be used. In the case of a double pump configuration, select a motor that is larger than the total power required by both pumps.

Installation Dimension Drawings

UVD-1A



Uni-pump	Motor Dimensions mm																	Frame No.	Output hp (4 poles)	Weight lbs
	A	IL	C	D	E	F	G	H	I	J	L	M	N	S × T	KD	KL	O			
UVD-1A-A2-0.75-4-40	133	105	80	170	62.5	50	4.5	165	—	35	238	165	130	18 × 10	φ27	157	27.5	80M	1	53
UVD-1A-A2-1.5-4-40	143	118.5	90	198	70	62.5	10	190	—	40	261.5	176	150	12 × 10	φ27	159	—	90L	2	55
UVD-1A-A3-1.5-4-40																				
UVD-1A-2A2-1.5-4-40																				
UVD-1A-A2-2.2-4-40	157.5	133	100	198	80	70	12	200	—	40	290.5	200	168	14 × 12	φ27	159	—	100L	3	66
UVD-1A-A3-2.2-4-40																				
UVD-1A-2A2-2.2-4-40																				
UVD-1A-A3-3.7-4-40																				
UVD-1A-2A2-3.7-4-40	186	140	112	214	95	70	12	—	261	40	326	220	168	14 × 12	φ27	166	—	112M	5	80
UVD-1A-2A3-3.7-4-40																				

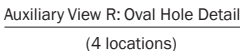
1 - 3 hp model does not have hangers.

1. Standard drive motor is the fully enclosed fan-cooled B type.

2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.

3. Standard terminal box is B terminal (right side viewed from pump).

4. See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).



1. 2 to 3 hp model does not have hangers.
1. Standard drive motor is the fully enclosed fan-cooled B type.
2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
3. Standard terminal box is B terminal (right side viewed from pump).
4. See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).



VDR13 Design Series Variable Volume Vane Pump

5.2 to 11.8 gpm
870 psi

The new design number 13 was created by modifying some of the components of old design numbers 11 and 12, and the new design installation is compatible with the old design.

Features

Energy efficient, economical operation

Built-in high-precision temperature compensation mechanism

The ring is displaced by a spring, and a rise in pressure automatically moves it to the center to make the discharge rate zero.

Relief valve and unloading valve can be eliminated from the circuit.

It was possible to reduce the size of the unit because there was no increase of proportional input to pressure which prevented increases in the temperature of the fluid.

New design for lower noise
and improved durability

• Handling

- 1 Rotation Direction The direction of rotation is always is clockwise (rightward) when viewed from the shaft side.
- 2 Drain Drain piping must be direct piping up to a point that is below the tank fluid level, and back pressure due to pipe resistance should not exceed 4.35 psi.

Specifications

Single Pump

Model No.	Capacity in ³ /rev	No-load Discharge Rate (gpm)				Pressure Adjustment Range kgf/cm ² (psi)	Allowable Peak Pressure kgf/cm ² (psi)	Revolution Speed min ⁻¹		Weight lbs
		1000min ⁻¹	1200min ⁻¹	1500min ⁻¹	1800min ⁻¹			Min.	Max.	
VDR-1A(B) -1A1-13	.84	3.6	4.3	5.5	6.6	10.2 ~ 20.6 (145 ~ 290)	143 (2030)	800	1800	17.6
-1A2-	.84	3.6	4.3	5.5	6.6	15.3 ~ 35.7 (217 ~ 507)				
-1A3-	.67	2.9	3.9	4.5	5.2	30.6 ~ 61.2 (435 ~ 870)				
VDR-2A(B) -1A1-13	1.5	6.6	7.9	10	11.8	10.2 ~ 20.6 (145 ~ 290)	143 (2030)	800	1800	46
-1A2-	1.5	6.6	7.9	10	11.8	15.3 ~ 35.7 (217 ~ 507)				
-1A3-	1.3	5.8	7.0	8.9	10.5	30.6 ~ 61.2 (435 ~ 870)				

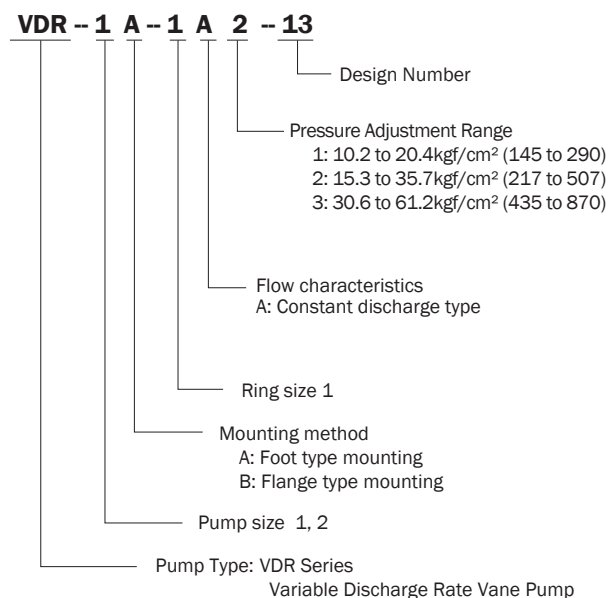
Double Pump

Model No.	Vent Side		Shaft Side		Vent Side	Shaft Side	Revolution Speed min ⁻¹		Weight lbs
Foot Mounting Type (Flange Mounting Type)	Discharge Rate gpm	Pressure Adjustment Range kgf/cm ² (psi)	Discharge Rate gpm	Pressure Adjustment Range kgf/cm ² (psi)	Allowable Peak Pressure kgf/cm ² (psi)		Min.	Max.	
VDR-11A(B)-1A1-1A1-13 VDR-11A(B)-1A1-1A2-13 VDR-11A(B)-1A1-1A3-13	6.6	10.2 ~ 20.6 (145 ~ 290)	6.6	10.2 ~ 20.6 (145 ~ 290) 15.3 ~ 35.7 (217 ~ 507)	143 (2030)		800	1800	A : 30 B : 30
VDR-11A(B)-1A2-1A2-13			5.2	30.6 ~ 51 (435 ~ 725)					
		15.3 ~ 35.7 (217 ~ 507)	6.6	15.3 ~ 35.7 (217 ~ 507)	143 (2030)				
			5.2	30.6 ~ 51 (435 ~ 725)					
VDR-11A(B)-1A3-1A3-13	5.2	30.6 ~ 51 (435 ~ 725)	5.2	30.6 ~ 51 (435 ~ 725)	143 (2030)				

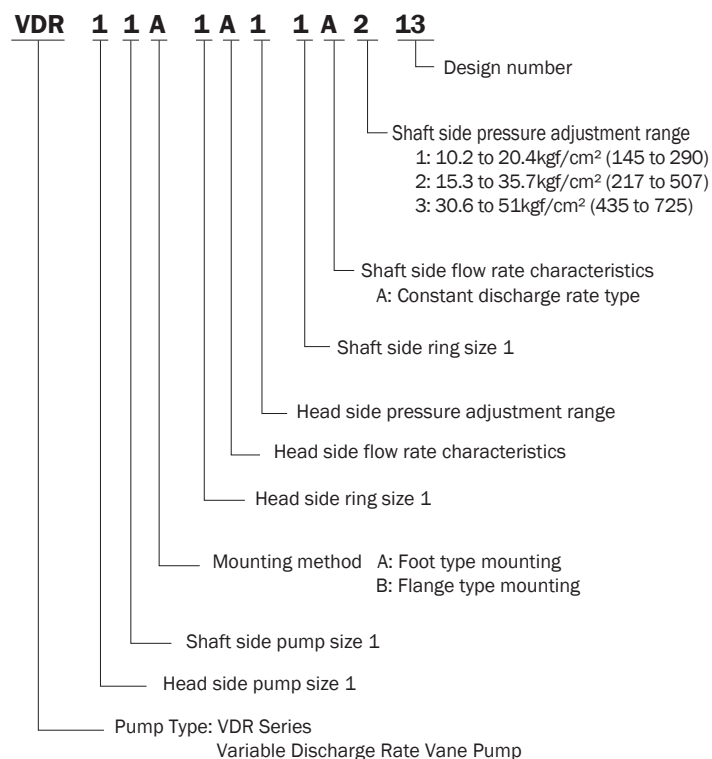
- Note:
1. The discharge rate is the value at 1800min⁻¹ no-load.
 2. In addition to this model, the VDC Series (maximum working pressure: 2030 psi) high-pressure variable vane pump is also available. See page B-25 for more information.
 3. The change from VDR-1 Series design number 11 to design number 12 represents a change in the shaft key width from .125 in. to .187 in. This means that when using a .125 in. key coupling, you need to use a stepped key (VD31J-302000) or add a new key groove at .187 in.
 4. There is no change in the mounting method with the change from the VDR-1 size design number 12 and VDR-2 design number 11 to design number 13.

Understanding Model Numbers

Single Pump



Double Pump



3 Discharge Volume Adjustment

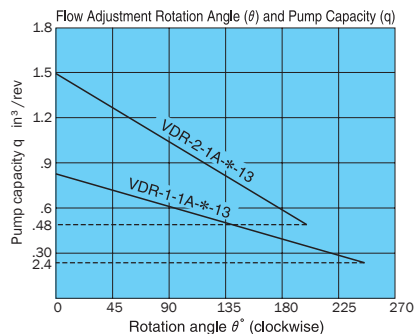
The discharge flow rate is decreased by clockwise (rightward) rotation of the discharge rate adjusting screw, and increased by counterclockwise (leftward) rotation. Loosen the lock nut before making adjustments. After adjustment is complete, re-tighten the lock nut. The graph below provides general guidelines for the relationship between the rotation angle of the flow rate adjusting screw and the no-load discharge rate.

However:

$$Q: \text{Flow rate gpm} = \frac{\text{in}^3 \times \text{rpm}}{231}$$

4 Pressure Adjustment

Pressure is decreased by clockwise (rightward) rotation of the discharge rate adjusting screw, and increased by counterclockwise (leftward) rotation.



5 Factory Default P-Q Settings (Standard Model)

- Flow Rate Setting = Maximum flow rate for model as indicated in the catalog
- Pressure Setting = Pressure shown in table to the right

6 Initial Operation

Before operating the pump for the first time, put the pump discharge side into the no-load state and then repeatedly start and stop the motor to bleed all air from inside the pump and the suction piping. After confirming that the pump is discharging oil, continue the no-load operation for at least 10 minutes to discharge all the air from the circuit. Provide an air bleed valve in circuits where it is difficult to bleed air before startup.

7 Sub Plate

When a sub plate is required, specify a sub-plate type from the table in the installation dimension diagram.

8 For the hydraulic operating fluid, use an R&O type and wear-resistant type of ISO VG32 to 68 or equivalent (viscosity index of at least 90). Use hydraulic operating

Note) The values indicated above are at maximum pump discharge volume with the flow volume adjusting screw at the 0° position.

The broken line shows the flow volume adjustment range lower limit value.

Factory Default Pressure Settings kgf/cm² (psi)

1: 20.4 (290)
2: 35.7 (507)
3: 30.6 (435)

fluid that provides kinematic viscosity during operation in the range of 20 to 150 centistokes.

- 9 The operating temperature range is 59 to 140 °F. When the oil temperature at startup is 59 °F or less, perform a warm-up operation at low pressure and low speed until the oil temperature reaches 59 °F. Use the pump in an area where the temperature is within the range of 32 to 140 °F.
- 10 Suction pressure is 4.35 psi, and the suction port flow rate should be to greater than 6 ft/sec.

- 11 Avoid pulley, gear, and other drive systems that impart a radial or thrust load on the end of the pump shaft. Mount the pump so its pump shaft is oriented horizontally.
- 12 Provide a suction strainer with a filtering grade of about 100 μ m (150 mesh). For the return line to the tank, use a 10 μ m line filter.
- 13 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water and other foreign matter, and watch out for

discoloration.

Whitish fluid indicates that air has contaminated the fluid, and brownish fluid indicates the fluid is dirty.

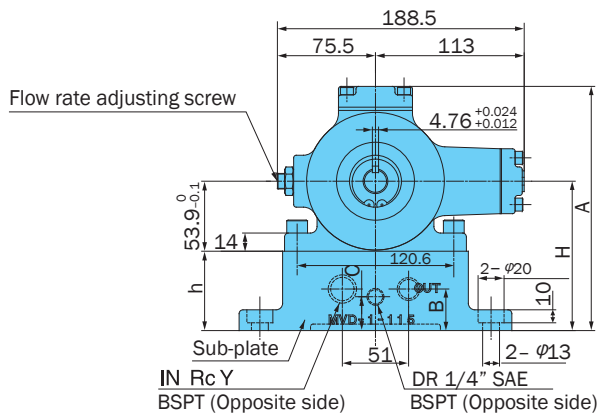
- 14 At startup, repeat the inching operation (start-stop) to bleed air from the pump and pipes.
- 15 Equip an air bleed valve in circuits where it is difficult to bleed air before startup. See page C-13 for more information.
- 16 To ensure proper lubrication of the pump's rubbing surfaces, supply oil to the interior of the pump before

starting operation.

- 17 When centering the pump shaft, eccentricity with the motor shaft should be no greater than 0.05mm. Use a pump mounting base of sufficient rigidity. The angle error should be no greater than 1°.

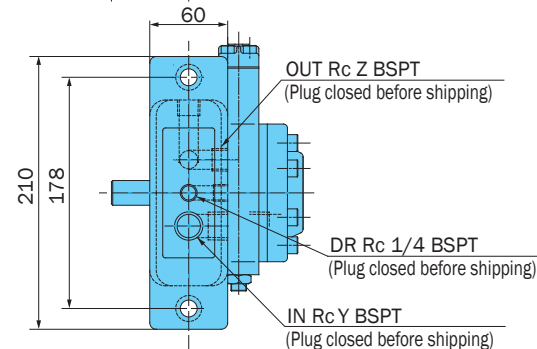
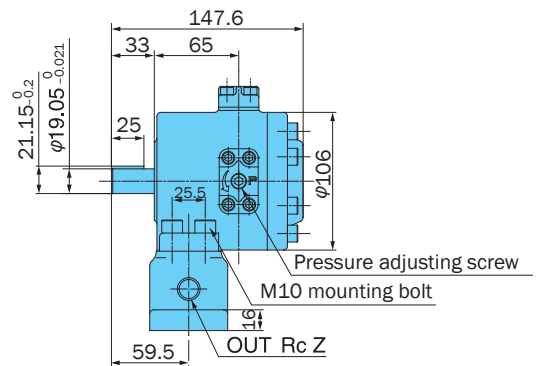
Installation Dimension Drawings

VDR-1A-*-13 (Foot Mounting)

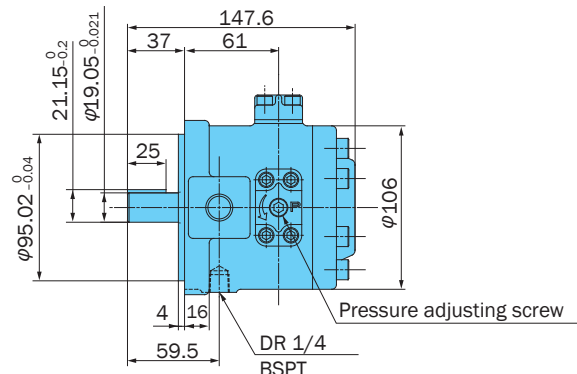
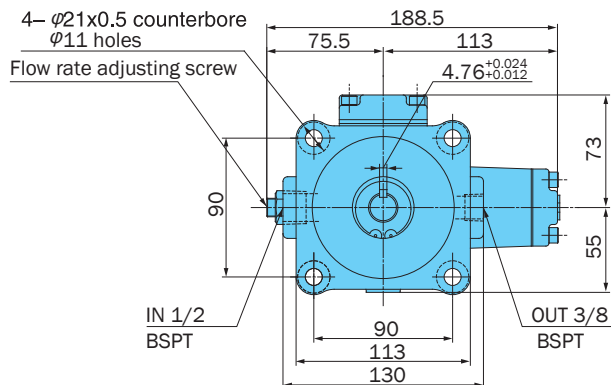


Note: Sub-plate is not provided. Must be provided separately if needed.

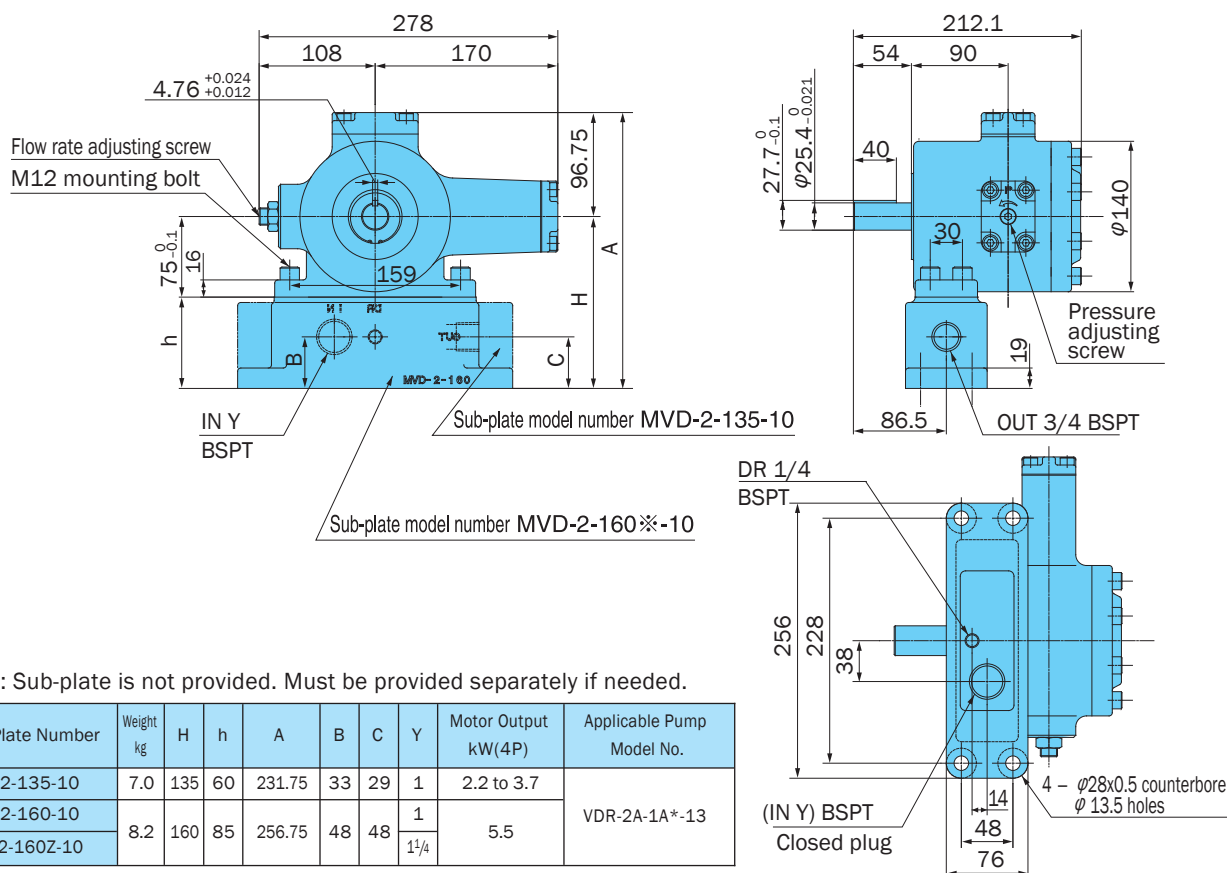
Sub Plate Number	Weight lb	H	h	A	B	C	Y	Z	Motor Output hp (4P)
MVD-1-115-10	8	115	61.1	188	32	26	1/2	3/8	1 to 2
MVD-1-115Y-10							3/4	1/2	
MVD-1-135-10	10.8	135	81.1	208	40	40	1/2	3/8	3 to 5
MVD-1-135Y-10							3/4	1/2	



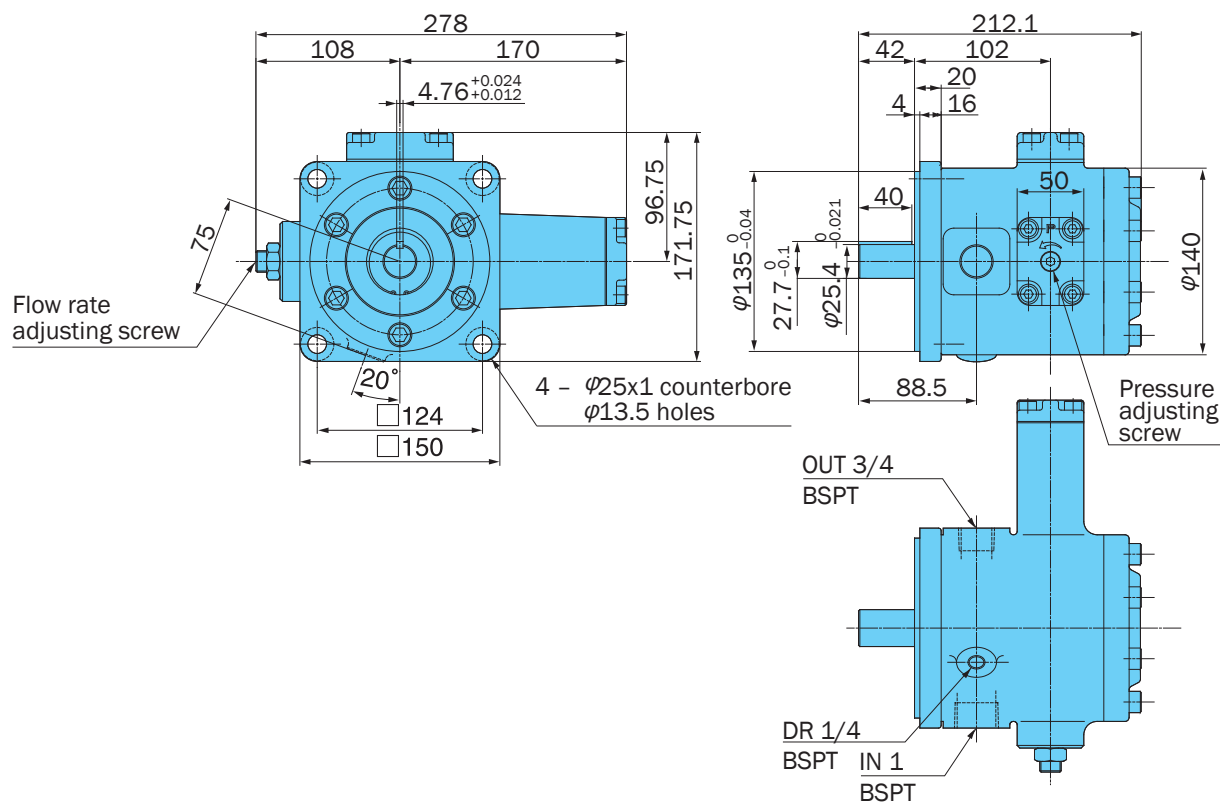
VDR-1B-*-13 (Flange Mounting) Not SAE Mount

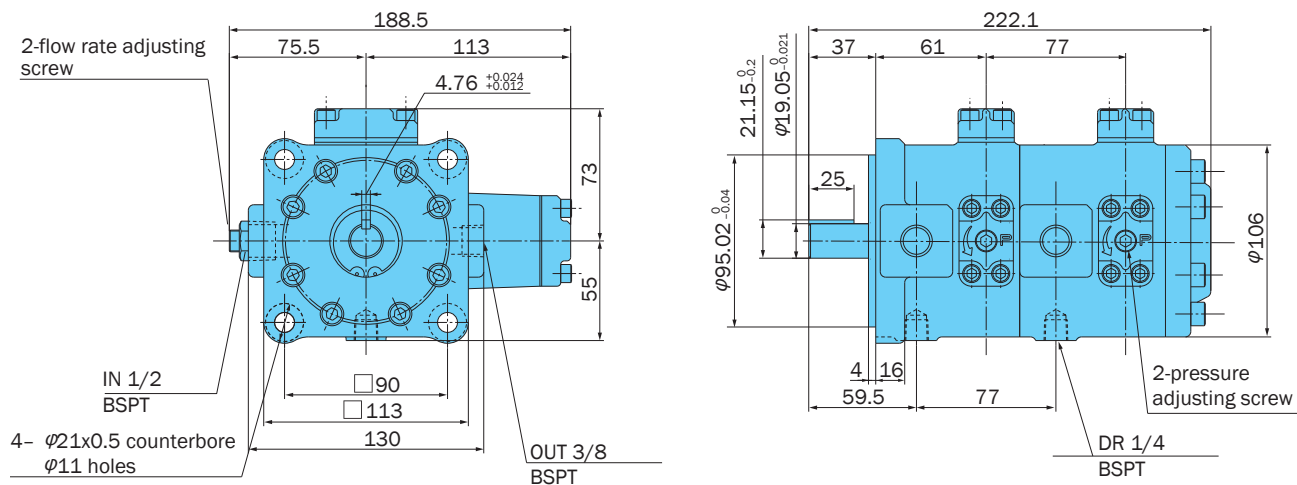
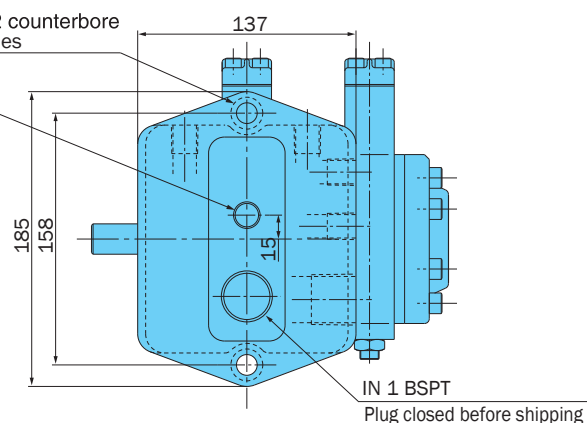


VDR-2A-*-13 (Foot Mounting)



VDR-2B-*-13 (Flange Mounting) Not SAE Mount

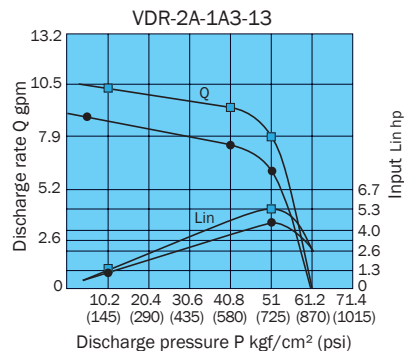
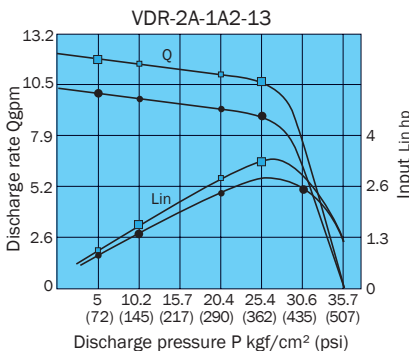
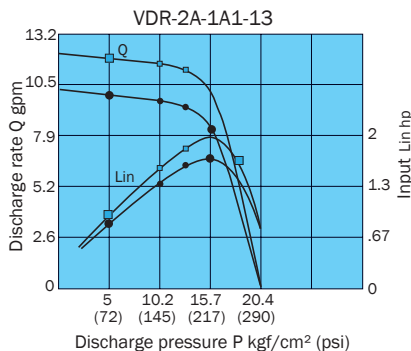
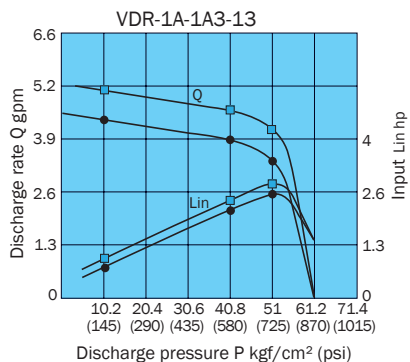
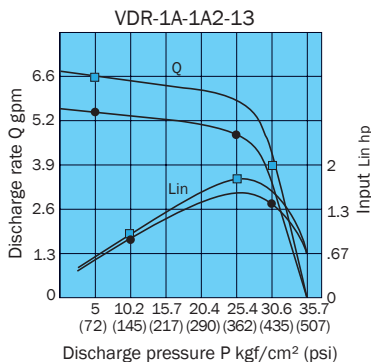
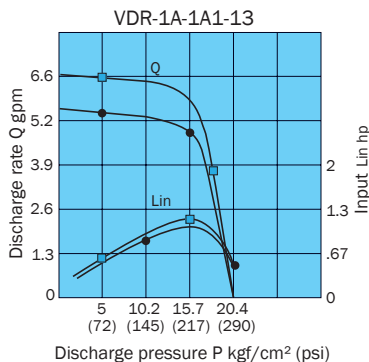




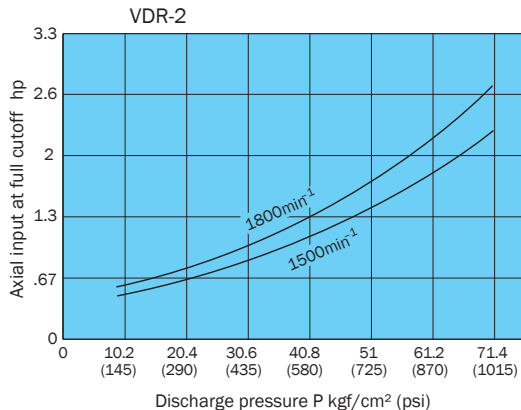
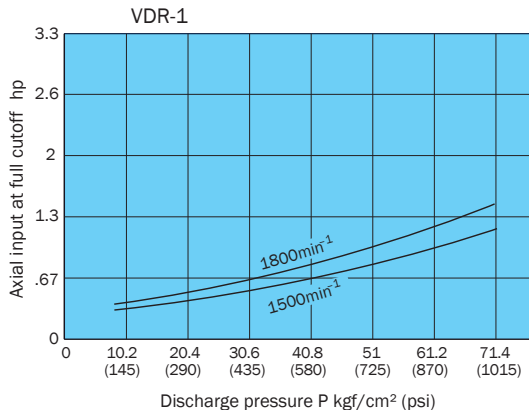
Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes.

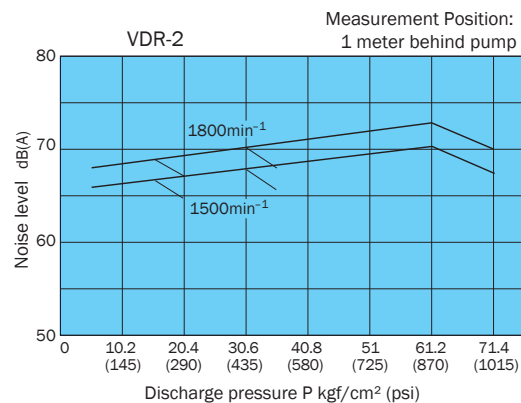
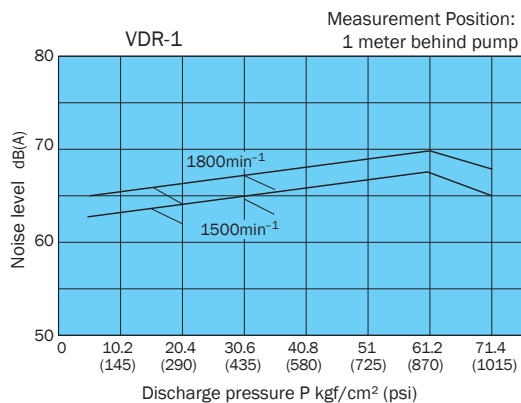
Revolution Speed 1500min^{-1} —●—
 1800min^{-1} —□—



Axial Input At Full Cutoff

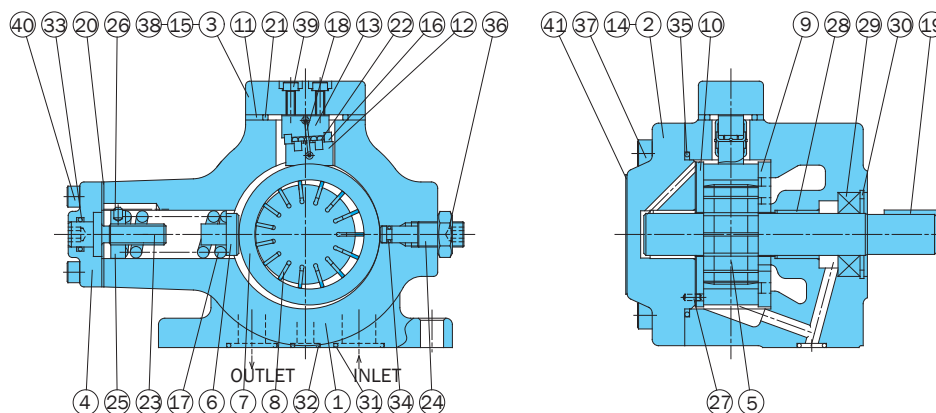


Noise Characteristics



Cross-sectional Drawing

VDR-1A-*-13
VDR-2A-*-13



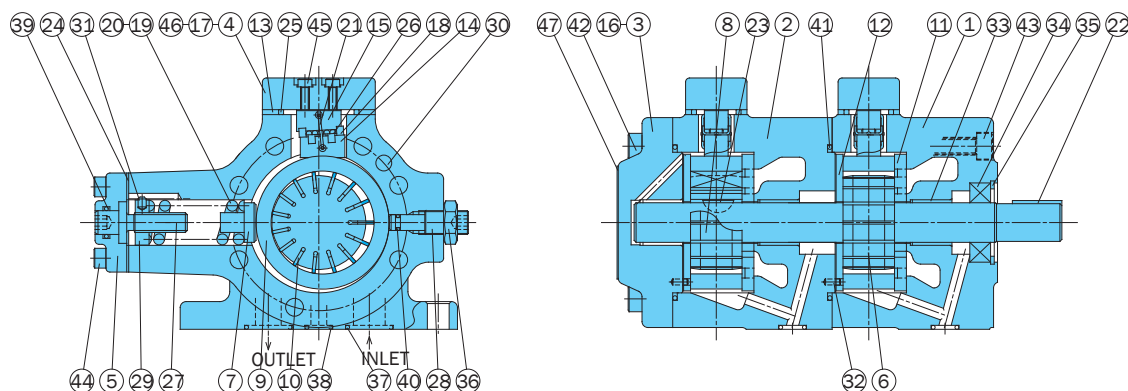
List of Sealing Parts

Part No.	Applicable Pump Model No.	VDR-1A-*-13		VDR-2A-*-13	
	Seal Kit Number	VDAS-101A00		VDAS-102A00	
	Part Name	Part Number	Q'ty	Part Number	Q'ty
20	Packing	VD32J-101000	1	VD32J-102000	1
21	Square ring	VD33J-101000	1	1A-G45	1
29	Oil seal	ISRD-204010	1	ISP-284811	1
31	O-ring	1A-P20	2	1A-G30	2
32	O-ring	1A-P10A	1	1A-P12	1
33	O-ring	1A-P12	1	1A-P14	1
34	O-ring	1A-P5	1	1A-P9	1
35	O-ring	1A-G70	1	1A-G100	1

Note: 1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK)
2. O-ring 1A-** refers to JIS B2401-1A-**.
3. For VDR-*B-*-13, the seal kit number becomes VDBS-10*B00, without the 31 and 32 O-rings.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	15	Shim	29	Oil seal
2	Cover	16	Retainer	30	Snap ring
3	Cover	17	Spring	31	O-ring
4	Cover	18	Spring	32	O-ring
5	Shaft	19	Key	33	O-ring
6	Piston	20	Packing	34	O-ring
7	Ring	21	Square ring (O-ring)	35	O-ring
8	Vane	22	Needle	36	Nut
9	Plate (S)	23	Screw	37	Screw
10	Plate (H)	24	Screw	38	Screw
11	Plate	25	Nut	39	Screw
12	Holder	26	Pin	40	Screw
13	Holder	27	Pin	41	Nameplate
14	Shim	28	Bearing		

VDR-11A-*-13



List of Sealing Parts

Part No.	Applicable Pump Model No.	VDR-11A-*-13	
	Seal Kit Number	VDAS-111A00	
	Part Name	Part Number	Q'ty
24	Packing	VD32J-101000	2
25	Square ring	VD33J-101000	2
34	Oil seal	ISRD-204010	1
37	O-ring	1A-P20	4
38	O-ring	1A-P10A	2
39	O-ring	1A-P12	2
40	O-ring	1A-P5	2
41	O-ring	1A-G70	2

Note: 1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
2. O-ring 1A-** refers to JIS B2401-1A-**.
3. For VDR-11B-*-13, the seal kit number becomes VDBS-111B00, without the 37 and 38 O-rings.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	11	Plate (S)	21	Spring
2	Body	12	Plate (H)	22	Key
3	Cover	13	Plate	23	Key
4	Cover	14	Holder	24	Packing
5	Cover	15	Holder	25	Square ring
6	Shaft	16	Shim	26	Needle
7	Piston	17	Shim	27	Screw
8	Rotor	18	Retainer	28	Screw
9	Ring	19	Spring	29	Nut
10	Vane	20	Spring	30	Pin
				31	Pin
				32	Pin
				33	Bearing
				34	Oil seal
				35	Snap ring
				36	Nut
				37	O-ring
				38	O-ring
				39	O-ring
				40	O-ring
				41	O-ring
				42	Screw
				43	Screw
				44	Screw
				45	Screw
				46	Screw
				47	Nameplate

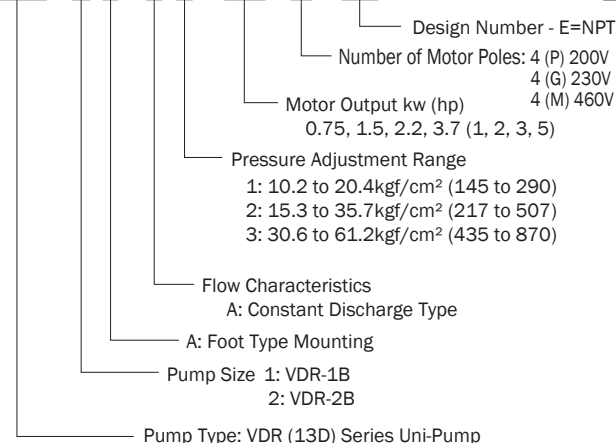
Performance Curves

(CE mark standard compliant)

Understanding Model Numbers

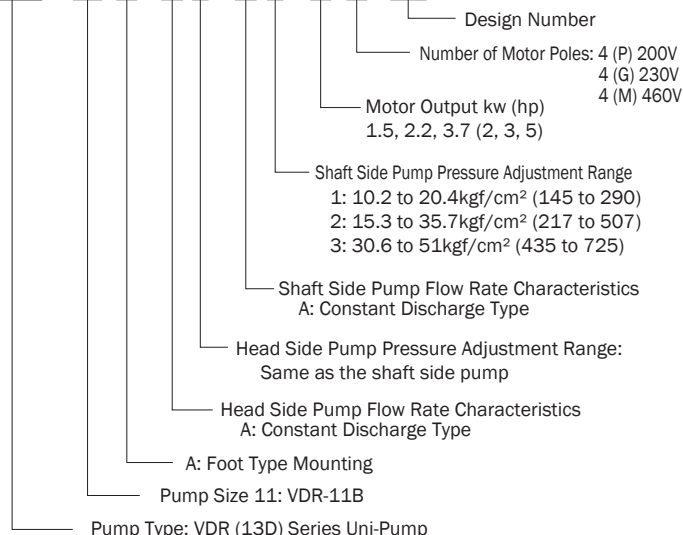
Single Pump

UVD - 1 A - A 2 - 1.5 - 4 - 30



Double Pump

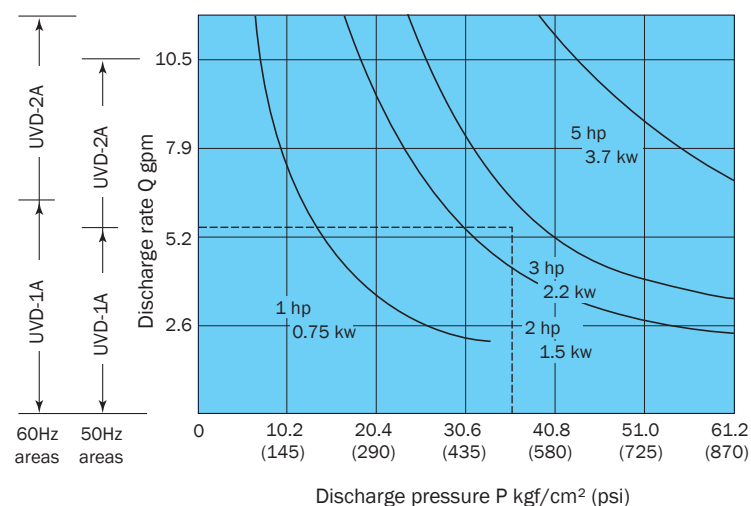
UVD - 11 A - A * - A * - * - 4 - 30



Specifications

Model No.	Maximum Working Pressure kgf/cm ² (psi)	Maximum Flow Rate gpm	
		50Hz	60Hz
UVD- 1A	61.2 (870)	5.5	6.6
UVD- 2A	51.0 (725)	10	11.8
UVD- 11A	51.0 (725)	5.5	6.5-6.6

Motor Selection Curves



• Selecting a motor

The area under a motor output curve in the graph to the left is the operating range for that motor under the rated output for that motor.

Example:

To find the motor that can produce pressure of 507 psi and a discharge rate of 5.5 gpm.

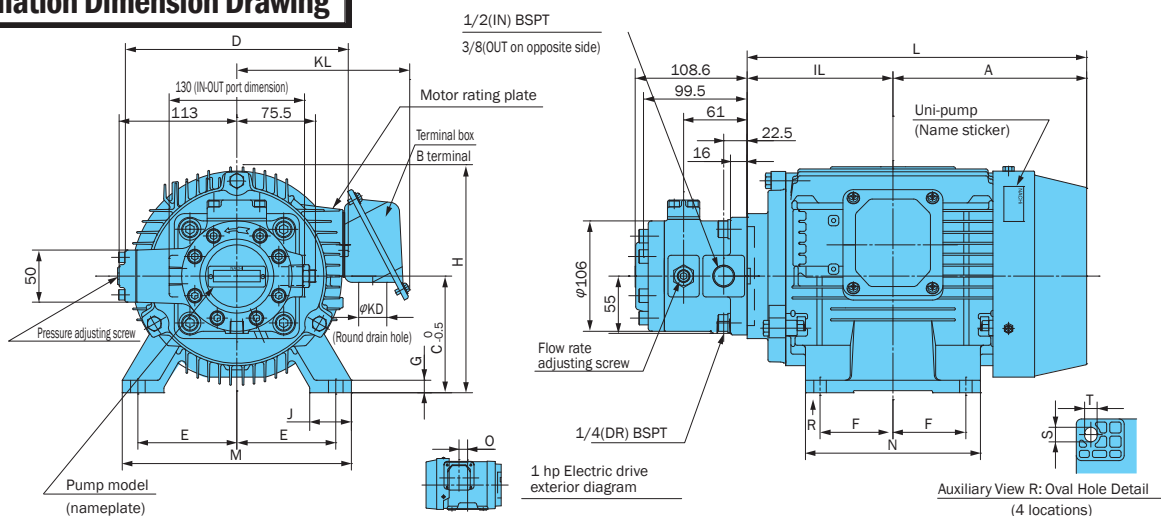
Selection Process:

Since the intersection of the two broken lines from a pressure of 507 psi and discharge rate of 5.5 gpm intersect in the area under the 3 hp curve, it means that a 3 hp motor should be used. In the case of a double pump configuration, select a motor that is larger than the total power required by both pumps.

*Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload.

Installation Dimension Drawing

UVD-1A



Uni-pump	Motor Dimensions mm																	Frame No.	Output hp (4poles)	Weight lbs
	A	IL	C	D	E	F	G	H	J	L	M	N	S×T	KD	KL	O				
UVD-1A-A1-0.75-4-30	133	105	80	170	62.5	50	4.5	165	35	238	165	130	18×10	φ27	157	27.5	80M	1	50	
UVD-1A-A2-0.75-4-30																				
UVD-1A-A2-1.5-4-30	143	118.5	90	198	70	62.5	10	190	40	261.5	176	150	12×10	φ27	159	—	90L	2	53	
UVD-1A-A3-1.5-4-30																				
UVD-1A-A3-2.2-4-30	157.5	133	100	198	80	70	12	200	40	290.5	200	168	14×12	φ27	159	—	100L	3	64	

No hanger.

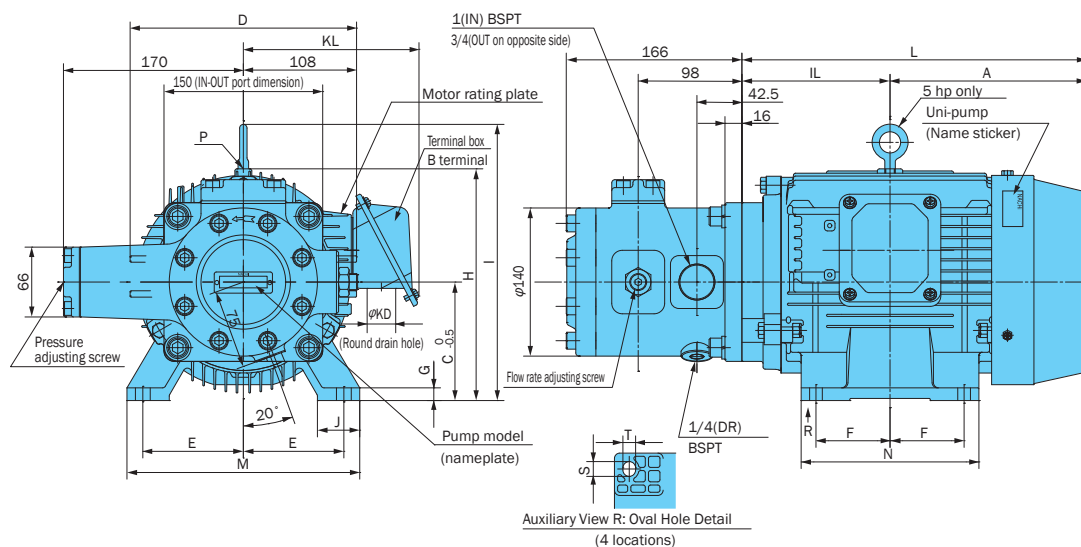
1. Standard drive motor is the fully enclosed fan-cooled B type.

2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.

3. Standard terminal box is B terminal (right side viewed from pump).

4. See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).

UVD-2A



Uni-pump	Motor Dimensions mm																	Frame No.	Output hp (4poles)	Weight lbs
	A	IL	C	D	E	F	G	H	I	J	L	M	N	S×T	KD	KL	O			
UVD-2A-A1-1.5-4-30	143	118.5	90	198	70	62.5	10	190	—	40	261.5	176	150	12×10	φ27	159	—	90L	2	84
UVD-2A-A2-1.5-4-30	143	118.5	90	198	70	62.5	10	190	—	40	261.5	176	150	12×10	φ27	159	—	90L	2	84
UVD-2A-A2-2.2-4-30	157.5	133	100	198	80	70	12	200	—	40	290.5	200	168	14×12	φ27	159	—	100L	3	95
UVD-2A-A3-2.2-4-30	157.5	133	100	198	80	70	12	200	—	40	290.5	200	168	14×12	φ27	159	—	100L	3	95
UVD-2A-A2-3.7-4-30	186	140	112	214	95	70	12	—	261	40	326	220	168	14×12	φ27	166	—	112M	5	108
UVD-2A-A3-3.7-4-30	186	140	112	214	95	70	12	—	261	40	326	220	168	14×12	φ27	166	—	112M	5	108

2 to 3 hp model does not have hangers.

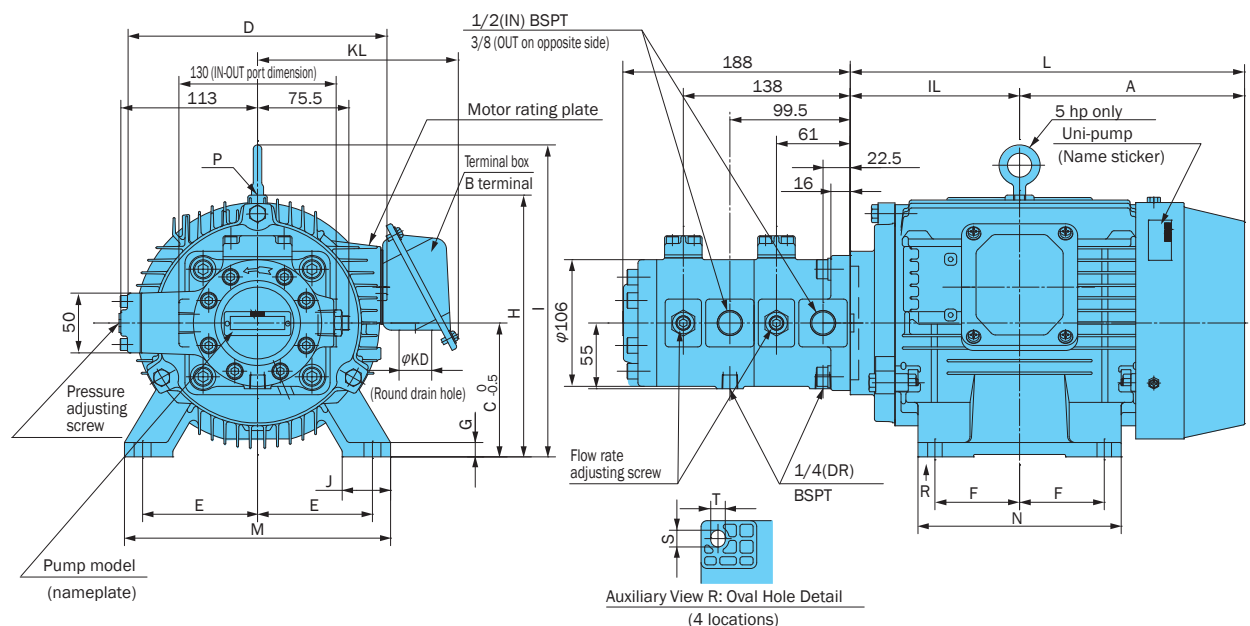
1. Standard drive motor is the fully enclosed fan-cooled B type.

2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.

3. Standard terminal box is B terminal (right side viewed from pump).

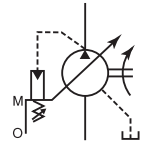
4. See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).

UVD-11A

[illegible]

No hanger on 2 and 3 hp models.

1. Standard drive motor is the fully enclosed fan-cooled B type.
2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
3. Standard terminal box is B terminal (right side viewed from pump).
4. See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).



VDC Series High Pressure Type Variable Volume Vane Pump

7.9 to 31.7 gpm
2000 psi

Features

Highly efficient and stable high-pressure operation

Innovative pressure control and pressure balance mechanisms combine with an original 3-point ring support system dramatically improves high-pressure operation. The result is outstanding performance at high pressures up to 2000 psi.

Low vibration and noise

A number of innovative new mechanisms are adopted to minimize vibration and noise. In particular, a 3-point support system is used for the control piston and bias piston to increase ring

stability. This minimizes ring vibration and delivers quiet operation.

Outstanding response, high-precision operation

An innovative new ring stopper eliminates excessive ring displacement and improves response. The result is high precision operation at all times, including during starts, stops, and load changes.

Precise characteristics for a stable discharge rate

A revolutionary new pressure compensator type pressure control mechanism

ensures a highly stable fixed discharge rate, even in the high pressure range.

High efficiency operation with minimal power loss

New mechanical innovations minimize power loss, especially at full cutoff.

Simplified maintenance and handling

Pressure adjusting and discharge rate adjusting mechanisms are located on the same side of the pump for simplified maintenance and handling.

Specifications

Single Pump

Model No.		Capacity in ³ /rev	No-load Discharge Rate gpm		Pressure Adjustment Range kgf/cm (psi)	Allowable Peak Pressure kgf/cm (psi)	Revolution Speed min ⁻¹		Weight lbs
Foot Mounting	Flange Mounting		1500min ⁻¹	1800min ⁻¹			Min.	Max.	
VDC-1A-1A2-*20 VDC-1A-1A3-*20 VDC-1A-1A4-*20 VDC-1A-1A5-*20	VDC-1B-1A2-*20/35 VDC-1B-1A3-*20/35 VDC-1B-1A4-*20/35 VDC-1B-1A5-*20/35	1.0	6.6	7.9	15.3 to 35.7 (217 to 507) 20.4 to 71.4 (290 to 1000) 51 to 107 (725 to 1500) 71.4 to 143 (1000 to 2000)	143 (2000) 214 (3000)	800	1800	21
VDC-1A-2A2-*20 VDC-1A-2A3-*20	VDC-1B-2A2-*20/35 VDC-1B-2A3-*20/35	1.3	8.7	10.5	15.3 to 35.7 (217 to 507) 20.4 to 71.4 (290 to 1000)	143 (2000)	800	1800	21
VDC-2A-1A2-*20 VDC-2A-1A3-*20 VDC-2A-1A4-*20 VDC-2A-1A5-*20	VDC-2B-1A2-*20/35 VDC-2B-1A3-*20/35 VDC-2B-1A4-*20/35 VDC-2B-1A5-*20/35	1.8	11.8	14.2	15.3 to 35.7 (217 to 507) 20.4 to 71.4 (290 to 1000) 51 to 107 (725 to 1500) 71.4 to 143 (1000 to 2000)	143 (2000) 214 (3000)	800	1800	55
VDC-2A-2A2-*20 VDC-2A-2A3-*20	VDC-2B-2A2-*20/35 VDC-2B-2A3-*20/35	2.3	15.3	18.4	15.3 to 35.7 (217 to 507) 20.4 to 71.4 (290 to 1000)	143 (2000)	800	1800	55
VDC-3A-1A2-*20 VDC-3A-1A3-*20 VDC-3A-1A4-*20 VDC-3A-1A5-*20	VDC-3B-1A2-*20 VDC-3B-1A3-*20 VDC-3B-1A4-*20 VDC-3B-1A5-*20	4.0	26.4	31.7	15.3 to 35.7 (217 to 507) 20.4 to 71.4 (290 to 1000) 51 to 107 (725 to 1500) 71.4 to 143 (1000 to 2000)	143 (2000) 214 (3000)	800	1800	103

Double Pump

Model No.	Vent Side			Shaft Side			Revolution		Weight lbs
Foot Mounting Type (Flange Mounting)	Discharge Rate gpm		Pressure Adjustment Range kgf/cm (psi)	Discharge Rate gpm		Pressure Adjustment Range kgf/cm (psi)	Speed min ⁻¹		
	1800min ⁻¹	1500min ⁻¹		1800min ⁻¹	1500min ⁻¹		Min.	Max.	
VDC-11A(B)-2A3-2A*20/35 VDC-11A(B)-2A3-1A*20/35	10.5	8.7	20.4 to 71.4 (290 to 1000)	10.5 7.9	8.7 6.6	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	800	1800	Type A 59 Type B 44
VDC-12A(B)-2A3-2A*20/35 VDC-12A(B)-2A3-1A*20/35 VDC-12A(B)-1A5-2A*20/35 VDC-12A(B)-1A5-1A*20/35	10.5 7.9	8.7 6.6	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	18.4 18.4 14.2	15.3 15.3 11.8	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000) 20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	800	1800	Type A 92 Type B 77
VDC-22A(B)-2A3-2A*20/35 VDC-22A(B)-2A3-1A*20/35	18.4	15.3	20.4 to 71.4 (290 to 1000)	18.4 17.2	15.3 11.8	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	800	1800	Type A 136 Type B 110
VDC-13A(B)-2A3-1A*20 VDC-13A(B)-2A3-1A*20 VDC-13A(B)-1A5-1A*20 VDC-13A(B)-1A5-1A*20	10.5 7.9	8.7 6.6	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	31.7	26.4	20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000) 20.4 to 71.4 (290 to 1000) 71.4 to 143 (1000 to 2000)	800	1800	Type A 136 Type B 105

Note: 1. VDC-3A, VDC-11A, VDC-12A and VDC-13A are foot mounting types, and come with foot mountings.
2. VDC-1A and VDC-2A are sub plate types. Sub plates are not included.

- Handling

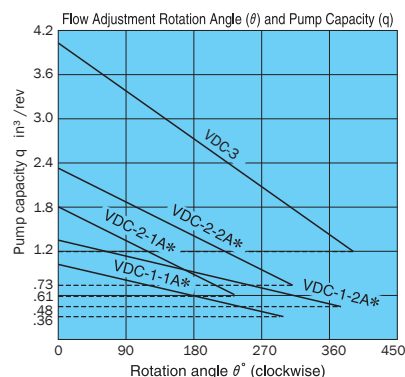
- 1 Rotation Direction The direction of rotation is always clockwise (rightward) when viewed from the shaft side.
- 2 Drain Drain piping must be direct piping up to a point that is below the tank fluid level, and piping should comply with the conditions shown in the table below to ensure that back pressure due to pipe resistance does not exceed 14 psi. When using a pump that has drain ports at two locations, use the drain port that is higher after the pump is installed. In the case of a double pump, run separate pipes from both the shaft side and the head side drains directly connect to the tank, so the drain pipe is below the surface of the oil.
- 3 Discharge Volume Adjustment

Model No.	VDC-1	VDC-2	VDC-3
Pipe Joint Size	At least 1/4"	At least 1/4"	At least 3/8"
Pipe I.D.	At least .29	At least .29	At least .37
Pipe Length	1m or less	1m or less	1m or less

The discharge flow rate is decreased by clockwise (rightward) rotation of the discharge rate adjusting screw, and increased by counterclockwise (leftward) rotation.

Loosen the lock nut before making adjustments. After adjustment is complete, re-tighten the lock nut. The graph below provides general guidelines for the relationship between the rotation angle of the flow rate adjusting screw and the no-load discharge rate.

$$Q: \text{Flow rate gpm} = \frac{\text{in}^3 \times \text{rpm}}{231}$$



Note:

The values indicated above are at maximum pump discharge volume with the flow volume adjusting screw at the 0° position.

The broken line shows the flow volume adjustment range lower limit value.

- 4 Pressure Adjustment Pressure is increased by clockwise (rightward) rotation of the discharge rate adjusting screw, and decreased by counterclockwise (leftward) rotation. Loosen the lock nut before making adjustments. After adjustment is complete, re-tighten the lock nut.
- 5 Factory Default P-Q Settings (Standard Model)
 - Flow Rate Setting = Maximum flow rate for model as indicated in the catalog
 - Pressure Setting = Pressure shown in table below
- 6 Thrust Screw and Stopper The thrust screw and stopper are precision adjusted at the factory during assembly. Never touch them. See callouts 15/43 and 15/38 in the VDC-1A and 2A/3A cross-section diagrams on pages B-33 and B-34.
- 7 An unload circuit is required when the motor is started under condition WYE Delta. Contact your agent about the unload circuit.
- 8 Initial Operation Before operating the pump for the first time, put the pump discharge side into the no-load state and then repeatedly start and stop the motor to bleed all air from inside the pump and the suction piping. After confirming that the pump is discharging oil, continue the no-load operation for at least 10 minutes to discharge all the air from the circuit. Provide an air bleed valve in circuits where it is difficult to bleed air before startup.
- 9 Sub Plate Use the table below for to specify a sub plate type when one is required.

Factory Default Pressure Settings kgf/cm ² (psi)
2: 35.7 (507)
3: 30.6 (435)
4: 51 (725)
5: 71.4 (1000)

- 10 Foot Mounting

For a double pump with VDC-3 foot mounting, the foot mounting kit and pump are sold as a set. When only the mounting feet are required, pump mounting bolts, washers and other parts are sold together as the Foot Mounting Kit.

See page B-36 for detailed dimensions.

- 11 For the hydraulic operating fluid, use type ISO VG32 or equivalent (viscosity index of at least 90) for pressures of 1000 psi or lower, and type ISO VG68 or equivalent (viscosity index of at least 90) for pressures greater than 1000 psi.
- 12 The operating temperature range is 59 to 140°F. When the oil temperature at startup is 59°F or less, perform a warm-up operation at low pressure until the oil temperature reaches 59°F. Use the pump in an area where the temperature is within the range of 32 to 140°F.
- 13 Suction pressure is 4.35 psi, and the suction port flow rate should be no greater than 6 ft/sec.
- 14 Avoid pulley, gear, and other drive systems that impart a radial or thrust load on the end of the pump shaft. Mount the pump so its pump shaft is oriented horizontally.
- 15 Provide a suction strainer with a filtering grade of about 100μm (150 mesh). For the return line to the tank, use a 10μm line filter.
- 16 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water and other foreign matter, and watch out for discoloration. Whitish fluid indicates that water has contaminated the fluid, and brownish fluid indicates the fluid is dirty.
- 17 Contact your agent about using water- and glycol-based hydraulic operating fluids.
- 18 At startup, repeat the inching operation (start-stop) to bleed air from the pump and pipes.

(Continued on following page)

Sub Plate Number

Pump Model No.	Sub Plate Number	Motor (hp)
VDC-1A-1A*-20	MVD-1-115-10	1 - 2
	MVD-1-135-10	3 - 5
VDC-1A-2A*-20	MVD-1-115Y-10	1 - 2
	MVD-1-135Y-10	3 - 5
VDC-2A-*A*-20	MVD-2-135-10	3 - 5
	MVD-2-160-10	7
VDC-2A-2A*-20	MVD-2-160Z-10	7

Note: See pages B-17 and B-18 for detailed dimensions.

- 19 Equip an air bleed valve in circuits where it is difficult to bleed air before startup. See page C-13 for more information.
- 20 To ensure proper lubrication of the pump's rubbing surfaces, supply oil to the interior of the pump before starting operation.

- 21 When centering the pump shaft, eccentricity with the motor shaft should be no greater than 0.001 in. Use a pump mounting base of sufficient rigidity. The angle error should be no greater than 1°.

Understanding Model Numbers

Single Pump

VDC - 2 A - 1 A 2 * 20

20 Design Number Metric
E20 - VDC-1A, 2A, 3A/B; Unified Threads
E35 - VDC-1B, VDC-2B; Unified Threads
* P - Remote Control Compensator

Pressure Adjustment Range

2: 15.3 to 35.7kgf/cm² (217 to 507)
3: 20.4 to 71.4kgf/cm² (290 to 1015)
4: 51 to 107kgf/cm² (725 to 1522)
5: 71.4 to 143kgf/cm² (1015 to 2000)

Note: Ring Size: In the case of 2, maximum setting pressure is 71.4kgf/cm² (1015).

Flow Characteristics A: Constant Discharge Type

Ring Size

at 1800min⁻¹

Ring size	VDC-1	VDC-2	VDC-3
1	7.9 gpm	14.2 gpm	31 gpm
2	10.5 gpm	18.5 gpm	—

Mounting Method

A: Foot Type Mounting B: Flange Type Mounting

Pump Size
1, 2, 3

Pump Type: VDC Series High-pressure Variable Discharge Rate Vane Pump

The ZR-T02-*-5895* is the recommended remote control valve. Provide piping to the remote control valve at a pipe volume of 9 cu in or less.

Double Pump

VDC - 1 2 A - 1 A 5 - 2 A 3 - 20

Design Number Metric
E35 - VDC-11B, 12B
E20 - VDC-13B

Shaft Side Pressure Adjustment Range

3: 20.4 to 71.4kgf/cm² (290 to 1015)
5: 71.4 to 143kgf/cm² (1015 to 2000)

Shaft Side Flow Rate Characteristics A: Constant Discharge Rate Type

Shaft Side Ring Size 1, 2
(Size 1 only for VDC-3)

Head Side Pressure Adjustment Range 3, 5

Head Side Flow Rate Characteristics A: Constant Discharge Rate Type

Head Side Ring Size 1, 2

Mounting Method

A: Foot Type Mounting B: Flange Type Mounting

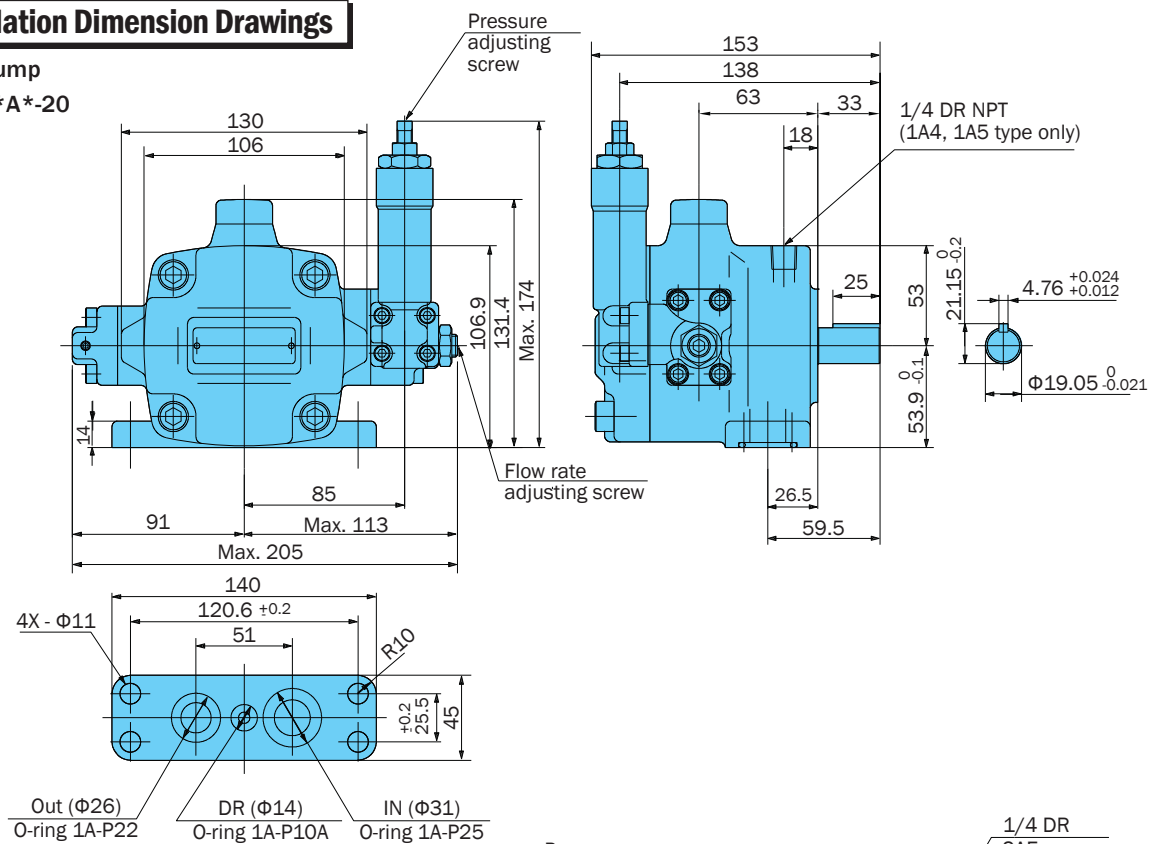
Shaft Side Pump Size 1, 2, 3

Head Side Pump Size 1, 2

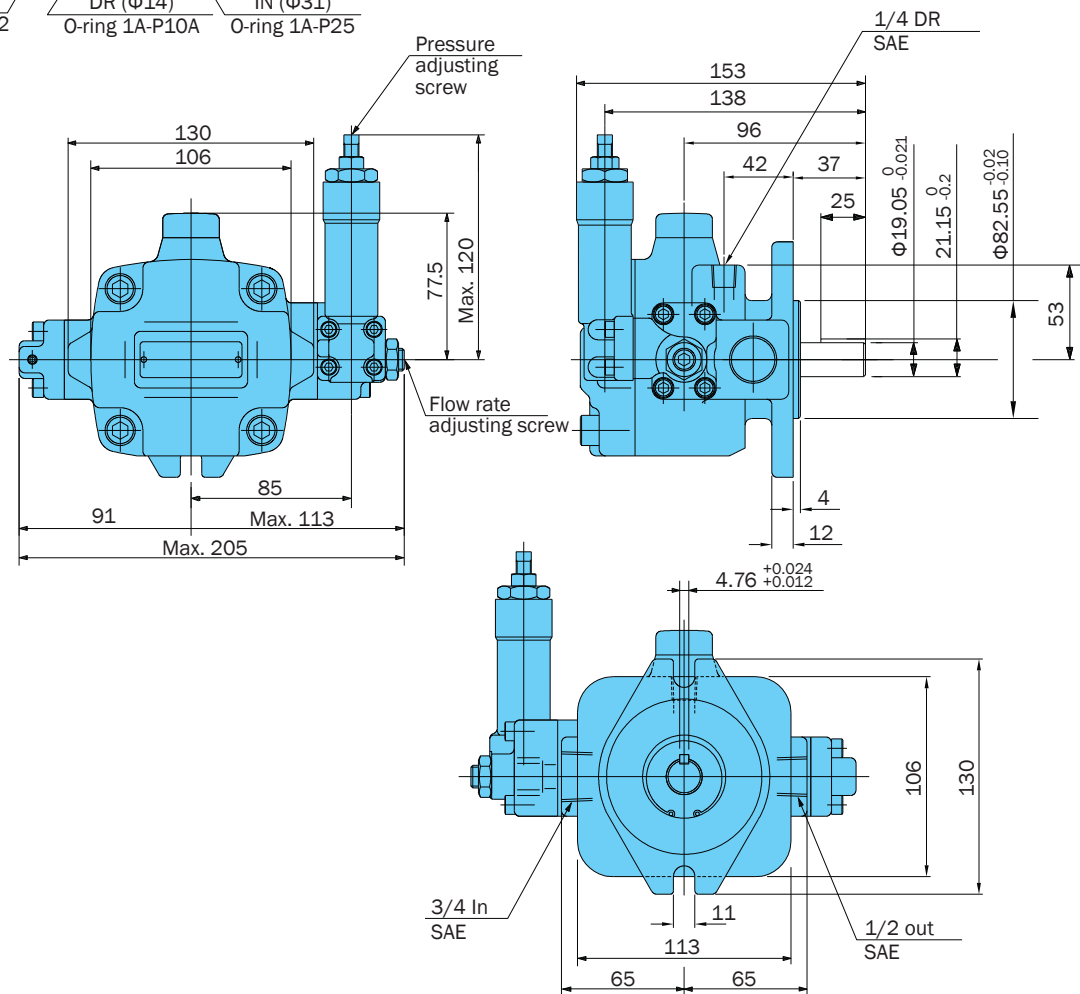
Pump Type: VDC Series High-Pressure Variable Discharge Rate Vane Pump

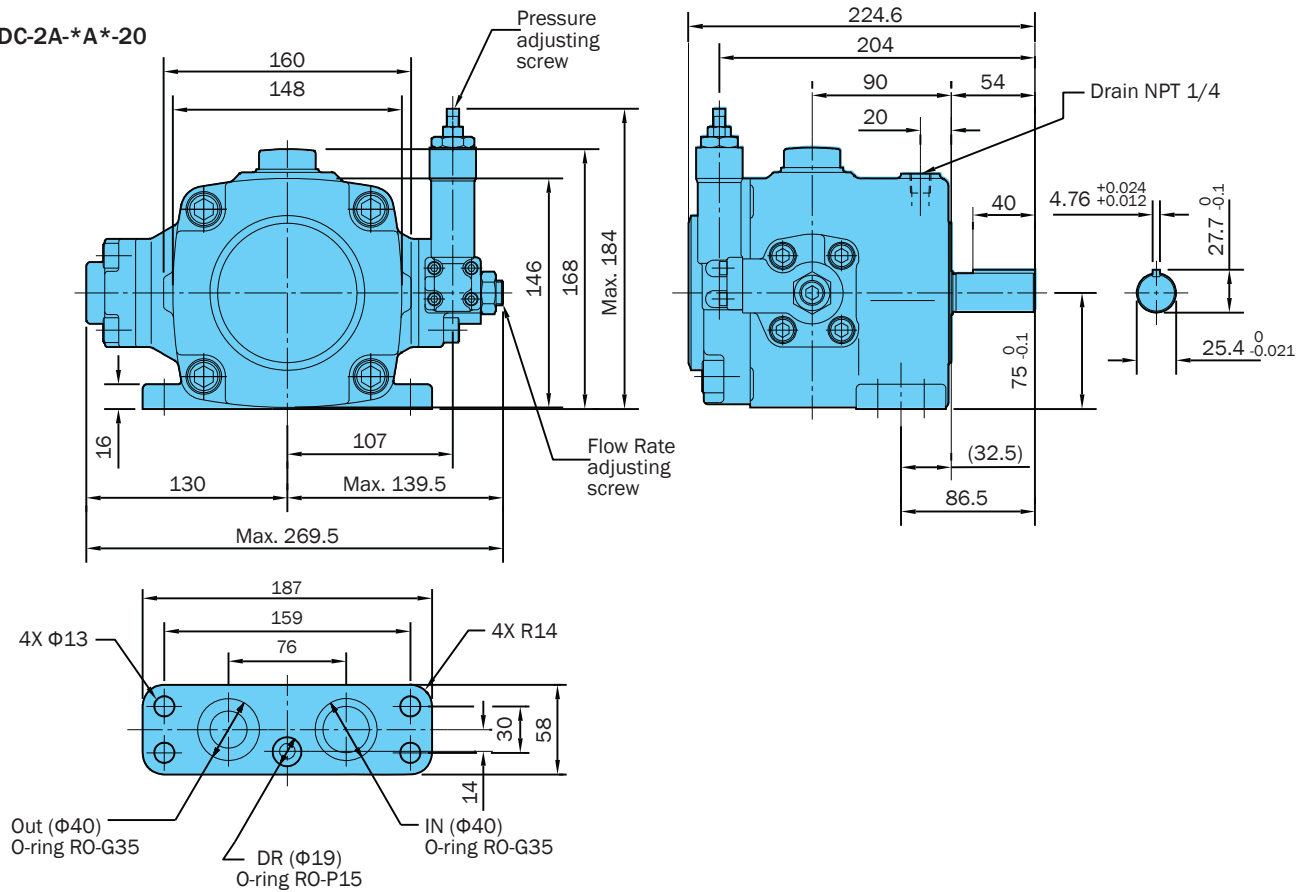
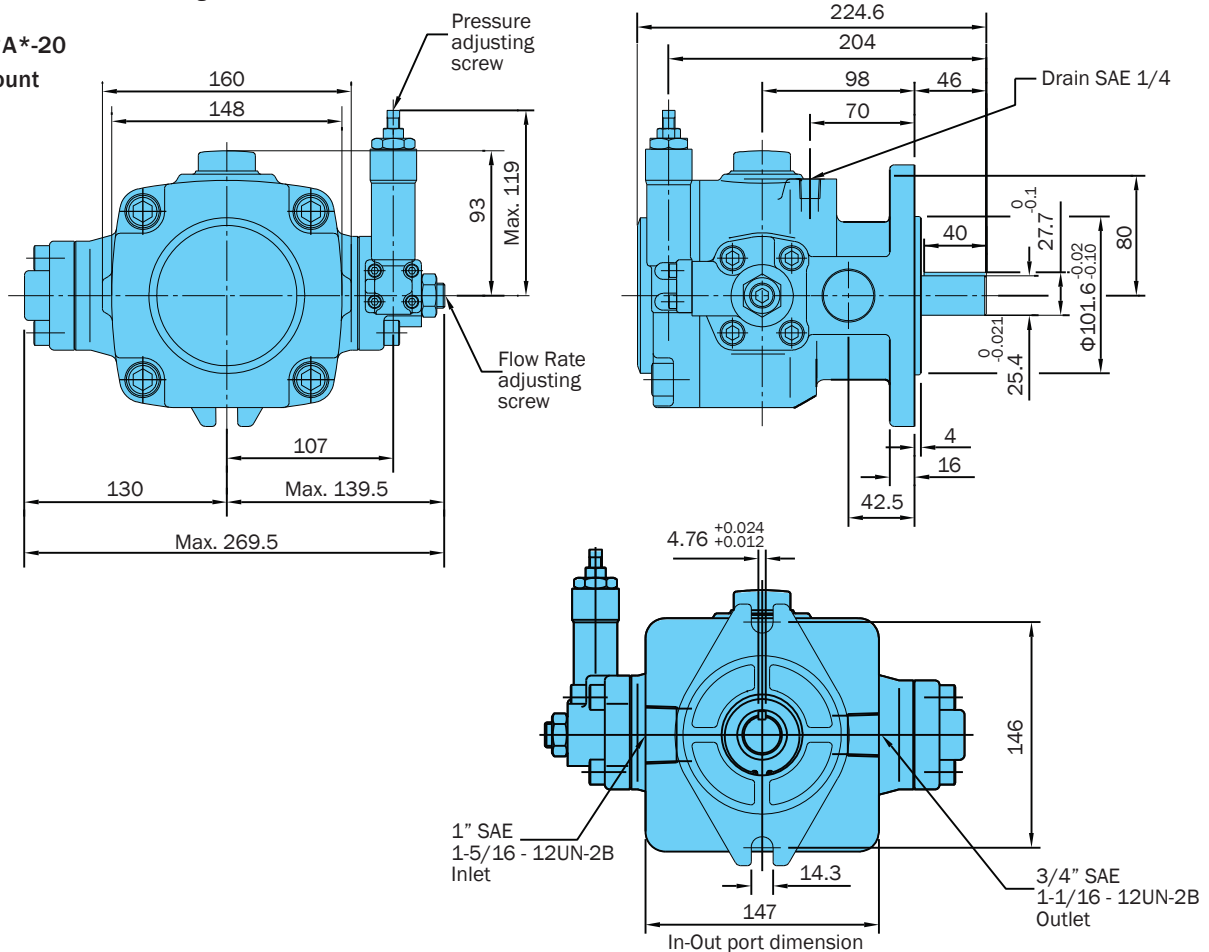
Installation Dimension Drawings

Single Pump
VDC-1A-*A*-20



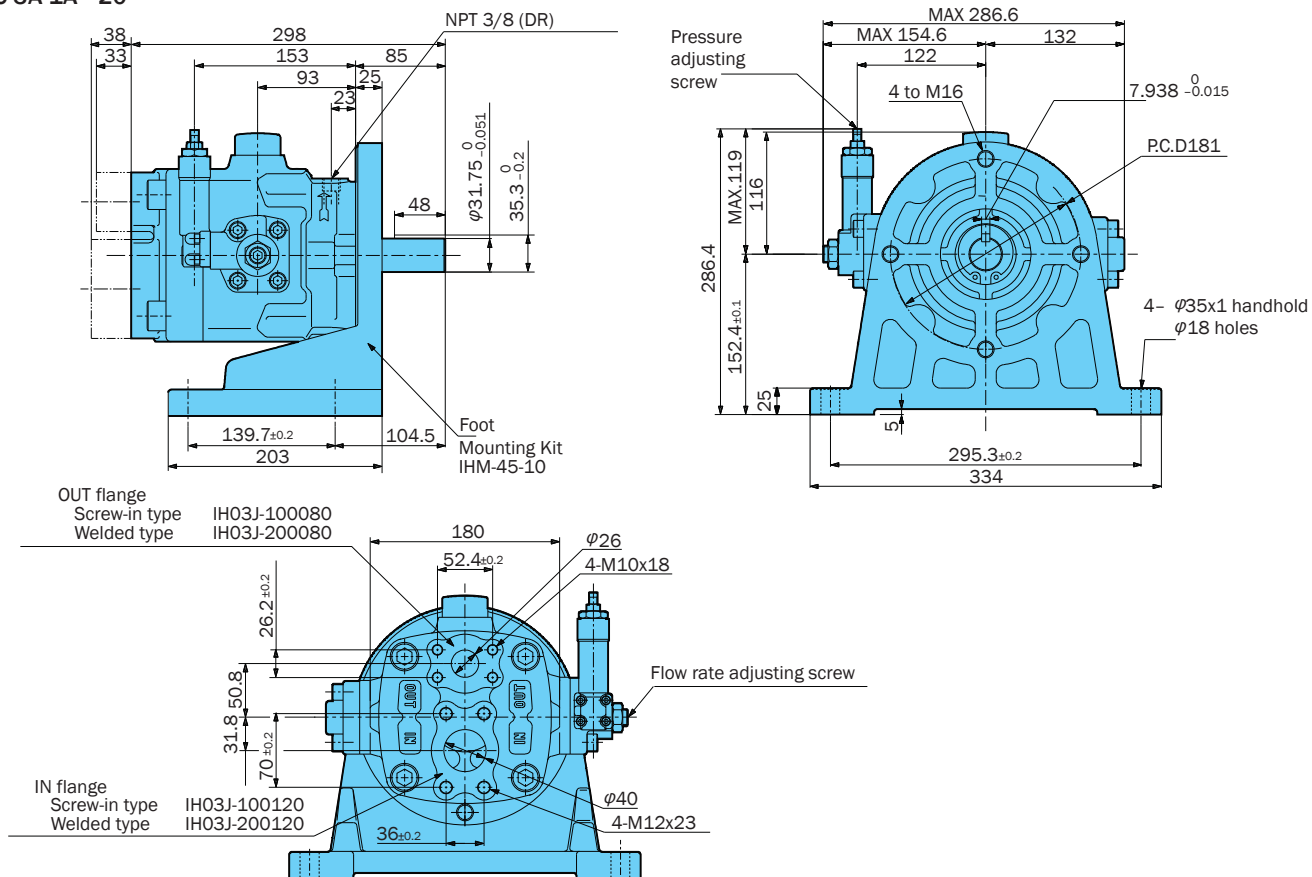
VDC-1B-*A*-E35
SAE A Mount



VDC-2A-*A*-20**VDC-2B-*A*-20**
SAE B Mount

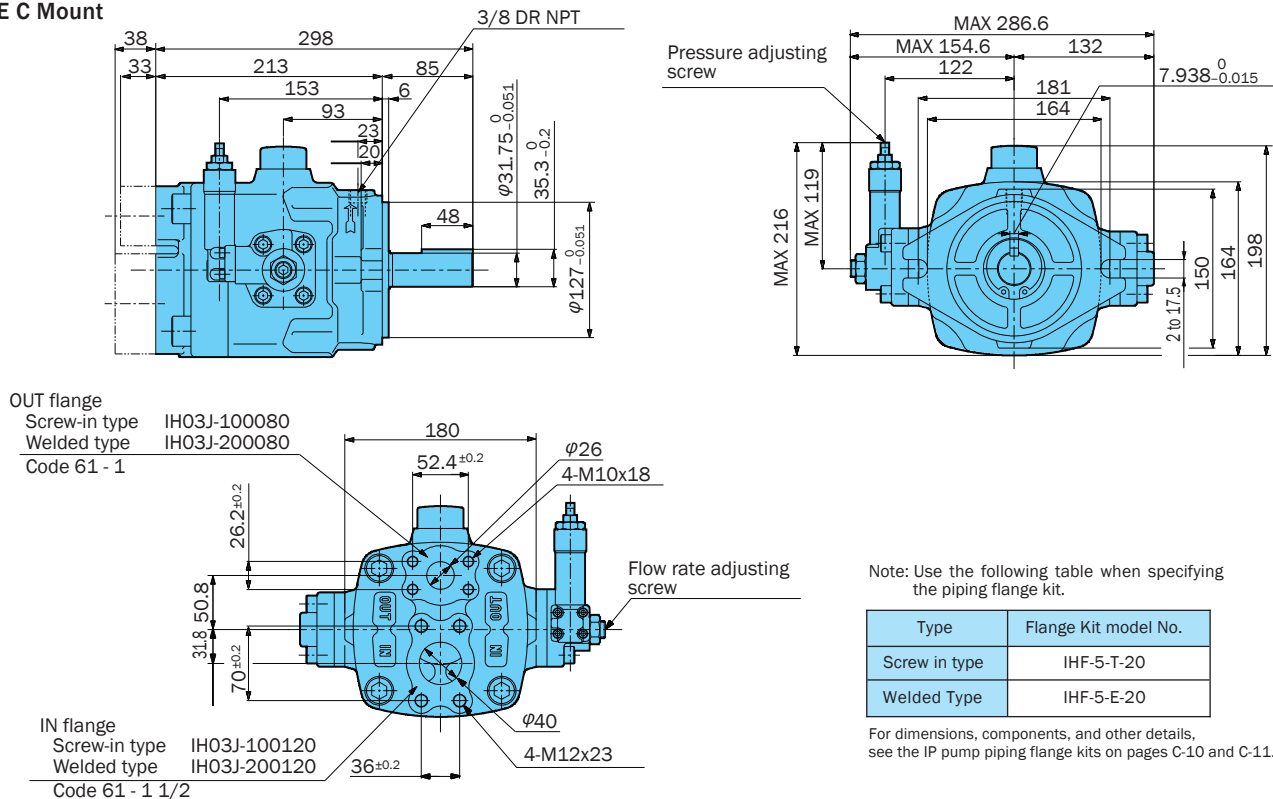
Installation Dimension Drawings

VDC-3A-1A*-20



VDC-3B-1A*-E35

SAE C Mount

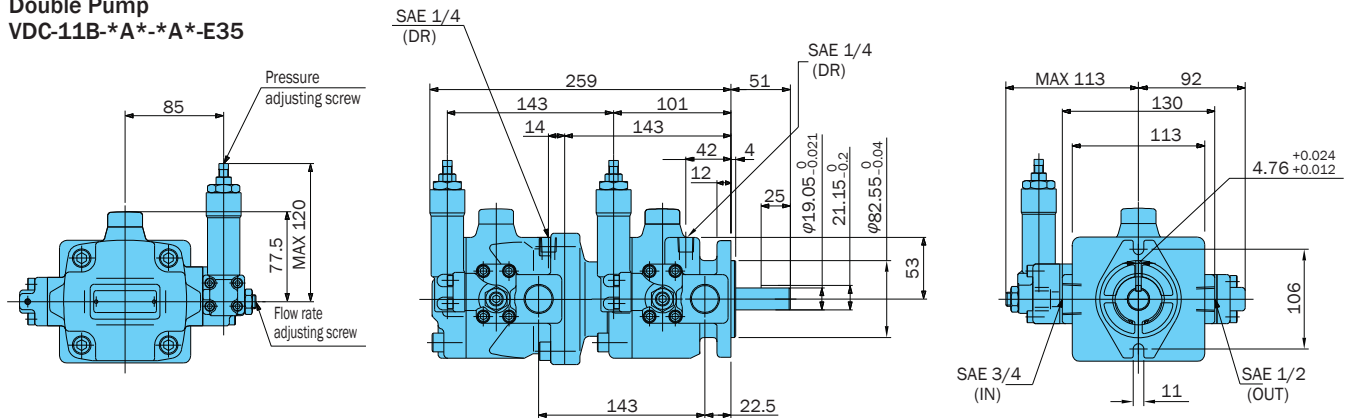


Note: Use the following table when specifying the piping flange kit.

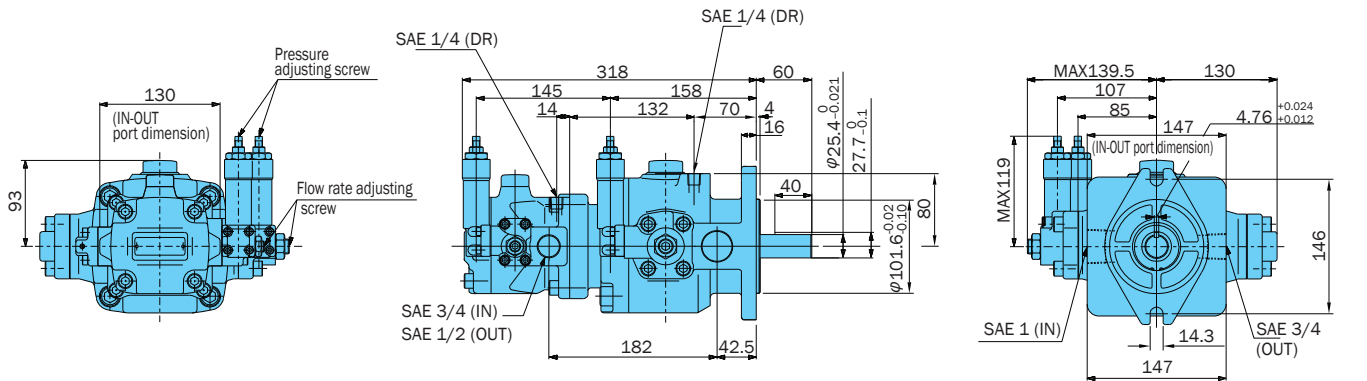
Type	Flange Kit model No.
Screw in type	IHF-5-T-20
Welded Type	IHF-5-E-20

For dimensions, components, and other details, see the IP pump piping flange kits on pages C-10 and C-11.

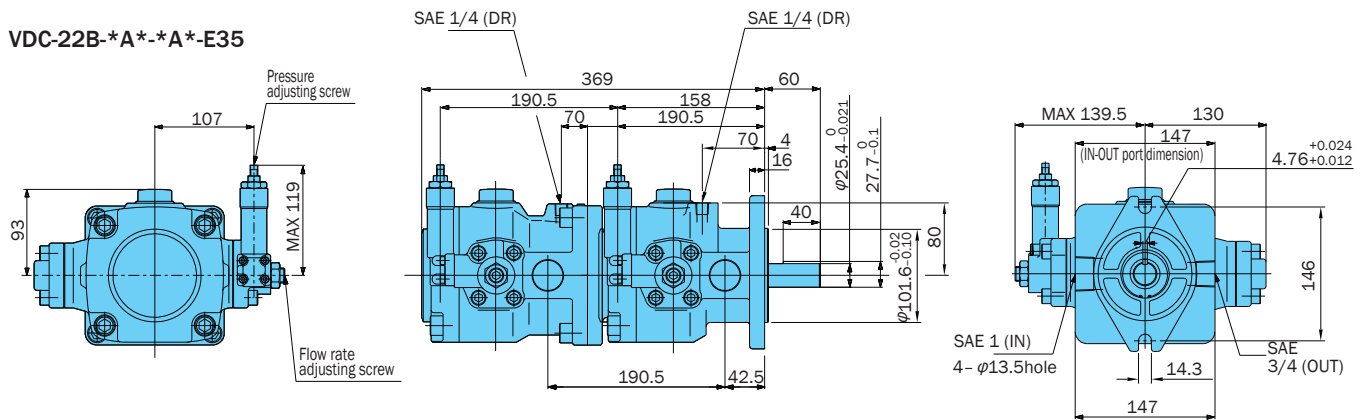
Double Pump VDC-11B-*A*-*A*-E35



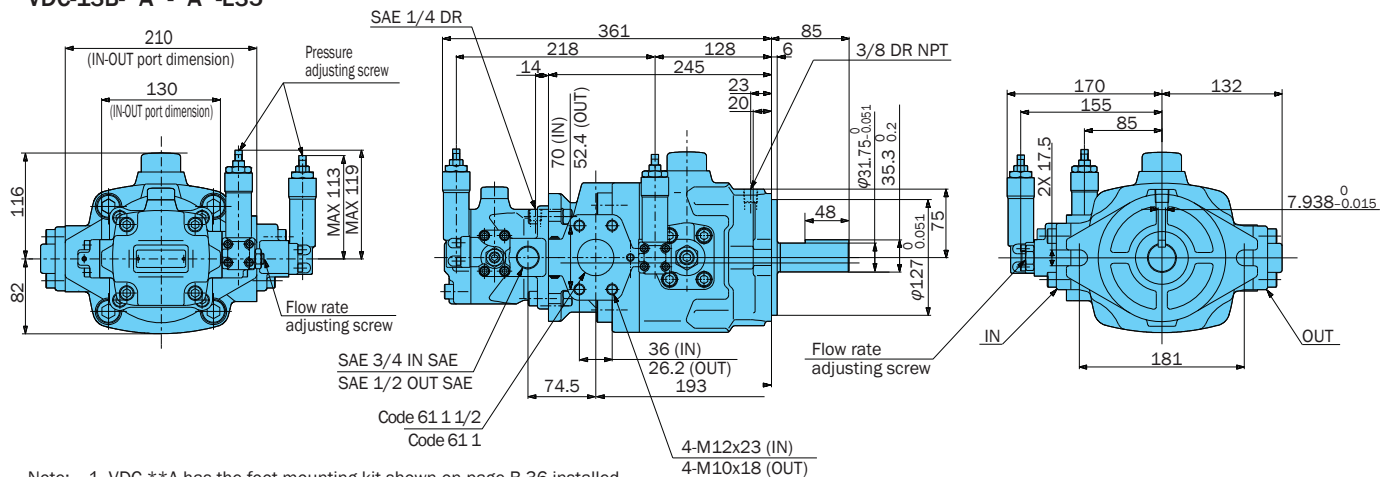
VDC-12B-*A*-*A*-E35



VDC-22B-*A*-*A*-E35



VDC-13B-*A*-*A*-E35



Note: 1. VDC-**A has the foot mounting kit shown on page B-36 installed.

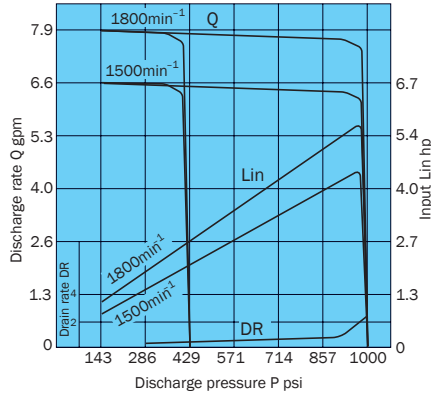
Performance Curves

Typical characteristics at hydraulic operating fluid kinematic viscosity of 32 centistokes

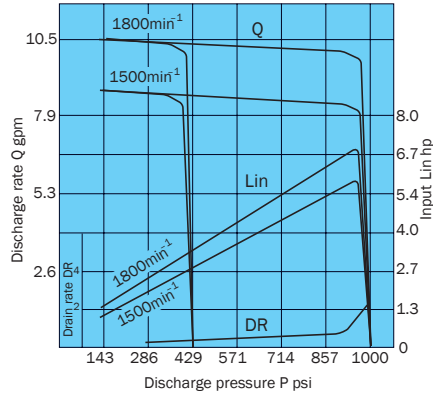
B

Vane Pumps

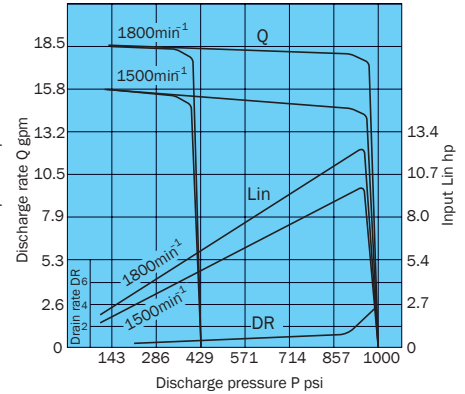
VDC-1A(B)-1A3-20/35



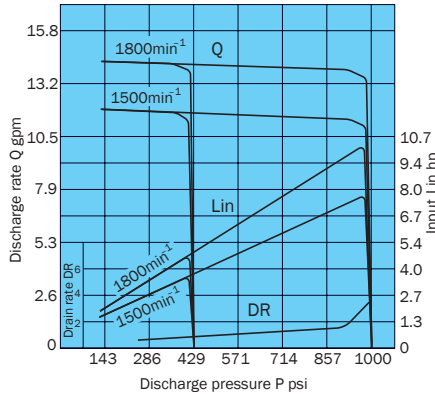
VDC-1A(B)-2A3-20/35



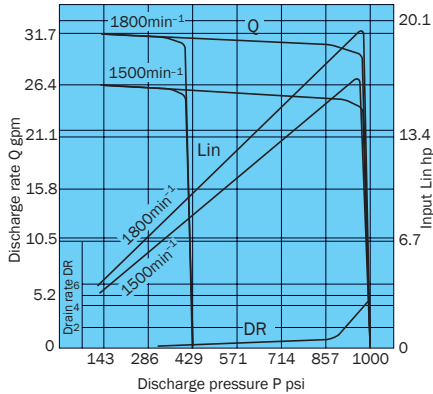
VDC-2A(B)-2A3-20/35



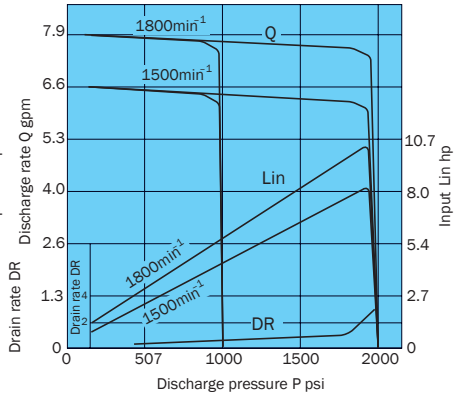
VDC-2A(B)-1A3-20/35



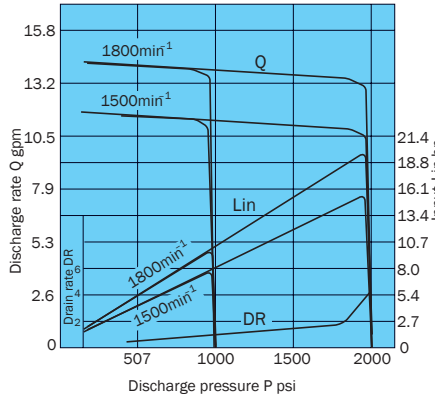
VDC-3A(B)-1A3-20/35



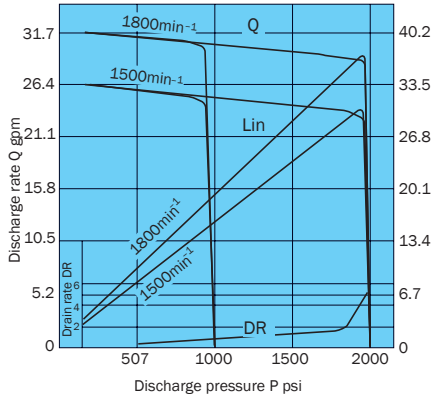
VDC-1A(B)-1A5-20/35



VDC-2A(B)-1A5-20/35

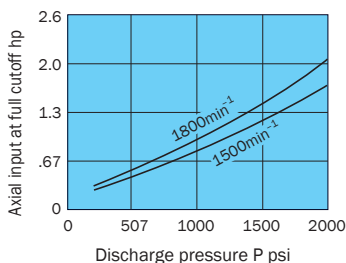


VDC-3A(B)-1A5-20/35

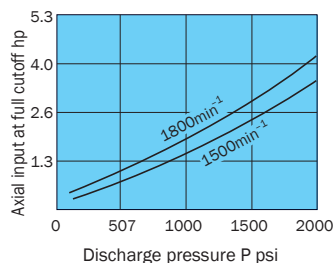


Axial input at full cutoff

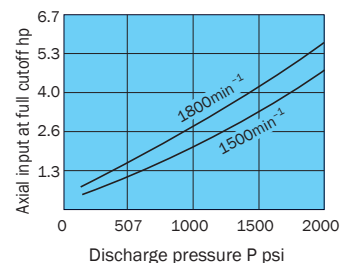
VDC-1



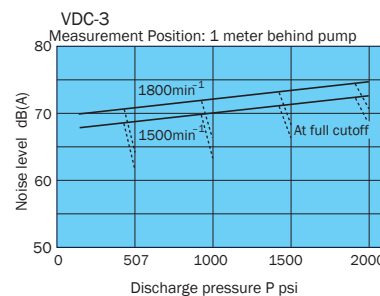
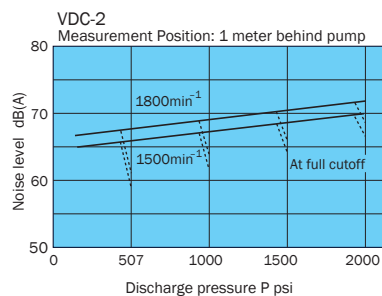
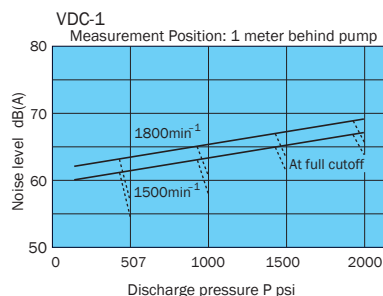
VDC-2



VDC-3



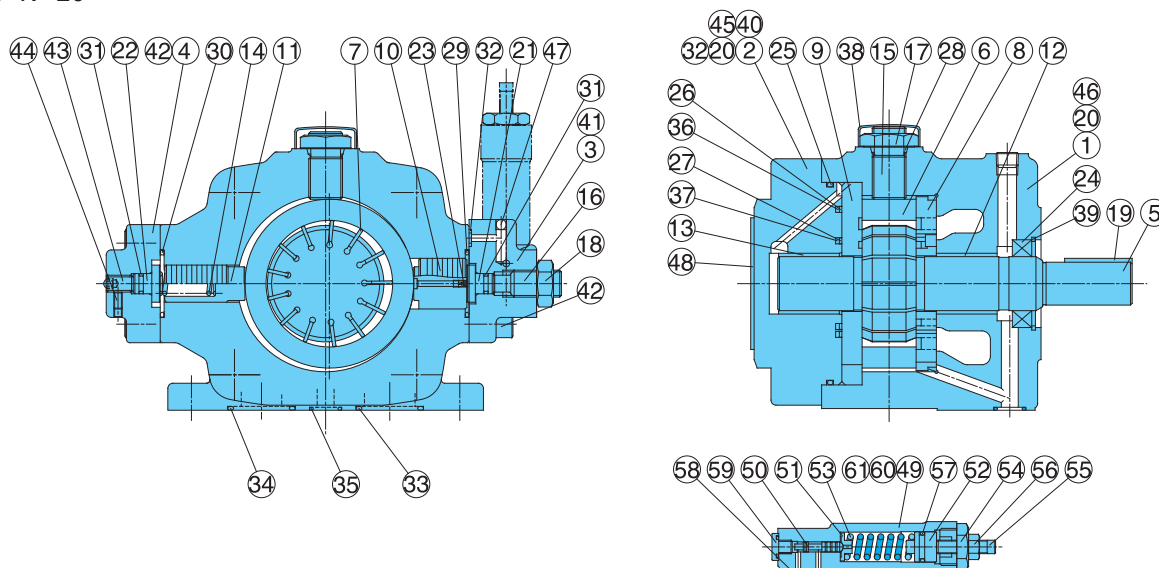
Noise Characteristics



Cross-sectional Drawing

VDC-1A-*A*-20

VDC-2A-*A*-20



Seal Component Table (VDC-1*, VDC-2*)

Part No.	Applicable Pump Model No.	VDC-1A-*A*-20		VDC-2A-*A*-20	
	Seal Kit Number	VCBS-101A00		VCBS-102A00	
	Part Name	Part Number	Q'ty	Part Number	Q'ty
24	Oil seal	TCV-224211	1	TCN-325211	1
25	O-ring	S85(NOK)	1	1A-G115	1
26	O-ring	AS568-034	1	AS568-150	1
27	O-ring	AS568-026	1	AS568-134	1
28	O-ring	1A-P14	1	1A-P18	1
29	O-ring	1A-P22	1	1A-G35	1
30	O-ring	1A-P20	1	1A-G35	1
31	O-ring	1A-P5	2	1A-P9	2
32	O-ring	1A-P6	4	1A-P7	4
33	O-ring	1A-P25	1	1A-G35	1
34	O-ring	1A-P22	1	1A-G35	1
35	O-ring	1A-P10A	1	1A-P15	1
36	Backup ring	VCB34-101000	1	VCB34-102000	1
37	Backup ring	VCB34-201000	1	VCB34-202000	1
57	O-ring	1A-P14	1	1A-P14	1
58	O-ring	1B-P6(Hs90)	3	1B-P6(Hs90)	3

Note: 1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
2. O-ring 1A-** refers to JIS B2401-1A-**.
3. For VDR-*B*-20, the seal kit number becomes VDBS-10*B00, without the 33, 24, and 35 O-rings.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body (1)	21	Holder	41	Screw
2	Body (2)	22	Holder	42	Screw
3	Cover (1)	23	Orifice	43	Screw (stopper)
4	Cover (2)	24	Oil seal	44	Screw
5	Shaft	25	O-ring	45	Plug
6	Ring	26	O-ring	46	Plug
7	Vane	27	O-ring	47	Pole
8	Plate (S)	28	O-ring	48	Nameplate
9	Plate (H)	29	O-ring	49	Valve body
10	Piston (1)	30	O-ring	50	Spool
11	Piston (2)	31	O-ring	51	Holder
12	Bearing	32	O-ring	52	Plunger
13	Bearing	33	O-ring	53	Spring
14	Spring	34	O-ring	54	Retainer
15	Thrust screw	35	O-ring	55	Screw
16	Screw	36	Backup ring	56	Nut
17	Nut	37	Backup ring	57	O-ring
18	Nut	38	Cap	58	O-ring
19	Key	39	Snap ring	59	Plug
20	Pin	40	Screw	60	Plug
				61	Screw

Cartridge Kits:

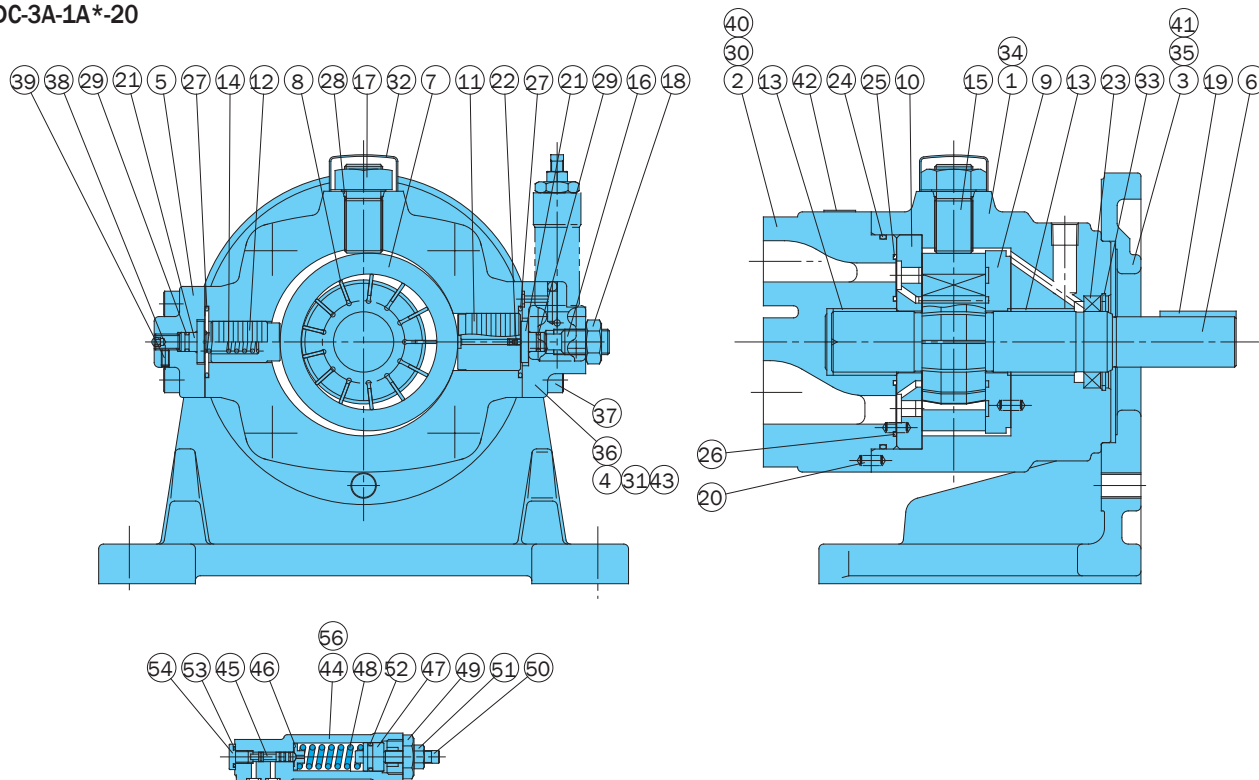
VDC-1 | VCBC-101*A*

VDC-2 | VCBC-102*A*

Includes Items: 5, 6, 7, 8, 9, 19, 20

Performance Curves

VDC-3A-1A*-20



Seal Component Table (VDC-3*)

Part No.	Applicable Pump Model No. VDC-3A(B)*-20		
	Seal Kit Number VCBS-103B00		
	Part Name	Part Number	Q'ty
23	Oil seal	TCN-385811	1
24	O-ring	1A-G130	1
25	O-ring	AS568-154(Hs90)	1
26	O-ring	AS568-151(Hs90)	1
27	O-ring	1A-G40	2
28	O-ring	1A-P22	1
29	O-ring	1A-P9	2
30	O-ring	1A-P7	2
31	O-ring	1A-P7	2
52	O-ring	1A-P14	1
53	O-ring	1B-P6(Hs90)	3

Note: 1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).

2. O-ring 1A-** refers to JIS B2401-1A-**.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body (1)	20	Pin	39	Screw
2	Body (2)	21	Holder	40	Plug
3	Mounting	22	Orifice	41	Washer
4	Cover (1)	23	Oil seal	42	Nameplate
5	Cover (2)	24	O-ring	43	Pole
6	Shaft	25	O-ring	44	Valve body
7	Ring	26	O-ring	45	Spool
8	Vane	27	O-ring	46	Holder
9	Plate (S)	28	O-ring	47	Plunger
10	Plate (H)	29	O-ring	48	Spring
11	Piston (1)	30	O-ring	49	Retainer
12	Piston (2)	31	O-ring	50	Screw
13	Bearing	32	Cap	51	Nut
14	Spring	33	Snap ring	52	O-ring
15	Thrust screw	34	Screw	53	O-ring
16	Screw	35	Screw	54	Plug
17	Nut	36	Screw	55	Plug
18	Nut	37	Screw	56	Screw
19	Key	38	Screw (stopper)		

Compensator Kits:

VDC-1 Thru -3 are same
VDC-A2 ZR-G01-A2-1688C
-A3 ZR-G01-A3-1688C
-A4 ZR-G01-A4-1688C
-A5 ZR-G01-A5-1688C
P-Remote ZR-G01-P-E1235A

Cartridge Kits:

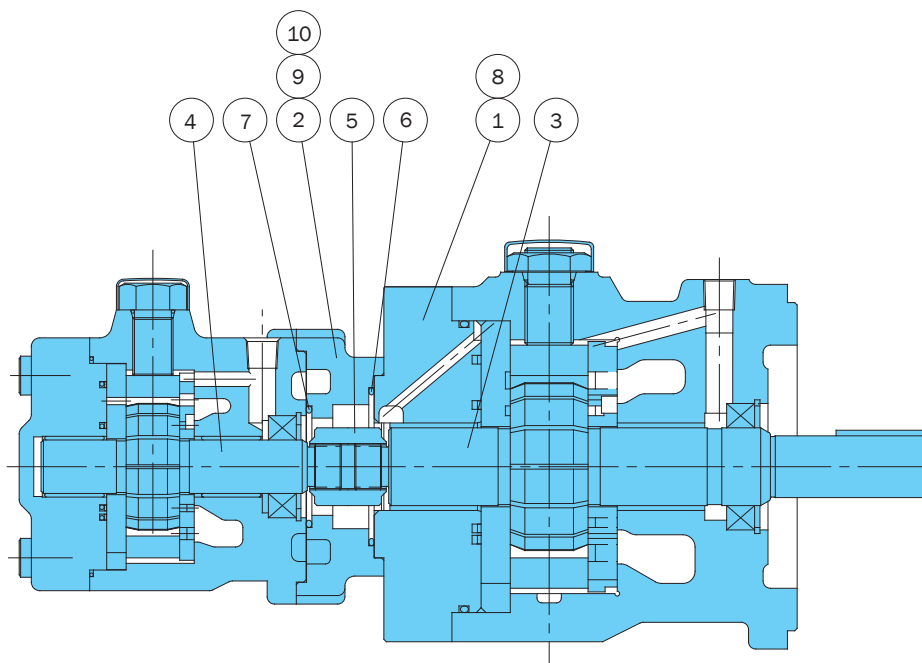
VDC-1-20/35
VCBC-1011A2 (A2,A3)
VCBC-1011A4 (A4,A5)
VCBC-1012A2 (2A2,2A3)

VDC-2-20/35
VCBC-1021A2 (A2,A3)
VCBC-1021A4 (A4,A5)
VCBC-1022A2 (2A2,2A3)

VDC-3-20/35
VCBC-1031A2 (A2,A3)
VCBC-1031A4 (A4,A5)

Includes Items: 6, 7, 8, 9, 10, 19, 20

VDC Series Double Pump



Part No.	Part Name
1	Body (2)
2	Body (3)
3	Shaft (S)
4	Shaft (H)
5	Joint
6	O-ring
7	O-ring
8	Screw
9	Screw
10	Screw

Note:
In the case of a double pump, use single
pump parts in addition to the 10 parts listed
above.

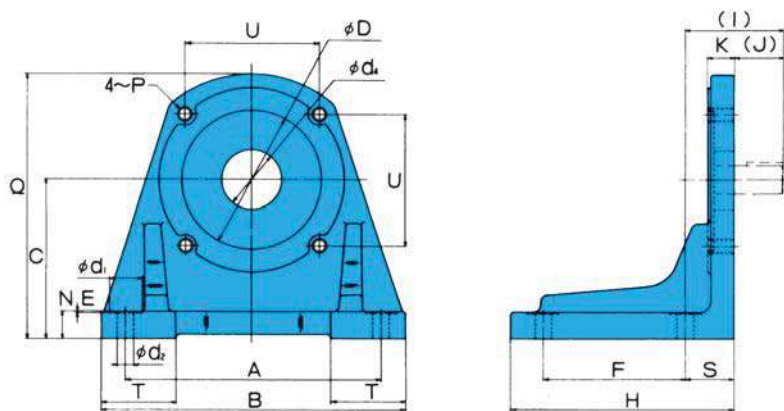
List of Sealing Parts

Part No.	Part Name	VDC-11A-*-20		VDC-12A-*-20		VDC-22A-*-20		VDC-13A-*-20	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
6	O-ring	☒		1A-G60	1	1A-G60	1	☒	
7	O-ring	1A-G85	1	1A-G45	1	1A-G60	1	1A-G85	1

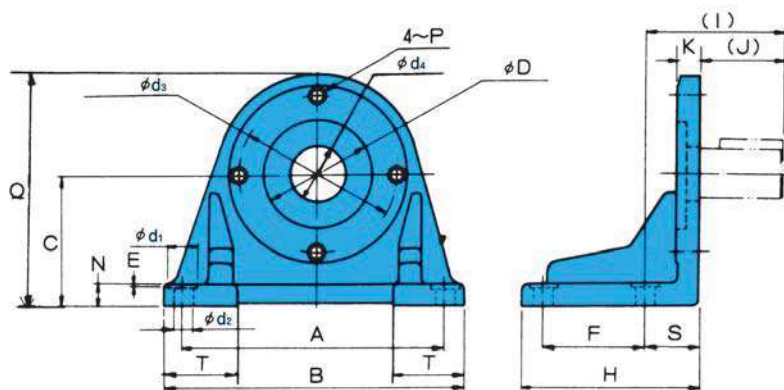
Note: 1. See the description of the single pump for seal parts that are not included in the list.
2. O-ring 1A-** refers to JIS B2401-1A-**.

Foot Mounting Installation Measurement Chart

For VDC-11A, VDC-12 and VDC-22 (for double pump)



For VDC-3A and VDC-13A



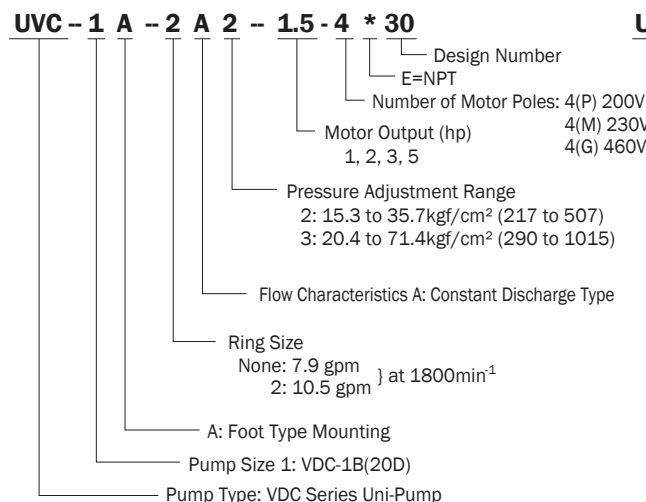
Foot Mounting Kit Model No.	Applicable Pump Model No.	Accessories				Dimensions (mm)					
		Bolt	Q'ty	Washer	Q'ty	A	B	C	E	F	H
VCM-11-20	VDC-1 (20) VDC-11 (20)	TH-10 × 30	4	WS-B-10	4	171.45	204	107.95	1	95.25	150
VCM-22-20	VDC-2 (20) VDC-12 (20) VDC-22 (20)	TH-12 × 35	4	WS-B-12	4	235	267	139.7	1	127	193
IHM-45-10	VDC-3 (20) VDC-13 (20)	TB-16 × 40	2	WP-16	2	295.3	334	152.4	1	139.7	203

Foot Mounting Kit Model No.	Dimensions (mm)														Weight lbs
	(I)	(J)	K	N	P	Q	S	T	U	ϕ D	ϕ d ₁	ϕ d ₂	ϕ d ₃	ϕ d ₄	
VCM-11-20	66.5	33	18	18	M10	180	32.5	50	90	95.02	22	11	∅	40	14.3
VCM-22-20	84.5	40	20	20	M12	232	44.5	57.5	124	135	22	14	∅	40	26.4
IHM-45-10	104.5	60	25	25	M16	259	44.5	61	∅	127	35	18	181	86	29.7

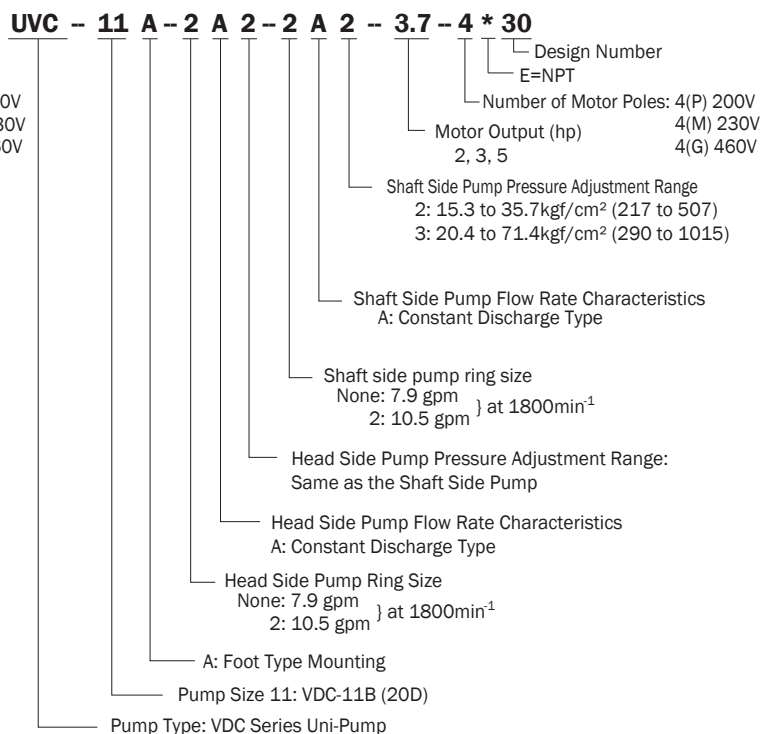
Uni-Pump Specifications

(CE mark standard compliant)

Single Pump



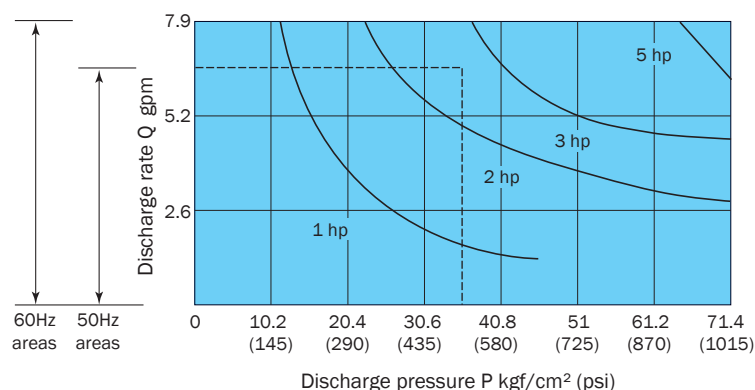
Double Pump



Specifications

Model No.	Maximum Working Pressure kgf/cm ² (psi)	Maximum Flow Rate gpm (A*)		Maximum Flow Rate gpm(2A*)	
		50Hz	60Hz	50Hz	60Hz
UVC- 1A UVC-11A	71.4 (1015)	6.6	7.9	8.7	10.3

Motor selection curves



Selecting a motor

The area under a motor output curve in the graph to the left is the operating range for that motor under the rated output for that motor.

Example:

To find the motor that can produce pressure of 507 psi and a discharge rate of 6.6 gpm.

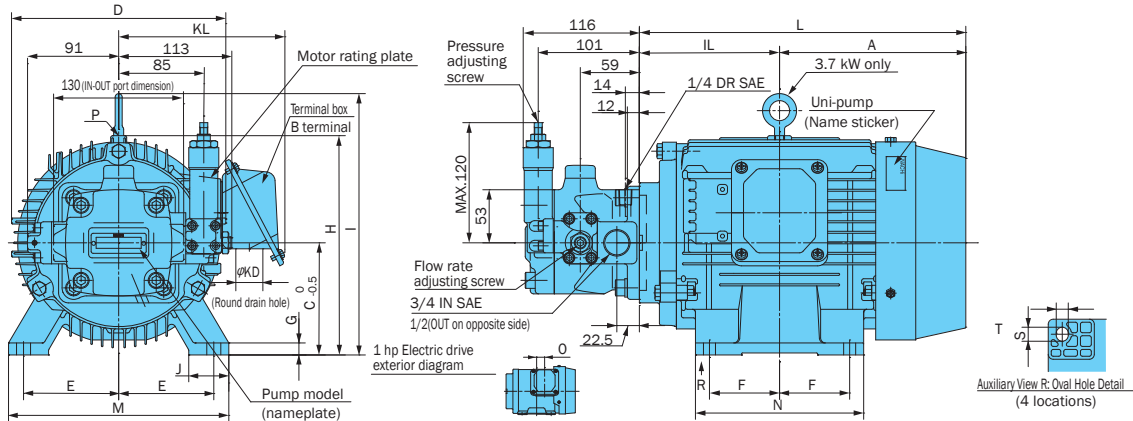
Selection Process:

Since the intersection of the two broken lines from a pressure of 507 psi and discharge rate of 6.6 gpm intersect in the area under the 3 hp curve, it means that a 3 hp motor should be used. In the case of a double pump configuration, select a motor that is larger than the total power required by both pumps.

* Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload.

Installation Dimension Drawings

UVC-1A

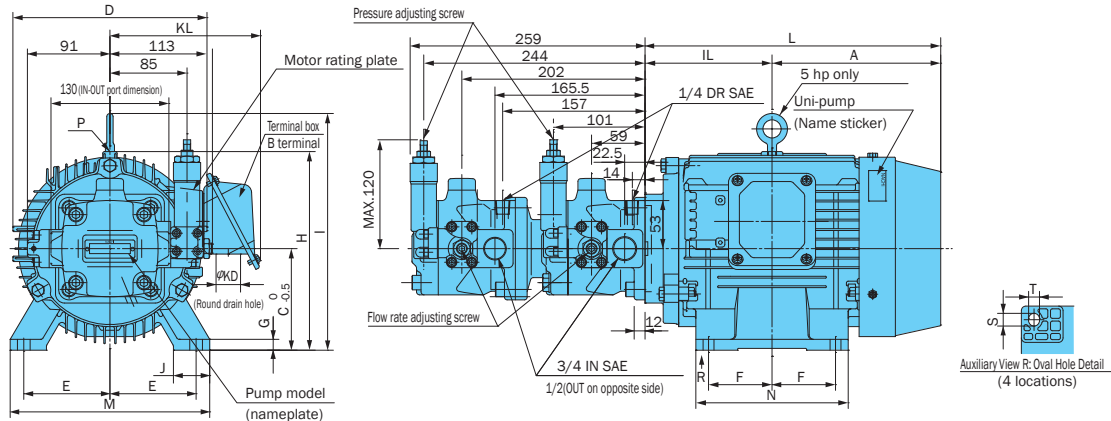


Uni-pump	Motor Dimensions mm																	Frame No.	Output hp (4 poles)	Weight lbs
	A	IL	C	D	E	F	G	H	I	J	L	M	N	S * T	KD	KL	O			
UVC-1A-A2-0.75-4-30	133	105	80	170	62.5	50	4.5	165	—	35	238	165	130	18 * 10	ø27	157	27.5	80M	1	53
UVC-1A-A2-1.5-4-30	143	118.5	90	198	70	62.5	10	190	—	40	261.5	176	150	12 * 10	ø27	159	—	90L	2	56
UVC-1A-A3-1.5-4-30																				
UVC-1A-2A2-1.5-4-30	157.5	133	100	198	80	70	12	200	—	40	290.5	200	168	14 * 12	ø27	159	—	100L	3	67
UVC-1A-A3-2.2-4-30																				
UVC-1A-2A2-2.2-4-30	186	140	112	214	95	70	12	—	261	40	326	220	168	14 * 12	ø27	166	—	112M	5	80
UVC-1A-A3-3.7-4-30																				
UVC-1A-A4-3.7-4-30																				
UVC-1A-2A2-3.7-4-30																				
UVC-1A-2A3-3.7-4-30																				

0.75 to 2.2kW model does not have hangers.

- Standard drive motor is the fully enclosed fan-cooled B type.
- Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
- Standard terminal box is B terminal (right side viewed from pump).
- See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).

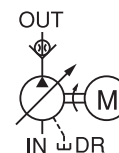
UVC-11A



Uni-pump	Motor Dimensions mm																	Frame No.	Output hp (4 poles)	Weight lbs
	A	IL	C	D	E	F	G	H	I	J	L	M	N	S * T	KD	KL	O			
UVC-11A-A2-A2-1.5-4-30	143	118.5	90	198	70	62.5	10	190	—	40	261.5	176	150	12 * 10	ø27	159	—	90L	2	79
UVC-11A-A3-A3-1.5-4-30																				
UVC-11A-A2-A2-2.2-4-30	157.5	133	100	198	80	70	12	200	—	40	290.5	200	168	14 * 12	ø27	159	—	100L	3	90
UVC-11A-A3-A3-2.2-4-30																				
UVC-11A-2A2-2.2-4-30	186	140	112	214	95	70	12	—	261	40	326	220	168	14 * 12	ø27	166	—	112M	5	103
UVC-11A-A2-A2-3.7-4-30																				
UVC-11A-A3-A3-3.7-4-30																				
UVC-11A-2A2-3.7-4-30																				
UVC-11A-2A3-3.7-4-30																				

No hanger on 2 and 3 hp models.

- Standard drive motor is the fully enclosed fan-cooled B type.
- Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
- Standard terminal box is B terminal (right side viewed from pump).
- See page A-21 for the characteristics of the drive motor for the unipump (domestic standard 3 rating).



UVN Series Variable Volume Vane Uni-Pump NSP Uni-Pump

7.9 to 31.7 gpm
2000 psi

Features

Energy efficient high performance

All the performance of a vane pump, right from the low pressure range, is enhanced even further by eliminating the external drain and optimizing the pressure balance, creating a design that generates little heat. The result is a pump that contributes to the energy efficiency of the

mother machine, as well as to process precision.

Lightweight, compact design

The pump and motor are designed for exclusive uni-pump use, making them lightweight, compact, easy to handle, and suitable for a wide range of applications.

Low noise, long life

The pump and motor shaft are linked by a joint, which minimizes noise by eliminating the effects of shaft vibration and an off-center shaft. The coupling is constructed to allow constant lubrication, for friction-free long life.

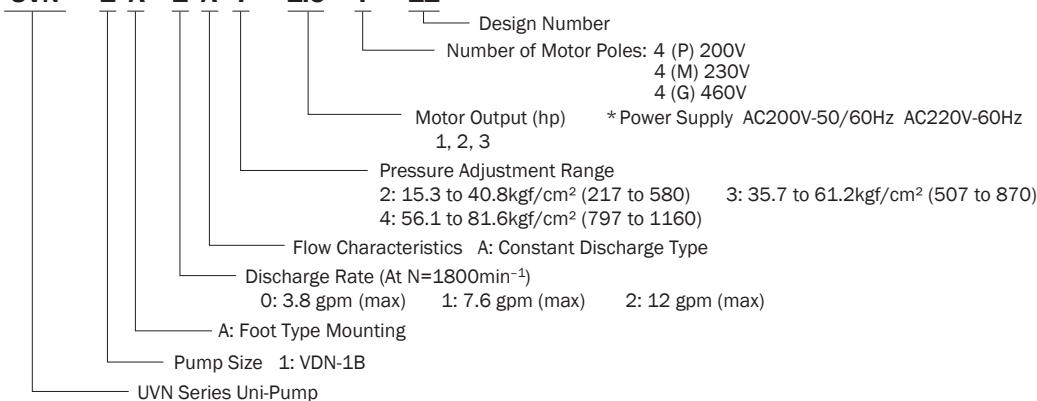
Specifications

Model No.	Pump Capacity in ³ /rev	Pressure Adjustment Range kgf/cm ² (psi)	No-load Discharge Rate gpm	
			50Hz	60Hz
UVN-1A-0A2- ^{0.7} / _{1.5} -4-11	.49	15.3 to 40.8 (217 to 580)	3.1	3.8
UVN-1A-0A3- ^{0.7} / _{1.5} -4-11		35.7 to 61.2 (507 to 870)		
UVN-1A-0A4- ^{0.7} / _{1.5} -4-11		56.1 to 81.6 (797 to 1160)		
UVN-1A-1A2- ^{1.5} / _{2.2} -4-11	.98	15.3 to 40.8 (217 to 580)	6.3	7.6
UVN-1A-1A3- ^{1.5} / _{2.2} -4-11		35.7 to 61.2 (507 to 870)		
UVN-1A-1A4- ^{1.5} / _{2.2} -4-11		56.1 to 81.6 (797 to 1160)		
UVN-1A-2A3- ^{2.2} / _{3.7} -4-11	1.59	(507 to 870)	10	3.7 - 12
UVN-1A-2A4- ^{2.2} / _{3.7} -4-11		(797 to 1160)		

Note: Contact your agent for combinations other than those noted above.

Understanding Model Numbers

UVN - 1 A - 1 A 4 - 1.5 - 4 - 11



• Handling

1. Installation and Piping Precautions
 - 1 Provide a mounting base of sufficient rigidity, and install so that the pump shaft is oriented horizontally.
 - 2 Make sure the flow rate of the suction piping is no more than 6 ft/s, and that the suction pressure at the pump suction port is in the range of 4.35 psi.
 - 3 Drain piping must be direct piping up to a point that is below the tank fluid level, and back pressure due to pipe resistance should not exceed 14 psi.

Provide a suction strainer with a filtering grade of about 100 μm (150 mesh).

2. Running Precautions

- 1 The direction of rotation is clockwise (rightward) when viewed from the motor fan side.
- 2 At startup, repeat the inching operation (start-stop) with the pump discharge side at no-load to bleed air from the pump and suction piping.
- 3 Equip an air bleed valve in circuits where it is difficult to bleed air before

startup.

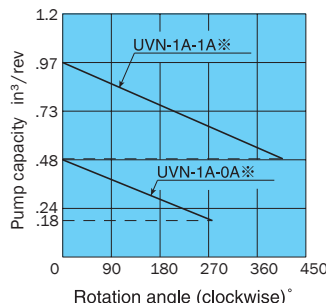
- 4 Make sure the maximum peak pressure (setting pressure + surge pressure) during operation does not exceed 2000 psi. Refer to the following piping conditions as a guideline to keep the maximum peak pressure below 2000 psi.
 - 1/2" x 2 m rubber hose (for 2000 psi) (pipe volume: approximately 15 in³)
- 5 Install a relief valve to cut surges in the circuit if pressure exceeds 2000 psi.

3. Management of Hydraulic Operating Fluid

- 1 Use only good-quality hydraulic operating fluid with a kinematic viscosity at a fluid temperature of 104°F within the range of (30 to 50cSt).
- 2 Normally, you should use an R&O type and wear-resistant type of ISO VG32 or 46, or equivalent.
The operating temperature range is 59 to 140°F. When the oil temperature at startup is 59°F or less, perform a warm-up operation at low pressure until the oil temperature reaches 59°F. Use the pump in an area where the temperature is within the range of 50 to 104°F.
- 3 For the return line to the tank, use a 10μm line filter.
- 4 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water, foreign matter, and other oil, and watch out for discoloration.

4. Setting the Pressure and Discharge Rate

- 1 When adjusting pressure, pressure is increased by clockwise (rightward) rotation of the adjusting screw and decreased by counterclockwise (leftward) rotation. After adjustment is complete, securely tighten the lock nut.
- 2 Turn adjustment screw right to decrease or left to increase volume of discharge. Refer to guidelines in the following diagram for the relationship of the non-load volume of discharge and the position of the flow adjustment screw.



After adjustment is complete, securely tighten the lock nut.

3 Factory Default P-Q Settings (Standard Model)

- Flow Rate Setting = Maximum flow rate for model as indicated in the catalog
- Pressure Setting = Pressure shown in table below

Factory Default Pressure Settings kgf/cm² (psi)
2: 35.7 (507)
3: 51.0 (725)
4: 71.4 (1015)

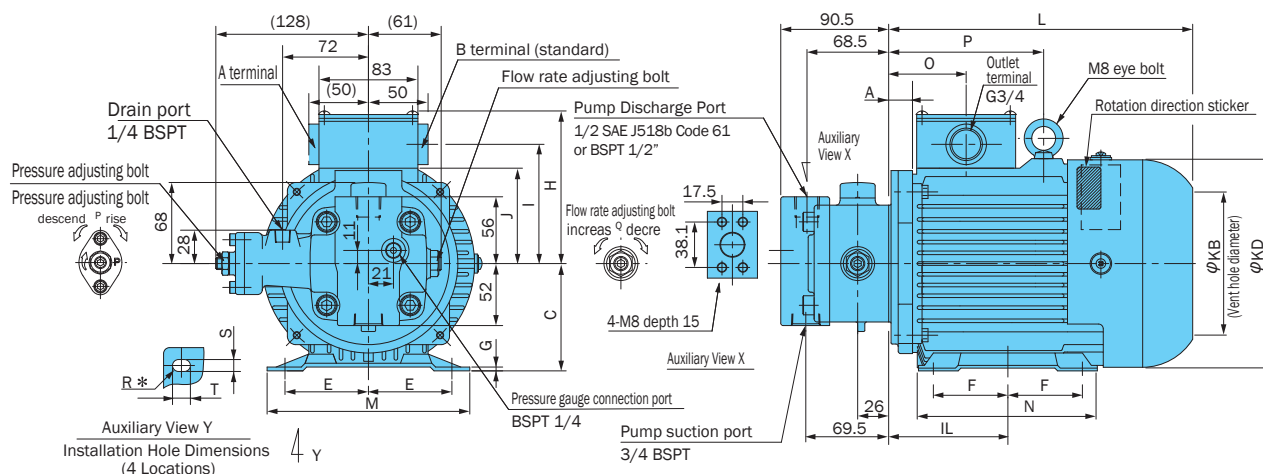
- 4 All adjustments, except the flow volume adjusting screw, are precision adjusted at the factory during assembly, do not adjust them. (Do not make any adjustments other than the pressure adjustment screw and the flow rate adjusting screw.)

Note:

The values indicated above are at maximum pump discharge volume with the flow volume adjusting screw at the 0° position. The broken lines show the flow volume adjustment range lower limit value.

Installation Dimensions

Installation method is the same as design number 10D (old design).



Model No.	Output - Poles (hp - 4P)	Motor Dimensions mm (mm)																		Weight lbs
		A	IL	C	φKD	E	F	G	H	J	L	M	N	T × S	R*	φKB	O	P	I	
UVN-1A-A*-0.7*4-11	1 - 4	20	90	80	157	62.5	50	2.3	120	72	230	155	120	15 × 10	R5	110	65	130	92	37
UVN-1A-A*-1.5*4-11	2 - 4	20	100	90	175	70	62.5	3.2	128	80	255	170	150	15 × 10	R5	120	65	130	100	46
UVN-1A-A*-2.2*4-11	3 - 4	20	110	100	195	80	70	3.2	138	90	285	200	165	17 × 12	R6	134	65	135	110	57

No hanger.

1. Standard drive motor is the fully enclosed fan-cooled E type.
2. Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.
3. Standard terminal box is B terminal (right side viewed from pump).

Characteristics of drive motor for Uni-Pump (domestic standard 3 rating)

Output hp	Poles	(Note1) Model Number	Voltage [V]	Frequency [Hz]	Current rating [A]	RPM rating [min ⁻¹]	Heat resistance
1	4	The drive motor is specialized for the unipump and is not a specific model.	230 200 460	50	3.9	1400	E
			230 200 460	60	3.6	1690	
			230 220 460	60	3.5	1710	
2	4		230 200 460	50	7.1	1390	E
			230 200 460	60	6.6	1670	
			230 220 460	60	6.3	1700	
3	4		230 200 460	50	9.0	1410	E
			230 200 460	60	8.7	1700	
			230 220 460	60	8.2	1720	

Performance Curves

UVN-1A-*A*-*4-11

Operating Fluid : ISO VG 32

Oil temperature : 104°F

Motor selection curves

The area under a motor output curve in the graph below is the operating range for that motor under the rated output for that motor.

Example:

To find the motor that can produce pressure of 507 psi and a discharge rate of 3.1 gpm.

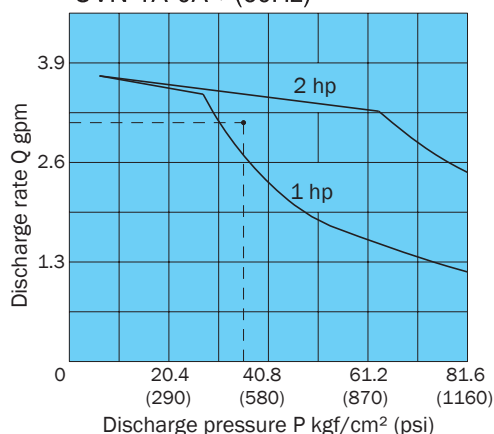
Selection Process

Since the intersection of the two broken lines from a pressure of 507 psi and discharge rate of 3.1 gpm intersect in

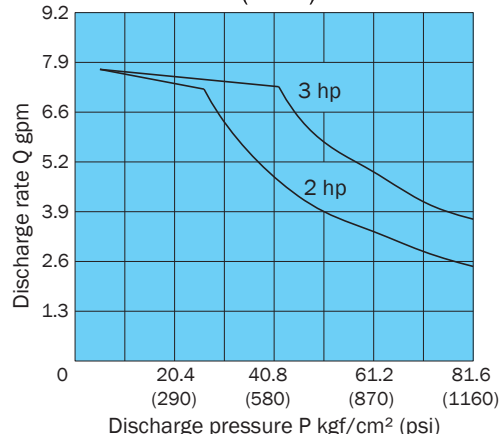
the area under the 2 hp curve, it means that a 2 hp motor should be used.

* Select a uni-pump that has a pressure and flow rate that is within the range of the drive so that the drive will not overload.

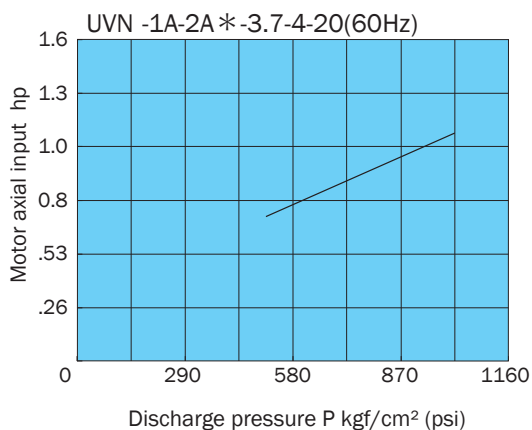
UVN-1A-0A * (60Hz)



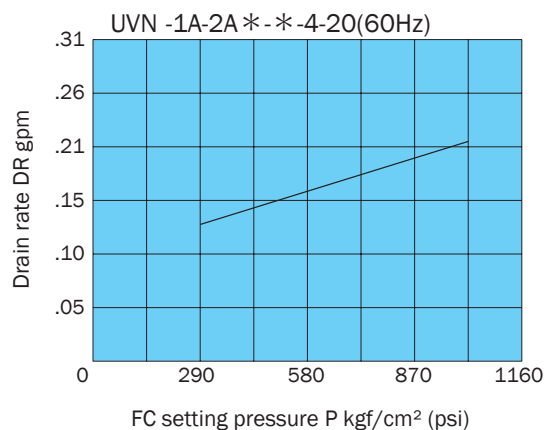
UVN-1A-1A * (60Hz)



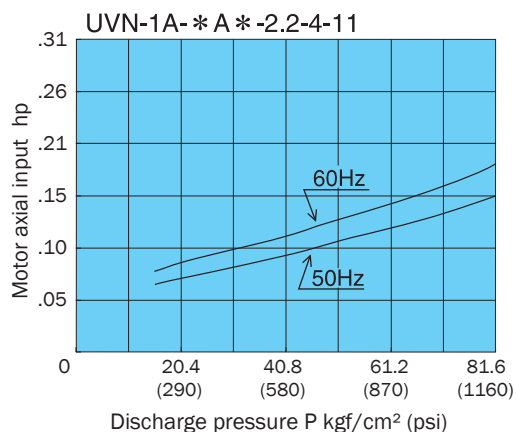
Motor Power Loss at Full Cutoff



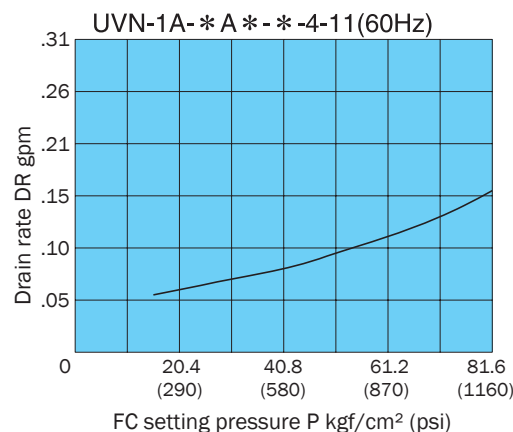
DR Volume at Full Cutoff

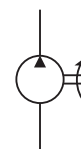


Motor Power Loss at Full Cutoff



DR Volume at Full Cutoff





IPH Series IP Pump

.21 to 7.68 in³/rev
4350 psi

This is a new design series in which all pump types are installation compatible with previous designs. Note, however, that there is no longer compatibility for some of the seal components between the IPH-3 and IPH-4 sizes and design numbers 10 and 12.

Features

A patented axial and radial pressure loading system provides high efficiency and generates pressures up to 4350 psi.

Outstanding durability and very long life. A modified involute short-tooth gear enables internal gearing for greatly reduced pulsation and noise, and

exceptionally quiet operation. A simple structure makes maintenance and inspection easier.

Specifications

Model No.	Capacity cm ³ /rev (in ³)	Rated Pressure psi	Maximum Operating Pressure psi	Minimum Revolution Speed min ⁻¹	Maximum Revolution Speed min ⁻¹	Weight lbs	
						Type A	Type B
IPH-2A(B)- 3.5-11	3.60 (.21)	3625	4350	600	2000	9.7	5.2
5	5.24 (.31)					9.9	5.5
6.5	6.55 (.39)					10.1	5.7
8	8.18 (.49)					10.5	6.1
IPH-3A(B) - 10-20	10.2 (.62)	3625	4350	600	2000	23.1	10.5
13	13.3 (.81)					23.5	11.0
16	15.8 (.96)					24.2	11.6
IPH-4A(B) - 20-20	20.7 (1.26)	3625	4350	500	2000	33.5	20.9
25	25.7 (1.56)					34.6	22.0
32	32.3 (1.97)					35.7	23.1
IPH-5A(B)- 40-21(11)	40.8 (2.48)	3625	4350	400	2000	70.5	41.8
50	50.3 (3.06)					72.7	44.1
64	63.9 (3.89)					74.9	46.3
IPH-6A(B)- 80-21(11)	81.3 (4.96)	3625	4350	300	2000	136.7	85.9
100	101.6 (6.19)					141.1	90.4
125	125.9 (7.68)					145.5	94.8

Note:

1. Suction Pressure: 3.6 psi.
2. Maximum working pressure shown here is the pressure limit when there are frequent pressure changes.
3. Avoid installation with the suction port towards the bottom of the pump.
4. Specify using the model number format shown below when pipe flanges are required.

• Handling

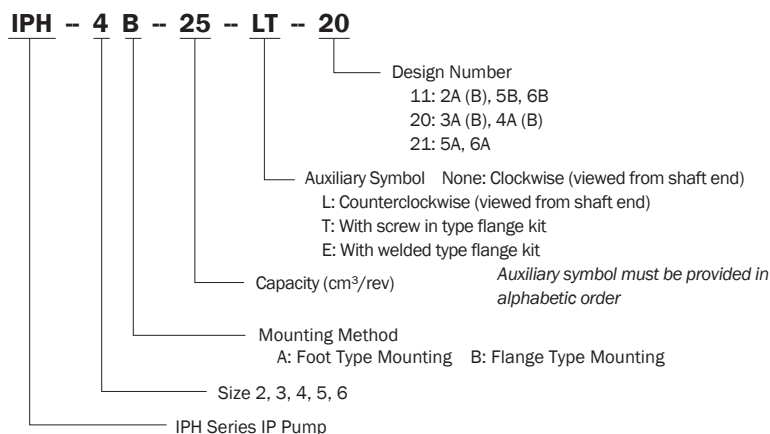
- 1 For the hydraulic operating fluid, use an R&O type and wear-resistant type of ISO VG32 to 68 or equivalent (viscosity index of at least 90). Use hydraulic operating fluid that provides kinematic viscosity during operation in the range of 20 to 150 centistokes.
- 2 The operating temperature range is 40 to 149 °F. When the oil temperature at

startup is 40 °F or less, perform a warm-up operation at low pressure until the oil temperature reaches 40 °F. Use the pump in an area where the temperature is within the range of 32 to 140 °F.

- 3 Suction pressure 3.6 psi, and the suction port flow rate should be to greater than 5 ft/sec.
- 4 Avoid pulley, gear, and other drive systems that impart a radial or thrust load on the end of the pump shaft.
- 5 Mount the hydraulic pump so its pump shaft is oriented horizontally. Provide a suction strainer with a filtering grade of about 100µm (150 mesh). For the return line to the tank, use a 10µm line filter.
- 6 Manage hydraulic operating fluid so contamination is maintained at class NAS10 or lower. Take care to avoid contamination with water and other foreign matter, and watch out for discoloration. Whitish fluid indicates that air has contaminated the fluid, and brownish fluid indicates the fluid is dirty.

(continued on following page)

Understanding Model Numbers



- 7 Operate within the RPM range in the catalog for the minimum RPM of the pump. Unload the pump's load pressure to operate at variable speeds. Condition of inflow piping must produce as little inflow load pressure as possible to minimize effect of cavitation.
- 8 When using water- or glycol-based hydraulic operating fluid, refer to page O-3 for details on applicable models
- 9 At startup, repeat the inching operation (start-stop) to bleed air from the pump and pipes.
- 10 Equip an air bleed valve in circuits where it is difficult to bleed air before startup. See page C-13 for more information.
- 11 To ensure proper lubrication of the pump's rubbing surfaces, supply oil to the interior of the pump before starting operation.
- 12 When centering the pump shaft, eccentricity with the motor shaft should be no greater than 0.001 in. Use a pump mounting base of sufficient rigidity. The angle error should be no greater than 1°.
- 13 Contact your agent for information about engines.

Discharge Rate and Required Input for Each Pump Speed

Speed	Pressure psi Model No.	Discharge Rate gpm						Required Input hp					
		100	1015	2030	3045	3625	4350	100	1015	2030	3045	3625	4350
1200 min ⁻¹	IPH-2A(B)- 3.5-11 5 6.5 8	1.1 1.6 2.0 2.5	1.1 1.6 2.0 2.5	1.0 1.5 1.9 2.4	1.0 1.5 1.9 2.4	1.0 1.5 1.8 2.3	1.0 1.4 1.8 2.3	.14 .20 .25 .30	.68 1.2 1.5 1.9	1.6 2.3 2.9 3.6	2.4 3.5 4.3 5.3	2.8 4.1 5.1 6.3	3.5 5.0 6.2 7.6
	IPH-3A(B)- 10-20 13 16	3.2 4.2 4.9	3.1 4.2 4.8	3.0 4.0 4.8	3.0 3.9 4.7	2.9 3.9 4.6	2.9 3.8 4.5	.40 .52 .60	2.4 3.1 3.7	4.3 5.7 6.8	6.6 8.6 10.2	7.9 10.1 12	9.6 12.4 14.8
	IPH-4A(B)- 20-20 25 32	6.5 8.1 10.2	6.7 8.0 10.0	6.28 7.8 9.8	6.1 7.7 9.7	6.1 7.6 9.5	6.0 7.5 9.4	.83 1.0 1.2	5.0 6.1 7.5	8.9 11.0 13.9	13.2 16.4 20.7	15.8 19.7 24.6	19.0 23.4 29.5
	IPH-5A(B)- 40-21(11) 50 64	12.9 15.9 20.2	12.6 15.6 19.8	12.4 15.4 19.5	12.1 15.1 19.2	12.0 14.9 19.0	11.8 14.7 18.8	1.6 1.9 2.4	9.9 11.9 15.0	17.2 21.7 27.6	26.1 32.1 40.9	30.9 38.3 48.6	38.0 45.9 58.3
	IPH-6A(B)- 80-21(11) 100 125	25.7 32.2 39.8	25.2 31.6 39.2	24.7 31.0 38.5	24.2 30.5 37.8	24.0 30.2 37.4	29.8 32.2 37.0	3.2 3.9 4.8	19.1 23.4 28.8	35.1 43.3 53.7	51.8 64.9 86.5	61.9 77.3 96.0	75.2 92.7 115.1
	IPH-2A(B)- 3.5-11 5 6.5 8	1.7 2.4 3.0 3.8	1.6 2.4 3.0 3.8	1.6 2.3 2.9 3.7	1.5 2.3 2.9 3.6	1.5 2.2 2.8 3.5	1.5 2.2 2.8 3.5	.22 .32 .40 .49	1.5 1.9 2.3 2.9	2.7 3.5 4.3 5.4	3.9 4.6 6.5 8.1	4.6 6.1 7.6 9.4	5.5 7.5 9.2 11.4
	IPH-3A(B)- 10-20 13 16	4.8 6.3 7.3	4.7 6.2 7.3	4.6 6.1 7.2	4.5 5.9 7.1	4.5 5.9 7.0	4.4 5.8 6.9	.65 .83 .96	3.8 4.9 5.7	6.7 8.8 10.4	10.0 12.9 15.2	11.9 15.1 18.1	14.4 18.6 22.1
	IPH-4A(B)- 20-20 25 32	9.8 12.2 15.3	9.6 12.0 15.1	9.5 11.8 14.9	9.3 11.7 14.6	9.2 11.5 14.5	9.1 11.4 14.3	1.3 1.6 1.9	7.5 9.1 11.3	13.4 16.6 20.9	19.9 24.8 30.9	23.6 29.0 36.8	28.4 35.2 44.2
	IPH-5A(B)- 40-21(11) 50 64	19.3 23.9 30.3	19.0 23.5 29.9	18.7 23.2 29.4	18.4 22.8 29.0	18.2 22.6 28.8	17.9 22.4 28.5	2.6 3.1 3.9	15.6 18.9 23.6	27.0 33.0 42.3	40.2 49.4 62.7	47.7 58.7 74.6	58.6 70.5 89.7
	IPH-6A(B)- 80-21(11) 100 125	38.6 46.2 59.8	37.9 47.6 58.9	37.3 46.9 58.1	36.7 46.2 57.3	36.3 45.8 56.8	35.8 45.3 56.1	5.2 6.3 7.4	30.0 37.1 45.3	53.9 67.4 83.4	79.9 99.7 123.7	95.0 118 147	115 142 176

Note: Values in the table are general values at an operating fluid viscosity of 46 centistokes. Use the values when selecting the model for your needs.

Parts for IPH Pump (Standard)

	Seal Kit	Najimi 3 Parts Set*	Radial Piston Kit**	Axial Plate Kit***
Single Pump	Mineral Oil/ Water Glycoloi	Mineral Oil	Mineral Oil	Mineral Oil
IPH-2B-***-(L)-11	IHAS-2S2***-10	FZD-7004-***	IHP-2-***-10	IHQ-2-10
IPH-3B-***-(L)-20	IHAS-2S30***-20	FZD-7004-0**	IHP-3-0***-10	IHQ-3-10
IPH-4B-***-(L)-20	IHAS-2S40***-30	FZD-7004-0**	IHP-4-0***-10	IHQ-4-10
IPH-5B-***-(L)-11	IHAS-2S50***-10	FZD-7004-0**	IHP-5-0***-10	IHQ-5-10
IPH-6B-***-(L)-11	IHAS-2S6***-10	FZD-7004-***	IHP-6-***-10	IHQ-6-10

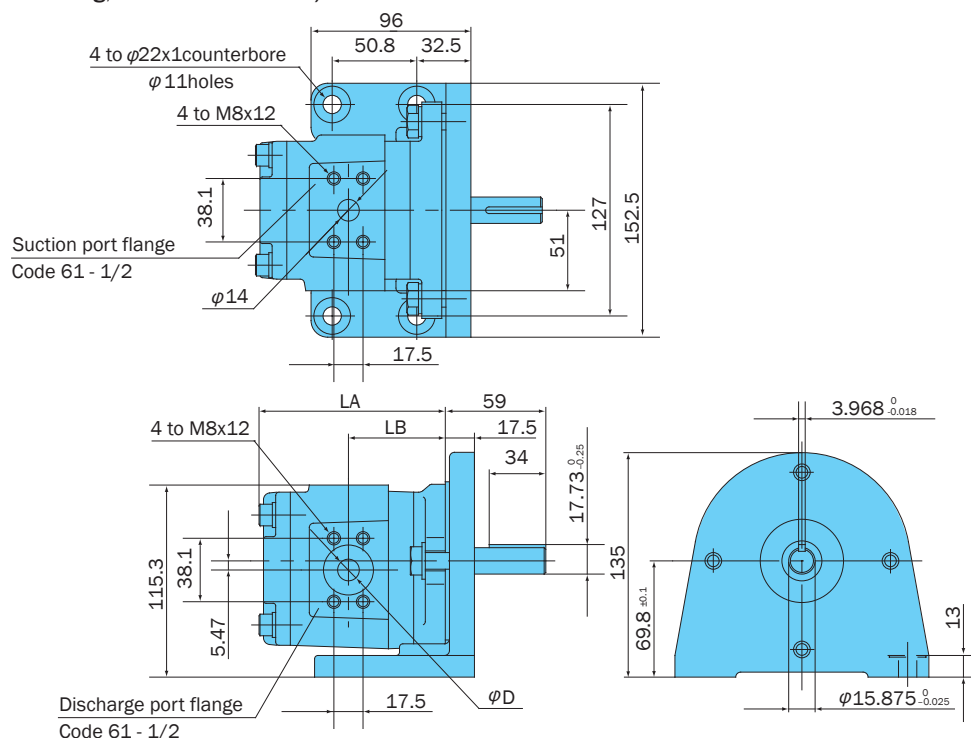
*Najimi set includes: Stopper-pin, axial plate-1, axial plate-2, feeler piece, axial backup ring, O-ring; **Radial Piston Kit includes: Radial piston, radial backup ring, backup ring, O-ring and washer
***Axial Plate Kit includes: Axial plate-1, axial plate-2, axial backup ring and O-ring

	Head (Rear) Side Pump		Shaft Side Pump	
Double Pump	Pump Model	Seal Kit	Pump Model	Seal Kit
IPH-22B-***-(L)-11	IPH-2H-***-(L)-11	IHAS-2H2***-10	IPH-2S-***-(L)-11	IHAS-2S2***-10
IPH-23B-***-(L)-11	IPH-2H-***-(L)-11	IHAS-2H2***-10	IPH-3S-***-(L)-11	IHAS-2S30***-20
IPH-24B-***-(L)-11	IPH-2H-***-(L)-11	IHAS-2H2***-10	IPH-4S-***-H(L)-11	IHAS-2S40***-30
IPH-25B-***-(L)-11	IPH-2H-***-(L)-11	IHAS-2H2***-10	IPH-5S-***-H(L)-11	IHAS-2S50***-10
IPH-26B-***-(L)-11	IPH-2H-***-(L)-11	IHAS-2H2***-10	IPH-6S-***-H(L)-11	IHAS-2S6***-10
IPH-33B-***-(L)-11	IPH-3H-***-(L)-11	IHAS-2H30***-20	IPH-3S-***-(L)-11	IHAS-2S30***-20
IPH-34B-***-(L)-11	IPH-3H-***-(L)-11	IHAS-2H30***-20	IPH-4S-***-(L)-11	IHAS-2S40***-30
IPH-35B-***-(L)-11	IPH-3H-***-(L)-11	IHAS-2H30***-20	IPH-5S-***-H(L)-11	IHAS-2S50***-10
IPH-36B-***-(L)-11	IPH-3H-***-(L)-11	IHAS-2H30***-20	IPH-6S-***-H(L)-11	IHAS-2S6***-10
IPH-44B-***-(L)-11	IPH-4H-***-(L)-11	IHAS-2H40***-30	IPH-4S-***-(L)-11	IHAS-2S40***-30
IPH-45B-***-(L)-11	IPH-4H-***-(L)-11	IHAS-2H40***-30	IPH-5S-***-(L)-11	IHAS-2S50***-10
IPH-46B-***-(L)-11	IPH-4H-***-(L)-11	IHAS-2H40***-30	IPH-6S-***-H(L)-11	IHAS-2S6***-10
IPH-55B-***-(L)-11	IPH-5H-***-(L)-11	IHAS-2H50***-10	IPH-5S-***-F(L)-11	IHAS-2S50***-10
IPH-56B-***-(L)-11	IPH-5H-***-(L)-11	IHAS-2H50***-10	IPH-6S-***-F(L)-11	IHAS-2S6***-10
IPH-66B-***-(L)-11	IPH-6H-***-(L)-11	IHAS-2H6***-10	IPH-6S-***-F(L)-11	IHAS-2S6***-10

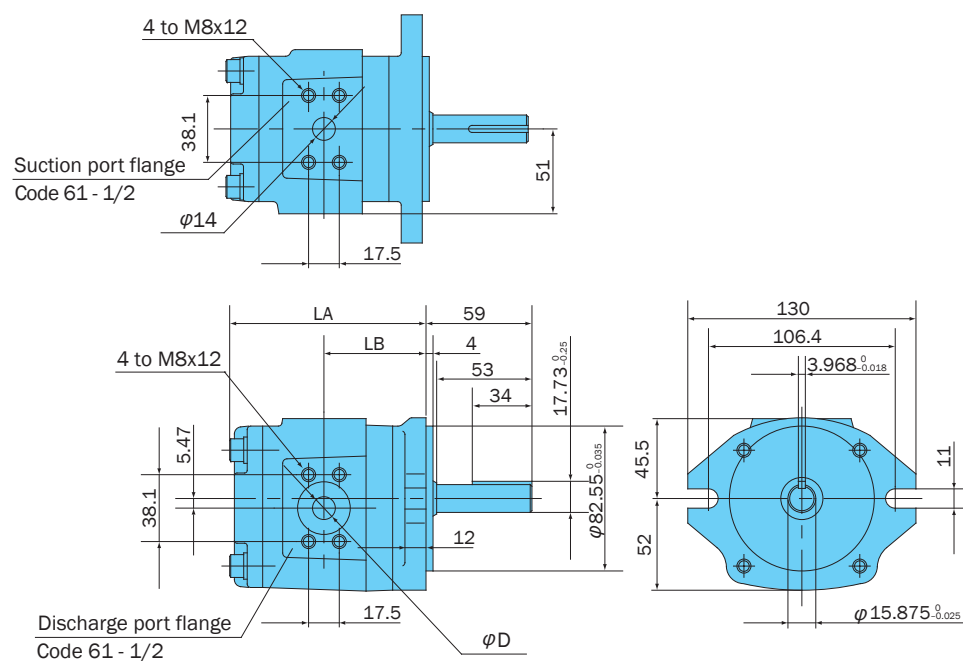
*Regarding Shaft side pump: H, F means the way of the bolt - H: 2-Bolt type, F: 4-Bolt type

Installation Dimension Drawings

IPH-2A-*-11 (Foot Mounting, Clockwise Rotation)



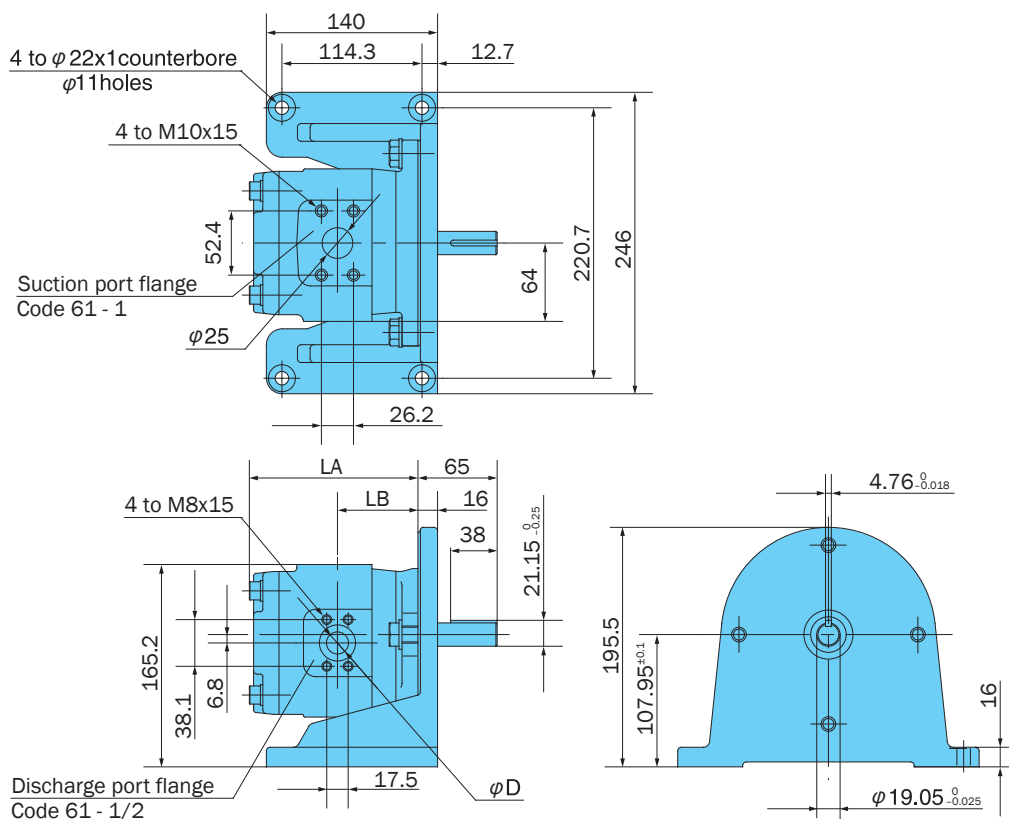
IPH-2B-*-11 (Flange Mounting, Clockwise Rotation) SAE A Mount



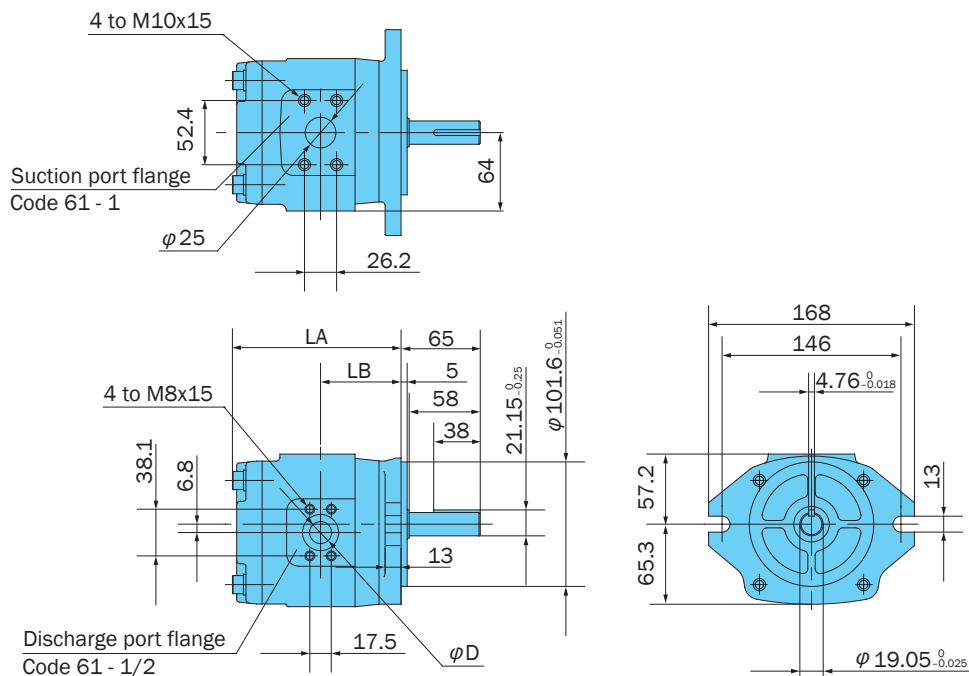
Model No.	Dimensions (mm)		
	LA	LB	ϕD
IPH-2*-3.5-*-11	107	51.0	8.9
IPH-2*-5-*-11	112	53.5	11
IPH-2*-6.5-*-11	116	55.5	12
IPH-2*-8-*-11	121	58.0	13

Note: IPH-2A (B)-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-3A-*-20 (Foot Mounting, Clockwise Rotation)



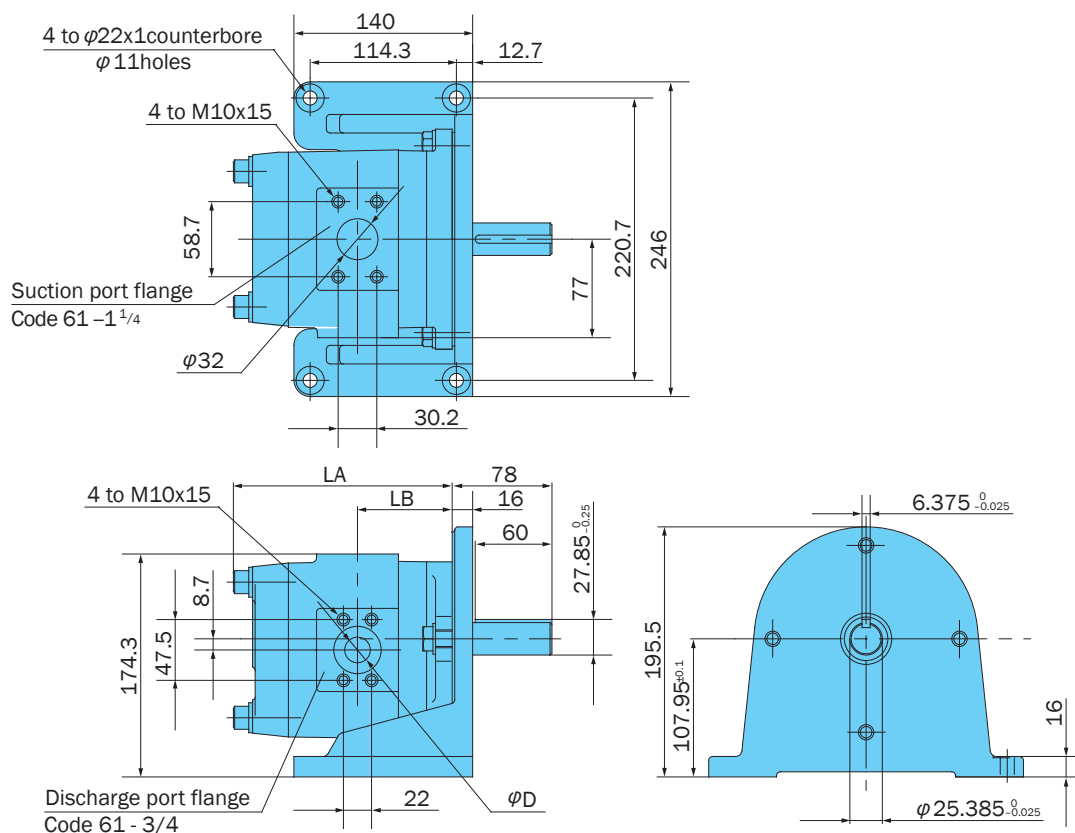
IPH-3B-*-20 (Flange Mounting, Clockwise Rotation) SAE B Mount 3/4 Shaft



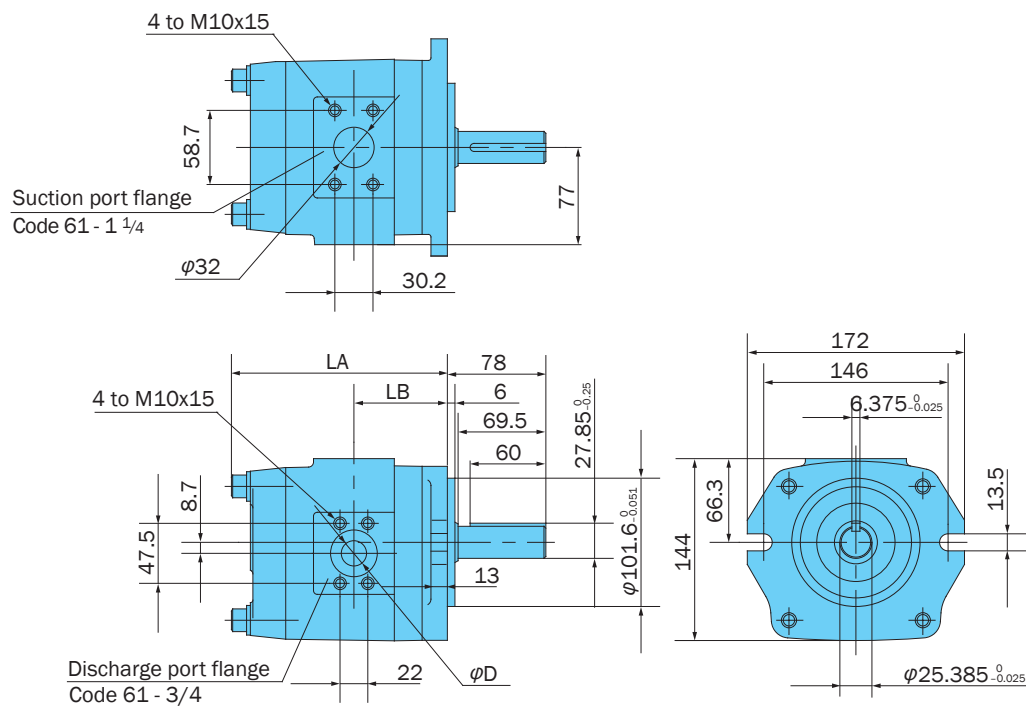
Model No.	Dimensions (mm)		
	LA	LB	ϕD
IPH-3*-10*-20	128.5	60.0	14
IPH-3*-13*-20	134.5	63.0	17
IPH-3*-16*-20	139.5	65.5	18

Note: IPH-3A (B)*-L-20 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-4A-*-20 (Foot Mounting, Clockwise Rotation)



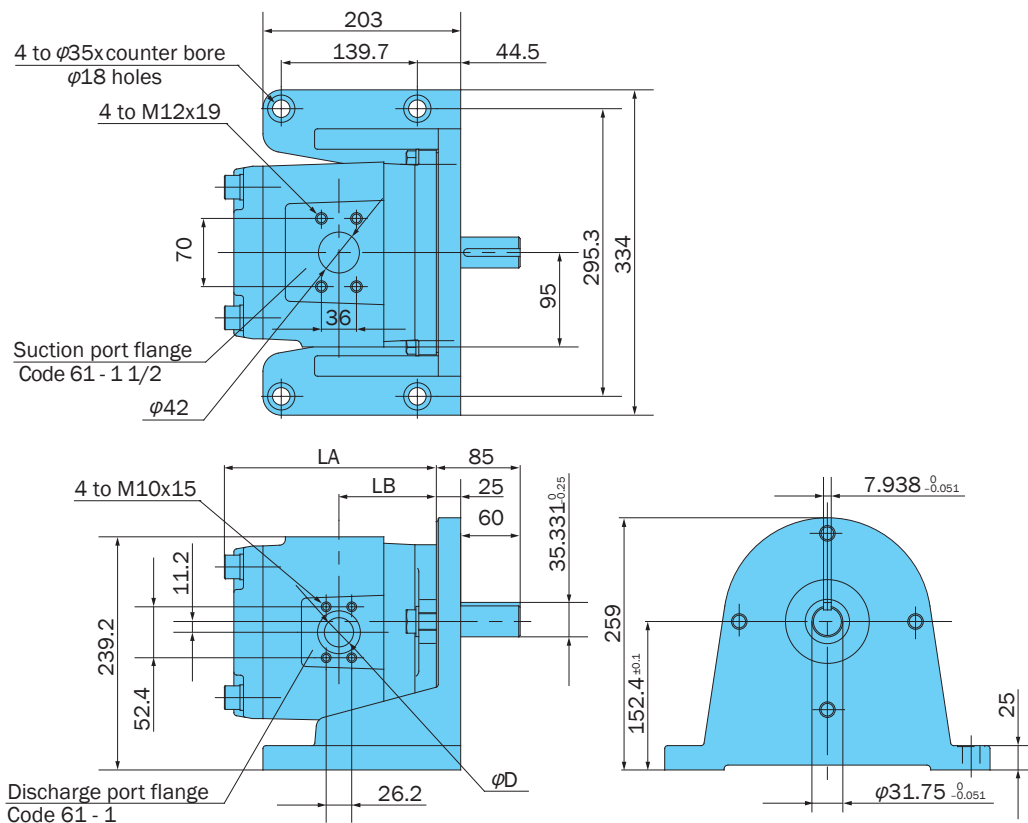
IPH-4B-*-20 (Flange Mounting, Clockwise Rotation) SAE BB Mount



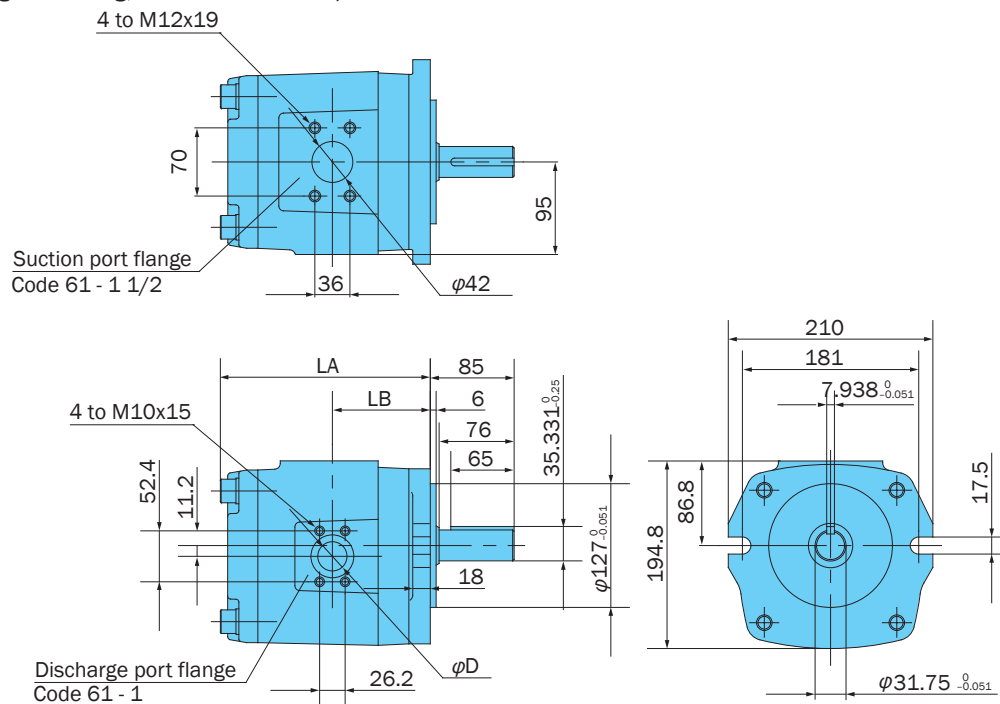
Model No.	Dimensions (mm)		
	LA	LB	ϕD
IPH-4*-20-*-20	164.5	71	18
IPH-4*-25-*-20	170.5	74	20
IPH-4*-32-*-20	178.5	78	24

Note: IPH-4A (B)-*-L-20 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-5A-*-21 (Foot Mounting, Clockwise Rotation)



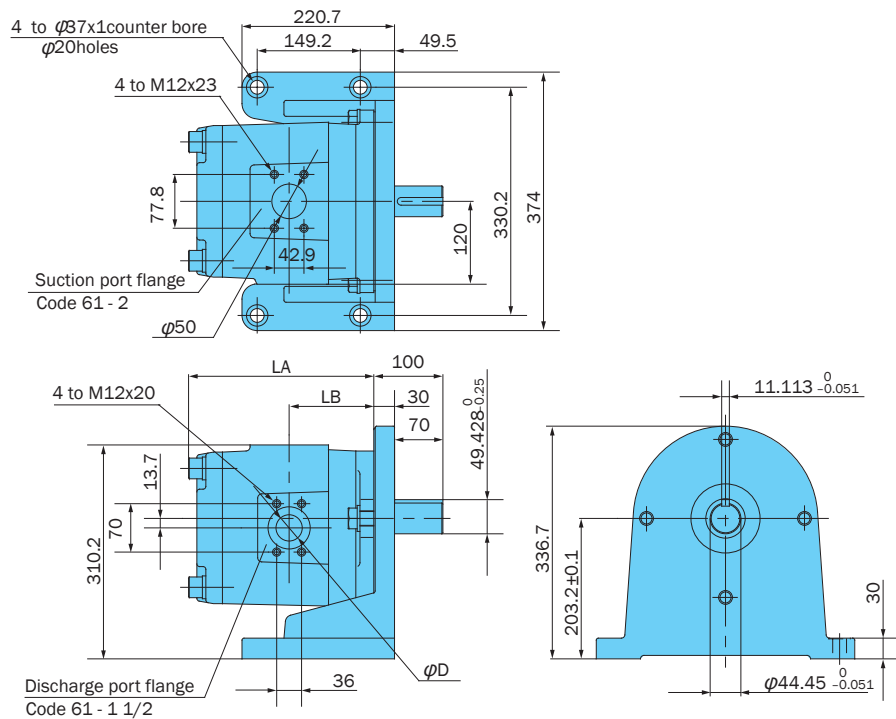
IPH-5B-*-11 (Flange Mounting, Clockwise Rotation) SAE C Mount



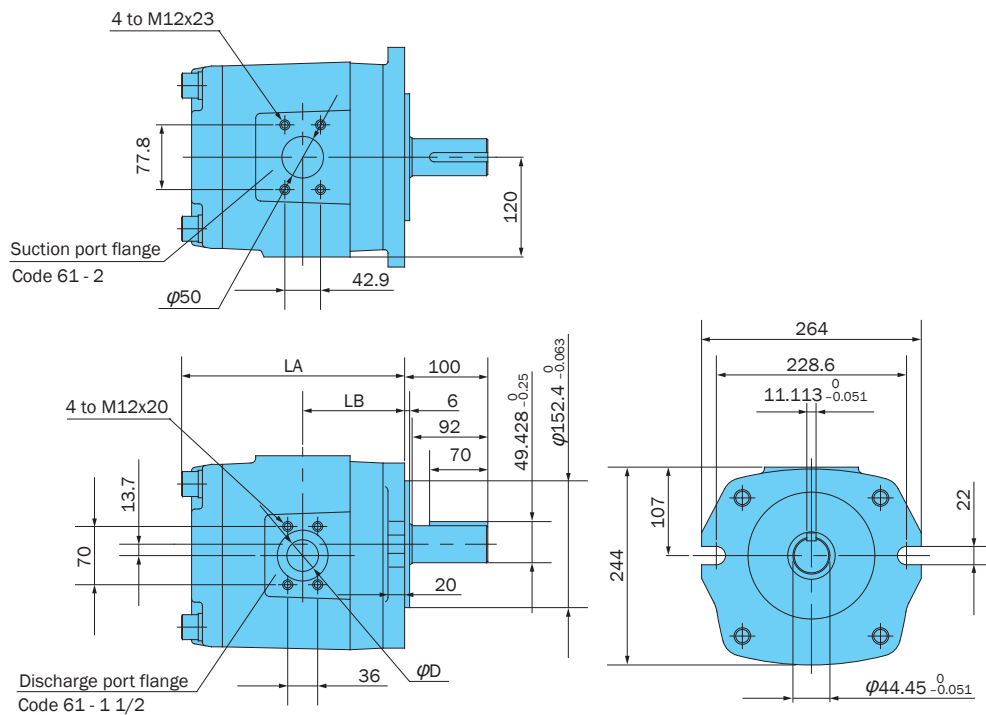
Model No.	Dimensions (mm)		
	LA	LB	ϕD
IPH-5*-40-*-21 (11)	201.5	91.0	24
IPH-5*-50-*-21 (11)	208.5	94.5	26
IPH-5*-64-*-21 (11)	218.5	99.5	28

Note: IPH-5A (B)-*-L-21 (11) (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-6A-*-21 (Foot Mounting, Clockwise Rotation)



IPH-6B-*-11 (Flange Mounting, Clockwise Rotation) SAE D Mount



Model No.	Dimensions (mm)		
	LA	LB	$\varnothing D$
IPH-6*- 80-*-21 (11)	241.5	111.5	32
IPH-6*-100-*-21 (11)	251.5	116.5	36
IPH-6*-125-*-21 (11)	263.5	122.5	38

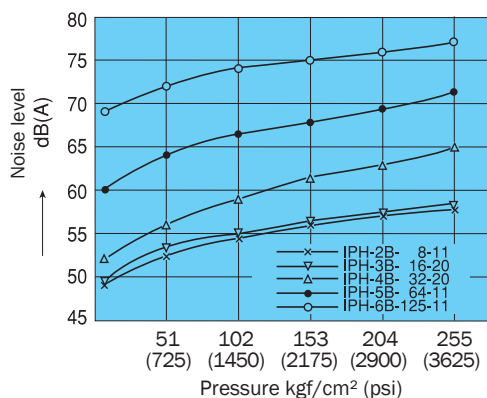
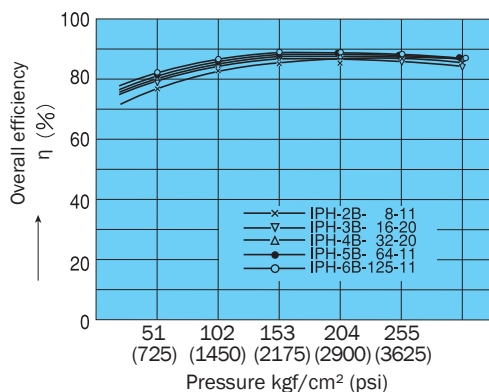
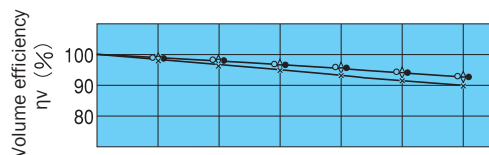
Note: IPH-6A (B)-*-L-21 (11) (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

Performance Curves

Revolution Speed 1200 rpm

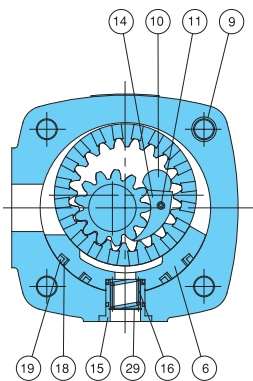
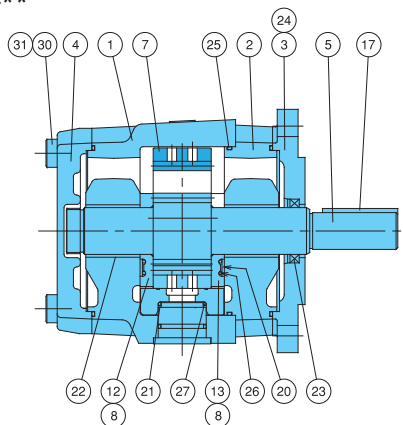
Operating Hydraulic Fluid Viscosity 46 centistokes

Representative Characteristics Under Above Conditions



Cross-sectional Drawing

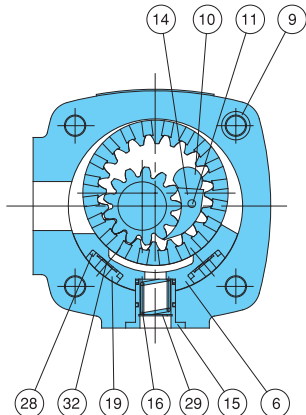
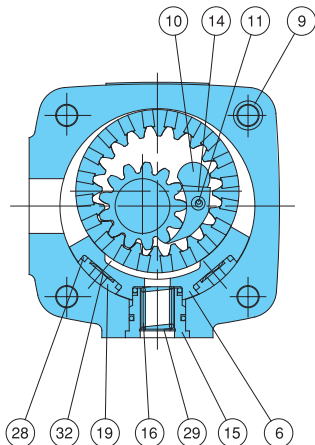
IPH-*B-***



Note: Drawings shown above are the IPH-5 and IPH-6.

The lower left cross-sectional drawing is the IPH-4, the radial seal #18 was removed and a wave washer was added.

The lower right cross-sectional drawing is the IPH-2 and IPH-3, the bushing #8 was removed, the spring pin #11 was replaced with a guide pin, and the radial seal #18 was removed and a wave washer #32 was added.



Part No. Part Name

1	Body -1
2	Body -2
3	Mounting
4	Rear cover
5	Pinion shaft
6	Radial piston
7	Internal gear
8	Bushing
9	Knock pin
10	Stopper pin
11	Spring pin (guide pin)
12	Axial plate -1
13	Axial plate -2
14	Feeler piece
15	Spring holder
16	Spring
17	Key
18	Radial seal
19	Radial backup ring
20	Axial backup ring
21	Backup ring
22	Bearing
23	Oil seal
24	Pin
25	O-ring
26	O-ring
27	O-ring
28	O-ring
29	Snap ring
30	Screw
31	Washer
32	Wave washer

*Note: See page C2 for Parts/Kit Numbers

IPH Series Seal Kit

Understanding Seal Kit
Model Numbers :

IHAS - 2 S * * - 10 (20, 30)**

Design Number (IPH3 : 20D, IPH4 : 30D)

Capacity Classification D35 to 125

Size 2, 3, 4, 5, 6

S: Shaft Side Single Pump or Double Pump

H: Head Side Double Pump

Indoor/Outdoor Use Sealing

IPH Series Seal Kit

Seal Kit Number	Applicable Pump Model No.	Component Part Numbers							
		18	Q'ty	19	Q'ty	20	Q'ty	21	Q'ty
		Radial Seal		Radial Backup Ring		Axial Backup Ring		Backup ring	
IHAS-2S2D35-10	IPH-2A(B)-3.5-11			IH34J-102D35-1A	2	IH34J-202000	2	IH34J-402D35	1
2S2005-10	5			102005-1A	2	"	2	402005	1
2S2D65-10	6.5			102D65-1A	2	"	2	402D65	1
2S2008-10	8			102008-1A	2	"	2	402008	1
IHAS-2S3010-20	IPH-3A(B)-10-20			IH34J-103010-1A	2	IH34J-203000	2	IH34J-403010	1
2S3013-20	13			103013-1A	2	"	2	403013	1
2S3016-20	16			103016-1A	2	"	2	403016	1
IHAS-2S4020-30	IPH-4A(B)-20-20			IH34J-104020-2A	2	IH34J-204000-1A	2	IH34J-404020	1
2S4025-30	25			104025-2A	2	"	2	404025	1
2S4032-30	32			104032-2A	2	"	2	404032	1
IHAS-2S5040-10	IPH-5A(B)-40-21(11)	IH33J-105040-1A	2	IH34J-105040-1A	2	IH34J-205000	2	IH34J-405040	1
2S5050-10	50	105050-1A	2	105050-1A	2	"	2	405050	1
2S5064-10	64	105064-1A	2	105064-1A	2	"	2	405064	1
IHAS-2S6080-10	IPH-6A(B)-80-21(11)	IH33J-106080-1A	2	IH34J-106080-1A	2	IH34J-206000	2	IH34J-406080	1
2S6100-10	100	106100-1A	2	106100-1A	2	"	2	406100	1
2S6125-10	125	106125-1A	2	106125-1A	2	"	2	406125	1

Seal Kit Number	Component Part Numbers								
	23	Q'ty	25	Q'ty	26	Q'ty	27	Q'ty	28
	Oil seal		O-ring		O-ring		O-ring		O-ring
IHAS-2S2D35-10	ISD-20328	1	R68 × 2	3	R23 × 2	2	R10 × 2	1	R10 × 2
2S2005-10	"	1	"	3	"	2	R12 × 2	1	R12 × 2
2S2D65-10	"	1	"	3	"	2	R14 × 2	1	R14 × 2
2S2008-10	"	1	"	3	"	2	R16 × 2	1	R16 × 2
IHAS-2S3010-20	ISD-25388	1	R86 × 2	3	R30 × 2	2	R15 × 2.5	1	R15 × 2.5
2S3013-20	"	1	"	3	"	2	R18 × 2.5	1	R18 × 2.5
2S3016-20	"	1	"	3	"	2	R20 × 2.5	1	R20 × 2.5
IHAS-2S4020-30	ISD-32458	1	R108 × 3	3	R38 × 2.5	2	R21 × 2.5	1	R21 × 2.5
2S4025-30	"	1	"	3	"	2	R23 × 3	1	R23 × 3
2S4032-30	"	1	"	3	"	2	R26 × 3	1	R26 × 3
IHAS-2S5040-10	ISD-40558	1	R140 × 3	3	R49 × 3	2	R26 × 3	1	
2S5050-10	"	1	"	3	"	2	R29 × 3.5	1	
2S5064-10	"	1	"	3	"	2	R33 × 3.5	1	
IHAS-2S6080-10	ISD-50659	1	R172 × 4	3	R60 × 3.5	2	R34 × 3.5	1	
2S6100-10	"	1	"	3	"	2	R38 × 4	1	
2S6125-10	"	1	"	3	"	2	R43 × 4	1	

Note: 1. Oil seals are manufactured by Nippon Oil Seal Industry Co. Ltd. (NOK).
2. O-rings are not available through retail sources. Consult your agent for more information.

IPH Series Pipe Flange Kit

Understanding Flange Kit Model Numbers :

The pipe flange kit combines the flanges, bolts, washers, and O-rings required for each type of pump into a single kit.

The component parts table shows the screw in type flange kit. In the case of the welded type flange, the flange part number is IH03J-200040 (1 of IH03J-100040 changes to 2). All other included parts are the same.

IHF - 3 - T - 20

Design Number
: 20 Design

T : Screw in Type
E : Welded Type

Pump Size

: Single Pump
2 to 6

: Double Pump
22 to 46

IPH Series Flange Kit

Note: O-ring 1B-* *

refers to JIS B2401-1B-* *

Screw in type Flange Kit model No.	Applicable Pump Model No.	Code 61	IN Flange							
		Size	Flange Part No.		Bolt		Washer		O-ring	
IHF-2-T-20	IPH-2A(B)-*-11	1/2"	IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1
IHF-3-T-20	IPH-3A(B)-*-20	1"	IH03J-100080	1	TH-10 × 50	4	WS-B-10	4	IB-G35	1
IHF-4-T-20	IPH-4A(B)-*-20	1 1/4"	IH03J-100100	1	TH-10 × 55	4	"	4	IB-G40	1
IHF-5-T-20	IPH-5A(B)-*-21(11)	1 1/2"	IH03J-100120	1	TH-12 × 55	4	WS-B-12	4	IB-G50	1
IHF-6-T-20	IPH-6A(B)-*-21(11)	2"	IH03J-100160	1	TH-12 × 60	4	"	4	IB-G60	1

Code 61	OUT Flange								Plug	
Size	Flange Part No.		Bolt		Washer		O-ring			
1/2"	IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1	TPHA-1/4	2
1/2"	IH03J-100040	1	TH- 8 × 45	4	"	4	IB-P22	1	"	2
3/4"	IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1	"	1
1"	IH03J-100080	1	TH-10 × 50	4	"	4	IB-G35	1	"	2
1 1/2"	IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	IB-G50	1	"	1

Note: 1. In the case of a double pump, the flange kit includes three flanges: one for the common IN port and two OUT port flanges. When using separate IN ports, use separate single pump flange kits, one each for the head side and the shaft side.

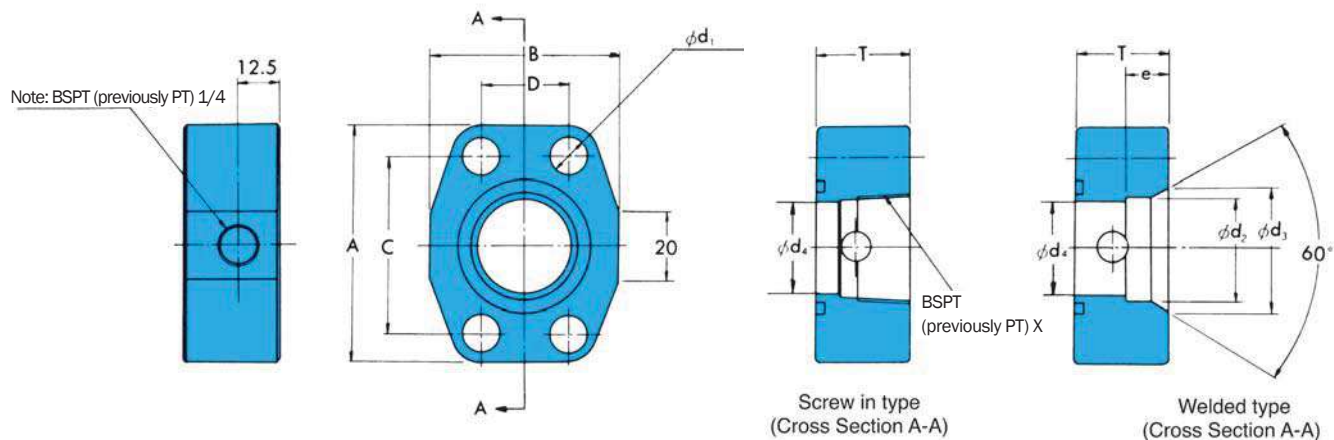
Note: 2. There is no common IN port in the case of the double pump models IPH-55, IPH-56, and IPH-66, or a single IN port is used.

Screw in type Flange Kit model No.	Applicable Pump Model No.	IN Flange							
		Flange Part No.		Bolt		Washer		O-ring	
IHF-22-T-20	IPH- 22B-*.-11	IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1
IHF-23-T-20	23	IH03J-100080	1	"	4	"	4	IB-G35	1
IHF-24-T-20	24	IH03J-100120	1	TH-12 × 55	4	WS-B-12	4	IB-G50	1
IHF-25-T-20	25	IH03J-100160	1	TH-12 × 60	4	"	4	IB-G60	1
IHF-26-T-20	26	IH03J-100200	1	TH-12 × 65	4	"	4	IB-G75	1
IHF-33-T-20	IPH- 33B-*.-11	IH03J-100100	1	TH-10 × 55	4	WS-B-10	4	IB-G40	1
IHF-34-T-20	34	IH03J-100120	1	TH-12 × 55	4	WS-B-12	4	IB-G50	1
IHF-35-T-20	35	IH03J-100160	1	TH-12 × 60	4	"	4	IB-G60	1
IHF-36-T-20	36	IH03J-100200	1	TH-12 × 60	4	"	4	IB-G75	1
IHF-44-T-20	IPH- 44B-*.-11	IH03J-100120	1	TH-12 × 55	4	"	4	IB-G50	1
IHF-45-T-20	45	IH03J-100200	1	TH-12 × 65	4	"	4	IB-G75	1
IHF-46-T-20	46	IH03J-100240	1	TH-16 × 75	4	WS-B-16	4	IB-G85	1

*IPH Numbers include both Inlet and Outlet Flange Kits

OUT Flange (Shaft Side)								OUT Flange (Head Side)								Plug	
Flange Part No.		Bolt		Washer		O-ring		Flange Part No.		Bolt		Washer		O-ring			
IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1	IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1	TPHA-1/4	3
IH03J-100040	1	”	4	”	4	IB-P22	1	”	1	”	4	”	4	”	1	”	3
IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1	”	1	”	4	”	4	”	1	”	3
IH03J-100080	1	”	4	”	4	IB-G35	1	”	1	”	4	”	4	”	1	”	2
IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	IB-G50	1	”	1	”	4	”	4	”	1	”	2
IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1	IH03J-100040	1	TH- 8 × 45	4	WS-B- 8	4	IB-P22	1	”	2
IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1	”	1	”	4	”	4	”	1	”	3
IH03J-100080	1	”	4	”	4	IB-G35	1	”	1	”	4	”	4	”	1	”	2
IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	IB-G50	1	”	1	”	4	”	4	”	1	”	2
IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1	IH03J-100060	1	TH-10 × 50	4	WS-B-10	4	IB-G30	1	”	3
IH03J-100080	1	”	4	”	4	IB-G35	1	”	1	”	4	”	4	”	1	”	2
IH03J-100120	1	TH-12 × 60	4	WS-B-12	4	IB-G50	1	”	1	”	4	”	4	”	1	”	2

Pipe Flange Installation Dimension Diagram



Screw in type

Pipe Flange Kit Part Number	SAE Standard Code 61	Nominal Diameter	Dimensions (mm)							Weight lbs
			A	B	C	D	T	ϕd_1	ϕd_4	
IH03J -100040	SAE J518b 1/2	1/2	54	46	38.1	17.5	33	9	12.7	.88
-100060	SAE J518b 3/4	3/4	65	52	47.5	22.0	33	11	20	1.3
-100080	SAE J518b 1	1	70	59	52.4	26.2	33	11	27	1.3
☆ -100100	SAE J518b 1 1/4	1 1/4	79	73	58.7	30.2	38	11	33	2.2
-100120	SAE J518b 1 1/2	1 1/2	94	83	70.0	36.0	38	13	37.5	3.0
☆ -100160	SAE J518b 2	2	102	97	77.8	42.9	38	13	50	3.7
☆ -100200	SAE J518b 2 1/2	2 1/2	114	109	88.9	50.8	43	13	60	4.6
☆ -100240	SAE J518b 3	3	135	131	106.4	61.9	48	17.5	71	7.2

Welded Type

Pipe Flange Kit Part Number	SAE Standard Code 61	Pipe Diameter	Dimensions (mm)										Weight lbs
			A	B	C	D	T	e	ϕd_1	ϕd_2	ϕd_3	ϕd_4	
IH03J -200040	SAE J518b 1/2	1/2	54	46	38.1	17.5	33	11	9	22.2	27	12.7	.88
-200060	SAE J518b 3/4	3/4	65	52	47.5	22.0	33	12	11	27.7	35	20	1.3
-200080	SAE J518b 1	1	70	59	52.4	26.2	33	14	11	34.5	42	27	1.3
☆ -200100	SAE J518b 1 1/4	1 1/4	79	73	58.7	30.2	38	16	11	43.2	48	33	2.2
-200120	SAE J518b 1 1/2	1 1/2	94	83	70.0	36.0	38	18	13	49.1	58	37.5	3.0
☆ -200160	SAE J518b 2	2	102	97	77.8	42.9	38	19	13	61.1	68	50	3.7
☆ -200200	SAE J518b 2 1/2	2 1/2	114	109	88.9	50.8	43	22	13	77.1	82	60	4.6
☆ -200240	SAE J518b 3	3	135	131	106.4	61.9	48	25	17.5	90.0	97	71	7.2

Recommended Tightening Torque for Flange Installation Bolts

For aluminum body

Mounting bolt	Tightening Torque ft/lbs
M8	14 to 17
M10	36 to 43
M12	65 to 83

For cast body (shared IN port)

Mounting bolt	Tightening Torque ft/lbs
M10	36 to 47
M12	64 to 82
M16	158 to 202

Note: There is no BSPT (previously PT) 1/4 tap for the above flange numbers (exclusively for suction port use) marked with a star (☆).

IPH Series Pipe Flange Kit

Understanding Foot Mounting Kit Numbers:

When only the mounting feet are required for a single pump or double pump, pump mounting bolts, washers and other parts are sold together as the Foot Mounting Kit.

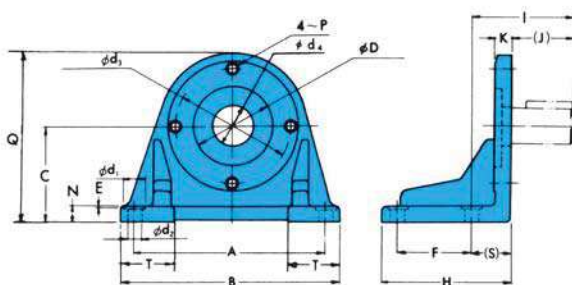
IHM - 2 - 10

Design Number

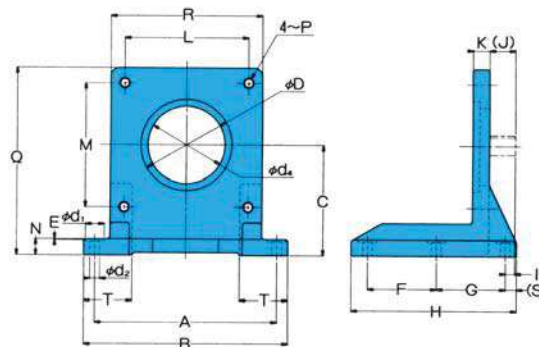
Pump Size: Single Pump 2 to 6
: Double Pump 22 to 66

IPH Series Foot Mounting Kit

Foot Mounting Installation Measurement Chart SAE-2BOLT-MOUNTING



SAE-4BOLT-MOUNTING



SAE-2BOLT-MOUNTING

Foot Mounting Kit Model No.	Applicable Pump Model No.		Accessories				Dimensions (mm)					
	SINGLE PUMP	DOUBLE PUMP	Bolt	Q'ty	Washer	Q'ty	A	B	C	E	F	H
IHM-2-10	IPH-2	—	TB-10 × 30	2	WP-10	2	127	152.5	69.8	1	50.8	96
IHM-4-10	IPH-3	—	TB-12 × 30	2	WG-12	2	220.7	246	107.95	1	114.3	140
IHM-4-10	IPH-4	—	TB-12 × 30	2	WG-12	2	220.7	246	107.95	1	114.3	140
IHM-22-10		IPH-22	TB-10 × 30	2	WP-10	2	171.45	204	107.95	1	95.25	150
IHM-44-10		IPH23, IPH-33	TB-12 × 30	2	WG-12	2	235	267	139.7	1	127	193
IHM-44-10		IPH-24, IPH-34, IPH-44	TB-12 × 30	2	WG-12	2	235	267	139.7	1	127	193
IHM-45-10	IPH-5	IPH-25, IPH-35, IPH-45	TB-16 × 40	2	WP-16	2	295.3	334	152.4	1	139.7	203
IHM-46-10	IPH-6	IPH-26, IPH-36, IPH-46	TB-20 × 50	2	WP-20	2	330.2	374	203.2	1	149.2	220.7

Foot Mounting Kit Model No.	Dimensions (mm)													Weight lbs
	I	(J)	K	N	P	Q	(S)	T	φD	φd ₁	φd ₂	φd ₃	φd ₄	
IHM-2-10	74	41.5	17.5	13	M10	135	32.5	36.5	82.55	22	11	106.4	50	4.4
IHM-4-10	61.7	49	16	16	M12	195.5	12.7	53	101.6	22	11	146	40	12.1
IHM-4-10	74.7	62	16	16	M12	195.5	12.7	53	101.6	22	11	146	40	12.1
IHM-22-10	73.5	41	18	18	M10	180	32.5	50	82.55	22	11	106.4	40	14.3
IHM-44-10	89.5	45	20	20	M12	232	44.5	57.5	101.6	22	14	146	40	26.4
IHM-44-10	102.5	58	20	20	M12	232	44.5	57.5	101.6	22	14	146	40	26.4
IHM-45-10	104.5	60	25	25	M16	259	44.5	61	127	35	18	181	86	29.7
IHM-46-10	119.5	70	30	30	M20	337	49.5	64	152.4	37	20	228.6	100	48.5

*IHM-2-10, IHM-4-10, and IHM-45-10 are the same as PVS pump foot mounting PSM-101000, PSM102000, and PSM103000 respectively.

SAE-4BOLT-MOUNTING

Foot Mounting Kit Model No.	Applicable Pump Model No.	Accessories				Dimensions (mm)							
	DOUBLE PUMP	Bolt	Q'ty	Washer	Q'ty	A	B	C	E	F	G	H	I
IHM-55-10	IPH-55	TH-20 × 50	4	WS-B-20	4	330	370	200	1	125	125	300	17
IHM-66-10	IPH56, IPH-66	TH-24 × 60	4	WS-B-24	4	380	430	260	1	140	140	340	17

Foot Mounting Kit Model No.	Dimensions (mm)														Weight lbs
	(J)	K	L	M	N	P	Q	R	(S)	T	φ D	φ d ₁	φ d ₂	φ d ₄	
IHM-55-10	47	30	224.6	224.6	30	M20	340	275	20	90	165.1	34	18	140	70.5
IHM-66-10	52	40	247.5	247.5	40	M24	415	310	25	105	177.8	34	18	150	105.8

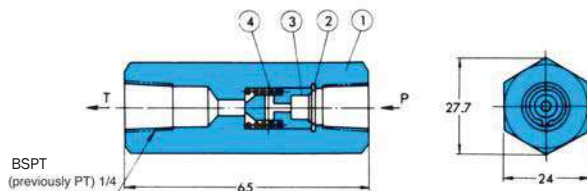
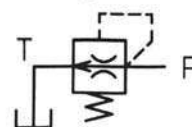
Air Bleed-off Valve

Equipping an air bleed-off valve on the pump's discharge side helps to simplify air bleeding during test operation.

Specifications

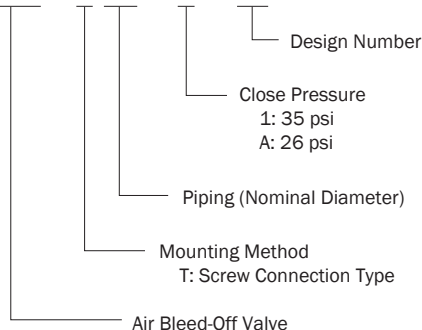
Air inside the pump and the suction pipe is exhausted rapidly when the pump is started up.
When discharge pressure reaches 29 psi or greater after the pump intakes oil, a valve closes to prevent oil from leaking.
Maximum operating pressure: 4350 psi.
Provide piping to ensure that the tank port is under the oil level surface.

JIS symbol



Understanding Model Numbers

CAB - T 02 - 1 - 11



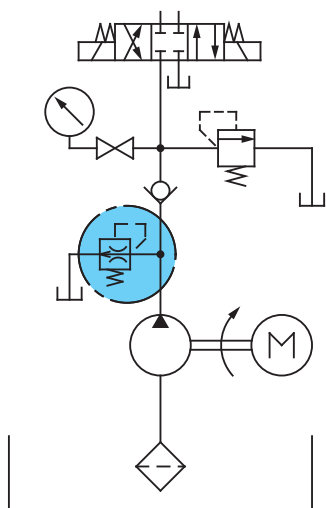
Part No.	Part Name	Q'ty
1	Valve body	1
2	Snap ring	1
3	Valve	1
4	Spring	1

Note: 1) If chattering occurs in a circuit when CAB-T02-1-11 is used, use CAB-T02-A-11 instead.
2) If chattering occurs in a circuit when CAB-T02-A-11 is used, use of a CAB air bleed-off valve is not required.

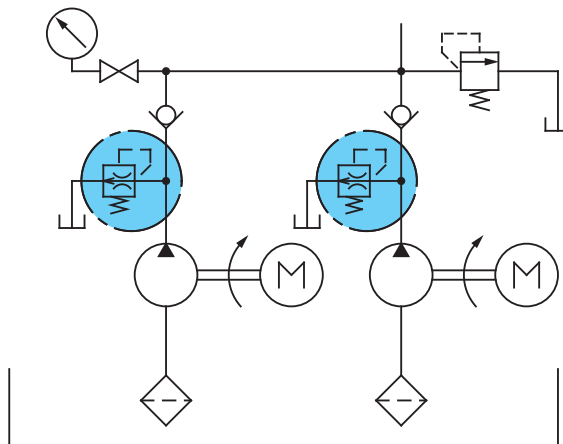
Application Examples

Example of Circuits that Require an Air Bleed-off Valve:

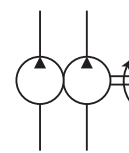
- 1) When using a Type 2 or Type 3 check valve (Sample Circuit A)
- 2) When unload circuit function cannot be achieved (Sample Circuit A)
- 3) When the discharge sides of multiple pumps run together (Sample Circuit B)



Circuit Diagram A



Circuit Diagram B



IPH Series Double IP Pump

.21 to 7.68 in³/rev
4350 psi

All the types in this new design (11D) series are installation compatible with the previous design (10D). Note, however, that there is no longer compatibility for some of the seal components between the IPH-3 and IPH-4 sizes and the 3 and 4 sizes.

Features

Configured with the high-pressure, low-noise IPH Series and IP pumps, these double pumps greatly expand

the range of application for the IP pump.
A wide selection of pump combinations

provides options that are perfect for just about any type of application imaginable.

Specifications

Model No.	Discharge Rate (1200min ⁻¹ No-load)		Revolution Speed		Operating Pressure MPa (psi)	Required Power at 1200min ⁻¹ , 3045 psi hp
	Vent Side gpm	Shaft Side gpm	Min. min ⁻¹	Max. min ⁻¹		
IPH-22B-*(*)-11 IPH-23B IPH-24B IPH-25B IPH-26B	1.1 to 2.5	4.3 to 9.8 12.2 to 18.9 24.8 to 38.7 48.9 to 76.6 97.5 to 151.0	600	2000	Rated: 21 (3045) Max: 30 (4350)	10.7 15.5 26.1 46.2 85.8
IPH-33B IPH-34B IPH-35B IPH-36B		12.2 to 18.9 24.8 to 38.7 48.9 to 76.6 97.5 to 151.0				20.5 30.9 51.0 90.7
IPH-44B IPH-45B IPH-46B		24.8 to 38.7 48.9 to 76.6 97.5 to 151.0				41.5 61.6 101.3
IPH-55B IPH-56B		48.9 to 76.6 97.5 to 151.0				81.8 121.4
IPH-66B		97.5 to 151.0				159.9
	6.5 to 10.2		500			
	12.9 to 20.2		400			
	25.7 to 39.8	97.5 to 151.0	300			

Note:

1. Maximum Pressure: Maximum pressure limit when there are frequent pressure changes. However, maximum pressure is the same as rated pressure when load is applied to the head side and shaft side simultaneously.
2. Suction Pressure: 4.3 psi
3. Avoid installation with the suction port towards the bottom of the pump. If the revolution speed will exceed 1800mm-1, provide separate piping for shaft side and head size IN ports.
4. Specify using the model number format shown below when pipe flange is required.

5. Working pressure is continuous operating pressure when the same pressure exists on the head side and shaft side.
6. Individual pump performance on the head side and shaft side is the same as that of the single pumps. Required power is the sum of the power required by each of the two pumps.
7. The "Required Power at 1200min-1, 3045 psi (hp)" column in the above table are based on combinations that provide the maximum capacity for each model number, when pressure at both the head side and shaft side is 3045 psi. Examples

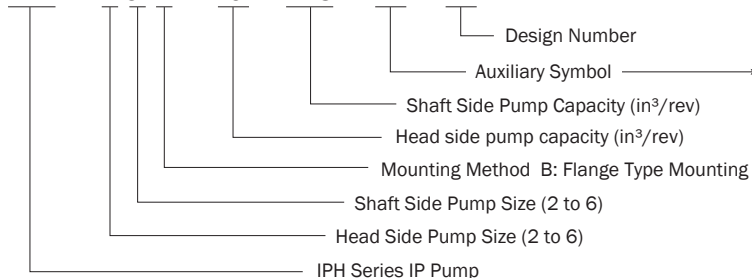
combinations that provide "the maximum capacity for each model number" are IPH-22B-8-8-11 for IPH-22b, and IPH-46B-32- 125-11 for IPH-46B.

• Handling

1. Handling is in accordance with procedures for the IPH pump. See page C-1 for more information.

Understanding Model Numbers

IPH - 4 6 B - 20 - 125 - LT - 11



- None: Clockwise (viewed from shaft end)
- L : Counterclockwise (viewed from shaft end)
- T : Includes Screw IN Flange Kit (for shared IN port)
- TT : Includes Screw IN Flange Kit (for individual IN port)
- E : Includes Welded Flange Kit (for shared IN port)
- EE : Includes Welded Flange Kit (for individual IN port)

Auxiliary symbol must be provided in alphabetic order.

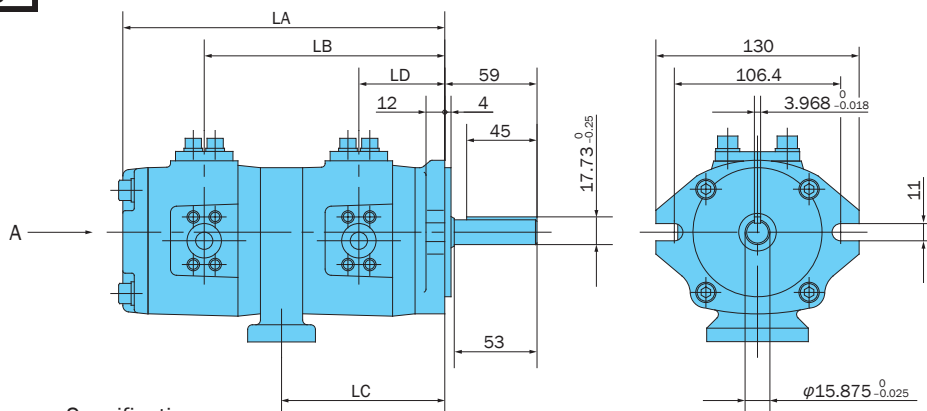
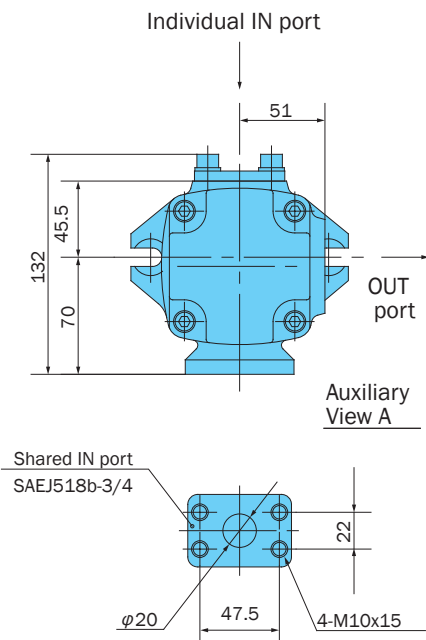
- IPH Series Double IP Pump Foot Mounting Kit
See the IPH Series (single) IP pump section in page C-12.

- IPH Series Double IP Pump Pipe Flange
See the IPH Series (single) IP pump section in page C-10.

Installation Dimension Drawings

IPH-22B-**-11

(Flange Mounting, Clockwise Rotation)



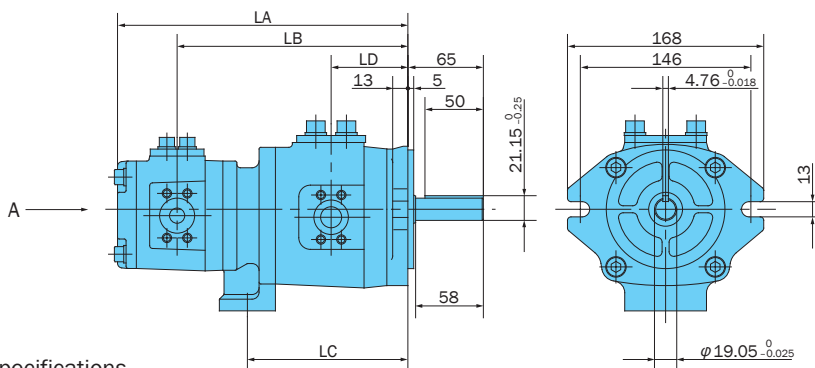
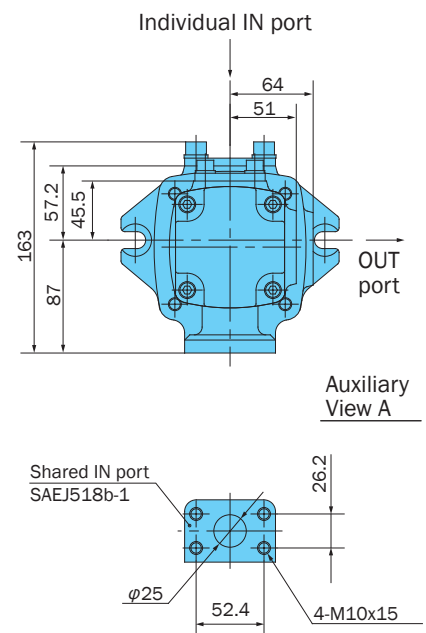
Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-22B-3.5-3.5-11	.21	.21	12.7	211.5	160	105.5	51
-5		.31	13.0	216.5	165	110.5	53.5
-6.5		.39	13.2	220.5	169	114.5	55
-8		.49	13.6	225.5	174	119.5	58
IPH-22B-5-5-11	.31	.31	13.2	221.5	167.5	110.5	53.5
-6.5		.39	13.4	225.5	171.5	114.5	55
-8		.49	13.8	230.5	176.5	119.5	58
IPH-22B-6.5-6.5-11	.39	.39	13.6	229.5	173.5	114.5	55
-8		.49	14.1	234.5	178.5	119.5	58
IPH-22B-8-8-11	.49	.49	14.5	239.5	181	119.5	58

Note: Dimensions shown in this diagram are for a single pump.

IPH-23B-**-11

(Flange Mounting, Clockwise Rotation)

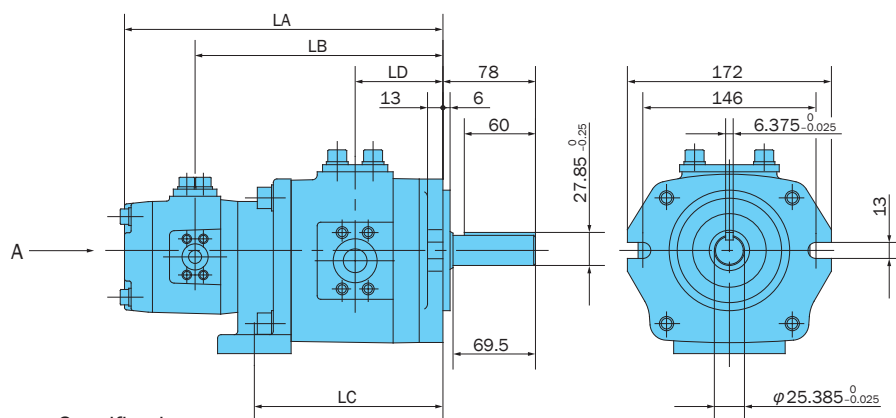
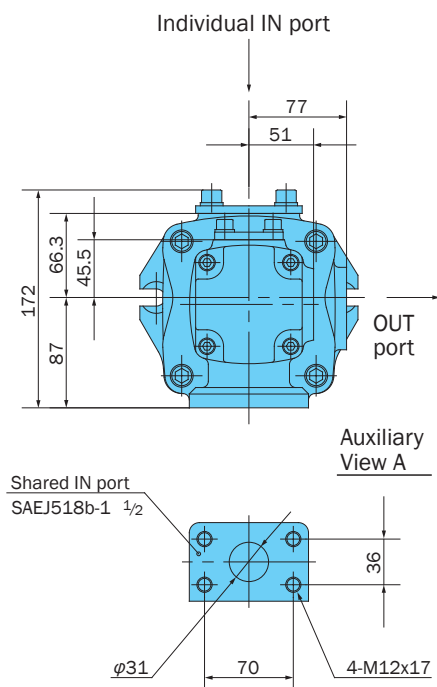


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-23B-3.5-10-11	.21	.62	18.0	230.5	179	126	60
-13		.81	18.5	236.5	185	132	63
-16		.96	19.1	241.5	190	137	65.5
IPH-23B-5-10-11	.31	.62	18.3	235.5	181.5	126	60
-13		.81	18.7	241.5	187.5	132	63
-16		.96	19.4	246.5	192.5	137	65.5
IPH-23B-6.5-10-11	.39	.62	18.5	239.5	183.5	126	60
-13		.81	18.9	245.5	189.5	132	63
-16		.96	19.6	250.5	194.5	137	65.5
IPH-23B-8-10-11	.49	.62	18.9	244.5	186	126	60
-13		.81	19.4	250.5	192	132	63
-16		.96	20.0	255.5	197	137	65.5

Note: IPH-22B (23B)-**-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-24B-*-11
(Flange Mounting, Clockwise Rotation)

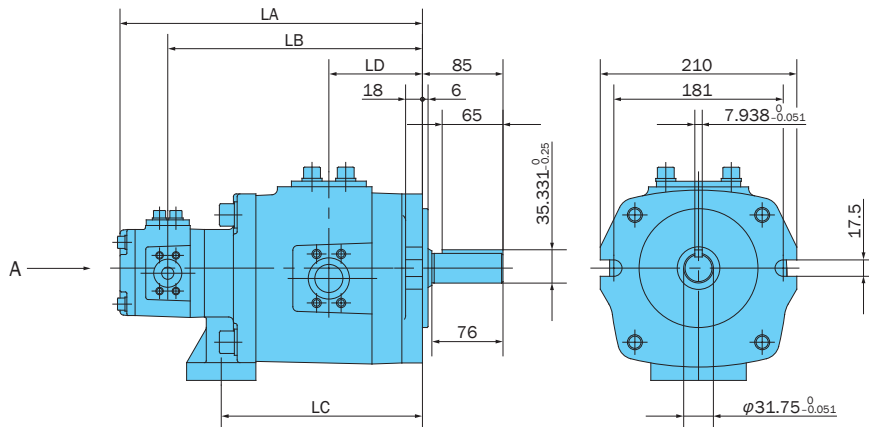
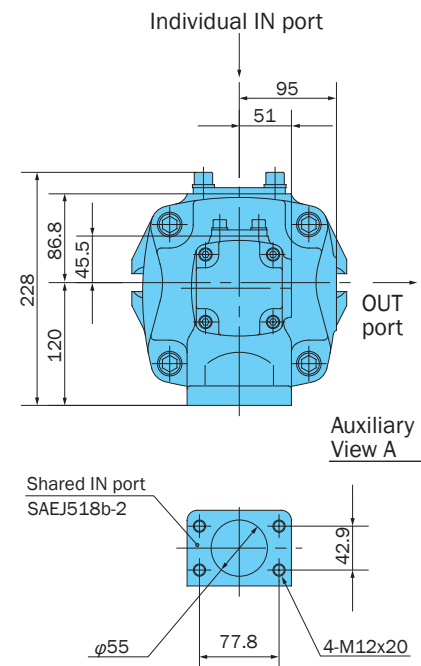


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-24B-3.5-20-11	.21	1.26	28.2	250.5	199	153	71
-25		1.56	19.3	256.5	205	159	74
-32		1.97	30.4	264.5	213	167	78
IPH-24B-5-20-11	.31	1.26	28.4	255.5	201.5	153	71
-25		1.56	29.5	261.5	207.5	159	74
-32		1.97	30.6	269.5	215.5	167	78
IPH-24B-6.5-20-11	.39	1.26	28.6	259.5	203.5	153	71
-25		1.56	29.7	265.5	209.5	159	74
-32		1.97	30.8	273.5	217.5	167	78
IPH-24B-8-20-11	.49	1.26	29.1	264.5	206	153	71
-25		1.56	30.2	270.5	212	159	74
-32		1.97	31.3	278.5	220	167	78

Note: Dimensions shown in this diagram are for a single pump.

IPH-25B-*-11
(Flange Mounting, Clockwise Rotation)

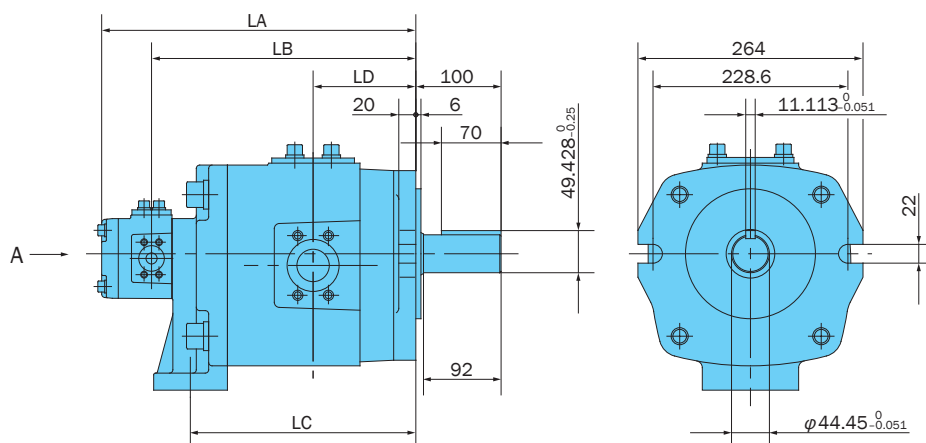
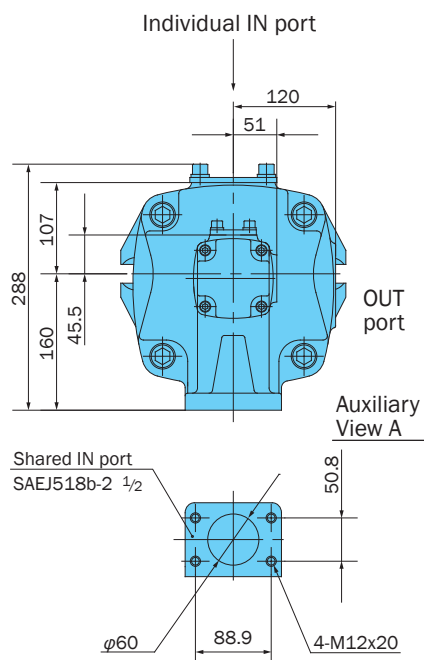


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-25B-3.5-40-11	.21	2.48	53.1	298.5	247	197	91
-50		3.06	55.3	305.5	254	204	94.5
-64		3.89	57.5	315.5	264	214	99.5
IPH-25B-5-40-11	.31	2.48	53.3	303.5	249.5	197	91
-50		3.06	55.5	310.5	256.5	204	94.5
-64		3.89	57.7	320.5	266.5	214	99.5
IPH-25B-6.5-40-11	.39	2.48	53.5	307.5	251.5	197	91
-50		3.06	55.7	314.5	258.5	204	94.5
-64		3.89	57.9	324.5	268.5	214	99.5
IPH-25B-8-40-11	.49	2.48	54.0	312.5	254	197	91
-50		3.06	56.2	319.5	261	204	94.5
-64		3.89	58.4	329.5	271	214	99.5

Note: IPH-24B (25B)-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-26B-*-11
(Flange Mounting, Clockwise Rotation)

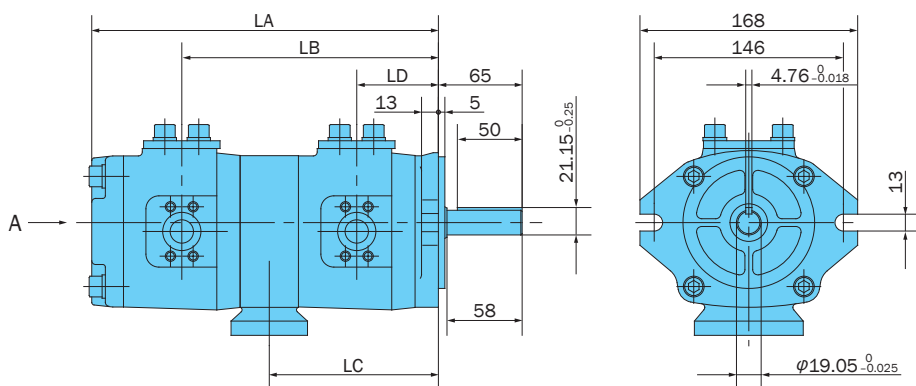
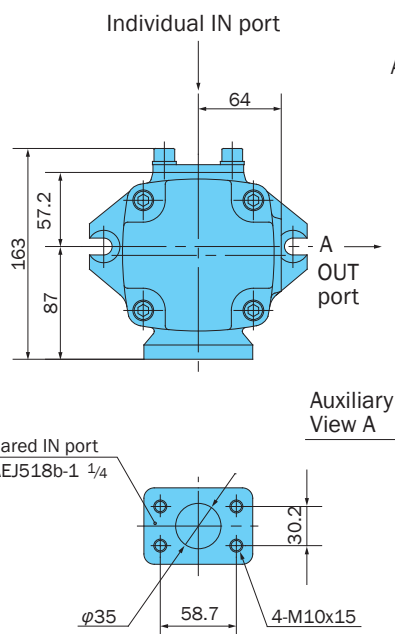


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-26B-3.5 - 80-11	.21	4.96	101	345.5	294	240	111.5
-100		6.19	105	355.5	304	250	116.5
-125		7.68	110	367.5	316	262	122.5
IPH-26B-5 - 80-11	.31	4.96	101	350.5	296.5	240	111.5
-100		6.19	105	360.5	306.5	250	116.5
-125		7.68	110	372.5	318.5	262	122.5
IPH-26B-6.5 - 80-11	.39	4.96	101	354.5	298.5	240	111.5
-100		6.19	106	364.5	308.5	250	116.5
-125		7.68	110	376.5	320.5	262	122.5
IPH-26B-8 - 80-11	.49	4.96	102	357	301	240	111.5
-100		6.19	106	367	311	250	116.5
-125		7.68	110	379	323	262	122.5

Note: Dimensions shown in this diagram are for a single pump.

IPH-33B-*-11
(Flange Mounting, Clockwise Rotation)

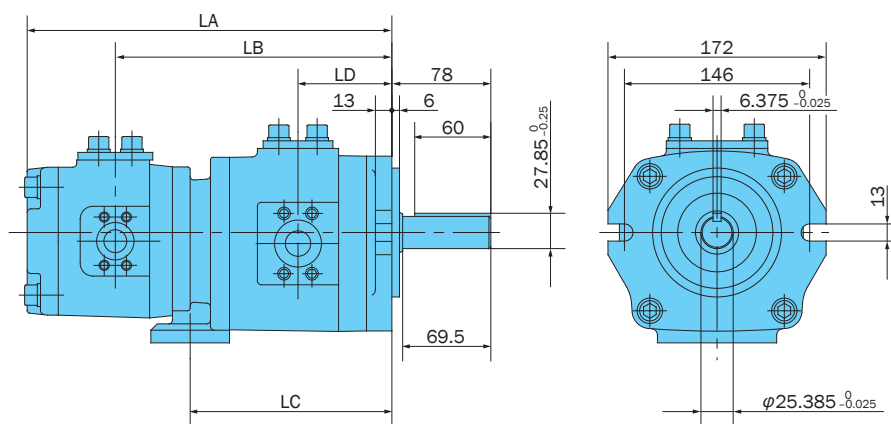
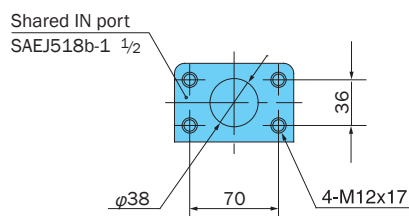
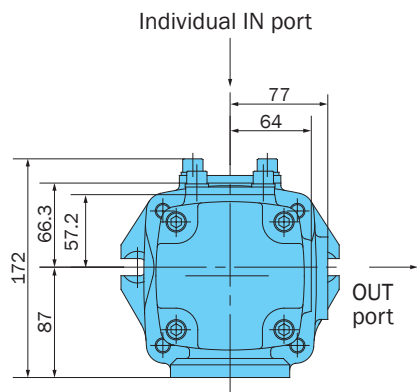


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-33B-10 -10-11	.62	.62	22.7	255.5	189	124.5	60
-13		.81	23.1	261.5	195	130.5	63
-16		.96	23.8	266.5	200	135.5	65.5
IPH-33B-13 -13-11	.81	.81	23.1	267.5	198	130.5	63
-16		.96	24.2	272.5	203	135.5	65.5
IPH-33B-16 -16-11	.96	.96	24.9	277.5	205.5	135.5	65.5

Note: IPH-26B (33B)-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-34B-*-11
(Flange Mounting, Clockwise Rotation)

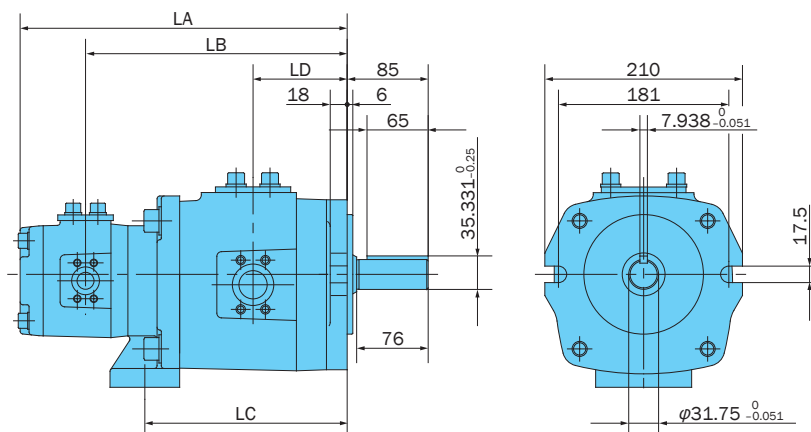
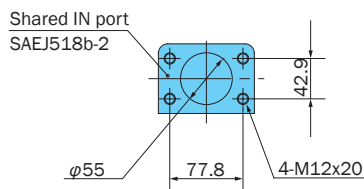
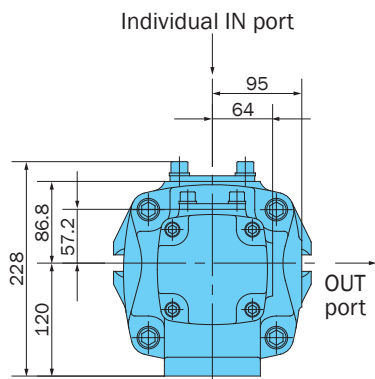


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-34B-10 -20-11	.62	1.26	32.8	272	209	153	71
-25		1.56	33.9	278	215	159	74
-32		1.97	35.0	286	223	167	78
IPH-34B-13 -20-11	.81	1.26	33.2	278	212	153	71
-25		1.56	34.3	284	218	159	74
-32		1.97	35.5	292	226	167	78
IPH-34B-16 -20-11	.96	1.26	33.9	283	214.5	153	71
-25		1.56	35.0	289	220.5	159	74
-32		1.97	36.1	297	228.5	167	78

Note: Dimensions shown in this diagram are for a single pump.

IPH-35B-*-11
(Flange Mounting, Clockwise Rotation)

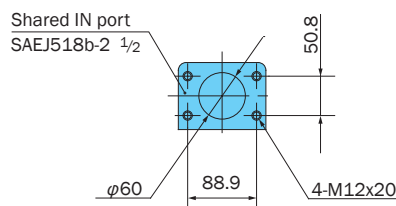
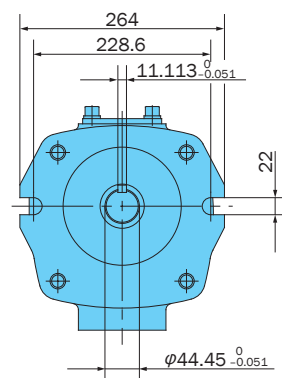
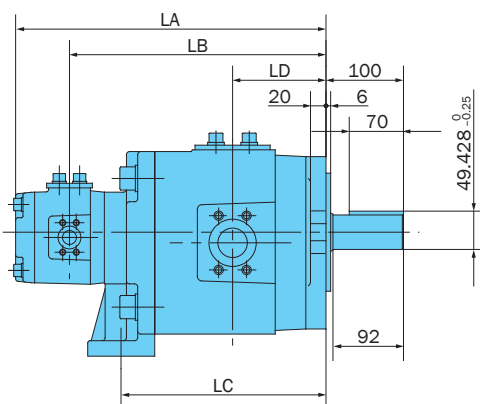
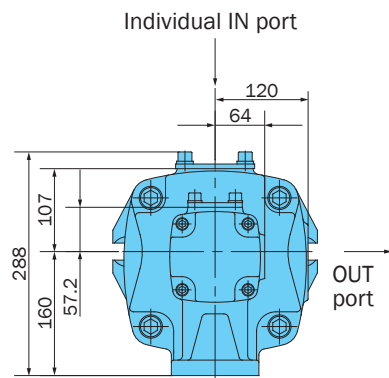


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-35B-10 -40-11	.62	2.48	58.2	323.5	257	197	91
-50		3.06	60.4	330.5	264	204	94.5
-64		3.89	62.6	340.5	274	214	99.5
IPH-35B-13 -40-11	.81	2.48	58.6	329.5	260	197	91
-50		3.06	60.8	336.5	267	204	94.5
-64		3.89	63.0	346.5	277	214	99.5
IPH-35B-16 -40-11	.96	2.48	59.3	334.5	262.5	197	91
-50		3.06	61.5	341.5	269.5	204	94.5
-64		3.89	62.7	351.5	279.5	214	99.5

Note: IPH-34B (35B)-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-36B-*-11
(Flange Mounting, Clockwise Rotation)

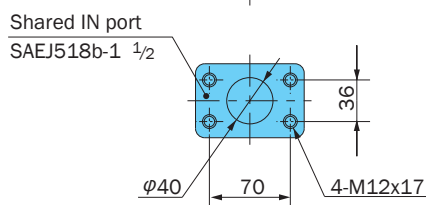
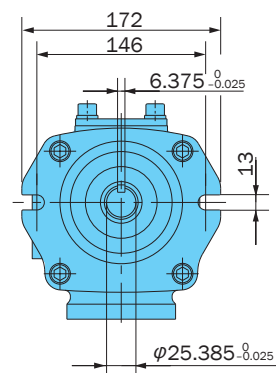
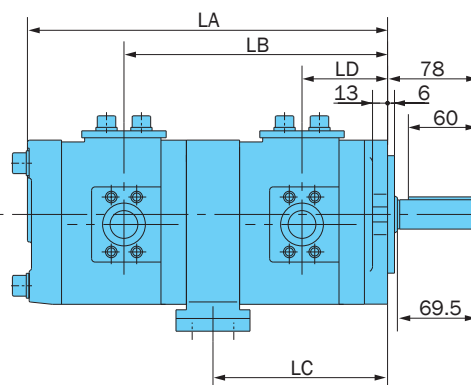
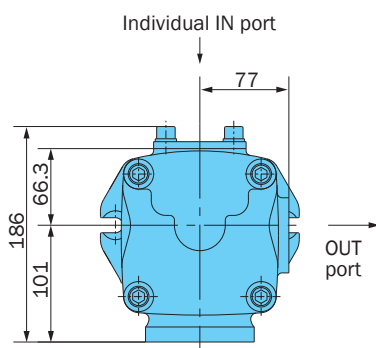


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-36B-10 - 80-11	.62	4.96	105	370.5	304	240	111.5
-100		6.19	110	380.5	314	250	116.5
-125		7.68	114	392.5	326	262	122.5
IPH-36B-13 - 80-11	.81	4.96	106	376.5	307	240	111.5
-100		6.19	110	386.5	317	250	116.5
-125		7.68	115	398.5	329	262	122.5
IPH-36B-16 - 80-11	.96	4.96	106	381.5	309.5	240	111.5
-100		6.19	111	391.5	319.5	250	116.5
-125		7.68	115	403.5	331.5	262	122.5

Note) Dimensions shown in this diagram are for a single pump.

IPH-44B-*-11
(Flange Mounting, Clockwise Rotation)

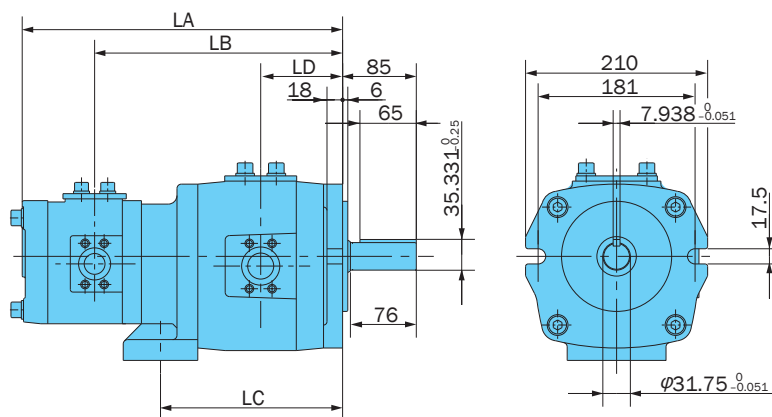
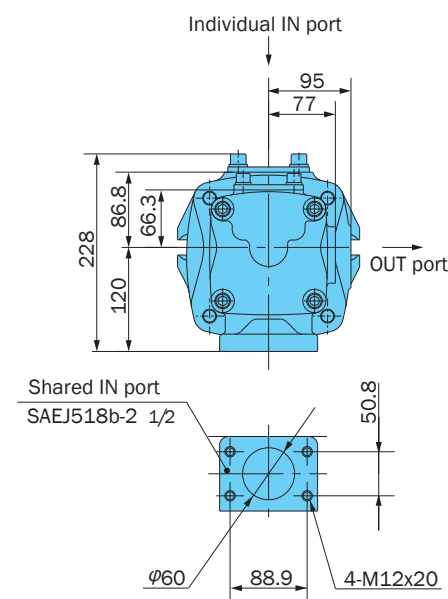


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-44B-20 -20-11	1.26	1.26	42.9	307	219	145	71
-25		1.56	44.1	313	225	151	74
-32		1.97	45.2	321	233	159	78
IPH-44B-25 -25-11	1.56	1.56	45.2	319	228	151	74
-32		1.97	46.3	327	236	159	78
IPH-44B-32 -32-11	1.97	1.97	47.4	335	240	159	78

Note: IPH-36B (44B)-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-45B--11**
(Flange Mounting, Clockwise Rotation)

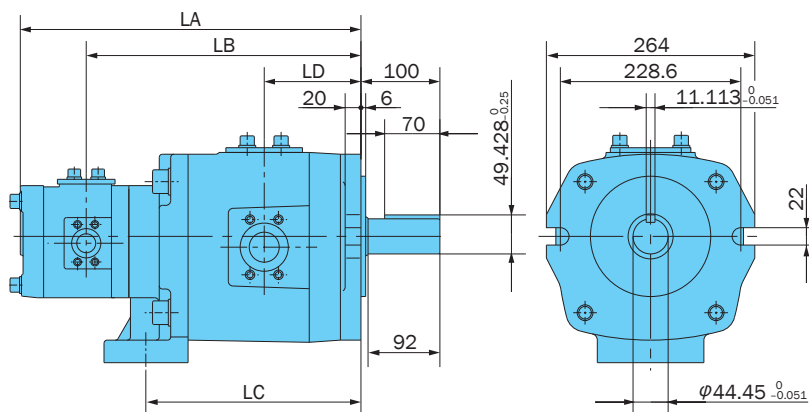
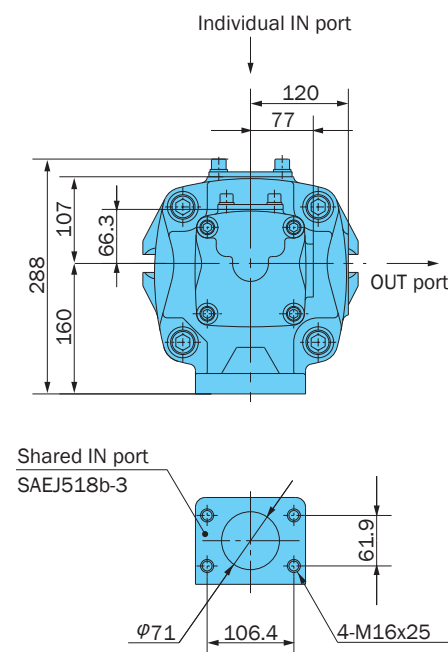


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-45B-20 -40-11	1.26	2.48	66.3	357	276	203	91
-50		3.06	68.5	364	283	210	94.5
-64		3.89	70.7	374	293	220	99.5
IPH-45B-25 -40-11	1.56	2.48	67.4	363	279	203	91
-50		3.06	69.6	370	286	210	94.5
-64		3.89	71.3	380	296	220	99.5
IPH-45B-32 -40-11	1.97	2.48	68.5	371	283	203	91
-50		3.06	70.7	378	290	210	94.5
-64		3.89	72.9	388	300	220	99.5

Note: Dimensions shown in this diagram are for a single pump.

IPH-46B--11**
(Flange Mounting, Clockwise Rotation)



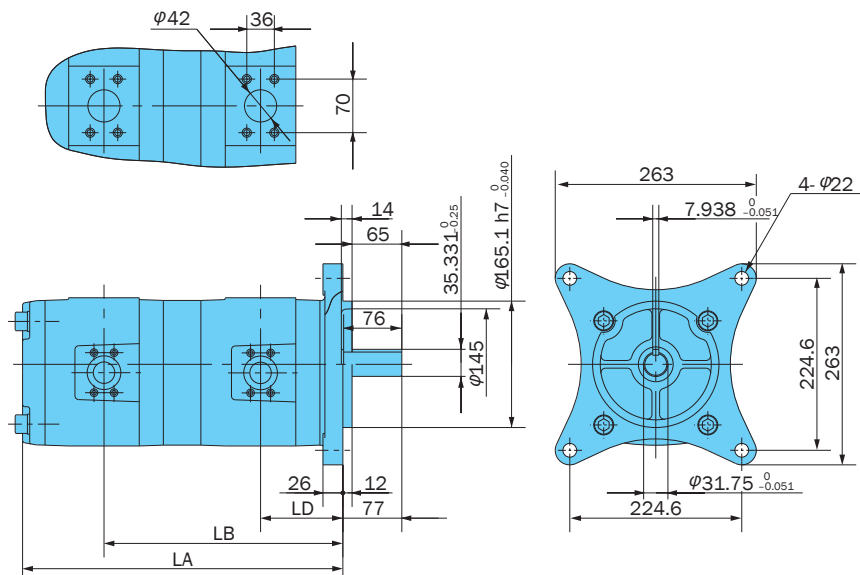
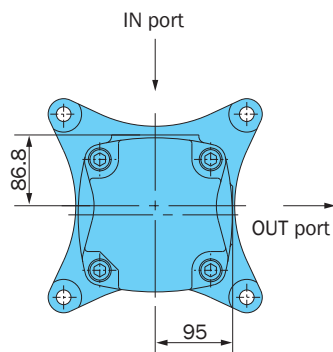
Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-46B-20 - 80-11	1.26	4.96	115	404	323	250	111.5
-100		6.19	119	414	333	260	116.5
-125		7.68	124	426	345	272	122.5
IPH-46B-25 - 80-11	1.56	4.96	116	410	326	250	111.5
-100		6.19	120	420	336	260	116.5
-125		7.68	125	432	348	272	122.5
IPH-46B-32 - 80-11	1.97	4.96	117	418	330	250	111.5
-100		6.19	121	428	340	260	116.5
-125		7.68	126	440	352	272	122.5

Note: Dimensions shown in this diagram are for a single pump.

Note: IPH-45B (46B)-**-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-55B-*. *-11
(Flange Mounting, Clockwise Rotation)

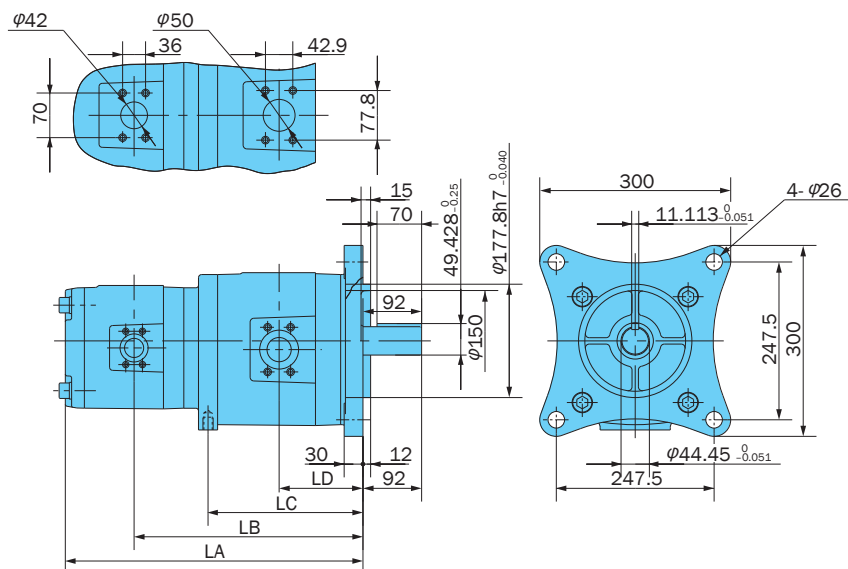
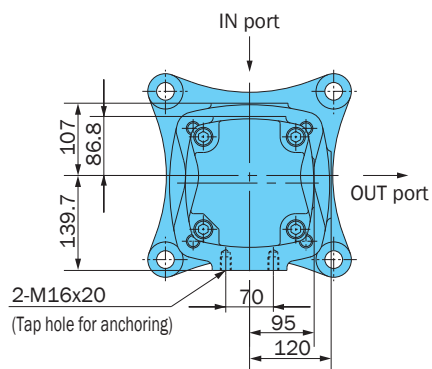


Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)		
	Vent Side	Shaft Side		LA	LB	LD
IPH-55B-40 -40-11	2.48	2.48	100	385	286	99
-50		3.06	102	392	293	102.5
-64		3.89	105	402	303	107.5
IPH-55B-50 -50-11	3.06	3.06	104	399	296.5	102.5
-64		3.89	107	409	306.5	107.5
IPH-55B-64 -64-11	3.89	3.89	109	419	311.5	107.5

Note: Dimensions shown in this diagram are for a single pump.

IPH-56B-*. *-11
(Flange Mounting, Clockwise Rotation)



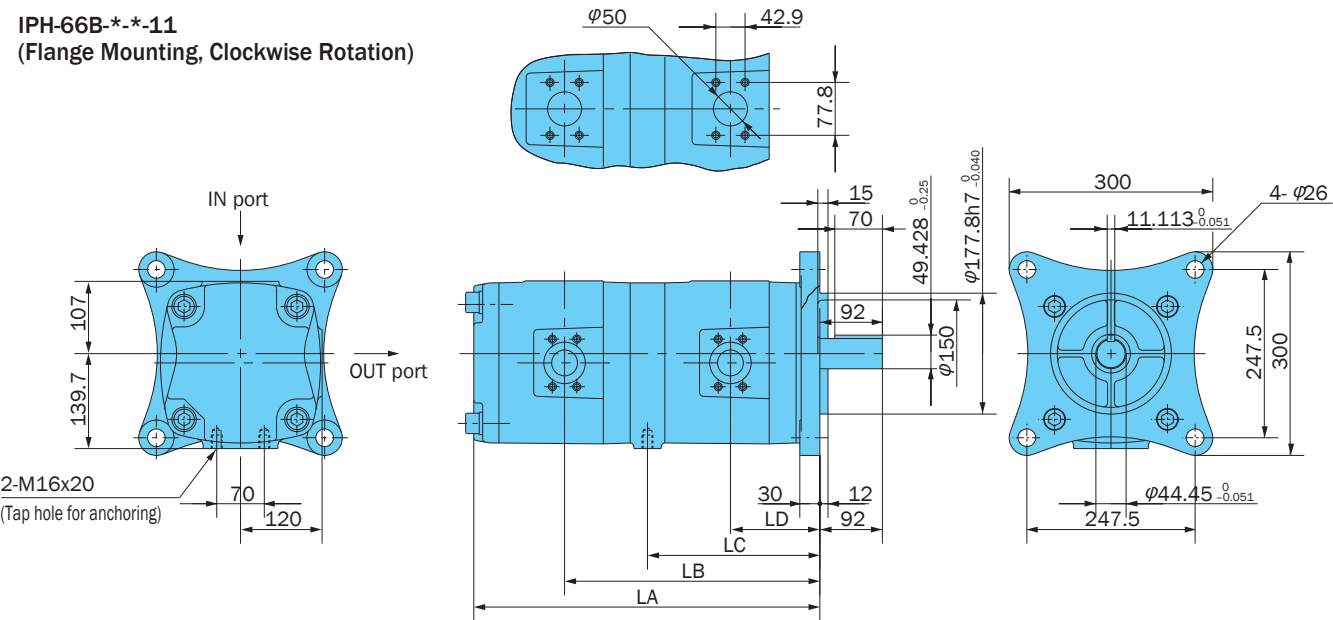
Specifications

Model No.	Volume in ³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-56B-40 - 80-11	2.48	4.96	156	427	328	221	120.5
-100		6.19	160	437	338	231	125.5
-125		7.68	164	449	350	243	131.5
IPH-56B-50 - 80-11	3.06	4.96	158	434	331.5	221	120.5
-100		6.19	162	444	341.5	231	125.5
-125		7.68	167	456	353.5	243	131.5
IPH-56B-64 - 80-11	3.89	4.96	160	444	336.5	221	120.5
-100		6.19	164	454	346.5	231	125.5
-125		7.68	169	466	358.5	243	131.5

Note: Dimensions shown in this diagram are for a single pump.

Note: IPH-55B (56B)-*. *-L-11 (foot mounting/counter-clockwise rotation) are the mirror image of the drawings shown above. In the case the individual IN port is facing upwards, the discharge port flange is positioned to the right when viewed from the shaft side.

IPH-66B--11**
(Flange Mounting, Clockwise Rotation)



Specifications

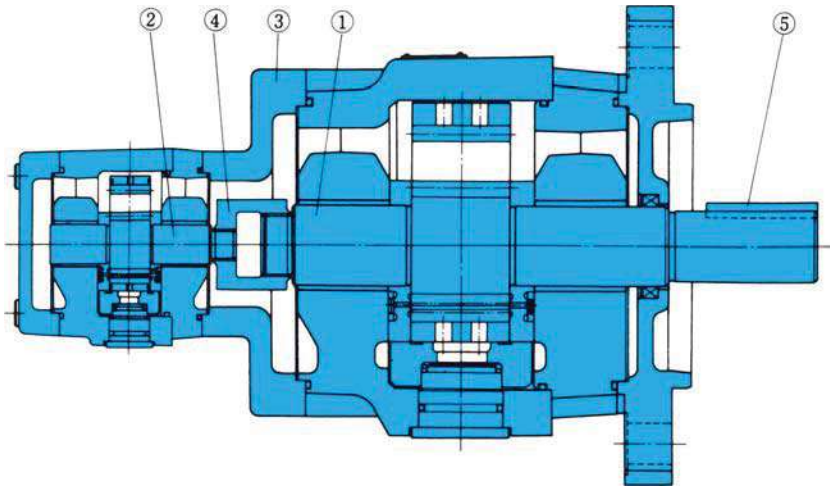
Model No.	Volume in³		Weight lbs	Dimensions (mm)			
	Vent Side	Shaft Side		LA	LB	LC	LD
IPH-66B- 80- 80-11	4.96	4.96	196	470	347.5	234	120.5
-100		6.19	201	480	357.5	244	125.5
-125		7.68	205	492	369.5	256	131.5
IPH-66B-100-100-11	6.19	4.96	205	490	362.5	244	125.5
-125		7.68	209	502	374.5	256	131.5
IPH-66B-125-125-11	7.68	7.68	214	514	380.5	256	131.5

Note: Dimensions shown in this diagram are for a single pump.

Note: IPH-66B-*-L-11 (foot mounting/flange mounting, counterclockwise rotation) are the mirror image of the drawings shown above. In the case the suction port flange is facing upwards, the discharge port flange position is to the right when viewed from the shaft side.

Cross-sectional Drawing

IPH Series Double IP Pump



Part No.	Part Name
1	Pinion shaft -1
2	Pinion shaft -2
3	Body -3
4	Joint
5	Key

Note: In the case of a double pump, use single pump parts in addition to the 5 parts listed above.

• **IPS Series Double IP Pump Seal Kit**
The double pump seal kit combines a shaft side pump seal kit with a head side pump seal kit. The shaft side pump seal kit (IHAS-2S*****) is the same as the single pump seal

kit. The head side pump seal kit (IHAS-2H*****) includes the same component parts as the single pump seal kit, except that it does not have a #23 oil seal. See the IPH Series (single) IP pump section in page C-9 for more information.

• **Air bleed-off valve**
See the IPH Series (single) IP pump section in page C-13.

NACHI Hydraulic Valves

Features

- 1 Maximum operating pressure of 3045 to 5000 psi provides smooth operation at high pressures. Low leakage for high efficiency.
- 2 Extremely stable performance across all pressure ranges.
- 3 Conformance with ISO recommended dimensions for most gasket installations enables a high degree of international compatibility.
- 4 A highly reliable and quiet wet type solenoid valve series is available when the noise and reliability issues of solenoid valves are a problem.
- 5 A comprehensive pipe-less series provides the ultimate in compact design and reliability.
- 3 Make sure that the return piping from the hydraulic valve to the tank is below the fluid level surface.
- 4 Be sure to use only specified bolts on hydraulic valves. Use grade 8 bolts or equivalent.
- 5 Installation bolts are not included with any modular valves, the SS, SA, SF, and SNG G01 size solenoid valves, the DMA-G01 manual valve, or with sub plates. Bolts are included with gasket type valves other than those mentioned above.
- 6 Use O-rings with a hardness of 90 durometer for valve gasket O-rings.

Installation and Maintenance

- 1 Installation is possible in horizontal, vertical, and diagonal configurations. However, the spool must be oriented horizontally in the case of a solenoid valve or hydraulic switching solenoid valve no-spring type.
- 2 Precision finish the mounting surface to a surface roughness of 1.6a and degree of flatness of 0.0003 in.

Management of Hydraulic Operating Fluid

- 1 Use mineral oil-based hydraulic operating fluid.
- 2 See pages N-1 and N-2 for information about the viscosity of the operating fluid you need to use.
- 3 When using water- or glycol-based hydraulic operating fluid, refer to pages N-4 through N-6 for details on applicable

models. Contact your agent for information about other fire-resistant hydraulic fluids and special fluids.

- 4 Foreign matter in the hydraulic operating fluid can lead to frequent valve operation problems. Use a 10µm line filter to protect against contamination.

Terms Used in This Catalog

The following describes the meanings of the following terms used in this catalog:

- Rated Flow Rate :
Specific guaranteed flow rate under certain fixed conditions
- Maximum Flow Rate :
Maximum flow rate that satisfies valve function
- The following are the ratings that apply to the seal part list.
JIS standard B2401 (O-ring)
JIS standard B2407 (backup ring)
SAE standard AS568 (O-ring)
- Pipe apertures mentioned in this catalog that are indicated as "G*/*" comply with BSPP O-ring seal systems.

Calculation of Hydraulic Valve Pressure Loss

Use the following formula to convert pressure loss values for each hydraulic valve in accordance with changes in operating fluid viscosity.

$$\Delta P_2 = \left(\frac{V_1}{V_2}\right)^{1/4} \cdot \Delta P_1$$

ΔP_1 : Pressure loss psi at for viscosity V_1

ΔP_2 : Pressure loss psi at for viscosity V_2

V_1 : Viscosity centistokes

V_2 : Viscosity centistokes

The graph on the right shows coefficient values $(V_2/V_1)^{1/4}$ viscosity ratios (V_1/V_2) .

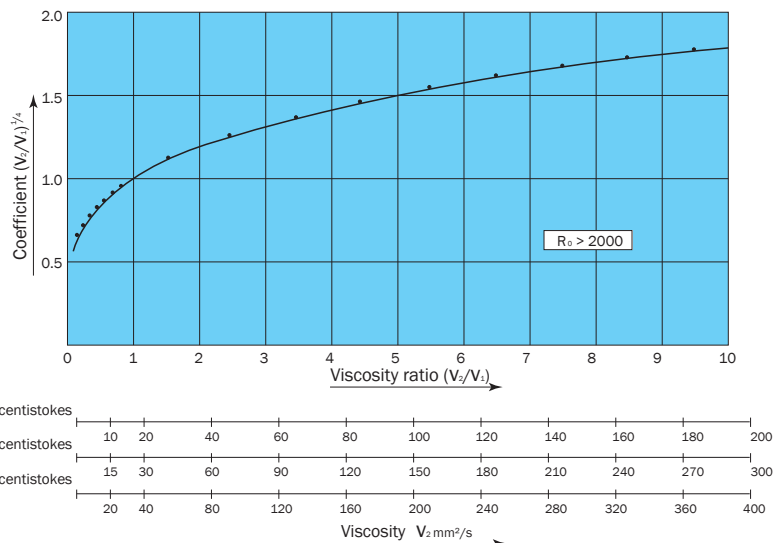
<Example>

For a value whose pressure loss at the rated flow rate when $V_1 = 30$ centistokes is $\Delta P_1 = 43$ psi, a change in viscosity to $V_2 = 90$ centistokes produces a pressure loss of $(V_2/V_1)^{1/4} = 1.3$.

According to the graph on the right, coefficient $(V_1/V_2)^{1/4} = 1.3$.

Accordingly :

$$\Delta P_2 = 1.3\Delta P_1 = 1.3 \times 43 \text{ psi} = 56 \text{ psi}$$



Factory Default Handle Setting

The following are the factory default pressure and flow rate settings for handles (screws) on adjustable valves.

- 1 Pressure Control Valve: Near the minimum control pressure.
- 2 Flow Control Valve: Near the minimum

control flow rate.

Note, however, that ER and ESR relief valves are set to rated pressures. For details, see the applicable pages for each type of valve.

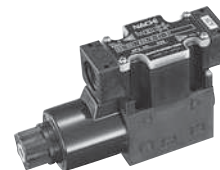
Hydraulic Valve Selection Table

	Pump Type	Name	Type Classification	Maximum Working Pressure psi	Maximum Flow Rate gpm													Page
					.26	.52	1.3	2.6	5.2	13.2	26.4	52.8	132	264	528	1320		
Modular Valves		Relief modular valve	OR	3600					01		03	04					F-10	
		Brake modular valve	ORO	3600		01			03								F-16	
		Direct relief modular valve	ORD	3600		01			03	04							F-20	
		Pressure reducing modular valve	OG	3600		01				03	04						F-25	
		01 Size balance type Pressure reducing modular valve	OGB	3600		01											F-32	
		Reducing valve & modular valve	OG	3600		01				03	04						F-34	
		2-pressure reducing modular valve	OGS	3600		01											F-41	
		Sequence modular valve	OQ	3600		01				03							F-44	
		Counter balance modular valve	OCQ	3600		01				03	04						F-47	
		Pressure switching modular valve	OW	3600		01											F-52	
		Flow regulator modular valve	O(C)Y	3600		01				03	04						F-55	
		Flow control modular valve	O(C)F	3600		01				03	04						F-63	
		Chcheck modular valve	OC(V)	3600		01				03	04						F-69	
		Pilot operated check modular valve	OCP	3600		01				03	04						F-76	
	Solenoid Valves		SS wet type solenoid valve	SS	5000				01				03					D-4
		SA wet type solenoid valve	SA	5000				01				03					D-16	
		SE low power type solenoid valve	SE	3000				01			03						D-28	
		SL wet type solenoid valve	SL	1000				01									D-34	
		DSS(A) solenoid control valve	DSS DSA	5000						04					06		D-41	
		Fine solenoid Valve	SF	3000				01									D-49	
		Non-leak type solenoid valve	SNH	5000				01			03	04	06				D-53	
		SAW solenoid with monitoring switch	SAW														D-62	
		SCW poppet type with monitoring switch	SCW														D-71	
		SK solenoid with Deutsch connector	SK														D-76	
Pressure Control Valves			Relief valve	R	3000						03		06	10				I-1
		RI series relief valve	RI	5000							03		06				I-5	
		Remote control valve	RC(D)	3000	RC-02	RCD-02											I-8	
		Solenoid control relief valve	RSS(A)	3000						03		06	10				I-10	
		RIS Series Solenoid control relief valve	RIS	5000							03		06				I-15	
		Reducing (& check) valve	(C)G	3000				03				06	10				I-18	
		Balancing valve	GR	3000				01		03							I-23	
		Pressure control (& check) valve	(C)Q	3000						03		06	10				I-25	

Maximum operating pressure for the modular valve series is 5000 psi.

Hydraulic Valve Selection Table

Pump Type	Name	Type Classification	Maximum Working Pressure	Maximum Flow Rate gpm													Page
			psi	.26	.52	1.3	2.6	5.2	13.2	26.4	52.8	132	264	528	1320		
Flow Control Valves	Throttle (& check) valve	(C)FR	3000	03 06 10													J-1
	FT type low control valve	(C)FT	3000	02 03													J-4
	F type control valve	(C)F	3000	06 10													J-8
	TN type flow control valve	(C)TN	1500	02													J-11
	TS type flow control valve	(C)TS	1500	01													J-14
	TL type flow control valve	TL(T)	1000	03, 04													J-16
Direction Control Valves	Right angle check valve	CA	3000	03 06 10													K-1
	In-line check valve	CN	3000	03 06 10													K-1
	Pilot check valve	CP	3000	03 06 10													K-4
	Gauge cock	K ₂	6000														K-7
	Flange type check valve	CA	3625	06 10 16 24													K-8
	DMA type manual valve	DMA	5000	01 03													E-1
Electro-hydraulic Proportional Control Valves	Pilot relief valve	EPR	5000	01													G-2
	Relief valve	ER	5000	03 06													G-4
	Relief and reducing valve	EGB	3600	03 06													G-6
	Flow control valve	(C)ES	3000	02 03 06 10													G-8
	Load response control valve	ESR	3600	03 06 10													G-11
	Flow direction control valve	ESD	3600	01 03 04 06 10													G-14
	Modular type reducing valve	EOG	3600	01													G-22
	Modular type flow control valve	EOF	3000	01													G-24
	Driver power amplifier	EMA EMC	—														G-26
	Driver power compact amplifier	EBA EBC	—														G-30
	Compact multi-function power amplifier	EDA EDC	—														G-34
High-response Proportional Flow Control Valve	High-response proportional flow control valve	ESH	4600	01 03 04 06													G-38
	High-speed response proportional control valve amplifier	EHA	—														



SS Series (Wiring System: Central Terminal Box) Wet Type Solenoid Valve

26.4 to 42 gpm
5075 psi

Features

Very long life

The movable iron core of the wet type solenoid is immersed in oil, which keeps it lubricated and cushions it from impact and vibration, ensuring very long life.

Low switching noise

The wet-type solenoid valve provides very low core switching noise, for quiet operation.

High pressure, large capacity, with minimal pressure loss

Comprehensive fluid reaction force

compensation and low pressure compensation construction provide large capacity and low pressure loss.

G01 : 5075 psi (26.4 gpm)

G03 : 5075 psi (42 gpm)

Easy connections

A special wiring box provides a COM port and indicator light as standard for simple wiring and maintenance.

Easy coil replacement

A plug-in type coil enables one-touch coil replacement.

Wide-ranging backward compatibility makes it simple to replace previous valve models with this one. Combining this valve with a modular valve contributes to the compact configuration of the overall device.

Compliant with global and international safety regulations (G01 size CE, UL, CSA, and G03 size UL). Can be used safely around the world. Contact us for models and specifications of compliant products.

Specifications

Model No.		SS-G01 (D03)				SS-G03 (D05)								
		Standard Type		Shockless Type		Standard Type				Shockless Type				
						AC Solenoid Type		DC Solenoid Type (With built-in rectifier)						
JIS Symbol	Operation Symbol	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi			
	-A2X-	7.9	5075	7.9	3625	10.5	5075	22.4	5075	22.4	3625			
	-H2X-													
	-E2X-													
	-A3X-	21												
	-H3X-													
	-E3X-													
	-A3Z-	26.4												
	-H3Z-													
	-E3Z-													
	-A4-	13.2												
	-H4-													
	-A5-	26.4						34.3	5075	42.2		5075	34.3	3625
	-H5-													
	-C2-													
	-C5-													
	-C9-													
	-C1S-													
	-C6S-													
	-C1-	AC Solenoid 17.1 DC Solenoid 21.1												
	-C6-													
	-C4-	13.2												
	-C7Y-													
	-C8-													

Note: The maximum flow rate of each valve depends on the pressure. For details, see pages D-12 and D-13.

			SS-G01			SS-G03			
			AC Solenoid	DC Solenoid		AC Solenoid	DC Solenoid		
				Built-in Rectifier			Built-in Rectifier		
			C*	E*	D*	C*	E*	D*	
Maximum Working Pressure	P, A, B ports		5075 psi						
Maximum Allowable Backpressure	T port		3045 psi			2320 psi			
Switching frequency (cycles/minute)		Standard Type	300	120	300	300	120	240	
		Shockless Type	—		120	—		120	
Standard	Indicator light		R			R			
Option	Shockless		—	F		—	F		
	Surgeless		G	—	G	G	—	G	
	With manual push-button		N			N			
	Quick Return		—	Q	—	—	Q	—	
Weight (kg)	Double Solenoid		1.8	2.0		4.2	5.5		
	Single Solenoid		1.4	1.5		3.5	4.1		
Operating Environment	Dust Resistance/Water Resistance Rank		IP64 (Dust-tight, Splash-proof)						
	Ambient Temperature		-4 to 122°F						
	Operating Fluid	Temperature Range		-4 to 158°F					
		Viscosity Range		15 to 300 centistokes					
		Filtration		10 microns or less					
Mounting bolt	Size × Length		10-24 x 1 3/4 LG (not included)			1/4-20 x 2 3/4			
	Tightening Torque		3.6 to 5 ft lbs			14.7 to 18.4 ft lbs			

Note: 1. Maximum operating pressure depends on the valve type. For details, see page D-1.
2. For mounting bolts, use 12T, grade 8 or equivalent.
3. Mounting bolts are not included with the O1 size. Bolts are included with the O3 size.

• Handling

- 1 In order to realize the full benefits of the wet type solenoid valve, configure piping so oil is constantly supplied to the T port. Never use a stopper plug in the T port.
- 2 Ensure that surge pressure in excess of the maximum allowable back pressure does not reach the T port.
- 3 Note that the maximum flow rate is limited when used as a four-way valve, or by blocking ports for use as a two-way valve or one-way valve.
- 4 Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.
- 5 When using petroleum type operating fluid, use ISO VG 32, 46.
- 6 For details about using fire-resistant hydraulic fluid, contact your agent.
- 7 Use this valve only within the allowable voltage range.
- 8 Do not allow the AC solenoid to become charged until you install the coil into the valve.
- 9 In the case of operation symbols A2X, H2X, and E2X, run drain piping from the valve T port.
- 10 Maintaining a switching position under high pressure for a long period can cause

abnormal operation due to hydraulic lockup. Contact your agent when you need to maintain a switching position for a long period.

- 11 When using a detent type (E2X, 3X, E3Z), use constant energization in order to securely maintain the switching position.

RSS-***-AR*(H)-** ¹⁵ ₂₃ RIS-***-AR*(H)-** ²¹	SS-G01-AR-R-**-31
RSS-***-AQ*(H)-** ¹⁵ ₂₃ RIS-***-AQ*(H)-** ²¹	SS-G01-A3X-R-**-31
RSS-***-F(H)-** ¹⁵ ₂₃ RIS-***-F-**-21	SS-G01-A8X0-R-**-31
	SS-G01-A3X-R-**-31

- 12 Note that manual pin operating pressure changes in accordance with tank line back pressure.

- 13 The series described in the table below are available for use as RSS and RIS Series solenoid control relief valves.

- 14 The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.

- 15 Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MSA-01X-E10	1/4	3625	5.2	1.2	SS-G01-**-R-**-31
MSA-01Y-E10	3/8		10.4		
MS-03-E30	3/8		11.8	2.3	SS-G03-**-R-**-22
MS-03X-E30	1/2		21.1		

• Solenoid Assembly Specifications

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	For SS-G01					For SS-G03				
				Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)	Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
AC	C1	AC100	50	EDC64-C1	2.2	0.52	25	80 to 110	ECB64-C1	5.4	0.92	36.0	80 to 110
			60		2.0	0.38	22	90 to 120		4.6	0.62	34.0	90 to 120
		AC110	60		2.2	0.46	28			5.0	0.78	42.0	
	C115	AC110	50	EDC64-C115	2.0	0.47	25	90 to 120	ECB64-C115	5.0	0.85	36.0	90 to 120
			60		1.8	0.35	22	100 to 130		4.2	0.57	34.0	100 to 130
		AC115	60		2.0	0.42	28			4.6	0.72	42.0	
	C2	AC200	50	EDC64-C2	1.1	0.26	25	160 to 220	ECB64-C2	2.7	0.46	36.0	160 to 220
			60		1.0	0.19	22	180 to 240		2.3	0.31	34.0	180 to 240
		AC220	60		1.1	0.23	28			2.5	0.39	42.0	
	C230	AC220	50	EDC64-C230	1.0	0.24	25	180 to 240	ECB64-C230	2.5	0.42	36.0	180 to 240
			60		0.91	0.17	22	200 to 260		2.1	0.29	34.0	200 to 260
		AC230	60		1.0	0.21	28			2.3	0.36	42.0	
DC with Built-in Rectifier	E1	AC100	50/60	EDC64-E1-1A	0.31		27	90 to 110	ECB64-E1	0.40		34.0	90 to 110
	E115	AC110	50/60	EDC64-E115-1A	0.26		25	100 to 125	ECB64-E115	0.33		31.0	100 to 125
					0.27		27			0.34		34.0	
	E2	AC200	50/60	EDC64-E2-1A	0.15		26	180 to 220	ECB64-E2	0.22		37.0	180 to 220
	E230	AC220	50/60	EDC64-E230-1A	0.12		24	200 to 250	ECB64-E230	0.16		30.0	200 to 250
					0.13		27			0.17		33.0	
DC	D1	DC12	☒	EDC64-D1-1A	2.2		26	10.8 to 13.2	ECB64-D1	2.6		31.0	10.8 to 13.2
	D2	DC24	☒	EDC64-D2-1A	1.1		26	21.6 to 26.4	ECB64-D2	1.5		36.0	21.6 to 26.4

Understanding Model Numbers

SS - G 03 - A 3 X - * R - C2 - E22

Design number
E31: 01 size; 10 - 24 mounting bolt
E22: 03 size; 1/4 - 20 mounting bolt

Power supply

C: AC (50/60Hz)

D: DC

E: AC (Built-in rectifier; 50/60Hz)

C1=AC100V

D1=DC12V

E1=AC100V

C115=AC110V

D2=DC24V

E115=AC115V

C2=AC200V

E2=AC200V

C230=AC220V

E230=AC230V

With indicator light

Auxiliary symbol (Can be combined in alphabetic sequence.)

F: Shockless type (Available with power supply D*, E)

G: Surgeless type (Available with power supply C*, D*)

N: With manual push-button

Q: Quick return type (Available with power supply E*)

Transition Flow Path (Specify for A2X, H2X, E2X, A3X, H3X, E3X, A3Z, H3Z, E3Z, C7Y only.)

X	Y	Z
Closed	Semi-open	Open

Center position

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

Note 1: P=Pressure port; A and B=Connection port to cylinder, etc.; T=Connection port to tank

Operation Method

A	H	C	E
Spring Offset	Spring Center	Spring Center	Detent

Nominal diameter
01 size (D03)
03 size (D05)

Mounting method
G: Cascade mounting

Wet type solenoid operated directional control valve

Options

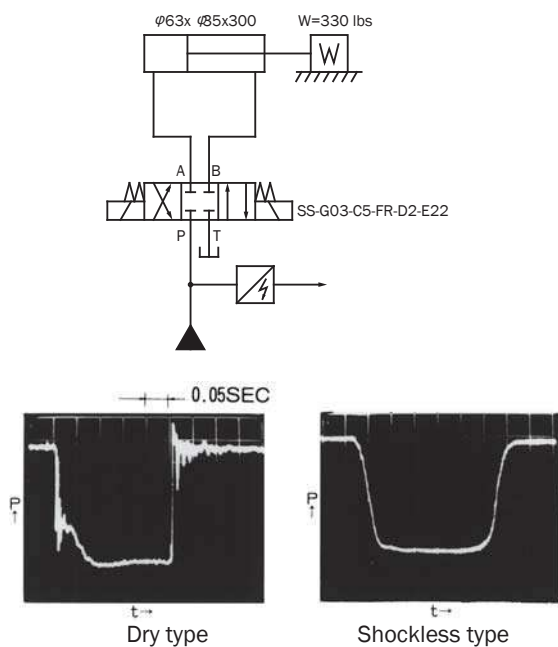
(Auxiliary Symbol Explanations)

Shockless Type (Auxiliary Symbol: F)

Switching Response Characteristics

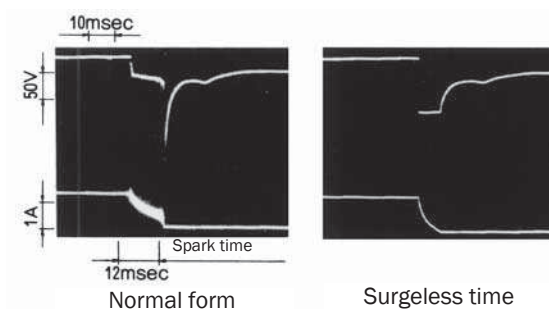
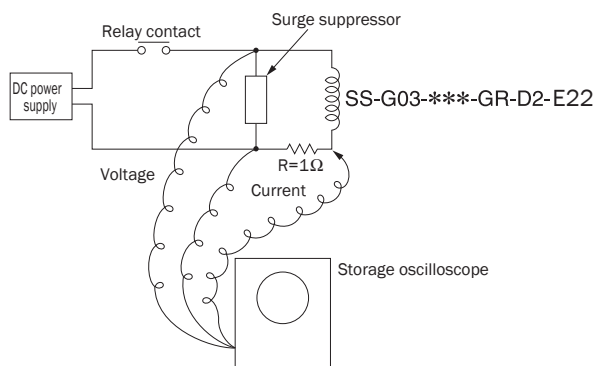
The pressure waveforms for each valve in the hydraulic circuit shown below are shown at the bottom of this block.

Opening and closing of a dry type valve generates shock (noise) and pipe vibration due to the sudden drop or rise in pressure. With a shockless solenoid valve, pressure fluctuation when the valve is opened or closed is smoothed, which eliminates shock (noise) and pipe vibration.

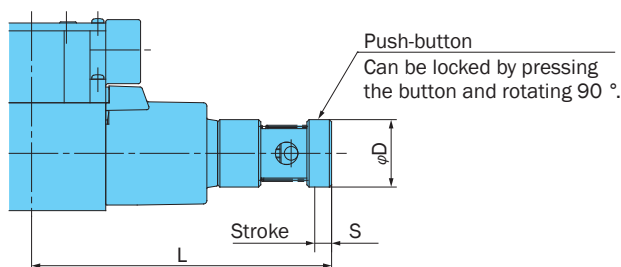


Surgeless Type (Auxiliary Symbol: G)

The surge pressure waveforms when the DC solenoid valve power supply is opened and closed by a relay are shown at the bottom of this block. A built-in surge absorber element eliminates sparking and surge pressure.



Manual Button Type (Auxiliary Symbol: N)

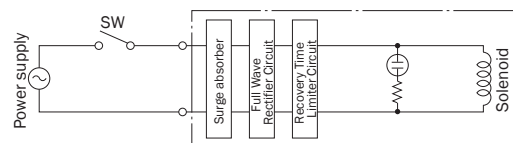


Part No.		L	S	D
EDB14-D-1A	AC Solenoid	133.5	7.5	30
EDB14-A	DC Solenoid	140.5		
ECB14-A	AC Solenoid	155.5	9.5	35
ECB14-D	DC Solenoid	173.5		

Quick Return (Auxiliary Symbol: Q)

• Handling

1. This type is used in the case of power supply type E* (with built-in rectifier) to shorten the spring return time. This also applies to D*.
2. Quick return device is built-in to central terminal box.



Installation Dimension Drawings

AC Solenoid

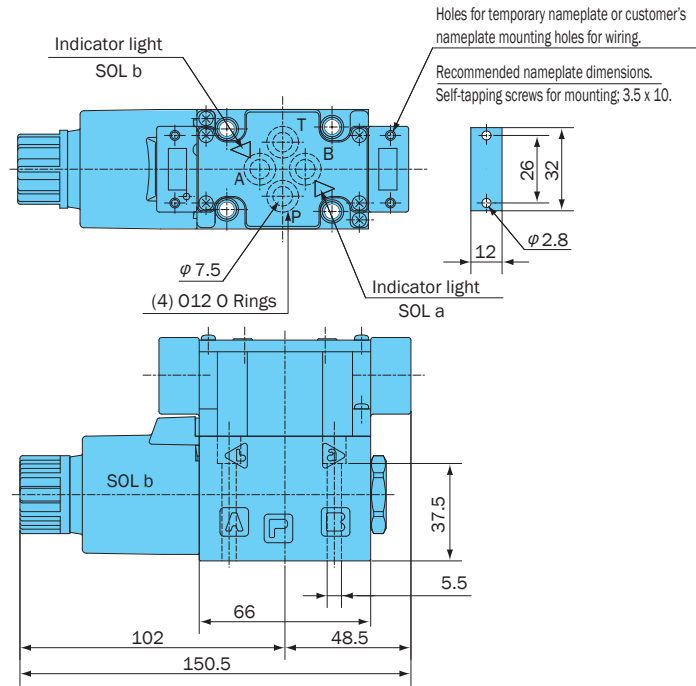
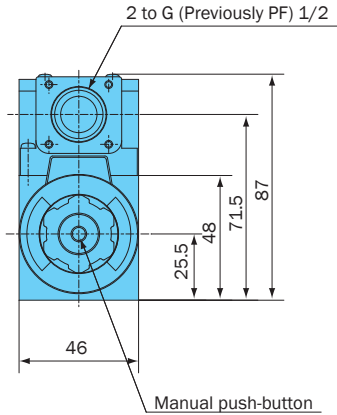
SS-G01-A**-R-C*-31

SS-G01-H**-R-C*-31

Note)

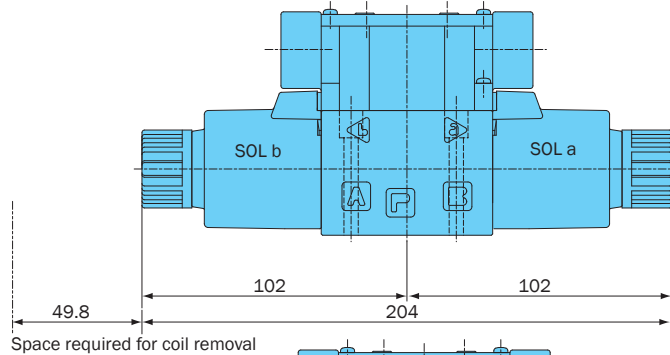
SS-G01-H**-R**-31

The solenoid is on the opposite side of that shown for SOLa in the illustrations shown here.



SS-G01-C **-R-C*-31

SS-G01-E **-R-C*-31



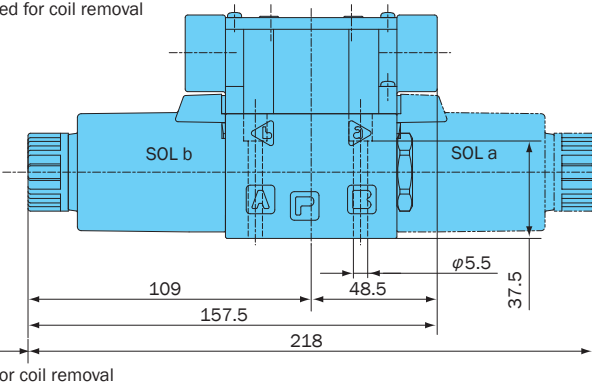
DDC Solenoid and Rectifier

SS-G01-A **-R-D/E*-31

SS-G01-H **-R-D/E*-31

SS-G01-C **-R-D/E*-31

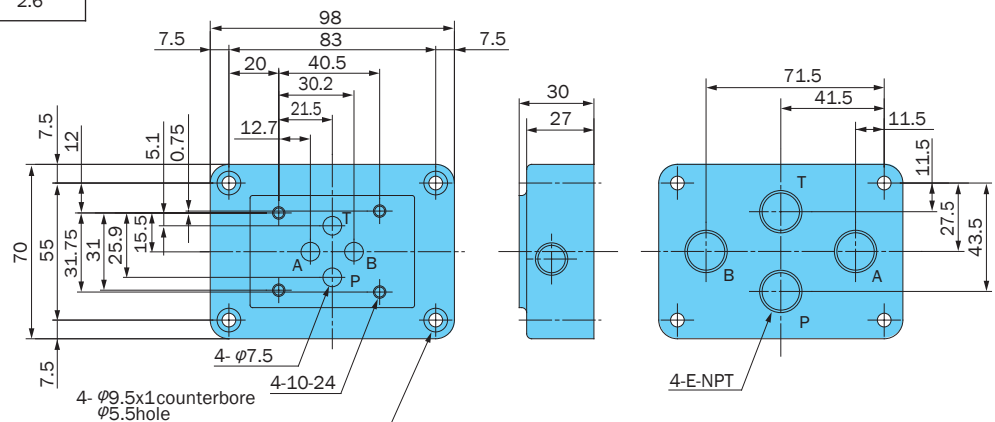
SS-G01-E **-R-D/E*-31



For sub plate SS-G01

Model No.	E	Weight lbs
MSA-01X-E10	1/4	2.6
MSA-01Y-E10	3/8	2.6

Gasket Surface Dimensions
ISO 4401-03-02-0-94
(JIS B 8355 D-03-02-0-94)



Installation Dimension Drawings

AC Solenoid

SS-G03-A**-R-C*-E22

SS-G03-H**-R-C*-E22

Note:

SS-G03-H**-R**-E22

The solenoid is on the opposite side of that shown for SOL.a in the illustrations shown here.

	SS-G03-**-R**-J22	SS-G03-**-R**-22
ϕD	$\phi 6.8$	$\phi 8.5$
L	60.5	58

SS-G03-C**-R-C*-E22

SS-G03-E**-R-C*-E22

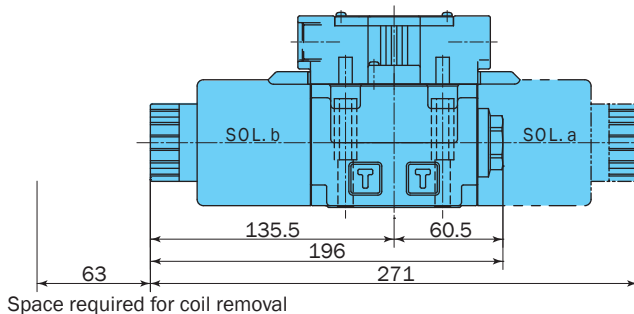
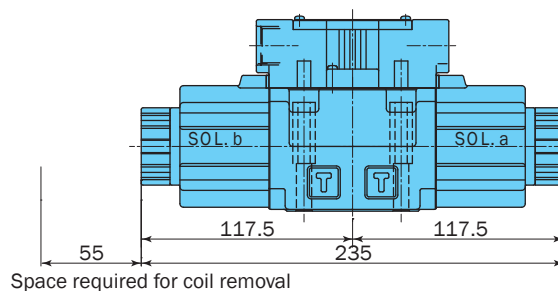
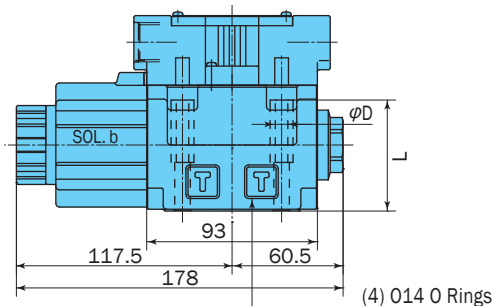
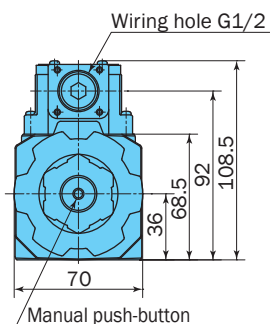
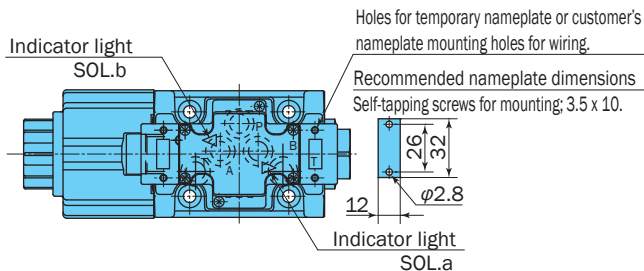
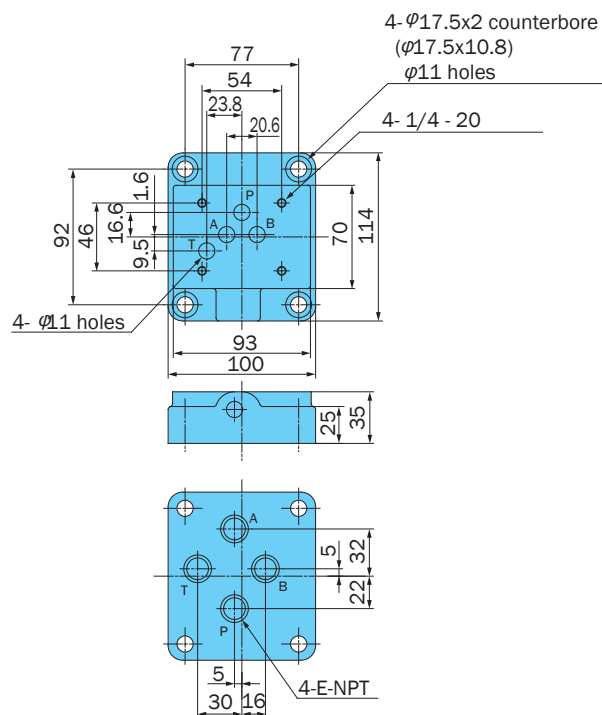
DC Solenoid and Rectifier

SS-G03-A **-R-D*/E*-E22

SS-G03-H **-R-D*/E*-E22

SS-G03-C **-R-D*/E*-E22

SS-G03-E **-R-D*/E*-E22



For sub plate SS-G03

Mounting bolt	Model No.	E	Weight lbs
1/4 - 20 x 2 3/4	MSA-03-E10	3/8	5.0
	MSA-03X-E10	1/2	

Gasket surface dimensions

(ISO 4401-05-04-0-94
JIS B 8355 D-05-04-0-94)

Wiring Diagram

The diagram shows a top-down view of a double solenoid valve. It has four main terminal groups: two labeled 'SOL a' and two labeled 'SOL b'. In the center, there are 'Common terminals' and 'Ground terminals'. Arrows indicate the internal wiring connections between these terminals.

Note:

1. In the case of a double solenoid valve, a common terminal is provided to simplify wiring. When the common terminal is not used, remove the terminal screws.
2. Use the ground terminal when grounding is required.
3. In the case of a solderless terminal, M3 screws.
4. Tighten terminal screws to a torque of 3.6 to 5 ft lbs.

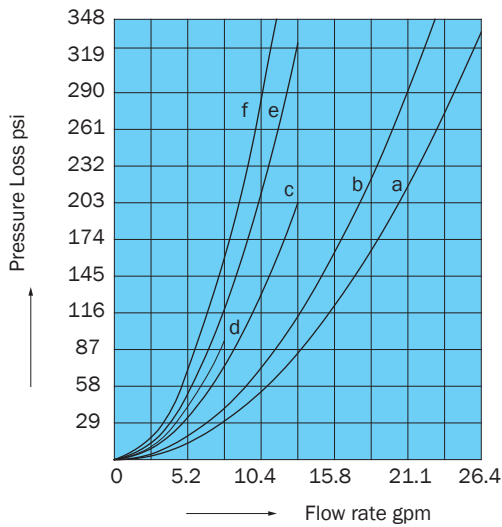
Electrical Circuit Diagram

Type	Model No.	Electrical Circuit
AC Solenoid	SS- G01-***-R-C*- 31 G03 22	
AC Solenoid Surgeless Type	SS- G01-***-GR-C*- 31 G03 22	
Built-in Rectifier	SS- G01-***-R-E*- 31 G03 22	
DC Solenoid	SS- G01-***-R-D*- 31 G03 22	
DC Solenoid Surgeless Type	SS- G01-***-GR-D*- 31 G03 22	
Built-in Rectifier Quick Return Type	SS- G01-***-QR-E*- 31 G03 22	See page D-7 for more information.

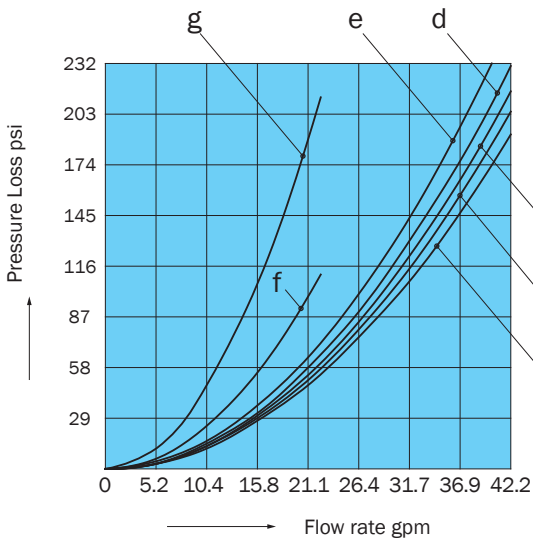
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics



Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SS-G01	A2X, H2X, E2X	d	d	—	—	—
	A3X, H3X	b	b	b	b	—
	E3X	b	b	b	b	—
	A3Z, H3Z, E3Z	a	a	a	a	—
	A4, H4, C4	a	a	a	a	a
	A5, H5, C5, C6S	b	b	b	b	—
	C1, C1S	b	b	a	b	—
	C2	a	b	b	b	—
	C6	b	b	a	a	—
	C7Y	f	f	e	e	c
	C8	a	f	b	e	c
	C9	a	a	b	b	—



Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SS-G03	A2X, H2X, E2X	e	e	—	—	—
	A5	—	c	c	—	—
	H5	c	—	—	c	—
	A3X, H3X, E3X	c	c	d	d	—
	A3Z, H3Z	a	a	d	d	—
	E3Z	b	b	a	a	—
	C1	c	c	a	c	—
	C2	a	c	c	c	—
	A4, H4, C4	a	a	a	a	a
	C5, C1S, C6S	c	c	c	c	—
	C6	c	c	a	a	—
	C7Y	g	g	g	g	f
	C8	a	g	a	g	f
	C9	a	a	c	c	—

Switching Response Time

Model No.	Response Time (sec)		Measurement Conditions
	Solenoid ON	Spring Return	
SS-G01-**-R-C*-E31	0.02 to 0.03	0.02 to 0.03	2030 psi 7.9 gpm
SS-G01-**-(G)R-D*-E31	0.03 to 0.04	0.02 to 0.04	
SS-G01-**-R-E*-E31	0.03 to 0.04	0.07 to 0.10	
SS-G01-**-F(G)R-D*-E31	0.07 to 0.10	0.04 to 0.07	
SS-G01-**-FR-E*-E31	0.07 to 0.10	0.10 to 0.15	
SS-G03-**-R-C*-E22	0.02 to 0.03	0.02 to 0.03	2030 psi 18.4 gpm
SS-G03-**-(G)R-D*-E22	0.06 to 0.09	0.03 to 0.05	
SS-G03-**-R-E*-E22	0.07 to 0.10	0.10 to 0.15	
SS-G03-**-F(G)R-D*-E22	0.13 to 0.15	0.08 to 0.15	
SS-G03-**-FR-E*-E22	0.10 to 0.15	0.15 to 0.20	

Note: 1. The switching response time changes slightly with operating conditions (pressure, flow rate, viscosity, etc.)

2. In the case of power supply type E* (with built-in rectifier), the spring return time using Quick Return (option symbol: Q) is the same as D*.

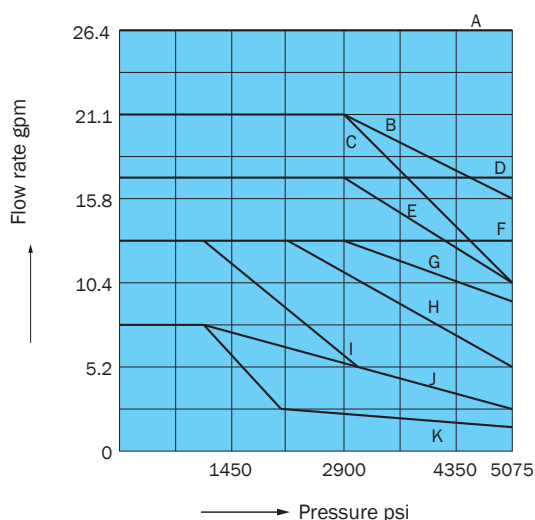
D

Solenoid Valves

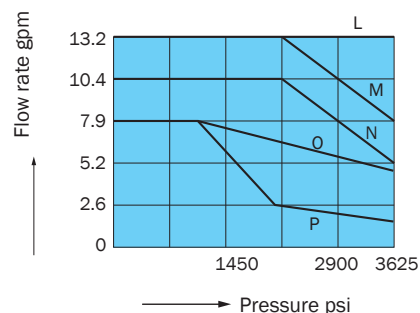
Pressure – Flow Volume Allowable Value

Size	Standard Form, with AC, DC solenoid		
	SS-G01-**-R-**-31		
Operation Example Operation Symbol			
A2X, H2X	–	K	K
E2X	–	J	J
A3X, H3X	B	K	K
E3X	A	J	J
A3Z, H3Z	D	D	D
E3Z	D	D	D
A5	A	–	I
H5	A	I	–
C1, C6	Note1) C(E)	I	I
C1S, C5, C6S	A	I	I
C2, C9	A	K	K
A4	F	F	F
H4	F	F	F
C4	F	F	F
C7Y, C8	Note2) G(H)	K	K

Note: 1. Letter in parentheses is for AC solenoid.
 2. Letter in parentheses is for solenoid with built-in rectifier (E*), but without Quick Return, and for DC solenoid (D*) with surge voltage absorbing diode on the electrical circuit.



Size	Shockless Type, with DC solenoid		
	SS-G01-**-FR-**-31		
Operation Example Operation Symbol			
A2X, H2X	–	P	P
E2X	–	O	O
A3X, H3X	L	P	P
E3X	L	O	O
A3Z, H3Z	L	L	L
E3Z	L	L	L
A5	L	–	P
H5	L	P	–
C1, C6	M	P	P
C1S, C2, C5, C6S, C9	L	P	P
A4, H4	L	L	L
C4	L	L	L
C7Y, C8	N	P	P

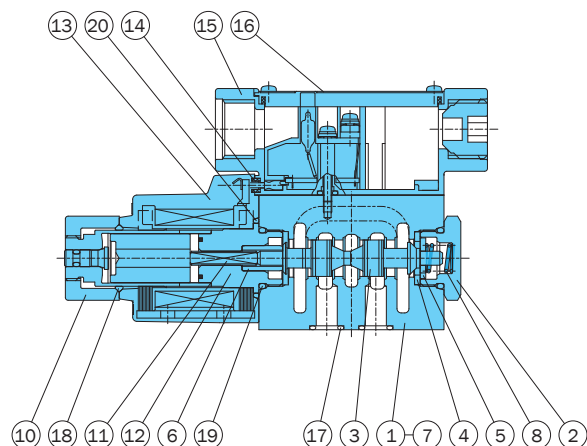


Pressure – Flow Volume Allowable Value

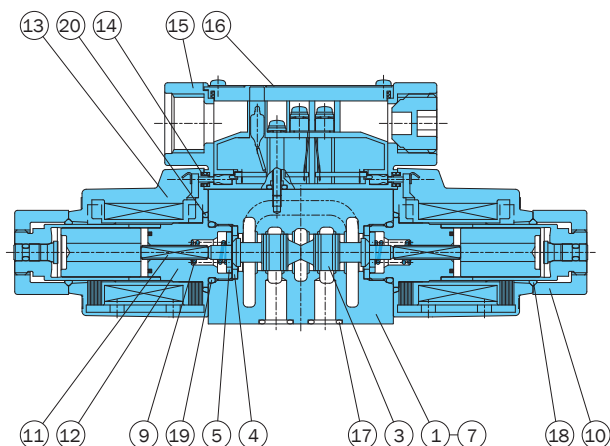
Model No.	Standard Form, with AC Solenoid			Standard Form, with DC Solenoid		
		SS-G03-**-R-C*-E22			SS-G03-**-R-**-E22	
Operation Example						
Operation Symbol						
A2X	—	F	E	☒	G	H
H2X	—	E	F	☒	H	G
E2X	—	C	C	☒	D	D
A3X	A	E	E	A	F	H
H3X	A	E	E	A	H	F
A3Z	A	A	C	A	D	D
H3Z	A	C	A	A	D	D
E3X, E3Z	A	C	C	A	D	D
A5	A	—	D	A	—	G
H5	A	D	—	A	G	—
C1S, C5, C6S	A	D	D	A	G	G
C1, C6	A	D	D	B	G	G
C2	A	G	D	A	I	G
A4, H4, C4	A	A	A	A	A	A
C9	A	G	G	A	I	I
C7Y, C8	B	B	B	Note1) C(E)	C(E)	C(E)
Model No.	Shockless Type, with DC solenoid					
	SS-G03-**-FR-**-E22					
Operation Example						
Operation Symbol						
A2X	—	E	F			
H2X	—	F	E			
E2X	—	C	C			
A3X	A	D	F			
H3X	A	F	D			
A3Z	A	C	C			
H3Z	A	C	C			
E3X, E3Z	A	C	C			
A5	A	—	E			
H5	A	E	—			
C1, C1S, C5, C6, C6S	A	E	E			
C2	A	G	E			
A4, H4, C4	A	A	A			
C9	A	G	G			
C7Y, C8	Note1) B(H)	B(H)	B(H)			
				Note: 1. Letter in parentheses is for solenoid with built-in rectifier (E*), but without Quick Return, and for DC solenoid (D*) with surge voltage absorbing diode on the electrical circuit. 2. There is no shockless type for the AC solenoid (C*), so use a solenoid with built-in rectifier (E*) when shockless operation is required with an AC power supply. 3. The maximum flow rate is the allowable value of each port.		

Cross-sectional Drawing

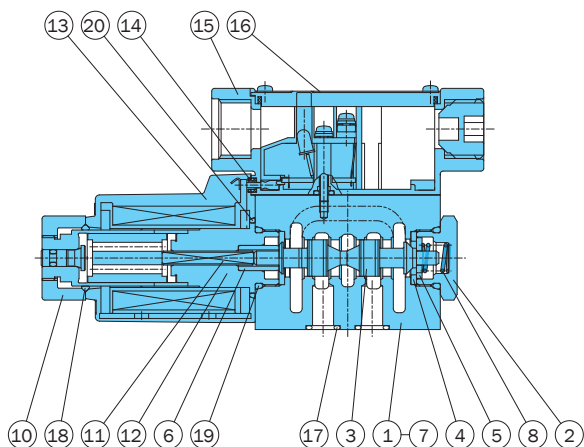
SS-G01-A**-R-C*-31



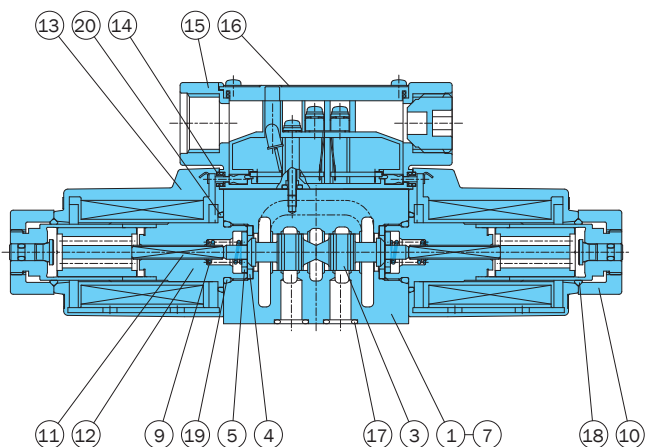
SS-G01-C**-R-C*-31



SS-G01-A**-R-D/E*-31



SS-G01-C**-R-D/E*-31



List of Sealing Parts

Part No.	Part Name	Part Number	Q'ty	
			Single Solenoid	Double Solenoid
17	O-ring	AS568-012(Hs90)	4	4
18	O-ring	1A-P20	1	2
19	O-ring	1B-P18	2	2
20	O-ring	S-25	1	2

Note: 1A and 1B are JIS Standard B 2401, while AS568 is SAE standard.

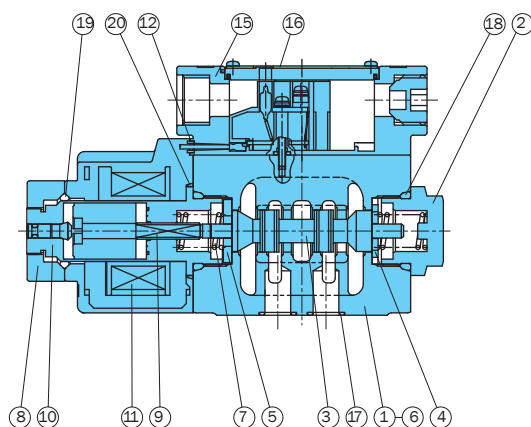
Seal Kit Number

Single Solenoid	Double Solenoid
EDCS-A	EDCS-C

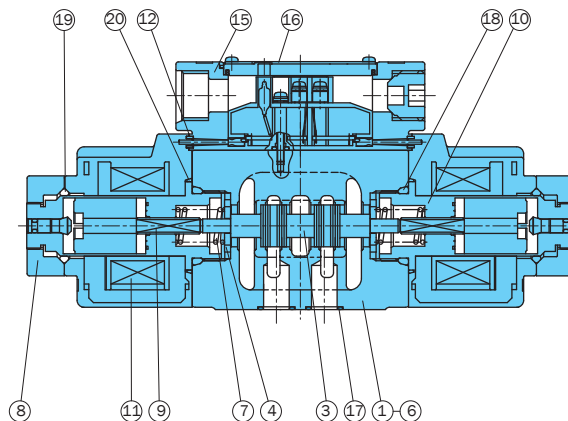
Part No.	Part Name	Part No.	Part Name
1	Body	11	Rod
2	Plug	12	Solenoid guide
3	Spool	13	Solenoid coil
4	Retainer A	14	Packing
5	Retainer B	15	Terminal box kit
6	Retainer C	16	Nameplate
7	Spacer	17	O-ring
8	Spring A	18	O-ring
9	Spring C	19	O-ring
10	Nut	20	O-ring

Cross-sectional Drawing

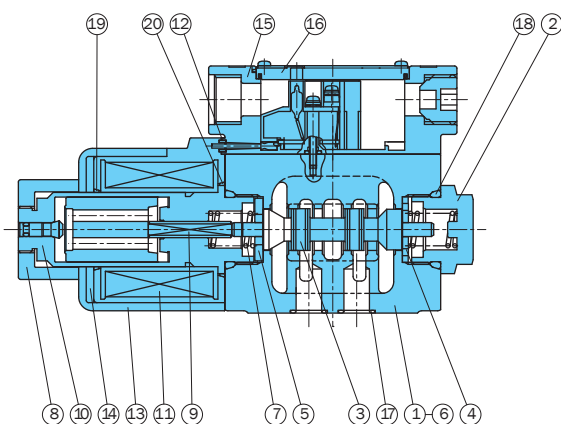
SS-G03-A**-R-C*-E22



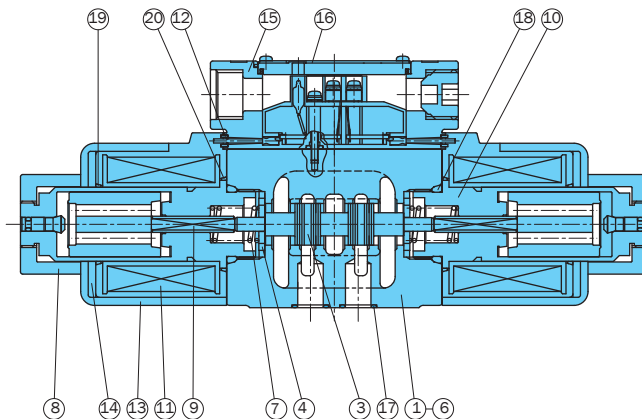
SS-G03-C**-R-C*-E22



SS-G03-A**-R-D/E*-E22



SS-G03-C**-R-D/E*-E22



List of Sealing Parts

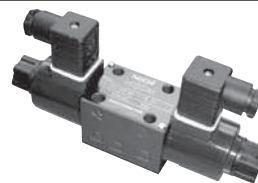
Part No.	Part Name	Type/Part Number		Q'ty	
		AC SOL.	DC SOL.	Single Solenoid	Double Solenoid
17	O-ring	AS568-014(Hs90)		5	5
18	O-ring	1B-P28		2	2
19	O-ring	1A-P26	AS568-026	1	2
20	O-ring	AS568-029		2	2

Note: 1A and 1B** indicate JIS Standard B 2401-1A/1B-**.

Seal Kit Number

AC SOL.		DC SOL.	
Single Solenoid	Double Solenoid	Single Solenoid	Double Solenoid
ECBS-AA	ECBS-CA	ECBS-AD	ECBS-CD

Part No.	Part Name	Part No.	Part Name
1	Body	14	Coil yoke
2	Plug	15	Terminal box kit
3	Spool	16	Nameplate
4	Retainer	17	O-ring
5	Retainer B	18	O-ring
6	Spacer	19	O-ring
7	Spring	20	O-ring
8	Nut		
9	Rod		
10	Solenoid guide		
11	Solenoid coil		
12	Packing B		
13	Coil case		



SA Series (Wiring System: DIN Connector Type) Wet Type Solenoid Valve

26.4 to 42 gpm
5075 psi

Features

Very long life

The movable iron core of the wet type solenoid is immersed in oil, which keeps it lubricated and cushions it from impact and vibration, ensuring very long life.

Low switching noise

The wet-type solenoid valve provides very low core switching noise, for quiet operation.

Shockless

A switching speed adjustment mechanism enables direct, shockless operation (Option F).

No surge voltage

Sparking and surge voltage during solenoid switching is canceled for stable switching (Option G).

Easy coil replacement

A DIN connector type coil enables one-touch coil replacement.

Wide-ranging backward compatibility makes it simple to replace previous valve models with this one. Combining this valve with a modular valve contributes to the compact configuration of the overall device.

Global support (G01 size)

Meets overseas safety standards (CE, UL, and CSA). It can be safely used anywhere in the world. Contact your agent for certified products.

Specifications

Model No.		SA-G01 (D03)				SA-G03 (D05)												
		Standard Type		Shockless Type		Standard Type				Shockless Type								
						AC Solenoid Type		DC Solenoid Type (With built-in rectifier)										
JIS Symbol	Operation Symbol	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi							
	-A2X-	7.9	5075	7.9	3625	10.5	5075	22.4	5075	22.4	3625							
	-H2X-																	
	-E2X-																	
	-A3X-	21.1				22.4		22.4										
	-H3X-																	
	-E3X-																	
	-A3Z-	17.1																
	-H3Z-																	
	-E3Z-																	
	-A4-	13.2																
	-H4-																	
	-A5-	26.4		13.2		34.3		5075		42.2		5075	34.3	3625				
	-H5-																	
	-C2-																	
	-C5-																	
	-C9-																	
	-C1S-																	
	-C6S-																	
	-C1-	AC Solenoid 17.1																
	-C6-	DC Solenoid 21.1																
	-C4-	13.2																
	-C7Y-																	
	-C8-																	
	-C7Y-	10.5		18.4		3625		26.4		3625		22.4						
	-C8-																	

		SA-G01			SA-G03		
		AC Solenoid	DC Solenoid		AC Solenoid	DC Solenoid	
			Built-in Rectifier			Built-in Rectifier	
		C*	E*	D*	C*	E*	D*
Maximum Working Pressure	P, A, B ports	5075 psi (Note 1)					
Maximum Allowable Backpressure	T port	3045 psi			2320 psi		
Switching frequency (cycles/minute)	Standard Type	300	120	300	300	120	240
	Shockless Type	--		120	--		120
Option	Indicator light	R			R		
	Shockless	--	F		--	F	
	Surgeless	G	--	G	G	--	G
	G Screw Connector	J	--	J	J	--	J
	With manual push-button	N			N		
	Quick Return	--	Q	--	--	Q	--
Weight (kg)	Double Solenoid	1.8	2.0		4.2	5.5	
	Single Solenoid	1.4	1.5		3.5	4.1	
Operating Environment	Dust Resistance/Water Resistance Rank		IP65 (Dust-tight, Waterjet-proof) (Note 2)				
	Ambient Temperature		-4 to 122°F				
	Operating Fluid	Temperature Range	-4 to 158°F				
		Viscosity Range	15 to 300 centistokes				
		Filtration	10 microns or less				
Mounting bolt	Size × Length	10-24 x 1 3/4 LG (not included)			1/4-20 x 2 3/4		
	Tightening Torque	3.6 to 5 ft lbs			7.3 to 9.5 ft lbs		

- Note: 1. Maximum operating pressure depends on the valve type. For details, see page D-16.
2. The power supply type for E* is IP64 (dust-tight, splash-proof).
3. For mounting bolts, use grade 8 or equivalent.
4. Mounting bolts are not included with the 01 size. Bolts are included with the 03 size.

• Handling

- In order to realize the full benefits of the wet type solenoid valve, configure piping so oil is constantly supplied to the T port. Never use a stopper plug in the T port.
- Ensure that surge pressure in excess of the maximum allowable back pressure does not reach the T port.
- Note that the maximum flow rate is limited when used as a four-way valve, or by blocking ports for use as a two-way valve or one-way valve.
- Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.
- When using petroleum type operating fluid, use ISO VG 32, 46.
- For details about using fire-resistant hydraulic fluid, contact your agent.
- Use this valve only within the allowable voltage range.
- Do not allow the AC solenoid to become charged until you install the coil into the valve.
- In the case of operation symbols A2X, H2X, and E2X, run drain piping from the valve T port.
- Maintaining a switching position under high pressure for a long period can cause

- abnormal operation due to hydraulic lockup. Contact your agent when you need to maintain a switching position for a long period.
- When using a detent type (E2X, 3X, E3Z), use constant energization in order to securely maintain the switching position.

RSA-***-AR*(H)-** ¹⁵ ₂₃	SA-G01-AR-**-31
RSA-***-AQ*(H)-** ¹⁵ ₂₃	SA-G01-A3X-**-31
RSA-***-F(H)-** ¹⁵ ₂₃	SA-G01-A8X0-**-31

- The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.

- Note that manual pin operating pressure changes in accordance with tank line back pressure.
- The series described in the table below are available for use as RSS and RIS Series solenoid control relief valves.

- Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MSA-01X-E10	1/4	3625	5.2	2.6	SA-G01-***-E31
MSA-01Y-E10	3/8		7.9		
MSA-03-E10	3/8		11.8	5.0	SA-G03-***-E21
MSA-03X-E10	1/2		21.1		

• Solenoid Assembly Specifications

Solenoid Assembly Specifications				For SA-G01					For SA-G03				
Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)	Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
AC	C1	AC100	50	EAC64-C1	2.2	0.52	25	80 to 110	EBB64-C1	5.4	0.92	36.0	80 to 110
			60		2.0	0.38	22	90 to 120		4.6	0.62	34.0	90 to 120
		AC110	60		2.2	0.46	28			5.0	0.78	42.0	
	C115	AC110	50	EAC64-C115	2.0	0.47	25	90 to 120	EBB64-C115	5.0	0.85	36.0	90 to 120
			60		1.8	0.35	22	100 to 130		4.2	0.57	34.0	100 to 130
		AC115	60		2.0	0.42	28			4.6	0.72	42.0	
	C2	AC200	50	EAC64-C2	1.1	0.26	25	160 to 220	EBB64-C2	2.7	0.46	36.0	160 to 220
			60		1.0	0.19	22	180 to 240		2.3	0.31	34.0	180 to 240
		AC220	60		1.1	0.23	28			2.5	0.39	42.0	
	C230	AC220	50	EAC64-C230	1.0	0.24	25	180 to 240	EBB64-C230	2.5	0.42	36.0	180 to 240
			60		0.91	0.17	22	200 to 260		2.1	0.29	34.0	200 to 260
		AC230	60		1.0	0.21	28			2.3	0.36	42.0	
DC with Built-in Rectifier	E1	AC100	50/60	EAC64-E1-1A	0.31		27	90 to 110	EBB64-E1	0.40		34.0	90 to 110
	E115	AC110	50/60	EAC64-E115-1A	0.26		25	100 to 125	EBB64-E115	0.33		31.0	100 to 125
		AC115			0.27		27			0.34		34.0	
	E2	AC200	50/60	EAC64-E2-1A	0.15		26	180 to 220	EBB64-E2	0.22		37.0	180 to 220
	E230	AC220	50/60	EAC64-E230-1A	0.12		24	200 to 250	EBB64-E230	0.16		30.0	200 to 250
		AC230			0.13		27			0.17		33.0	
DC	D1	DC12	☒	EAC64-D1-1A	2.2		26	10.8 to 13.2	EBB64-D1	2.6		31.0	10.8 to 13.2
	D2	DC24	☒	EAC64-D2-1A	1.1		26	21.6 to 26.4	EBB64-D2	1.5		36.0	21.6 to 26.4

Understanding Model Numbers

SA - G 01 - A 3 X - * * - C2 - 31

Design number
E31: 01 size; 10 - 24 mounting bolt
E21: 03 size; 1/4 - 20 mounting bolt

Power supply
C: AC (50/60Hz)
D: DC
E: AC (Built-in rectifier; 50/60Hz)

C1=AC100V C115=AC110V C2=AC200V C230=AC220V
D1=DC12V D2=DC24V
E1=AC100V E115=AC115V E2=AC200V E230=AC230V

With indicator light

Auxiliary symbol (Can be combined in alphabetic sequence.)
F: Shockless type (Available with power supply D*, E)
G: Surgeless type (Available with power supply C*, D*)
N: With manual push-button
Q: Quick return type (Available with power supply E*)

Transition Flow Path (Specify for A2X, H2X, E2X, A3X, H3X, E3X, A3Z, H3Z, E3Z, C7Y only.)

X	Y	Z
Closed	Semi-open	Open

Center position

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

Note 1: P=Pressure port; A and B=Connection port to cylinder, etc.; T=Connection port to tank

Operation Method

A	H	C	E
Spring Offset	Spring Center	Detent	

Nominal diameter
01 size (D03)
03 size (D05)

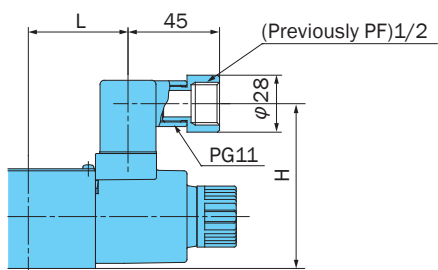
Mounting method
G: Cascade mounting

Wet type solenoid operated directional control valve

Options

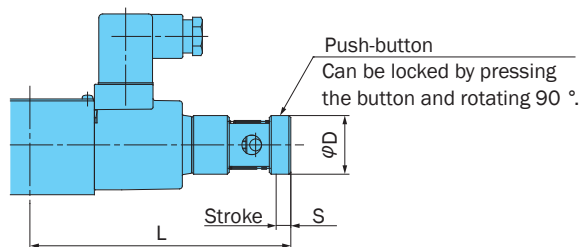
(Auxiliary Symbol Explanations)

G Screw Adapter (Auxiliary Symbol: J)



Model No.	L	H
SA-G01	49	81
SA-G03	60.5	100.5

With manual push-button (Auxiliary Symbol: N)



Part No.		L	S	D
EDB14-D-1A	AC Solenoid	133.5	7.5	30
	DC Solenoid	140.5		
ECB14-A	AC Solenoid	155.5	9.5	35
	DC Solenoid	173.5		

Other Options

Note: For information about the shockless and surgeless options, see page D-7.

Installation Dimension Drawings

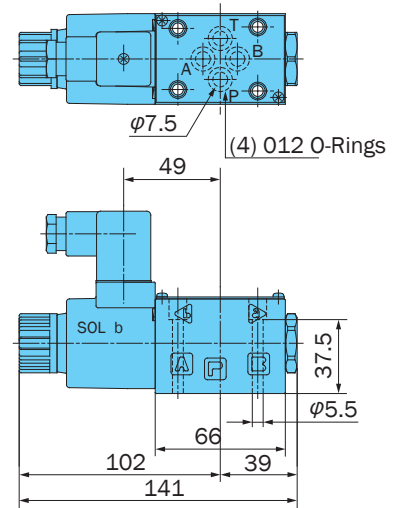
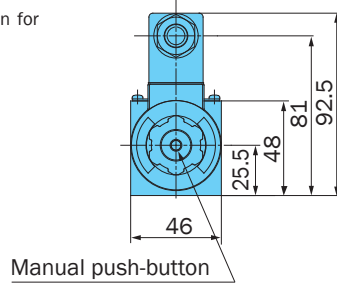
AC Solenoid

SA-G01-A**-C*-E31

SA-G01-H**-C*-E31

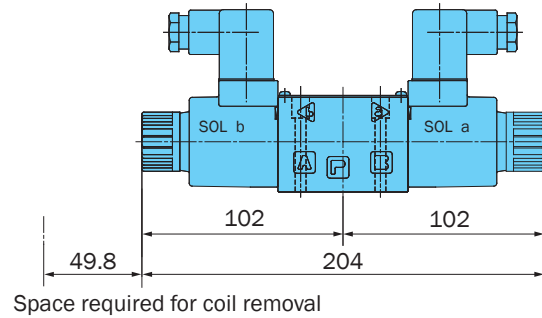
Note: SA-G01-H**-R**-E31

The solenoid is on the opposite side of that shown for SOLa in the illustrations shown here.



SA-G01-C**-R-C*-E31

SA-G01-E**-R-C*-E31



Space required for coil removal

DC Solenoid and Rectifier

SA-G01-A**-D*/E*-E31

SA-G01-H**-D*/E*-E31

SA-G01-C**-D*/E*-E31

SA-G01-E**-D*/E*-E31

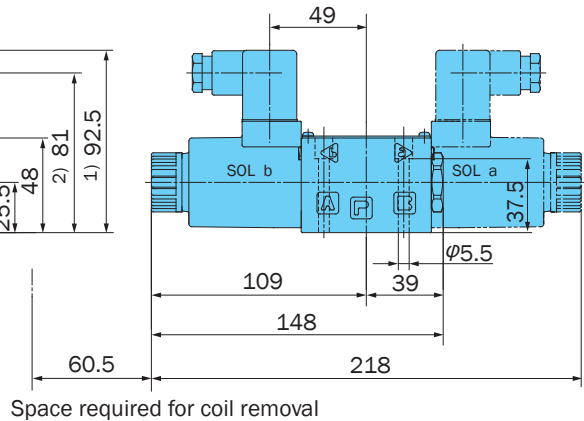
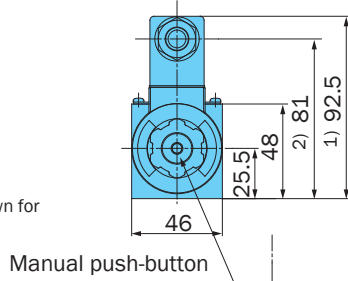
Note: 1.SA-G01-H**-D*/E*-E31

The solenoid is on the opposite side of that shown for SOLa in the illustrations shown here.

2.SA-G01-**-E*-E31

Dimension 1 is 96.

Dimension 2 is 73.



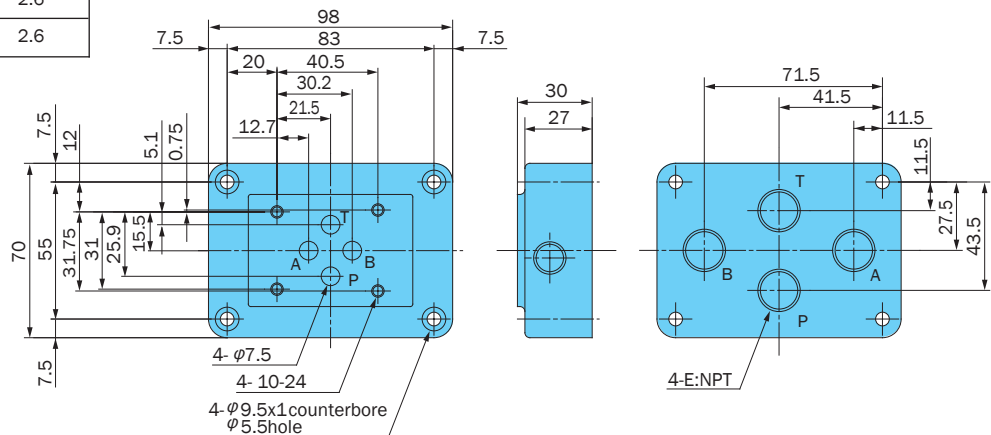
Space required for coil removal

For sub plate SA-G01

Model No.	E	Weight lbs
MSA-01X-E10	1/4	2.6
MSA-01Y-E10	3/8	2.6

Gasket Surface Dimensions

(ISO 4401-03-02-0-94
JIS B 8355 D-03-02-0-94)



Installation Dimension Drawings

AC Solenoid

SA-G03-A***-C*-E21

SA-G03-H***-C*-E21

Note: SA-G03-H***-C*-E21

The solenoid is on the opposite side of that shown for SOLa in the illustrations shown here.

	SA-G03-***-C*-E21	SA-G03-***-C*-E21
ϕD	$\phi 6.8$	$\phi 8.5$
L	60.5	58

SA-G03-C***-C*-E21

SA-G03-E***-C*-E21

DC Solenoid and Rectifier

SA-G03-A***-D*/E*-E21

SA-G03-H***-D*/E*-E21

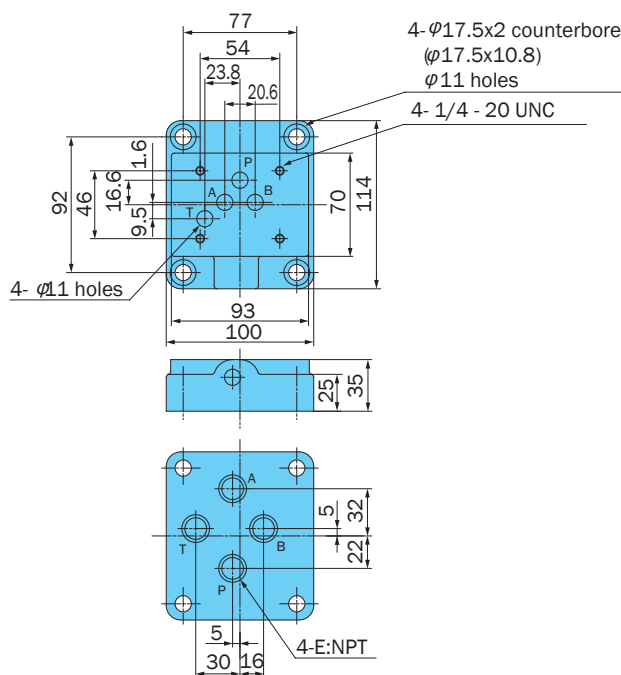
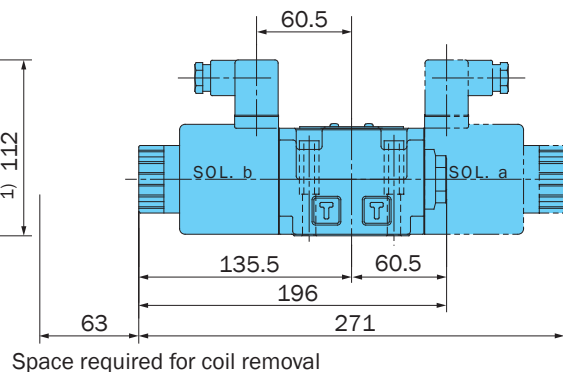
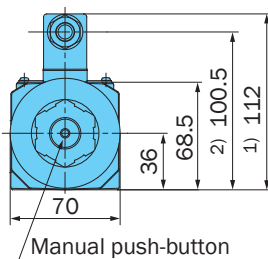
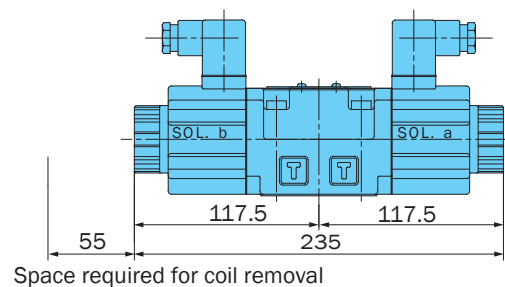
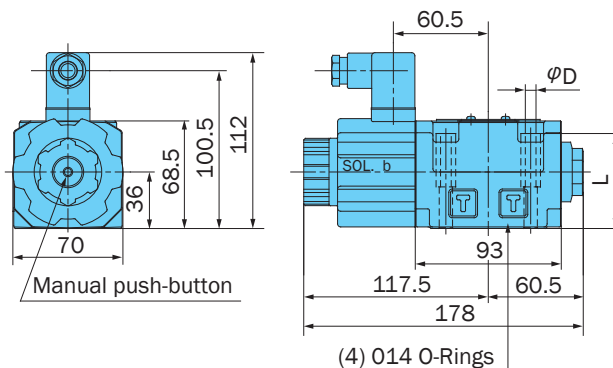
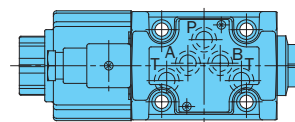
SA-G03-C***-D*/E*-E21

SA-G03-E***-D*/E*-E21

Note: 1.SA-G03-H***-D*/E*-E21

The solenoid is on the opposite side of that shown for SOLa in the illustrations shown here.

2.SA-G03-***-D*/E*-E21
Dimension 1 is 115.5.
Dimension 2 is 92.5.

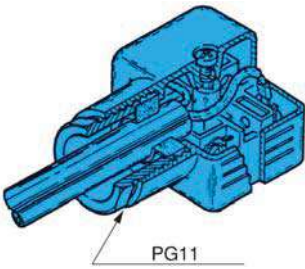
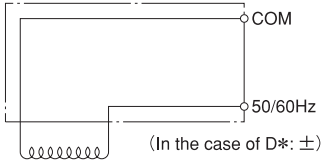
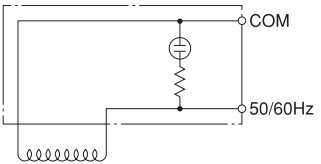
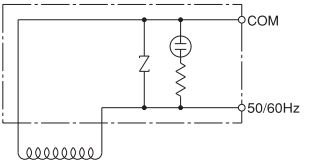
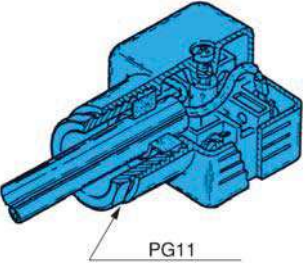
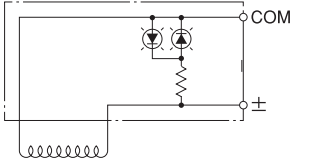
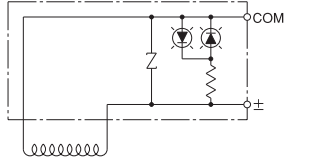
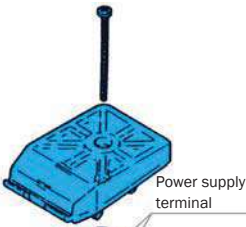
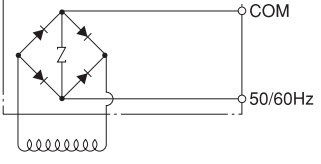
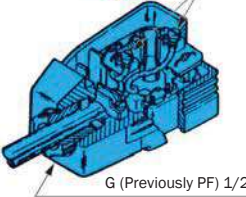
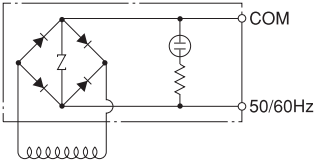


For sub plate SA-G03

Mounting bolt	Model No.	E	Weight lbs
1/4 - 20 x 2 3/4	MSA-03-E10	3/8	5.0
	MSA-03X-E10	1/2	

Gasket surface dimensions
(ISO 4401-05-04-0-94
JIS B 8355 D-05-04-0-94)

Connectors

Model No.	Wiring	Electrical Circuit Diagram
SA- G01-***C* 31 G03 D* E21 (EA41-1A)	 PG11	Connect the power supply to terminals No.1 and No. 2. The ⊕ terminal is ground. Use this terminal as required.  (In the case of D*: ±)
SA- G01-***R-C* 31 G03 E21 (EA41-R*-1C)		
SA- G01-***GR-C* 31 G03 E21 (EA41-GRC*-1C)		
SA- G01-***R-D* 31 G03 E21 (EA41-DR*-1C)	 PG11	Connect the power supply to terminals No.1 and No. 2. The ⊕ terminal is ground. Use this terminal as required. 
SA- G01-***GR-D* 31 G03 E21 (EA41-GRD*-1C)		
SA- G01-***E* 31 G03 E21 (EA42-1B)	 Power supply terminal	Connect the power supply to the terminals on the board. When ground connection is required, remove the board and use the ⊕ terminal. In this case, do not connect the power supply to the No. 1 and No. 2 terminals. 
SA- G01-***R-E* 31 G03 E21 (EA42-R*-1B)	 G (Previously PF) 1/2	

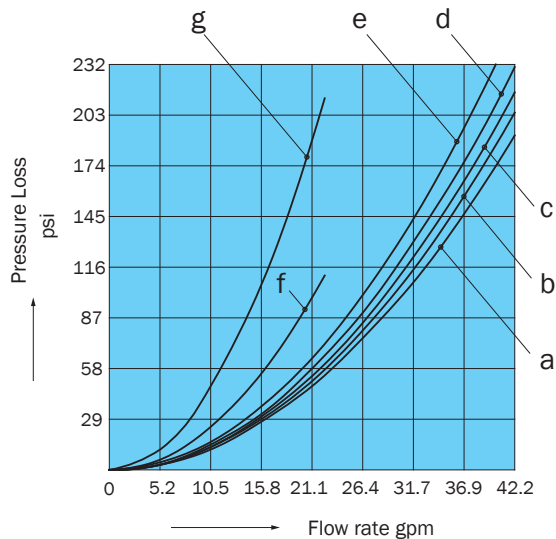
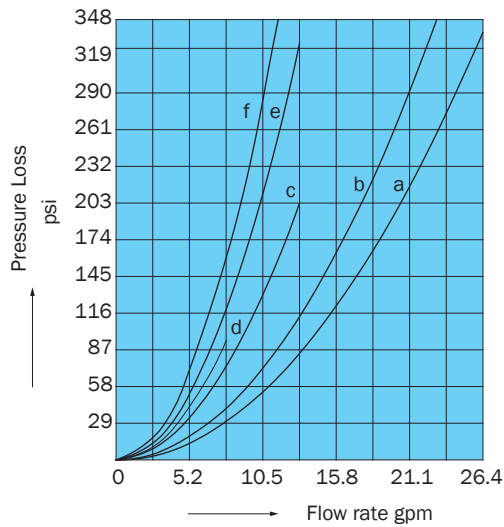
Symbols in parentheses indicate connector configuration.

- Note:
- 1.Asterisks in the connector configuration and power supply symbols are fillers for the voltage symbol (1 or 2).
 - 2.The connector cord diameter is $\varnothing 8$ to 10. Anything outside this range causes water tightness to be lost.
 - 3.The orientation of the connectors can be changed in 90° increments by changing the terminal block.
 - 4.The cover cannot be removed unless the installation screws are removed.
 - 5.When J is specified for the auxiliary symbol, a G screw conversion adapter is attached to the connector, and the wiring port is a G (previously PF) 1/2 screw (standard: PG11). EA42 and EA42-R* also have a G (previously PF) wiring port.
 - 6.Use M3 for round type and Y type solderless terminals.
 - 7.Tighten the M3 screws that secure connectors and terminals to a torque of 42 to 70 in lbs.
 - 8.An EA-41-1A or EA41-R*-1C connector is used in the case of power supply type E* with Quick Return type Q.

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics



Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SA-G01	A2X, H2X, E2X	d	d	--	--	--
	A3X, H3X	b	b	b	b	--
	E3X	b	b	b	b	--
	A3Z, H3Z, E3Z	a	a	a	a	--
	A4, H4, C4	a	a	a	a	a
	A5, H5, C5, C6S	b	b	b	b	--
	C1, C1S	b	b	a	b	--
	C2	a	b	b	b	--
	C6	b	b	a	a	--
	C7Y	f	f	e	e	c
	C8	a	f	b	e	c
	C9	a	a	b	b	--

Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SA-G03	A2X, H2X, E2X	e	e	--	--	--
	A5	--	c	c	--	--
	H5	c	--	--	c	--
	A3X, H3X, E3X	c	c	d	d	--
	A3Z, H3Z	a	a	d	d	--
	E3Z	b	b	a	a	--
	C1	c	c	a	c	--
	C2	a	c	c	c	--
	A4, H4, C4	a	a	a	a	a
	C5, C1S, C6S	c	c	c	c	--
	C6	c	c	a	a	--
	C7Y	g	g	g	g	f
	C8	a	g	a	g	f
	C9	a	a	c	c	--

Switching Response Time

Model No.	Response Time (sec)		Measurement Conditions
	Solenoid ON	Spring Return	
SA-G01-**- (GR)-C*-E31	0.02 to 0.03	0.02 to 0.03	2030 psi 7.9 gpm
SA-G01-**- (GR)-D*-E31	0.03 to 0.04	0.02 to 0.04	
SA-G01-**- (R)-E*-E31	0.03 to 0.04	0.07 to 0.10	
SA-G01-**-F (GR)-D*-E31	0.07 to 0.10	0.04 to 0.07	
SA-G01-**-F (R)-E*-E31	0.07 to 0.10	0.10 to 0.15	
SA-G03-**- (GR)-C*-E21	0.02 to 0.03	0.02 to 0.03	2030 psi 18.4 gpm
SA-G03-**- (GR)-D*-E21	0.06 to 0.09	0.03 to 0.05	
SA-G03-**- (R)-E*-E21	0.07 to 0.10	0.10 to 0.15	
SA-G03-**-F (GR)-D*-E21	0.13 to 0.15	0.08 to 0.15	
SA-G03-**-F (R)-E*-E21	0.10 to 0.15	0.15 to 0.20	

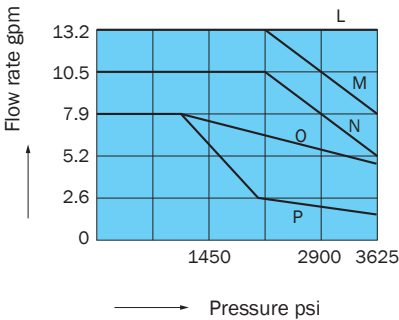
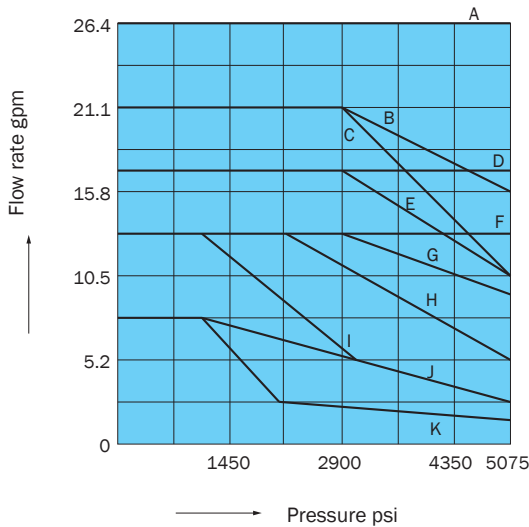
Note: 1. The switching response time changes slightly with operating conditions (pressure, flow rate, viscosity, etc.)

• Pressure - Flow Volume Allowable Value

Size	Standard Form, with AC, DC solenoid		
	SA-G01-**-R-**-31		
Operation Example Operation Symbol			
A2X, H2X	—	K	K
E2X	—	J	J
A3X, H3X	B	K	K
E3X	A	J	J
A3Z, H3Z	D	D	D
E3Z	D	D	D
A5	A	—	I
H5	A	I	—
C1, C6	Note1) C(E)	I	I
C1S, C5, C6S	A	I	I
C2, C9	A	K	K
A4	F	F	F
H4	F	F	F
C4	F	F	F
C7Y, C8	Note2) G(H)	K	K

Size	Shockless Type, with DC solenoid		
	SA-G01-**-FR-**-31		
Operation Example Operation Symbol			
A2X, H2X	—	P	—
E2X	—	O	P
A3X, H3X	L	P	P
E3X	L	O	L
A3Z, H3Z	L	L	L
E3Z	L	L	P
A5	L	—	
H5	L	P	
C1, C6	M	P	
C1S, C2, C5, C6S, C9	L	P	
A4, H4	L	L	
C4	L	L	
C7Y, C8	N	P	

Note: 1. Letter in parentheses is for AC solenoid.
 2. Letter in parentheses is for solenoid with built-in rectifier, but without Quick Return, and for DC solenoid with surge voltage absorbing diode on the electrical circuit.



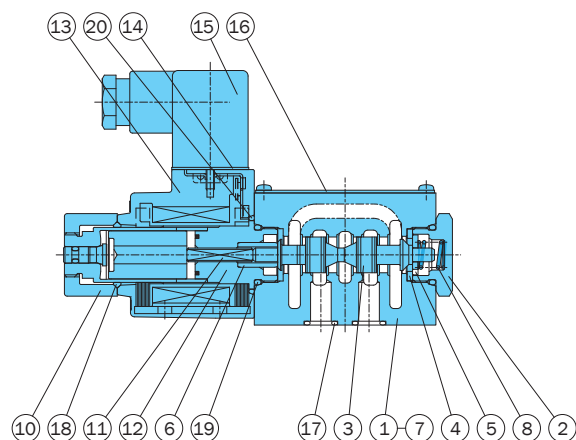
• Pressure - Flow Volume Allowable Value

Model No.		Standard Form, with AC, DC solenoid			Standard Form, with DC solenoid		
		SA-G03-**-C*-E21			SA-G03-**-**-E21		
Operation Symbol	Operation Example						
A2X		--	F	E	--	G	H
H2X		--	E	F	--	H	G
E2X		--	C	C	--	D	D
A3X		A	E	E	A	F	H
H3X		A	E	E	A	H	F
A3Z		A	A	C	A	D	D
H3Z		A	C	A	A	D	D
E3X, E3Z		A	C	C	A	D	D
A5		A	--	D	A	--	G
H5		A	D	--	A	G	--
C1S, C5, C6S		A	D	D	A	G	G
C1, C6		A	D	D	B	G	G
C2		A	G	D	A	I	G
A4, H4, C4		A	A	A	A	A	A
C9		A	G	G	A	I	I
C7Y, C8		B	B	B	Note1) C(E)	C(E)	C(E)
Model No.		Shockless Type, with DC solenoid					
		SA-G03-**-F**-E21					
Operation Symbol	Operation Example						
A2X		☒	E	F			
H2X		☒	F	E			
E2X		☒	C	C			
A3X		A	D	F			
H3X		A	F	D			
A3Z		A	C	C			
H3Z		A	C	C			
E3X, E3Z		A	C	C			
A5		A	--	E			
H5		A	E	--			
C1, C1S, C5, C6, C6S		A	E	E			
C2		A	G	E			
A4, H4, C4		A	A	A			
C9		A	G	G			
C7Y, C8		Note 1: B(H)	B(H)	B(H)			

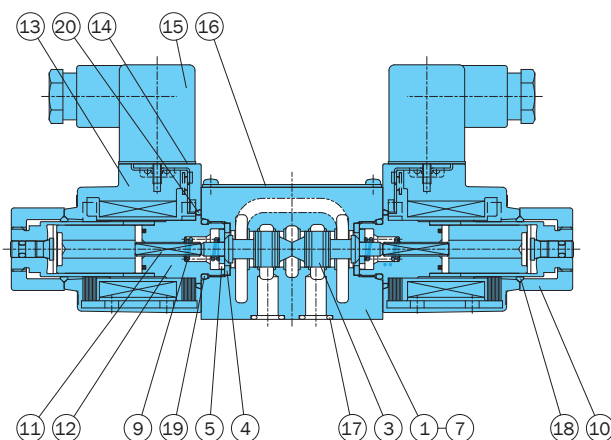
- Note: 1. Letter in parentheses is for solenoid with built-in rectifier (E*), but without Quick Return, and for DC solenoid (D*) with surge voltage absorbing diode on the electrical circuit.
 2. There is no shockless type for the AC solenoid (C*), so use a solenoid with built-in rectifier (E*) when shockless operation is required with an AC power supply.
 3. The maximum flow rate is the allowable value of each port.

Cross-sectional Drawing

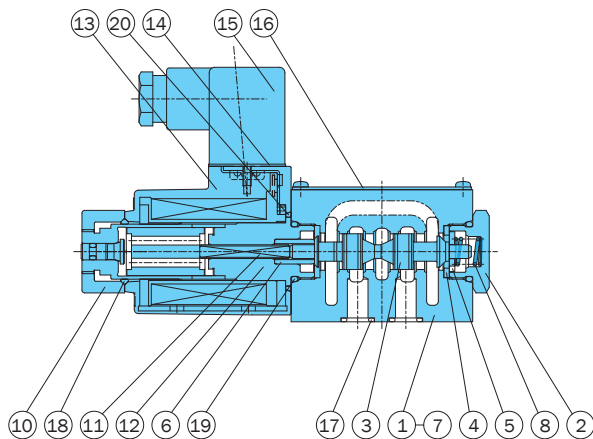
SA-G01-A**-C*-31



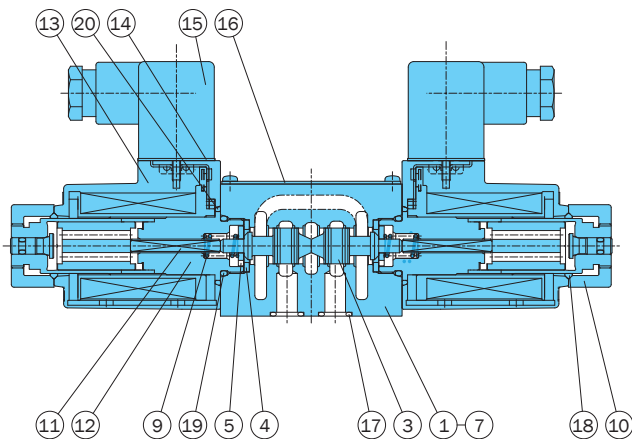
SA-G01-C**-C*-31



SA-G01-A**-D/E*-31



SA-G01-C**-D/E*-31



List of Sealing Parts

Part No.	Part Name	Part Number	Q'ty	
			Single Solenoid	Double Solenoid
17	O-ring	AS568-012(Hs90)	4	4
18	O-ring	1A-P20	1	2
19	O-ring	1B-P18	2	2
20	O-ring	S-25	1	2

Note: 1A and 1B are JIS Standard B 2401, while AS568 is SAE standard.

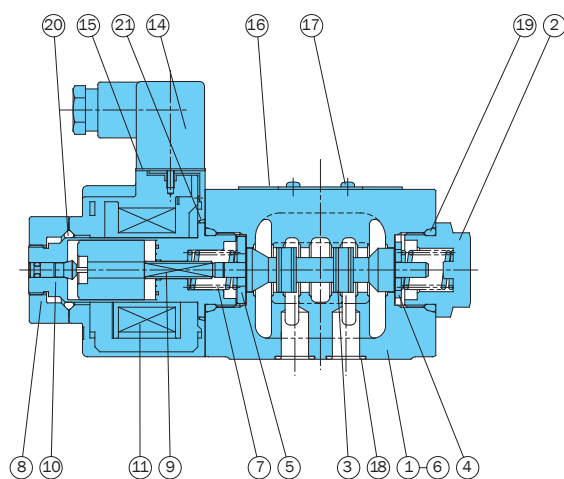
Seal Kit Number

Single Solenoid	Double Solenoid
EDCS-A	EDCS-C

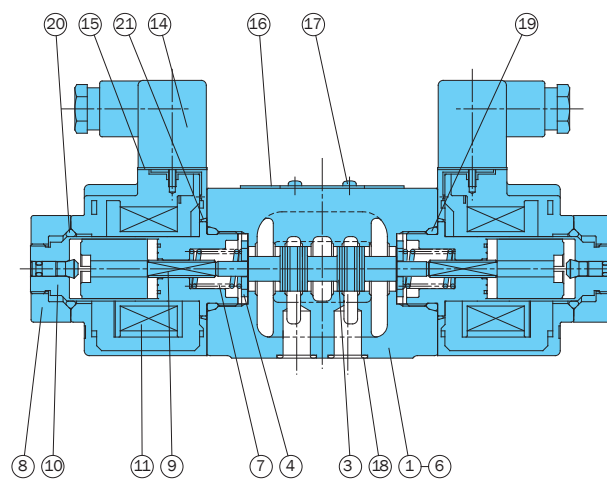
Part No.	Part Name	Part No.	Part Name
1	Body	11	Rod
2	Plug	12	Solenoid guide
3	Spool	13	Solenoid coil
4	Retainer A	14	Packing
5	Retainer B	15	Connector
6	Spring pin	16	Nameplate
7	Spacer	17	O-ring
8	Spring A	18	O-ring
9	Spring C	19	O-ring
10	Nut	20	O-ring

Cross-sectional Drawing

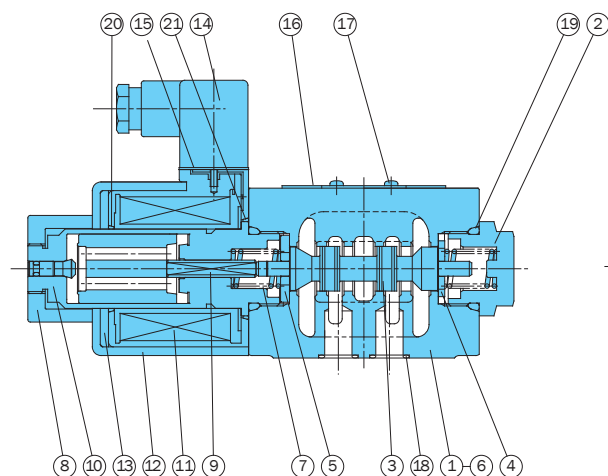
SA-G03-A**-C*-E21



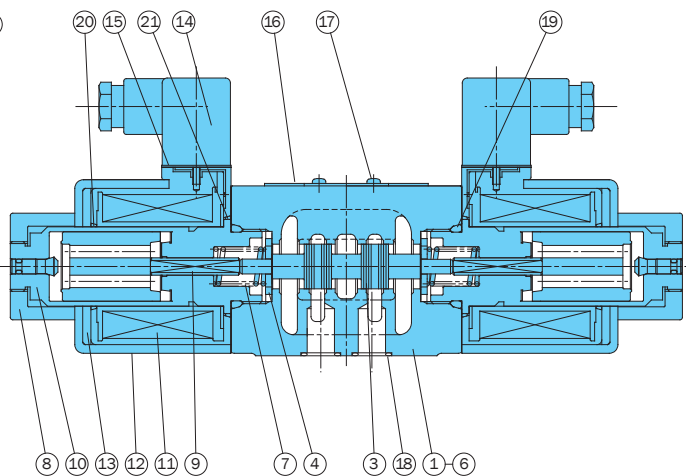
SA-G03-C**-C*-E21



SA-G03-A**-D/E*-E21



SA-G03-C**-D/E*-E21



List of Sealing Parts

Part No.	Part Name	Type/Part Number		Q'ty	
		AC SOL.	DC SOL.	Single Solenoid	Double Solenoid
18	O-ring	AS568-014(Hs90)		5	5
19	O-ring	1B-P28		2	2
20	O-ring	1A-P26	AS568-026	1	2
21	O-ring	AS568-029		1	2

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name	Part No.	Part Name
1	Body	11	Solenoid coil
2	Plug	12	Coil case
3	Spool	13	Coil yoke
4	Retainer	14	Connector
5	Retainer B	15	Connector packing
6	Spacer	16	Nameplate
7	Spring	17	Screw
8	Nut	18	O-ring
9	Rod	19	O-ring
10	Solenoid guide	20	O-ring
		21	O-ring

Seal Kit Number

AC SOL.		DC SOL.	
Single Solenoid	Double Solenoid	Single Solenoid	Double Solenoid
ECBS-AA	ECBS-CA	ECBS-AD	ECBS-CD

SE Series Lower Power Solenoid Valve

10.5 to 15.8 gpm
1450 to 2320 psi

Features

Low current, low power

The SE series magnetic switching valve's solenoid has significantly lower power consumption.

Directly drivable by a programmable controller

Low-current operation means not only allows direct drive by a programmable controller (PC) output circuit, it also enables the use of a compact and simple control circuit.

Little coil temperature rise

Low power operation means there is little heat generated from the coil, which minimizes the effects of heat on mechanisms. Even with the AC solenoid, there is little chance of coil burnout.

With M12-4 pin connector (option)

Makes it easier to interface with open networks like Device Net. This connector streamlines wiring work. The diode for

preventing current back surge is built in to the terminal box to protect the slave unit connection. (With M12-4 pin connector)

Global compliance (G01 size)

Meets overseas safety standards TÜV (CE marking). Can be used safely around the world.

Specifications

Operation Symbol	JIS Symbol	SE-G01-**-*(G)R-**-40		SE-G03-**-GR-**-*(J) 30	
		Rated Flow Rate - Maximum Flow Rate gpm	Maximum Working Pressure psi	Rated Flow Rate - Maximum Flow Rate gpm	Maximum Working Pressure psi
A2X		7.9	2320	10.5	1450
A3X		10.5		13.2	
H3X				—	
E3X				13.2	
C4		15.8			
C5					
C6					

Note: The maximum flow rate of each valve depends on the pressure. For details, see page D-32.

• Handling

- In order to realize the full benefits of the solenoid valve, configure piping so oil is constantly supplied to the T(DR) port.
- Ensure that surge pressure in excess of the maximum allowable back pressure can be accidentally at the T port.
- Note that the maximum flow rate is limited when used as a four-way valve, or by blocking ports for use as a two-way valve or one-way valve.
- Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.

- When using petroleum type operating fluid, use ISO VG 32, 46.
- Be sure to note the allowable pressure range of the coil being used.
- Maintaining a switching position under high pressure for a long period can cause abnormal operation due to hydraulic lockup. Contact your agent when you need to maintain a switching position for a long period.
- When using a detent type (E3X), provide constant energization when secure maintenance of the switching position is required.
- Note that manual pin operating pressure changes in accordance with tank line back pressure.
- If you do not select the option with the M12-4 pin connector, current back surge may occur because there is no solenoid in the central terminal box. Therefore, install solenoid valves to protect against current back surge on both ends of the coil in the output circuit of the programmable controller (PC) if directly operating the solenoid valves.

Solenoid Assembly Specifications

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	For SE-G01				For SE-G03			
				Solenoid Coil Type	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)	Solenoid Coil Type	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
Built-in rectifier type AC	E1	AC100	50	EED64-E1	0.08	7.0	80 to 120	SLH1-03BR1-01	0.06	5.8	80 to 120
			60								
DC	D2	DC24	—	EED64-D2	0.2	4.8	21.6 to 26.4	SLH1-03BD2-01	0.2	4.8	21.6 to 26.4

Solenoid Type			SE-G01		SE-G03		
			DC Solenoid	Internal DC solenoid for rectifier	DC Solenoid	Internal DC solenoid for rectifier	
			D2	E1	D2	E1	
Maximum Working Pressure	P, A, B Ports		2320 psi		1450 psi		
Maximum Allowable Backpressure	T port		2320 psi		1450 psi (In the case of 290 psi operation symbol E3X)		
Changeover Frequency (per minute)			120		120		
Standard	Indicator light Surgeless		GR	R	GR		
Weight lbs	Double Solenoid		4.8		7.7		
	Single Solenoid		3.7		7.2		
Operating Environment	Dust Resistance/Water Resistance Rank		IP64 (Dust-tight, Splash proof)		IP65 (Dust-tight, Waterjet-proof)		
	Ambient Temperature		-4 to 122° F		14 to 122° F		
	Operating Fluid	Temperature Range	-4 to 158° F		32 to 149° F		
		Viscosity Range		15 to 300 centistokes			
		Filtration		10 microns or less			
Bundled Accessories	Mounting bolt		(4) 10-24 x 1 3/4 LG (not included)		1/4-20 UNC x 2 3/4		
	Tightening Torque		3.6 to 5 ft lbs		7.2 to 9.4 ft lbs		

Note: For mounting bolts, use grade 8 or equivalent.

Understanding Model Numbers

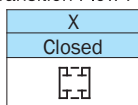
SE - G 03 - A 3 X - GR - C2 - J30

Design number
40: For 01 size
30: 03

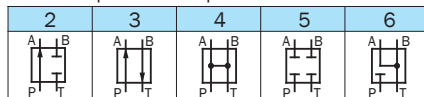
Power supply
D: DC
E: For AC (joint 50/60 Hz inside rectifier) E1=AC100V

Auxiliary symbol
GR: Surgeless type with indicator (applicable for power supply D2 only)
R: With indicator light (applicable for power supply E1 only)
V: With M12-4 pin connector, load side - common (applicable for power supply D2 only)
W: With M12-4 pin connector, load side + common (applicable for power supply D2 only)

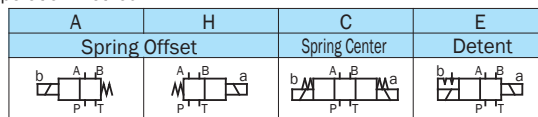
Transition Flow Path (Specify for A2X, A3X only.)



Center valve position flow path



Operation Method



Nominal pipe diameter
01 size (D03)
03 size (D05)

Mounting method
G: Gasket type

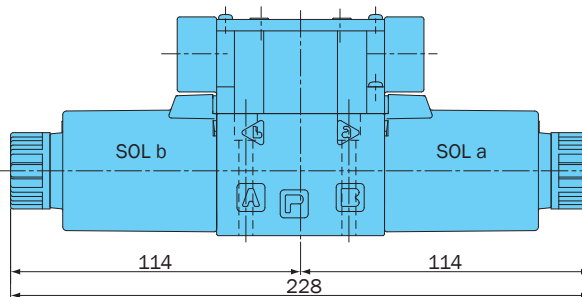
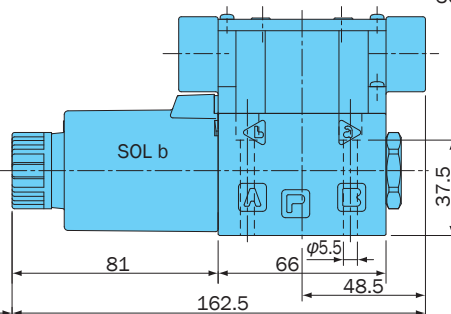
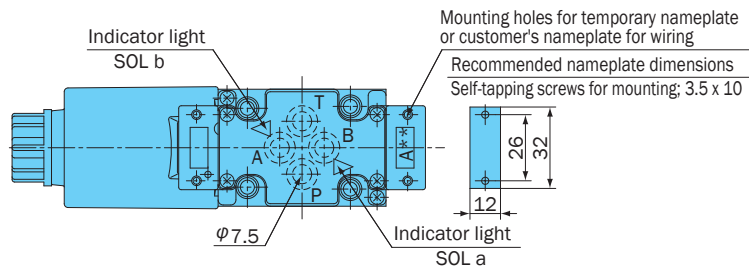
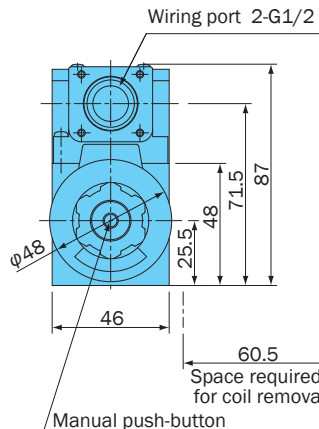
Low-power solenoid

Installation Dimension Drawings

SE-G01-A***-(G)R-**-40

SE-G01-H***-(G)R-**-40

Note: For SE-G01-H*** (G) R ** 40, the solenoid is on the opposite side as that shown in the diagram (SOL.a).

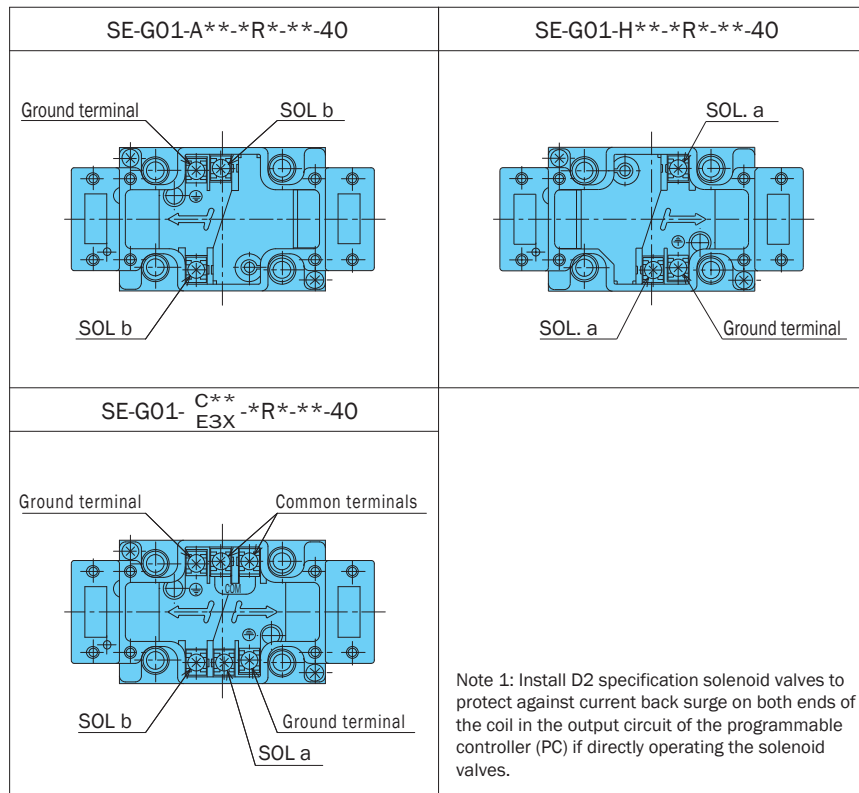


SE-G01-C**-(G)R-**-40

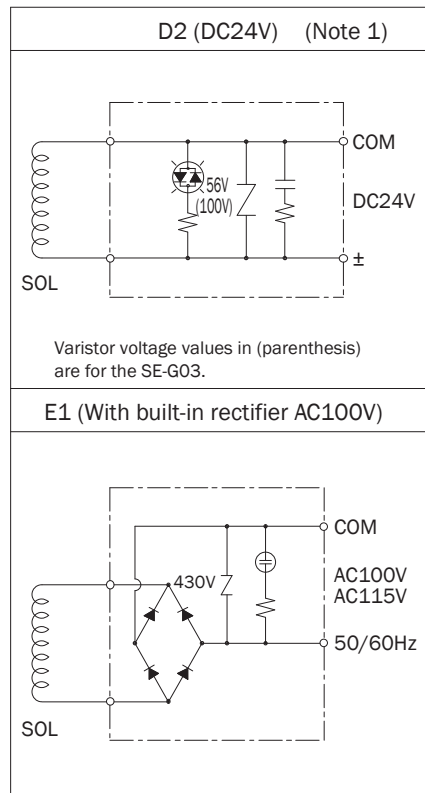
SE-G01-E3X-(G)R-**-40

Note: Gasket surface dimensions and sub plate are the same as those for SS-G01. See page D-8 for more information.

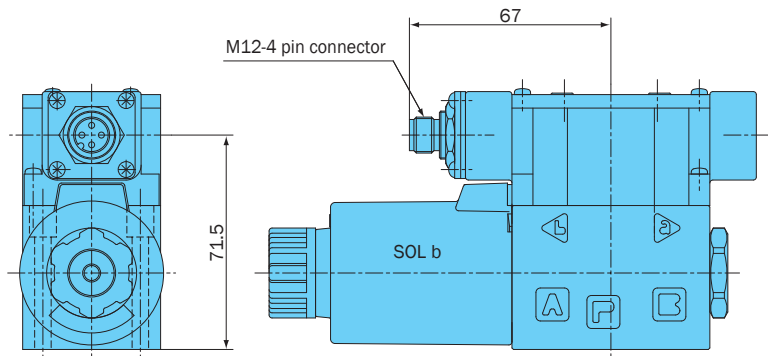
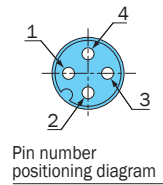
Wiring diagram for central terminal box kit



Electrical circuit diagram for central terminal box kit

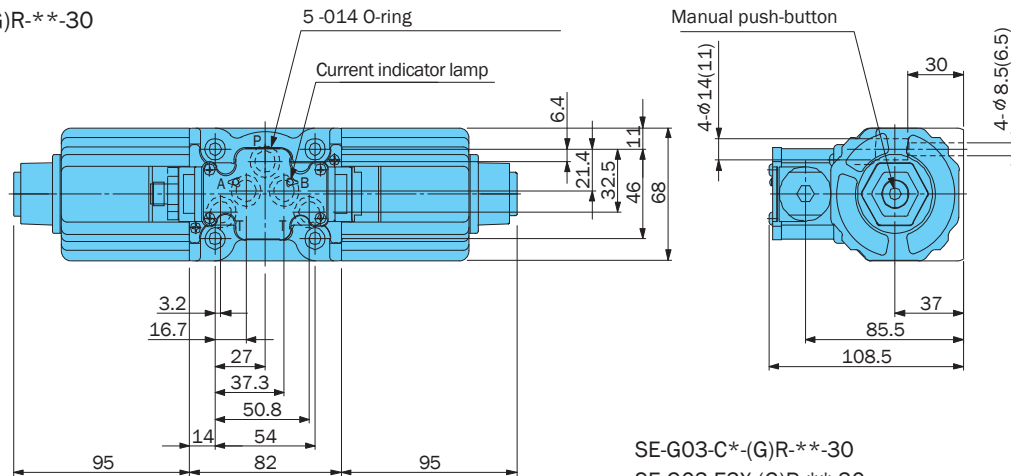


With M12-4 pin connector
SE-G01-**-GRV-D2-40
SE-G01-**-GRW-D2-40

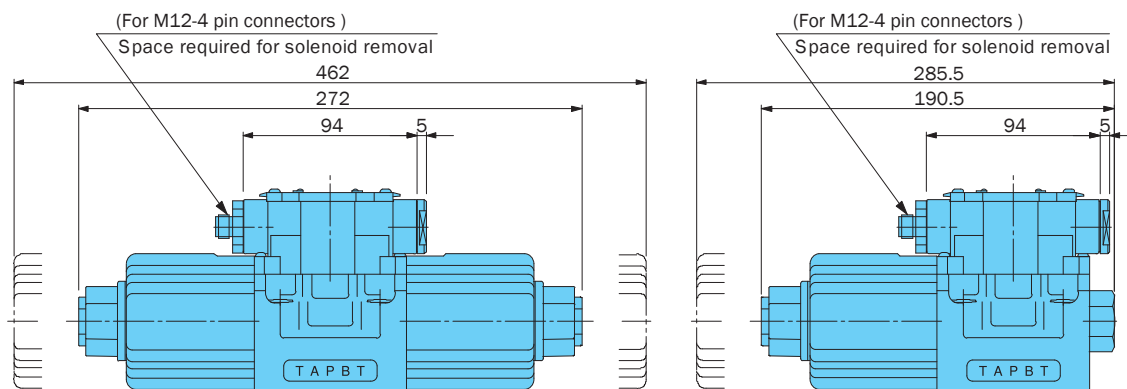


	M12-4 pin connector	Electrical Circuit Diagram
Type V	1: Not used 2: SOL a 3: COM (-) 4: SOL b	Terminal box Short circuit equipment
Type W	1: COM (+) 2: SOL a 3: Not used 4: SOL b	Terminal box Short circuit equipment

SE-G03-A**-(G)R**-30



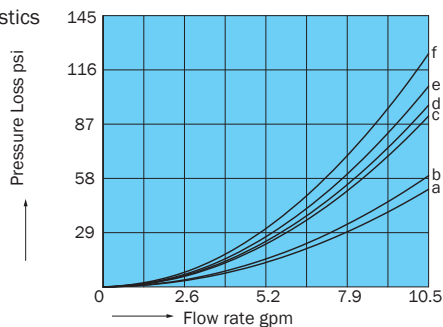
SE-G03-C*-(G)R**-30
SE-G03-E3X-(G)R**-30



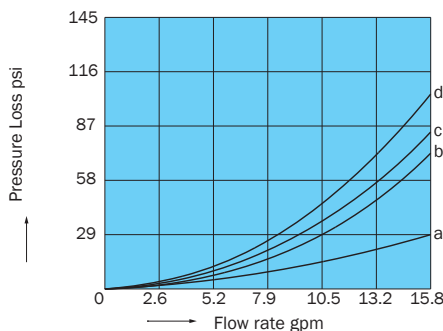
Performance Curves

Differential Hydraulic Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

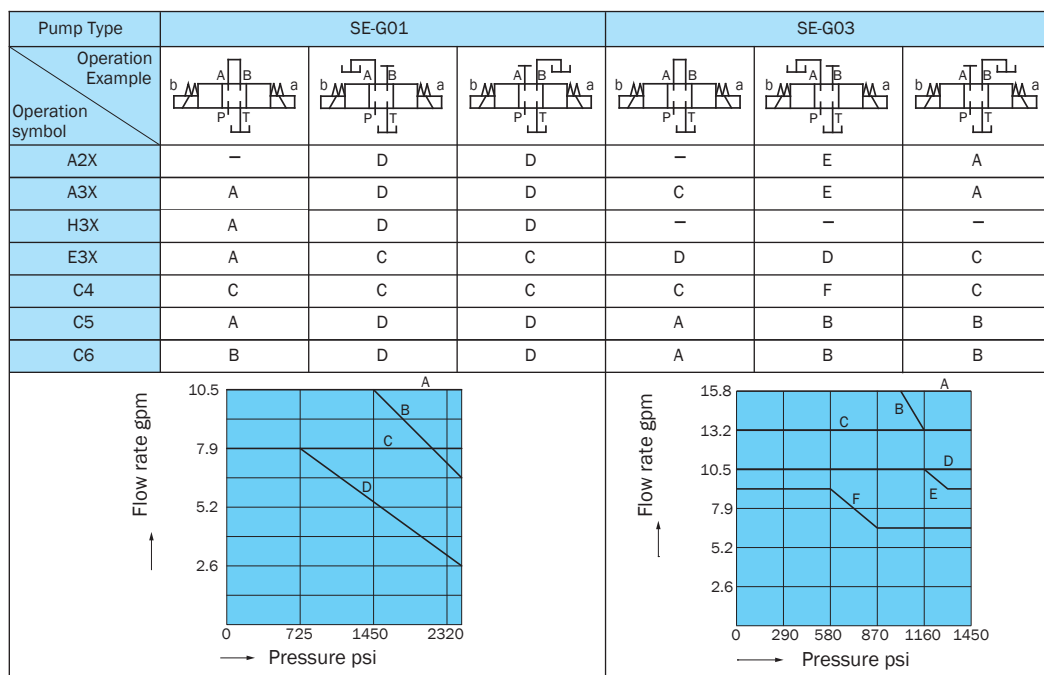


Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SE-G01	A2X	d	f	—	—	—
	A3X	f	f	e	e	—
	H3X	f	f	e	e	—
	E3X	c	c	e	e	—
	C4	b	b	b	b	d
	C5	e	e	d	d	—
	C6	f	f	a	a	—



Pump Type	Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
SE-G03	A2X	d	d	—	—	—
	A3X	d	d	d	d	—
	E3X	d	d	c	c	—
	C4	c	c	a	a	b
	C5	d	d	d	d	—
	C6	d	d	b	b	—

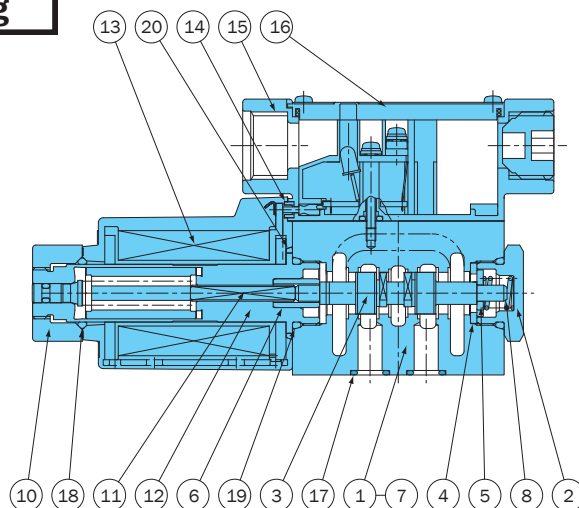
Pressure -
Flow Volume
Allowable Value



Note: 1.The maximum flow rate is the value when a rated 90%V is applied following solenoid temperature rise and saturation.
2.The maximum flow rate is the allowable value of each port.

Cross-sectional Drawing

SE-G01-A3X-(G)R-**-40



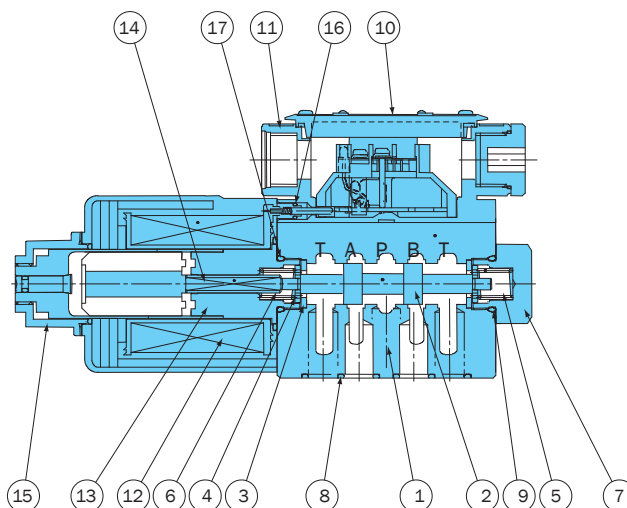
List of Sealing Parts

Part No.	Part Name	SE-G01		
		Part Number	Q'ty	
			Single Solenoid	Double Solenoid
17	O-ring	AS568-012(HS90)	4	4
18	O-ring	1A-P18	1	2
19	O-ring	1B-P18	2	2
20	O-ring	S-25	1	2

Note: O-ring 1A-** and 1B-** indicate JIS Standard B 2401-1A-** and 1B-**.

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

SE-G03-A3X-GR-**-J)30



Part No.	Part Name
1	Body
2	Spool
3	Spacer
4	Holder
5	Spring
6	Spring
7	Plug
8	O-ring
9	O-ring
10	Nameplate
11	Terminal box kit
12	Solenoid coil
13	Solenoid guide
14	Rod
15	Nut
16	O-ring
17	O-ring

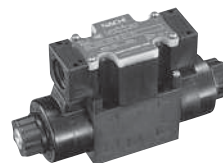
List of Sealing Parts

Part No.	Part Name	SE-G03		
		Part Number	Q'ty	
			Single Solenoid	Double Solenoid
8	O-ring	1B-P12	5	5
9, 17	O-ring	1B-P18	2	2
16	O-ring	1A-P3	2	4

Note: O-ring 1A-** and 1B-** indicate JIS Standard B 2401-1A-** and 1B-**.

Seal Kit Number

SE-G01		SE-G03	
Single Solenoid	Double Solenoid	Single Solenoid	Double Solenoid
EEDS-01A	EEDS-01C	EECS-03A	EECS-03C



SL Series (Wiring System: Central Terminal Box) Lower Power Solenoid Valve

7.9 gpm
1015 psi

Features

Very long life

The movable iron core of the wet type solenoid is immersed in oil, which keeps it lubricated and cushions it from impact and vibration, ensuring very long life.

Low switching noise

The wet-type solenoid valve provides very low core switching noise, for quiet operation.

Low power consumption type.

The low power for the AC solenoid 9.6 W (60 Hz), DC solenoid 10 W contribute to energy conservation.

Easy connections

A special wiring box provides a COM port and indicator light as standard for simple wiring and maintenance.

Easy coil replacement

A plug-in type coil enables one-touch coil replacement.

Wide-ranging backward compatibility

makes it simple to replace previous valve models with this one. Combining this valve with a modular valve contributes to the compact configuration of the overall device.

Global support

Meets overseas safety standards (CE, UL, and CSA). It can be safely used anywhere in the world. Contact your agent for certified products.

Specifications

JIS Symbol	Operation symbol	Maximum flow rate gpm
	-A5-	7.9
	-H5-	
	-A3X-	
	-H3X-	
	-E3X-	
	-C1-	
	-C2-	

JIS Symbol	Operation symbol	Maximum flow rate gpm
	-C4-	7.9
	-C5-	
	-C6-	
	-C9-	
	-C6S-	
	-C7Y-	3.9

Solenoid Type		AC Solenoid		DC Solenoid	
				Built-in Rectifier	
		C1	C2	E1	D2
Maximum Working Pressure	P.A.B. Ports	1015 psi			
Maximum Allowable Backpressure	T Port	1015 psi			
Changeover Frequency (per minute)		240		120	240
Standard	Indicator light	R			
Options	Surgeless	G		—	G
	With manual push-button	N			
	Quick Return	—		Q	—
Mass lbs	Double Solenoid	3.3		4.4	
	Single Solenoid	2.6		3.3	
Recommended	Ambient Temperature	-4 to 158° F			
	Viscosity Range	15 to 300 centistokes			
	Viscosity Index	90 or greater			
	Filtration	10 microns or less			
Mounting bolt		Allen head - 10-24 x 1 3/4 LG			
Tightening Torque		3.6 to 5 ft lbs			

Note: Mounting bolts are not included.

- Handling

- 1 In order to realize the full benefits of the wet type solenoid valve, configure piping so oil is constantly supplied to the T port. Never use a stopper plug in the T port.
- 2 Ensure that surge pressure in excess of the maximum allowable back pressure does not reach the T port.
- 3 Note that the maximum flow rate is limited when used as a four-way valve, or by blocking ports for use as a two-way valve or one-way valve.
- 4 Always keep the operating fluid clean. (contamination level: 12 or lower)

- 5 When using petroleum type operating fluid, use ISO VG 32, 46.
- 6 Use the SS series solenoid valve when using fire resistant hydraulic operating fluid.
- 7 Use this valve only within the allowable voltage range.
- 8 Do not allow the AC solenoid to become charged until you install the coil into the valve.
- 9 Maintaining a switching position under high pressure for a long period can cause abnormal operation due to hydraulic lockup. Contact your agent when you need to maintain a switching position for a long period.

- 10 When using a detent type (3X), use constant energization in order to securely maintain the switching position.
- 11 Note that manual pin operating pressure changes in accordance with tank line back pressure.
- 12 Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Maximum flow rate gpm	Weight lbs
MSA-01X-E10	1/4	5.2	2.6
MSA-01Y-E10	3/8	10.5	

- Solenoid Assembly Specifications

Solenoid Type		AC Solenoid						DC Solenoid	
								Built-in Rectifier	
Power Supply Type		C1			C2			E1	D2
Voltage (V)		AC100		AC110	AC200		AC220	AC100	DC24
Cycles (Hz)		50	60	60	50	60	60	50/60	—
For 01	Solenoid Coil Type	EL64-C1			EL64-C2			ELC64-E1-1A	ELC64-D2-1A
	Drive Current (A)	1.30	1.10	1.30	0.65	0.55	0.65	0.11	0.42
	Holding Current (A)	0.30	0.24	0.28	0.15	0.12	0.14		
	Holding Power (W)	12.0	9.6	12.2	12.0	9.6	12.2		
	Allowable Voltage Range	80 to 110	90 to 120		160 to 220	180 to 240		90 to 110	21.6 to 26.4
	Allowable Pressure psi	1000							
	Insulator Resistance (M Ω)	100 or greater (500 V)							

- Note: 1. A DC solenoid surge absorption circuit is effective in preventing misoperation in sensitive relays and IC circuits. (Applicable for power supply display D", option: G)
2. A DC solenoid RAC type (power supply E1) greatly increases the life of the contacts by eliminating contact arc without changing circuit sequence on an AC line, 50/60Hz can be used.

Understanding Model Numbers

SL - G 01 - A 3 X - ※ R - C2 - 31

Design Number

Power supply

C: AC (50/60 Hz) C1 = AC100 V C2 = AC200 V

D: For DC D2 = DC24V

E: AC (Built-in rectifier; 50/60Hz) E1 = AC100V

With indicator light

Auxiliary symbol (Can be combined in alphabetic sequence.)

G: Surgeless type (Power supply C ※ D2 Applicable)

N: With manual push-button (Available with power supply D2, E1)

Q: Quick return type (Available with power supply E1)

Transition flow path (A3X, H3X, E3X, C7Y only)

X	Y
Close	Semi-open

Center position

1 	2 	3 	4 	5
6 	7 	9 	6S 	

Note 1. P is pressure port, A and B are connection ports to cylinder.
T (R) shows the connection port to the tank.

Operation Method

A	H	C	E
Spring Offset type	Spring Center	Spring Center	Detent

Nominal Diameter: 01 size (D03)

Mounting method: Gasket type

Machine type: SL Series wet magnetic switching valve.

Options

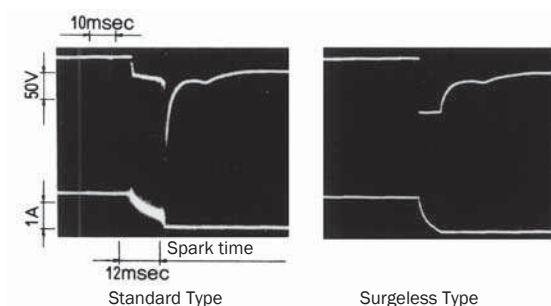
(Auxiliary Symbol)

Surgeless Type (Auxiliary Symbol: G)

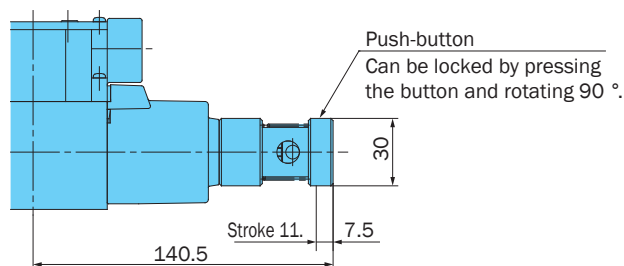
The surge pressure waveforms when the DC solenoid valve power supply is opened and closed by a relay are shown at the bottom of this block.

A built-in surge absorber element eliminates sparking and surge pressure.

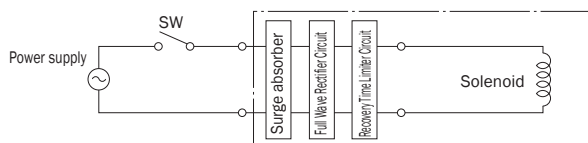
- Features
- ┆ Surge voltage is inhibited.
 - ┆ Sparking at relay contact points is eliminated.



Manual Push-button Type (Auxiliary symbol: N)



Quick Return Type (Auxiliary Symbol: Q)



Handling

1. This type is used in the case of power supply type E1 (with built-in rectifier) to shorten the spring return time. This also applies to D2.
2. The quick return mechanism is built-in.

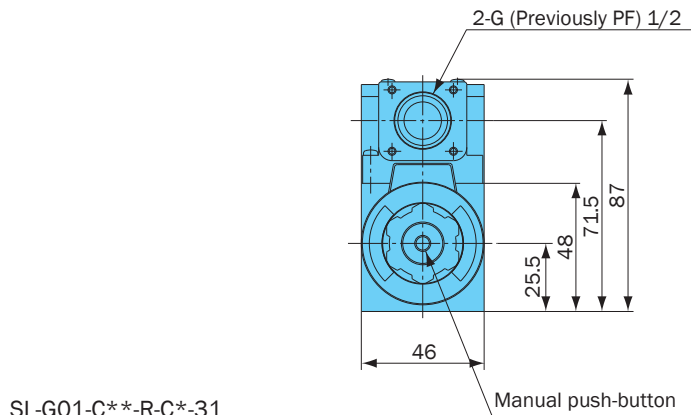
Installation Dimension Drawing

AC Solenoid

SL-G01-A**-R-C*-31

SL-G01-H**-R-C*-31

Note: The SL-G01-H**-R**-31 solenoid, is attached to the opposite side (SOL a) as shown in the diagram.



SL-G01-C**-R-C*-31

SL-G01-E**-R-C*-31

DC Solenoid and Rectifier

SL-G01-A**-R-D/E*-31

SL-G01-H**-R-D/E*-31

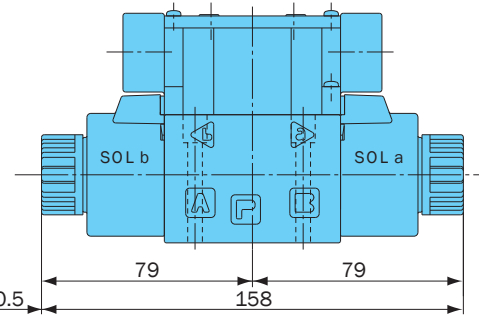
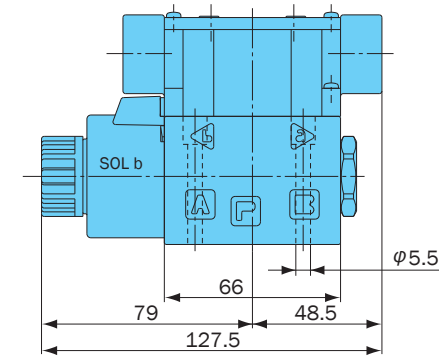
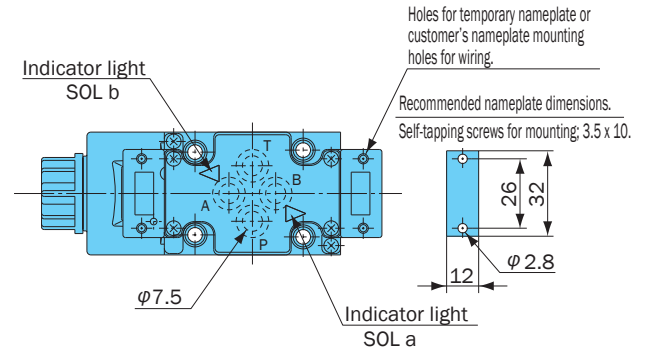
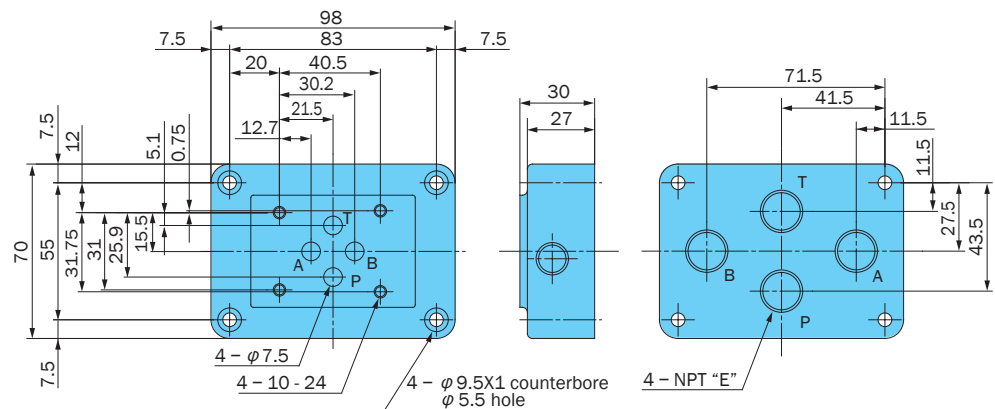
SL-G01-C**-R-D/E*-31

SL-G01-E**-R-D/E*-31

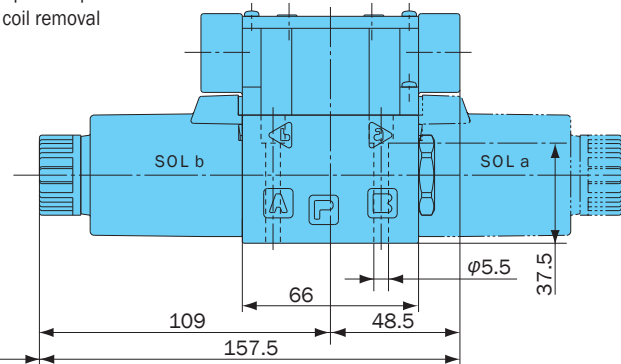
For sub plate SL-G01

Model No.	E	Mass
MSA-01X-E10	1/4	2.6
MSA-01Y-E10	3/8	2.6

Gasket Surface Dimensions
(ISO 4401-03-02-0-94
JIS B 8355 D-03-02-0-94)

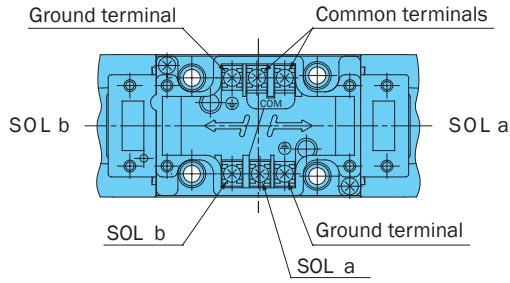


Space required for coil removal



Space required for coil removal

Wiring Diagram



- Note:
1. In the case of a double solenoid valve, a common terminal is provided to simplify wiring.
When the common terminal is not used, remove the terminal screws.
 2. Use the ground terminal when grounding is required.
 3. Use an M3 type as a solderless terminal.
 4. Tighten terminal screws to a torque of 4.4 to 6.1 in lbs

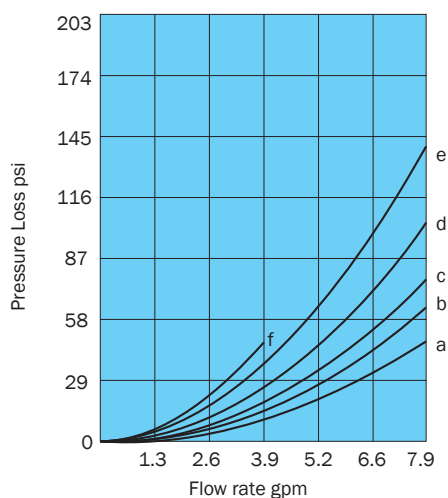
Electrical Circuit Diagram

Type	Model No.	Electrical Circuits
AC Solenoid	SL-G01-***-R-C*-31	
AC Solenoid Surgeless Type	SL-G01-***-GR-C*-31	
Built-in Rectifier	SL-G01-***-R-E*-31	
DC Solenoid	SL-G01-***-R-D*-31	
DC Solenoid Surgeless Type	SL-G01-***-GR-D*-31	
Built-in Rectifier Quick Return Type	SL-G01-***-QR-E*-31	See page D-7 for more information.

Performance Curves

Hydraulic Operating Fluid Viscosity 20 centistokes

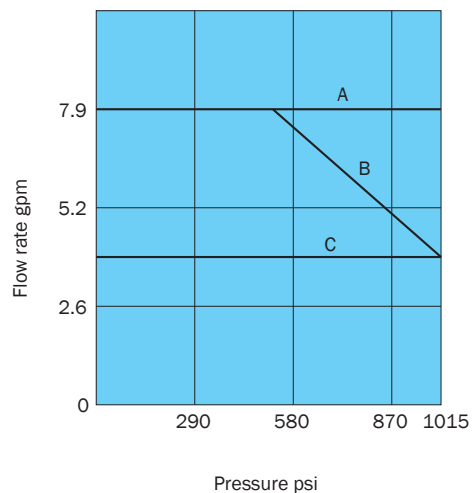
Pressure Loss Characteristics



Flow Path	P/ A	P/ B	A/ T	B/ T	P/ T
A5	—	c	c	—	—
H5	c	—	—	c	—
A3X, H3X, E3X	b	b	e	e	—
C1	c	c	a	c	—
C2	a	c	e	c	—
C4	a	a	c	c	d
C5, C6S	c	c	c	c	—
C6	c	c	a	a	—
C7Y	f	f	e	e	d
C9	a	a	e	e	—

Pressure – Flow Volume Allowable Value

Operation Example	Operation symbol	A	B	C
A5		—	B	—
H5		B	—	—
A3X, H3X, E3X C1, C2, C4, C5 C6, C9, C6S		B	B	—
C7Y		C	C	C



Switching Response Time

Model No.	Response Time (sec)		Measurement Conditions
	Solenoid ON	Spring Return	
SL-G01-**-R-C*-31	0.010 to 0.020	0.010 to 0.020	1015 psi
SL-G01-**-R-E1-31	0.055 to 0.080	0.150 to 0.185	5.2 gpm
SL-G01-**-G)R-D2-31	0.055 to 0.080	0.025 to 0.035	40 centistokes

Note: 1. The switching response time changes slightly with operating conditions (pressure, flow rate, viscosity, etc.)

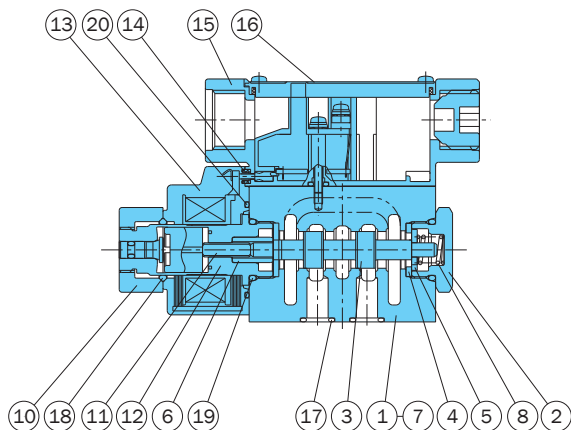
2. In the case of power supply type E1 (with built-in rectifier), the spring return time using Quick Return (option symbol: Q) is the same as D2.

D

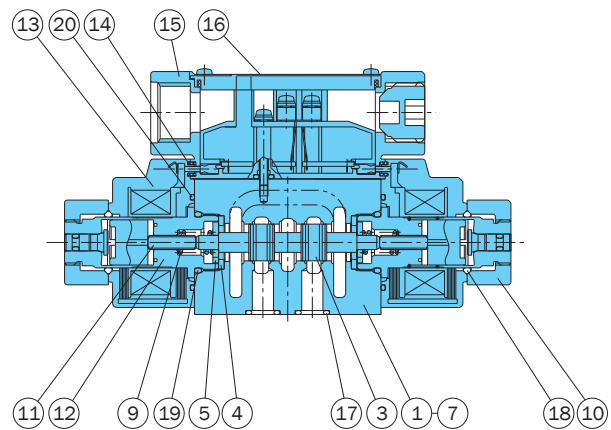
Solenoid Valves

Cross-sectional Drawing

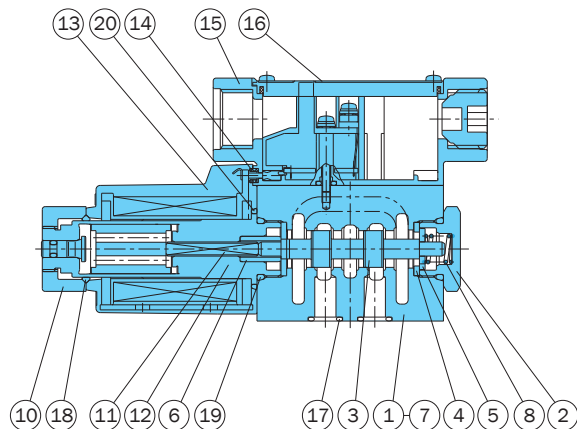
SL-G01-A**-R-C*-31



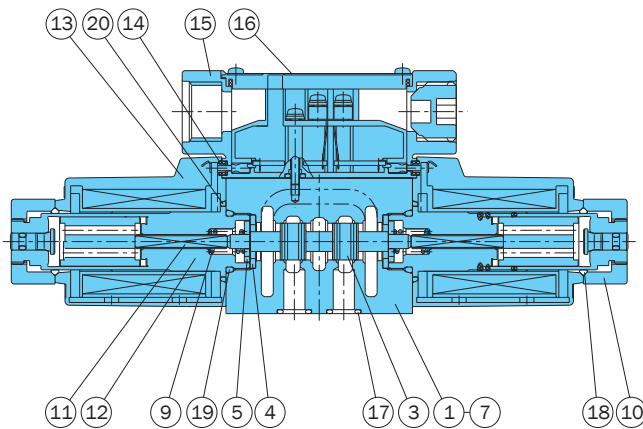
SL-G01-C**-R-C*-31



SL-G01-A**-R-D/E*-31



SL-G01-C**-R-D/E*-31



List of Sealing Parts

Part No.	Part Name	Type / Part Number		Q'ty	
		DC SOL	AC SOL	Single Solenoid	Double Solenoid
17	O-ring	AS568-012(Hs90)		4	4
18	O-ring	1A-P20	1A-P18	1	2
19	O-ring	1B-P18		2	2
20	O-ring	S-25	AS568-025(Hs70)	1	2

Note: O-ring 1A/1B-** indicates JIS B2401-1A/1B**. AS568 is SAE standard.

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



DSS (DSA) 22 Design Series Solenoid Control Valve

7.9 to 15.8 gpm
4640 to 5075 psi

Features

Long-life operation is ensured by use of the high-performance, renowned SS (SA)-G01 wet solenoid valve as the pilot valve.

High pressure, high capacity

The 04 size can provides up to 79 gpm, while the 06 size delivers up to 158 gpm.

Low pressure loss

An original flow path design provides wide-ranging low pressure loss and enhanced system circuit efficiency. Internal modification of the pilot and drain can be accomplished without removing the valve by simply connecting and disconnecting plugs.

Built-in pilot pressure check valve

When tandem center type valve is used for the internal pilot valve (option), pilot pressure required for switching is self-maintained.

Specifications

Valve Size			04 Size (D07)	06 Size (D08)
Valve Model Number			DSS(DSA)-G04-***-R-**-22	DSS(DSA)-G06-***-R-**-22
Maximum Working Pressure psi	P.A.B. Ports		5075	4640
	T Port	Internal Drain Type	2320	2320
		External Drain Type	3045	3045
Maximum Flow Rate gpm			79	158
Rated Flow Rate gpm			39	79
Maximum Pilot Pressure psi			3625	3625
Minimum pilot pressure psi	A** (Spring Offset Type)		116	116
	E** (No-spring Detent Type)			
	C** (Spring Center Type)		174	174
	D** (Pressure Center Type)			
	Built-in Pilot Pressure Check Valve Type (For Internal Pilot)		65	
Maximum Changeover Frequency (cycles/minute)			120	120
Pilot Volume cu in	A** (Spring Offset Type)		.48	1.2
	C** (Spring Center Type)		.24	.6
Weight lbs	A** (Spring Offset Type)		19	31.9
	E** (No-spring Detent Type)		20.2	33
	C** (Spring Center Type)			
	D** (Pressure Center Type)		23	36.3
Operating Environment	Dust-resistance/Water-resistance Rank JIS C 0920		DSS: IP64 (Dust-tight, Splash-proof) DSA: IP65 (Dust-tight, Waterjet-proof)	
	Ambient Temperature		-4 to 122° F	
	Operating Fluid	Temperature Range	-4 to 158° F	
		Viscosity Range	15 to 300 centistokes	
		Filtration	10 microns or less	
Bundled Accessories	Mounting bolt		(2) 1/4-20 x 1 3/4 (4) 3/8-16 x 2	(6) 1/2-13 x 2 3/8
	Tightening Torque		1/4 - 7.3 to 9.5 ft lbs 3/8 - 33 to 40 ft lbs	44 to 51 ft lbs

Note: 1.The maximum flow rate of each valve depends on the pressure. For details, see pages D-46 and D-47.

2.Weight in parentheses is for stroke adjustment type.

3.Solenoid specifications are the same as those for SS (SA)-G01. For more information, see pages D-6 and D-18.

• Handling

- 1 Pilot pressure values show the differential pressure between the pilot port and tank port or drain port. In the case of the pressure center, they show differential pressure between the pilot and drain ports (DR1, DR2).
- 2 The standard configuration is internal pilot and external drain, but other configurations are possible when required. See page D-48 for more information.
- 3 The JIS number on the nameplate indicates the standard internal pilot and external drain.
Note therefore that the JIS numbers on

- page D-46 and D-47 are used even if the pilot is external and the drain is internal.
- 4 The maximum operating pressure for internal pilot is 3625 psi because it is limited by the pilot pressure.
 - 5 For the PT mounting type DSS (DSA)-G**-C7*-**-22, open cross over with restrictor C7Y is standard.
 - 6 When adjustable spool stroke is desired, specify L in the auxiliary symbol position of the model number. Note, however, that this is not available with the pressure center type.
 - 7 When using a detent type (E3*), use

- constant energization in order to securely maintain the switching position.
- 8 Use of the pressure center type is recommended for large-volume flow control.
 - 9 For the all ports open center type (A3Z, E3Z, C4, D4), PT mounting type (C7X, C7Y, D7X, D7Y), and PAT mounting type, use the type with built-in external pilot pressure check valve.
 - 10 The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.

Valve Model Number	DSS(DSA)-G04	DSS(DSA)-G06
Front Position		
Simplified Symbols		
Detailed Symbols		
Flow Regulator Adjusting Screw Positions	A Port Restrictor: Right side A B Port Restrictor: Left side B	A Port Restrictor: Left side A B Port Restrictor: Right side B
Adjustable Stroke Adjusting Screw Positions	A Port Side: P / A, B / T flow rate adjustment (For C7Y, P / B, A / T) B Port Side: P / B, A / T flow rate adjustment (For C7Y, P / A, B / T)	

Understanding Model Numbers

DSS - G 06 - C 7 Y C - **R* - C2 - E22

Power supply
C: AC (50/60Hz) C1=AC100V C115=AC110V C2=AC200V C230=AC220V
D: DC D1=DC12V D2=DC24V
E: AC (Built-in rectifier; 50/60Hz)
E1=AC100V E115=AC115V E2=AC200V E230=AC230V

Auxiliary symbol - For multiple specifications, use alphabetic sequence.

A: Internal drain
E: External pilot
L: Spool stroke limiter
P: Flow regulator valve to restrict P port
Y: With meter-out flow regulator valve
R: With indicator light
N: With manual lock
Q: Quick return type
GR: Surgeless type with indicator

Pilot pressure check valve
None: No check valve
C: Built-in check valve

Transition flow path (Specify for *3*, *7* only.)
X: Closed Y: Restrictor open Z: Open

X	Y	Z
Closed	Semi-open	Open

Center valve position flow path
1, 2, 3, 4, 4S, 5, 6, 6S, 7, 8

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

Operation Method
A: Spring offset
E: No-spring detent
C: Spring center
D: Pressure center

A	E	C	D
Spring Offset	No-spring detent	Spring Center	Pressure center

Nominal diameter 04 size, 06 size

Mounting method G: Gasket type

Pump Type DSS: Central terminal box solenoid control valve
DSA: DIN connector type solenoid control valve

Pilot (PP), Drain (DR)

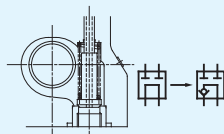
*High Pilot Pressure
Use at pressures that do not exceed 3625 psi
*Internal PP, external DR are Nachi-Fujikoshi standards.
For external PP: Built-in stopper plug (Option E)
For internal DR: Stopper plug modification (Option A)
*Internal DR Precautions
Make sure that the differential pressure between the pilot pressure and tank back pressure is greater than the minimum pilot pressure.
Do not connect any pipe that generates sudden surge pressure.

Built-in Pilot Solenoid Valve

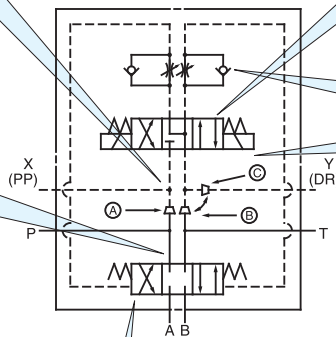
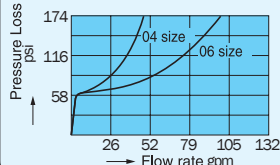
Valve Model Number	For G04	For G06
DSS(DSA)-G**-A**	SS(SA)-G01-A3X	SS(SA)-G01-H3X
DSS(DSA)-G**-E**	SS(SA)-G01-E3X	
DSS(DSA)-G**-C**	SS(SA)-G01-C6	
DSS(DSA)-G**-D**	SS(SA)-G01-C9	

Built-in Pilot Pressure Check Valve

*Like the C7Y, this internal PP type is used in a flow path configuration where maintenance of pilot pressure is required.



Check Valve Pressure Loss



Simple a symbols



Note: Above symbols are for DSS (DSA)-G06.

Flow Regulator Valve

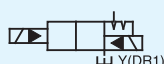
*Rotating the adjusting screw clockwise (rightward) slows the main spool switching speed.
P: Excitation of the solenoid (starting of the actuator) causes a restrictor effect.
Y: The restrictor effect can be obtained especially when the solenoid is de-excited (actuator stopped).

Pilot Valve Mounting Bolts

	Standard	M5 x 45 (four)
Stage 1	M5 x 85 (four)	
Stage 2	M5 x 125 (four)	
Stage 3	M5 x 165 (four)	

Tightening Torque: 3.6 to 5 ft.lbs.)

Detent Type Installation



*Install the valve in a horizontal configuration.
*Provide constant energization for secure holding.

Adjustable Stroke Type

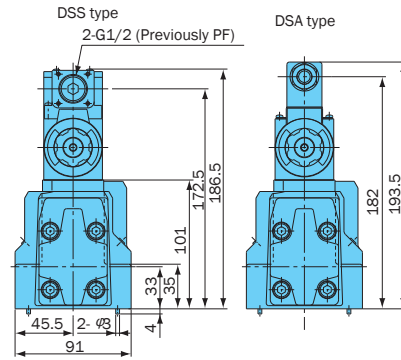
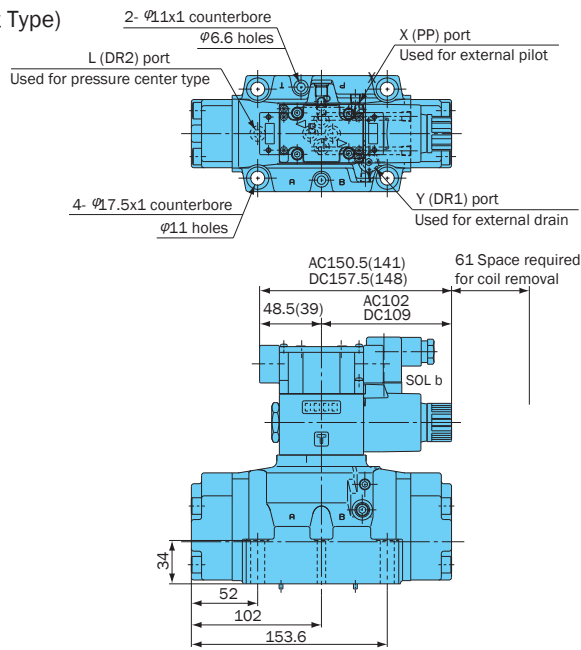
*Tightening the adjusting screw makes the main spool stroke smaller, which restricts flow.

Pressure center

*Use this valve in a high-pressure, large-volume circuit to ensure reliable return of the main spool to the neutral position.

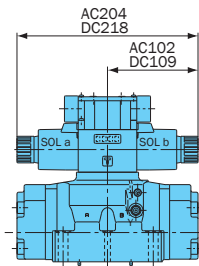
DSS(DSA)-G04-A**-R**-22

(Spring Offset Type)



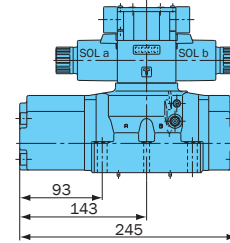
DSS(DSA)-G04-^E/_C**-R**-**22

(No-spring Detent Type)
(Spring Center Type)



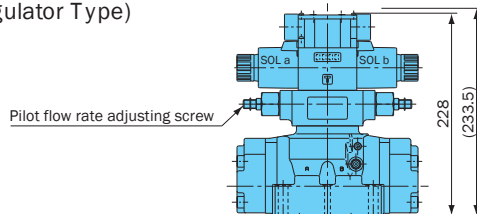
DSS(DSA)-G04-D**-R**-**22

(Pressure Center Type)



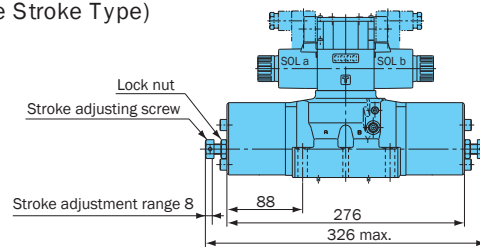
DSS(DSA)-G04-^A/_C/_D**-R_Y-**22

(Flow Regulator Type)



DSS(DSA)-G04-E^A/_C**-LR**-**22

(Adjustable Stroke Type)



Dimensions in the parentheses are for the DSA-G04-***-21.

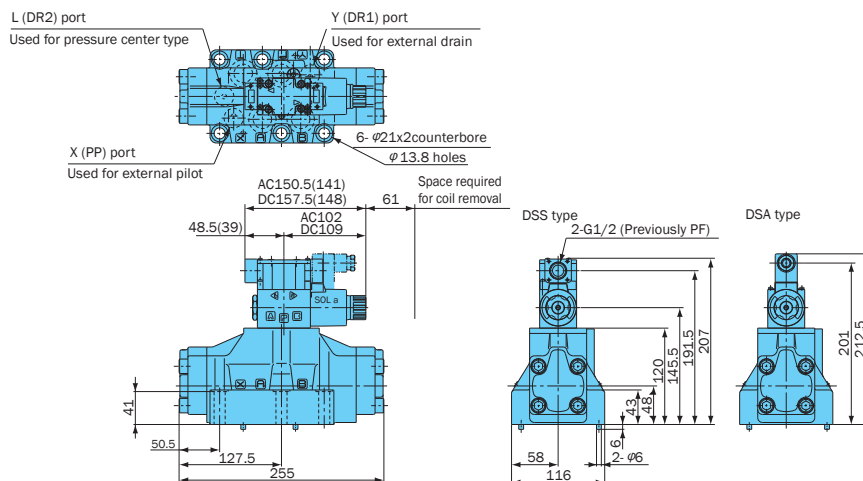
(ISO 4401-07-06-0-94
JIS B 8355 D-07-06-0-94)

For sub plate DSS (DSA) -G04

Model No.	E	Weight
MDS-04X-E10-D	SAE-12	4.1 lbs

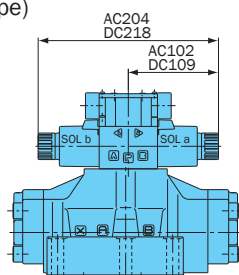
DSS(DSA)-G06-A**-R**-22

(Spring Offset Type)

DSS(DSA)-G06-^E/_C**-R**-22

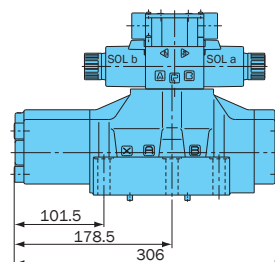
(No-spring Detent Type)

(Spring Center Type)

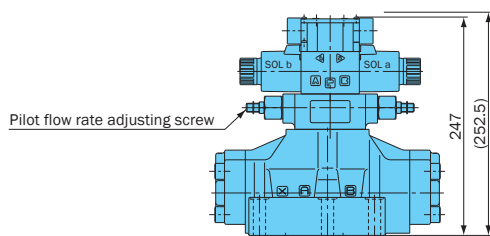


DSS(DSA)-G06-D**-R**-22

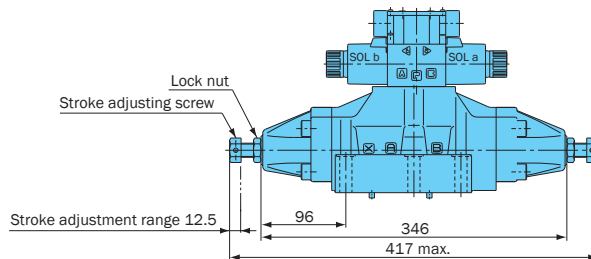
(Pressure Center Type)

DSS(DSA)-G06-^A/_C**-RY**-22

(Flow Regulator Type)

DSS(DSA)-G06-^A/_C**-LR**-22

(Adjustable Stroke Type)



Dimensions in the parentheses are for the DSA-G06-**-RY**-21.

(ISO 4401-08-07-0-94
JIS B 8355 D-08-07-0-94)

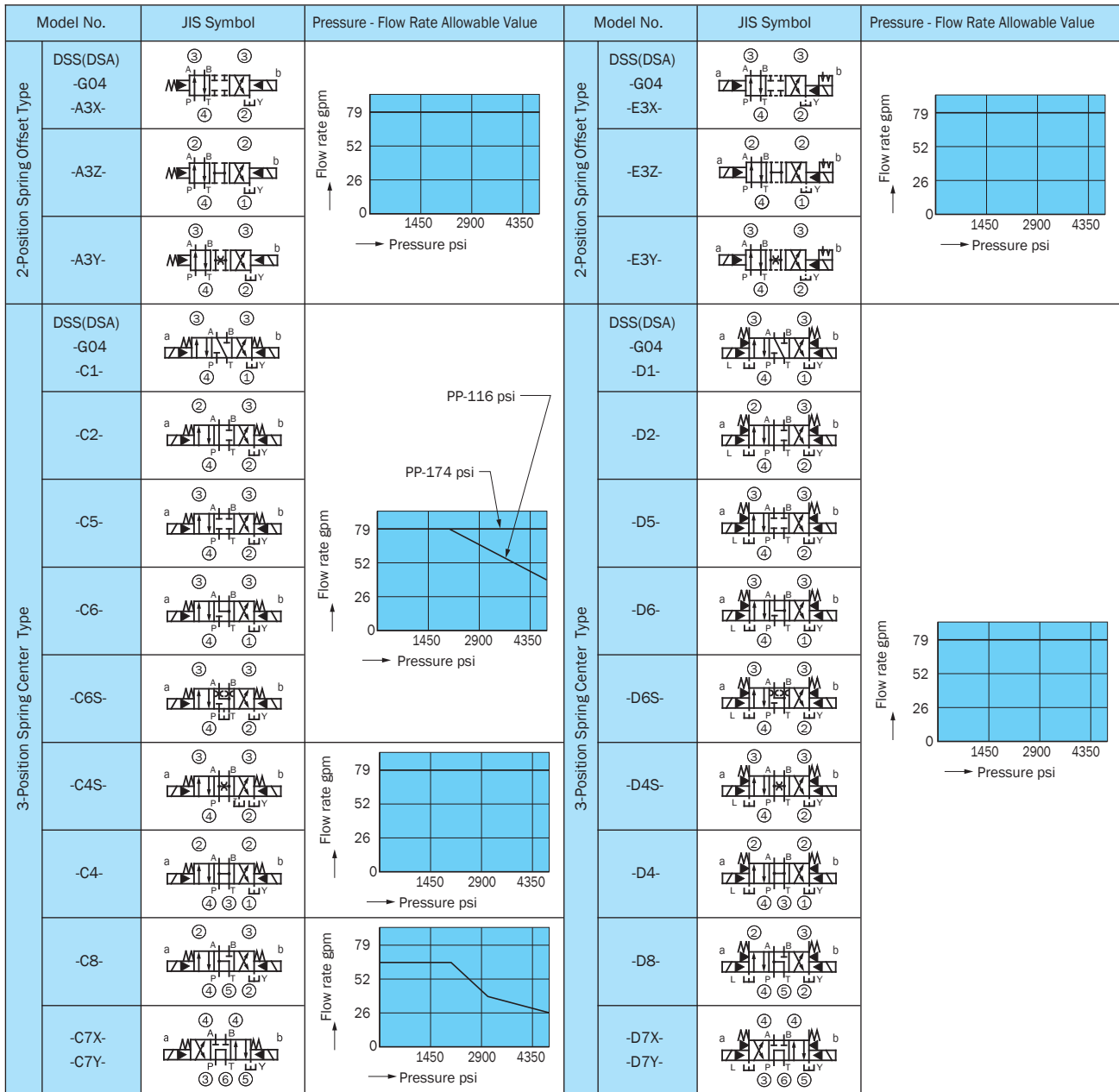
For sub plate DSS (DSA) -G06

Model No.	E	Weight
MDS-06X-E30-D	SAE-16	5.3 lbs

Performance Curves

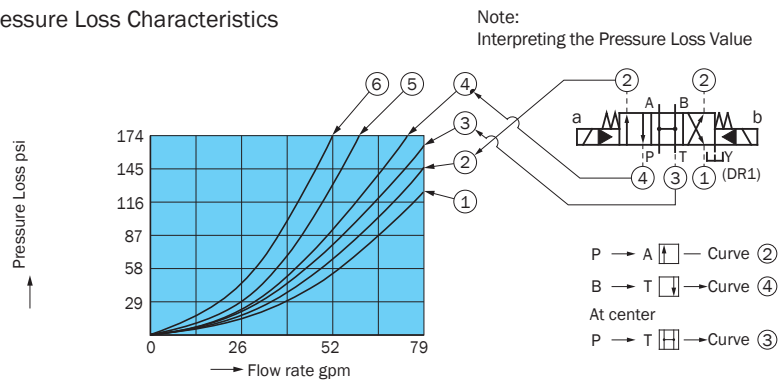
Hydraulic Operating Fluid Viscosity 32 centistokes

DSS(DSA)-G04



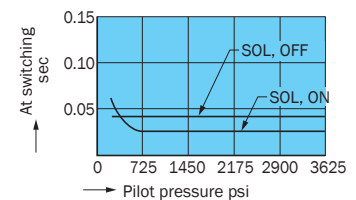
Note: The JIS number indicates the standard internal pilot and external drain.

Pressure Loss Characteristics



Switching Response Time

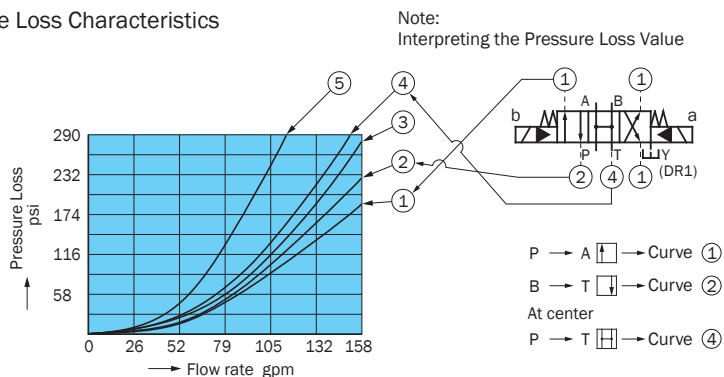
Model No. : DSS-G04-C5
Voltage Symbol : C1 (AC Solenoid)



Model No.	JIS Symbol	Pressure - Flow Rate Allowable Value	Model No.	JIS Symbol	Pressure - Flow Rate Allowable Value
2-Position Spring Offset Type	DSS(DSA) -G06 -A3X-		2-Position Spring Offset Type	DSS(DSA) -G06 -E3X-	
	-A3Z-			-E3Z-	
	-A3Y-			-E3Y-	
3-Position Spring Center Type	DSS(DSA) -G06 -C1-		3-Position Spring Center Type	DSS(DSA) -G06 -D1-	
	-C2-			-D2-	
	-C5-			-D5-	
	-C6-			-D6-	
	-C6S-			-D6S-	
	-C4S-			-D4S-	
	-C4-			-D4-	
	-C8-			-D8-	
	-C7X- -C7Y-			-D7X- -D7Y-	

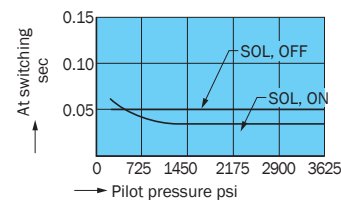
Note: The JIS number indicates the standard internal pilot and external drain.

Pressure Loss Characteristics



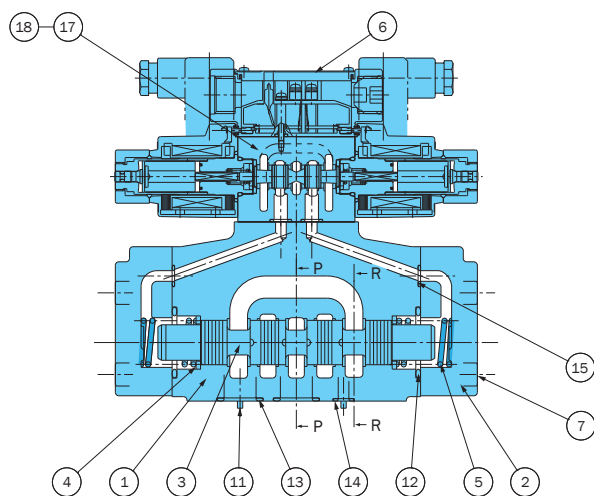
Switching Response Time

Model No. : DSS-G06-C5
Voltage Symbol: C1 (AC Solenoid)

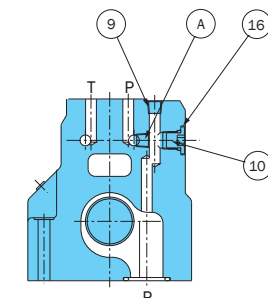


Cross-sectional Drawing

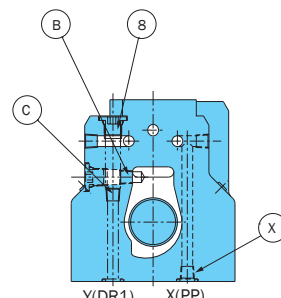
DSS(DSA)-G04-C**-R-C*-22



Pilot, Drain System Change

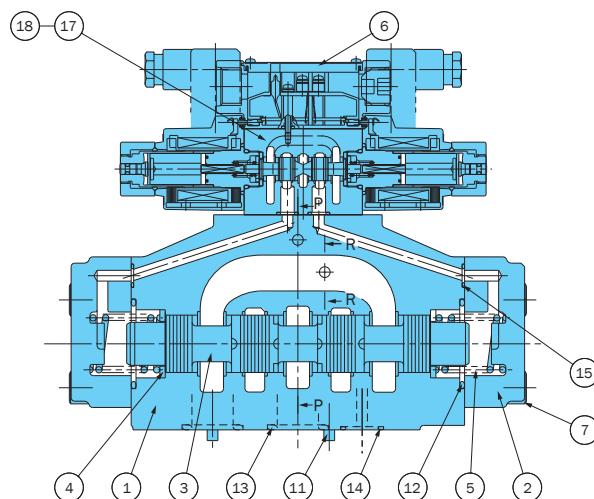


Cross-sectional P-P

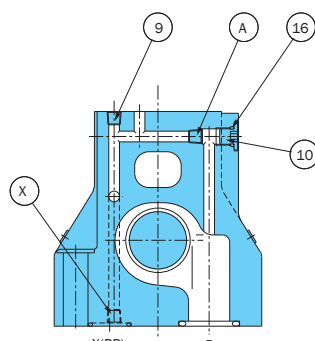


Cross-sectional R-R

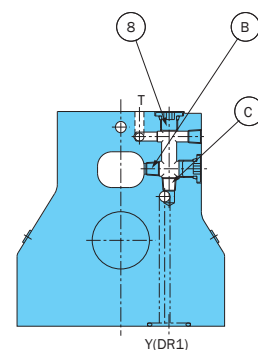
DSS(DSA)-G06-C**-R-C*-22



Pilot, Drain System Change



Cross-sectional P-P



Cross-sectional R-R

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	8	Plug	14	O-ring
2	Cover	9	Plug	15	O-ring
3	Spool	10	Plug	16	O-ring
4	Ring	11	Pin	17	Solenoid Valves
5	Spring	12	O-ring	18	Screw
6	Nameplate	13	O-ring		
7	Screw				

Changing the Pilot and Drain Connections

After Change		Hexagon Socket Head Plug
Pilot	Internal	Switch from A to x .
	External	Switch from x to A .
Drain	Internal	Switch from B to C .
	External	Switch from C to B .

List of Sealing Parts

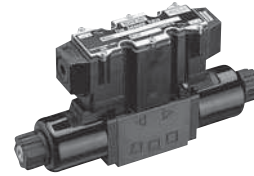
Part No.	Part Name	Part Number		Q'ty
		O4 size	O6 Size	
12	O-ring	1B-P34	1B-G45	2
13	O-ring	1B-P22	1B-P28	4
14	O-ring	1B-P10A	1B-P20	2
15	O-ring	1B-P9	1B-P10	2
16	O-ring	1B-P8	1B-P8	3

Seal Kit Number

O4 size		O6 Size	
Single Solenoid	Double Solenoid	Single Solenoid	Double Solenoid
EDBS-04AA-1A	EDBS-04CA-1A	EDBS-06AA-1A	EDBS-06CA-1A

Note: The seal kit includes a seal for the pilot solenoid valve.

Note: 1.O-ring 1A/1B/4D-** indicate JIS Standard B 2401-1A/1B/4D-**. 2.See SS/SA-G01-**-31for information about the seal part for the pilot solenoid valve.



Fine Solenoid Valve SF Series

2.6 to 10.5 gpm
3045 psi

Features

The function of two valves in one

A two-speed controller provides smooth speed adjustment from low speed to high, and from high-speed to low.

Quiet starts and stops

A low-speed startup and stop feature makes startups and stops smooth and soft.

Separate control of forward and back cylinder movement
There are five volume settings for highspeed flow rate and acceleration/-deceleration times that can be independently adjusted SOL.a and SOL.b (ON side, OFF side).

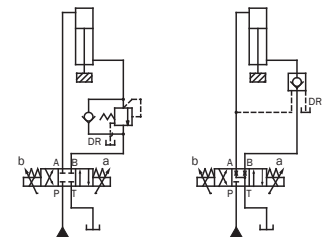
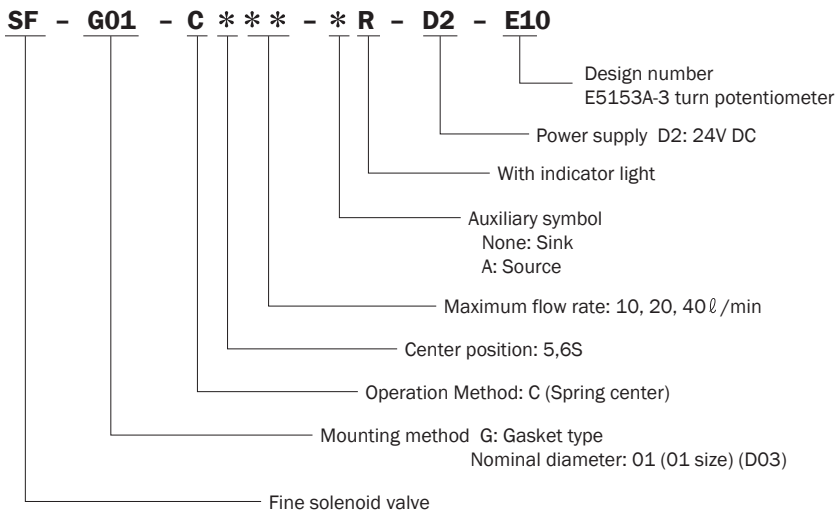
- Handling
- 1 Valve differential pressure
Volume adjustment becomes sensitive when P→A (B) and B(A)→T differential pressure is large. Maintain the pressure differential so it is no greater than 500 psi.
- 2 Low-speed flow rate
The spool may not move if the low-speed flow rate is below the minimum. Use this valve only within the allowable minimum low-speed flow rate range.
- 3 Deceleration circuit
 - Use a C5** spool for the deceleration circuit. Deceleration is difficult with the C6S** spool.
 - When large deceleration is required or for a system that uses a vertical cylinder, equip an external drain type counter balance valve. See the illustration below.
- 4 Pilot check circuit
 - For a circuit with a pilot check valve, knocking may occur in the pilot check valve due to large load inertia and circuit pressure loss. In cases like this, use an external drain type pilot check valve. See the illustration below.

Specifications

Model No.	SF-G01 -C*10-D2-10	SF-G01 -C*20-D2-10	SF-G01 -C*40-D2-10
Item			
Valve Maximum Operating Pressure psi	3045		
Maximum Flow Rate l (gpm)	10 (2.6)	20 (5.2)	40 (10.5)
High-speed Flow Rate gpm	1.3 to 2.6	2.6 to 5.2	5.2 to 10.5
Low-speed Flow Rate gpm	.13 to 1.0	.52 to 2.1	1.0 to 4.2
Maximum Allowable Back Pressure psi	1000		
Acceleration/Deceleration Time Adjustment Range SEC	0.1 to 2		
Hysteresis (Note 2)	7%		
Repeatability (Note 2)	3%		
Power Supply Voltage V	D2: 24V DC regulated DC power supply		
Maximum Power Consumption W	36W		
Operating Environment	Dust Resistance/Water Resistance Rank		
	IP63 (Dust-tight, Rain-proof)		
	Ambient Temperature		
	41 to 122° F		
Operating Fluid	Temperature Range		
	41 to 140° F		
	Viscosity Range		
Mounting	15 to 300centistokes		
	Filtration		
	10 microns or less		
Size x Length	10-24 x 1 3/4		
	Tightening Torque		
	3.6 to 5 ft lbs		

- Note) 1.The above high-speed and low-speed flow rates are obtained with a differential pressure (PA, PB) of 145 psi. The flow rates depend on differential pressure.
2.Hysteresis and repeatability values are those at maximum flow rate.
3.For mounting bolts, use Grade 8 or equivalent.
4.Mounting bolts are not included.

Understanding Model Numbers



When large brake pressure is required (Use an external drain type counter valve.)

When there is the possibility of pilot check valve knocking (Use an external drain type pilot check valve.)

Environmental conditions

- 5 The IC circuit board is located inside the central control box, so care must be exercised concerning water-resistance and ambient temperature.
 - Water: Cover the box so there is no direct splashing with water.
 - Ambient Temperature: Use in an area where the temperature is 41 to 122° F
 - 6 Operating Fluid
 - Always keep the operating fluid clean. Allowable contamination is class NAS11 or less.
 - Use oil-based hydraulic operating fluid.
 - Contact your agent when you want to use fire-resistant hydraulic fluid.
- (Continued on following page)

7 Note the following points to optimize operation.

- (1) Control fluid temperature when using this valve. Since the valve perform restrictor valve control on all processes, temperature differential changes flow volume and acceleration/deceleration time. The recommended temperature range is 86 to 140° F.

- (2) During the positioning operation following deceleration, make sure that sufficient low-speed running is provided following deceleration

before stopping operation. If low-speed operation time is too short can cause stopping during deceleration and shock problems due to fluctuation in load, etc.

Spool Type and JIS Symbols

Spool Type	C5**	C6S**
JIS Symbol		

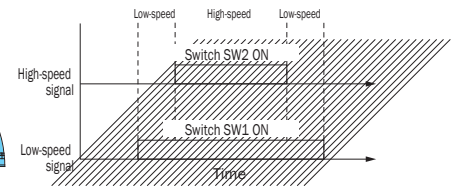
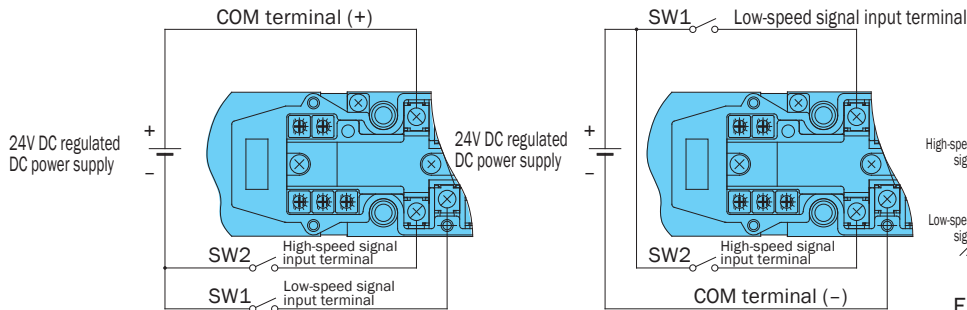
Cross-sectional Drawing

- Sink Type (Auxiliary Symbol: None)

Switches on load and power supply minus side

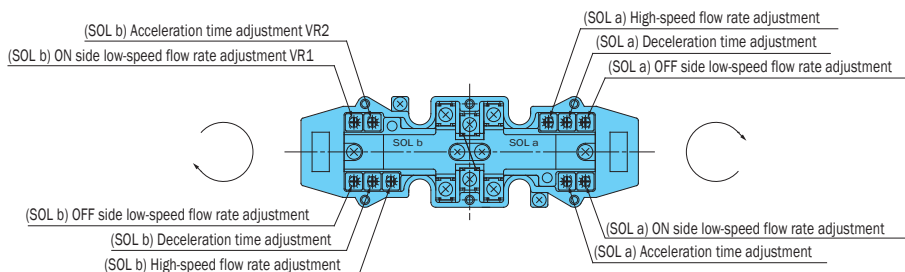
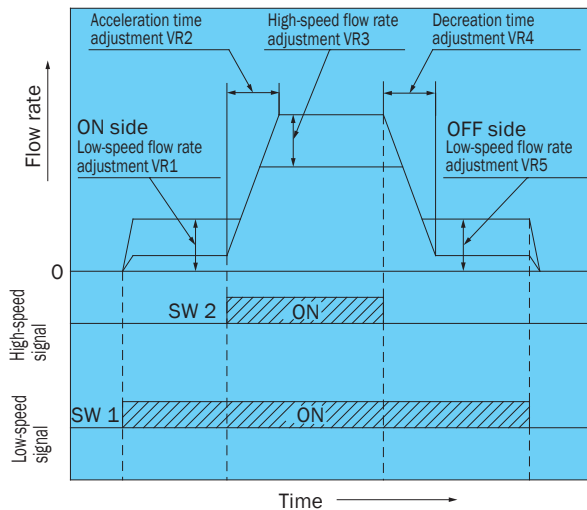
- Source Type (Auxiliary Symbol: A)

Switches on load and power supply plus side



Adjustment Elements

Control Pattern



Electrical Control Precautions

- Do not introduce a high-speed signal prior to a low-speed signal. Make sure the two signals are introduced simultaneously or that the low-speed signal is introduced first.
- (1) Repeatedly introducing the high-speed signal first in a source type configuration can damage the IC board.
- (2) The valve will not operate on the high-speed signal only.
- The following adjustments in the range of VR1 through VR5 can be made independently for SOL.a and SOL.b. You can make adjustments for the best conditions for forward and back operations when considering the cylinder operations.
- Adjustment volume is arranged in from VR1 through VR5 in clockwise (rightward) rotation sequence when viewed from the coil side.
- The following are the factory default volume settings.

VR1 . 2 . 4 . 5

--- Minimum setting

VR3 --- Maximum setting

All Adjustment VRs

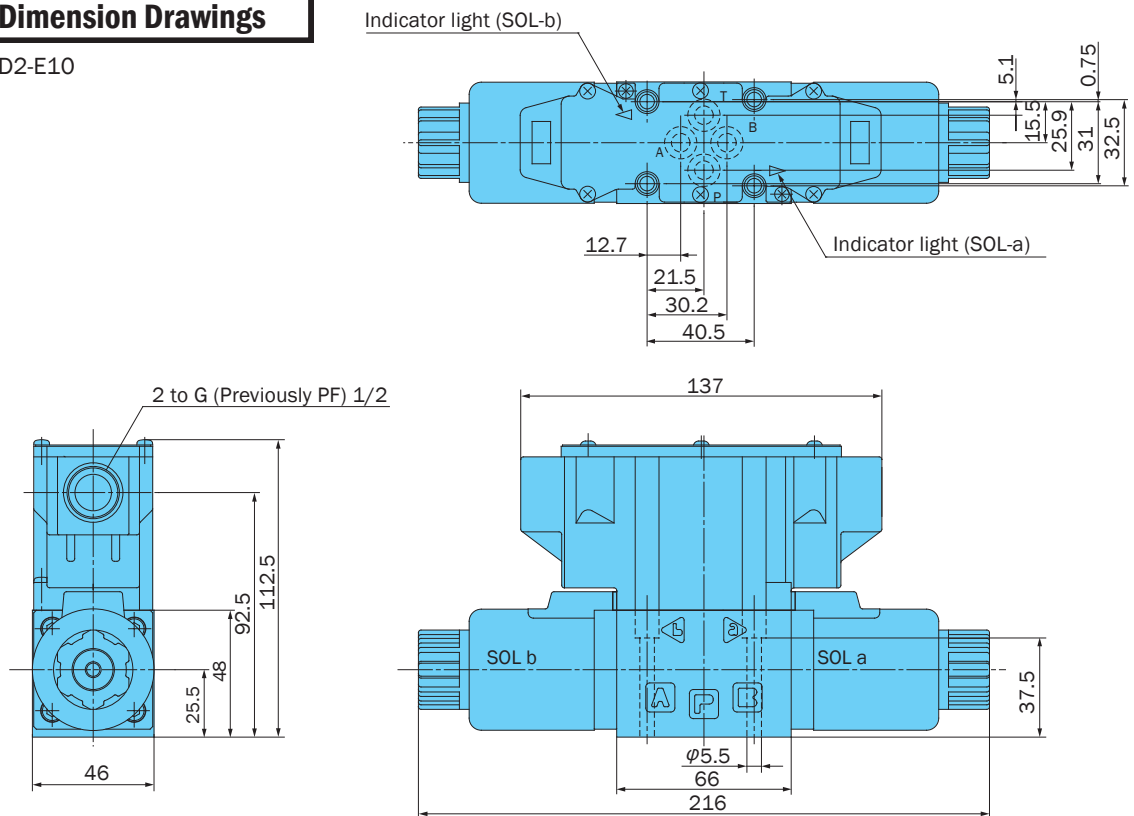
Maximum is clockwise (rightward) rotation.



- The volume rotation angle is 270°. Contact your agent about a three-rotation type adjustor for fine adjustment.

Installation Dimension Drawings

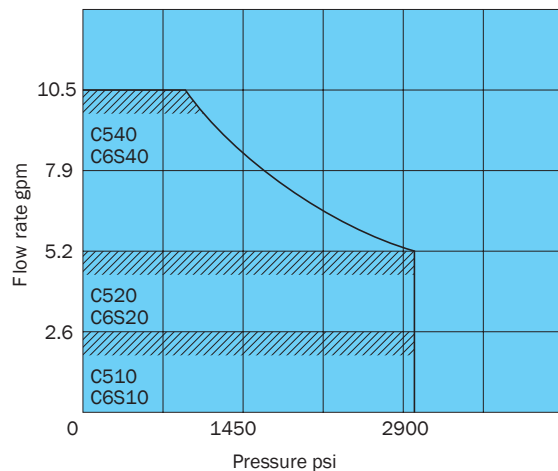
SF-G01-C***-(A)R-D2-E10



Performance Curves

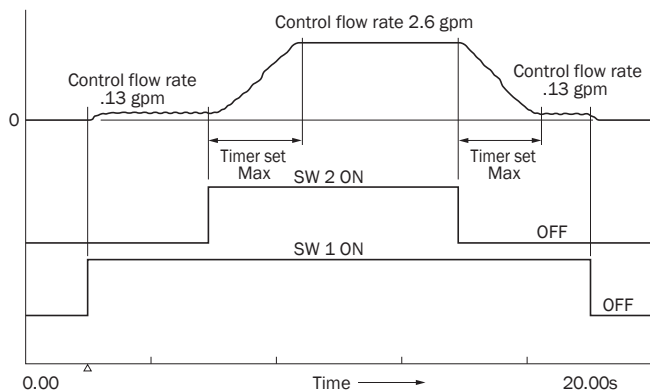
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure - Flow Rate Characteristics

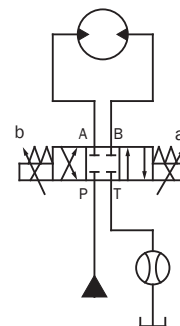


- Use the valve within the allowable flow rate range shown by the graph to the right.
- There are no operational problems within the allowable flow rate range, even when one-pass is used.

Control Waveform Example

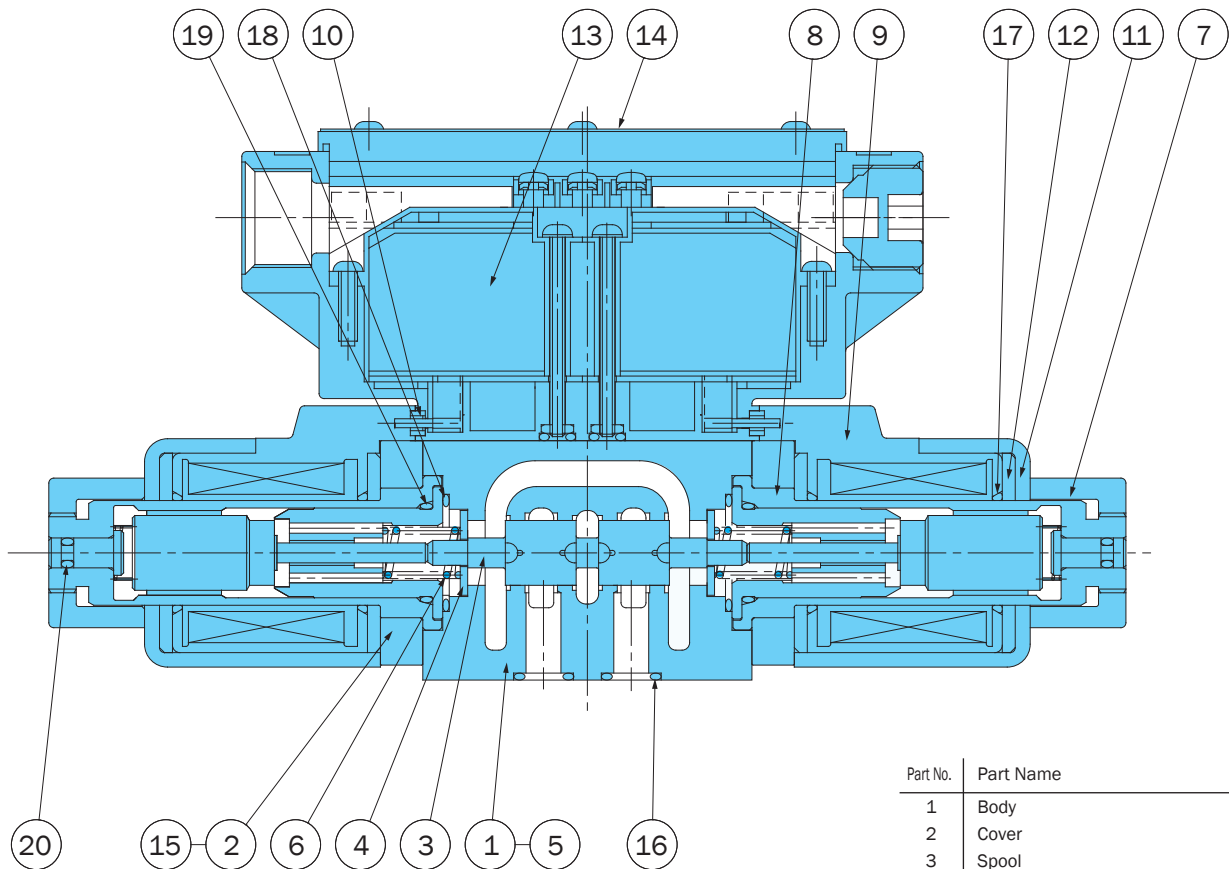


- Valve: SF-G01-C510-R-D2-E10
- Supply Pressure: 3000 psi
- Hydraulic Circuit



Cross-sectional Drawing

SF-G01-C***-(A)R-D2-E10



Seal Part List (Kit Model Number EFS)

Part No.	Part Name	Type/Part Number	Q'ty
16	O-ring	AS568-012(Hs90)	4
17	O-ring	AS568-019	4
18	O-ring	AS568-019(Hs90)	2
19	O-ring	AS568-017(Hs90)	2
20	O-ring	P3 Note2	2

Note: 1.O-ring 1B-** refers to JIS B 2401-1B-**.
2.Special flurorubber is used (Part Number: RO-P3-VS).

Part No.	Part Name
1	Body
2	Cover
3	Spool
4	Retainer
5	Spacer
6	Spring
7	Nut
8	Solenoid guide
9	Solenoid coil
10	Packing B
11	Coil case
12	Coil yoke
13	Central terminal box kit
14	Nameplate
15	Hexagon Socket Head Bolt
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	O-ring



SNH Series Non-Leak Type Solenoid Valve

5.2 to 26.4 gpm
5075 psi

Features

Virtually no internal leakage

A poppet structure minimizes internal leaks from low pressures to as high as 5075 psi. Enhanced hydraulic circuit efficiency reduces energy needs.

Virtually no pressure loss at high volumes

An original fluid reaction force suppression mechanism is provided for all sizes. Though compact, this valve provides the highest level switching capacity for its class.

High reliability

Since a wet type solenoid valve is used, the movable iron core remains immersed in oil as it moves, which minimizes switching noise and ensures reliable operation. A wet type valve also provides superior water resistance and longer life than a dry type valve.

ISO standard mounting service (01, 03 sizes)

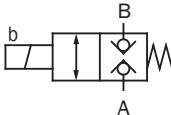
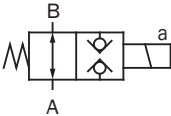
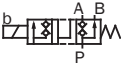
This valve can be ganged together with a modular valve, enabling simple configuration of circuits and an overall

compact device configuration.

EC connector for improved switching (06 size)

During switching, twice the current (starting current) flows to the coil than normal (holding current), which ensures reliable switching operations. The 06 size has compact configuration made possible by an original design that uses a small coil that provides high output, without the need for a large coil.

Specifications

Model No.			SNH-G01 (D03)	SNH-G03 (D05)	SNH-G04 (D07)	SNH-G06 (D08)
JIS Symbol	AR					
	HQ					
	A2K		----			
Maximum Working Pressure psi (P, A, B Ports)			5075			
Rated Flow Rate - Maximum Flow Rate gpm			AR,HQ; 2.6-5.2 A2K; 1.3-5.2	5.2 - 10.5	10.5 - 15.8	15.8 - 26.4
Maximum Changeover Frequency (per minute)			120			
Operating Environment	Dust Resistance/ Water Resistance Rank		JIS C 0920 IP65 (Dust-tight, Waterjet-proof) (Note 2)			IP64 (Dust-tight, Splash-proof)
	Ambient Temperature		-4 to 122° F			
	Operating Fluid	Temperature Range	-4 to 158° F			
		Viscosity Range	15 to 300 centistokes			
		Filtration	10 microns or less			
Weight AR/HQ (A2K) lbs			3.9	11.4	12.1	15.2
Mounting bolt	Size x Length		M5 × 45 (Four)	M8 × 70 (Four)	M8 × 70 (Four)	M10 × 75 (Four)
	Tightening Torque ft lbs		4.4 to 5.9	22 to 25	22 to 25	40 to 44

Note: 1. Internal leaking does not exceed 1 droplet/minute (.003 cu in)

2. The power supply type for E* is IP64 (dust-tight, splash-proof).

3. For mounting bolts, use grade 8 or equivalent.

4. Mounting bolts are not included with the 01 size. Bolts are included with the 03, 04, 06 sizes.

• Handling

- 1 Take care so the B port is not subjected to abnormal surge pressure that is in excess of the maximum operating pressure.
- 2 The manual switching (Options M, N) push pin receives B port pressure, so it cannot be pressed with a pressure in excess of about 725 psi. In the case of the HQ and A2K types, note that leaks are not completely stopped, even in the locked state.
- 3 Use this valve only within the allowable voltage range.
- 4 Use of water- or glycol-based hydraulic operating fluid is standard. Contact your agent about using other fire-resistant hydraulic fluid.
- 5 Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.
- 6 In order to realize the full benefits of the wet type solenoid valve, configure piping so oil is constantly supplied to the B port.
- 7 The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.
- 8 Never try to take this valve apart. The cap seal cannot be reassembled without using special tools.

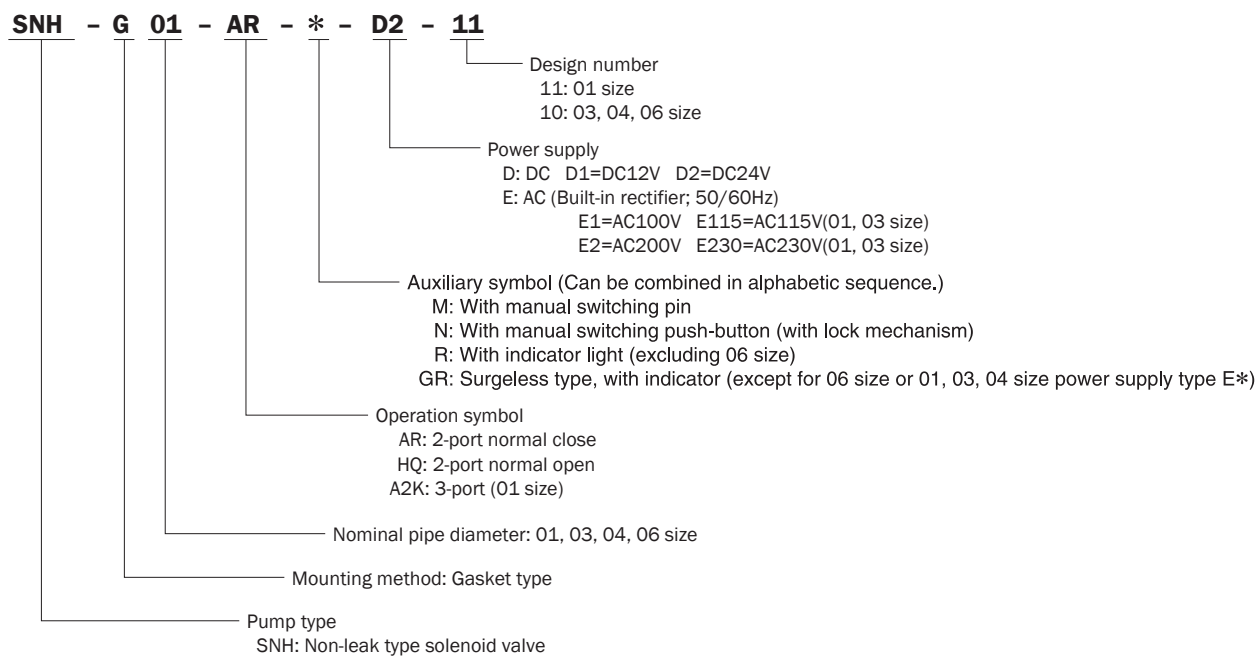
• Solenoid Assembly Specifications

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	For SNH-G01				For SNH-G03			
				Solenoid Coil Type	Current (A)	Power (W)	Allowable Voltage Range (V)	Solenoid Coil Type	Current (A)	Power (W)	Allowable Voltage Range (V)
DC with Built-in Rectifier	E1	AC100	50/60	EAC64-E1-1A	0.31	27	90 to 110	EBB64-E1	0.40	34	90 to 110
	E115	AC110	50/60	EAC64-E115-1A	0.26	25	100 to 125	EBB64-E115	0.33	31	100 to 125
		AC115			0.27	27			0.34	34	
	E2	AC200	50/60	EAC64-E2-1A	0.15	26	180 to 220	EBB64-E2	0.22	37	180 to 220
	E230	AC220	50/60	EAC64-E230-1A	0.12	24	200 to 250	EBB64-E230	0.16	30	200 to 250
		AC230			0.13	27			0.17	33	
DC	D1	DC12	☒	EAC64-D1-1A	2.2	26	10.8 to 13.2	EBB64-D1	2.6	31	10.8 to 13.2
	D2	DC24	☒	EAC64-D2-1A	1.1	26	21.6 to 26.4	EBB64-D2	1.5	36	21.6 to 26.4

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	For SNH-G04			
				Solenoid Coil Type	Current (A)	Power (W)	Allowable Voltage Range (V)
DC with Built-in Rectifier	E1	AC100	50/60	EBB64-E1	0.40	34	90 to 110
	E2	AC200	50/60	EBB64-E2	0.22	37	180 to 220
DC	D2	DC24	☒	EBB64-D2	1.5	36	21.6 to 26.4

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	For SNH-G06				
				Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
DC with Built-in Rectifier	E1	AC100	50/60	EBB64-D60	0.71	0.36	33.2	90 to 110
	E2	AC200	50/60	EBB64-D120	0.39	0.19	36.4	180 to 220
DC	D2	DC24	☒	EBB64-D17	3.0	1.5	37.4	21.6 to 26.4

Understanding Model Numbers

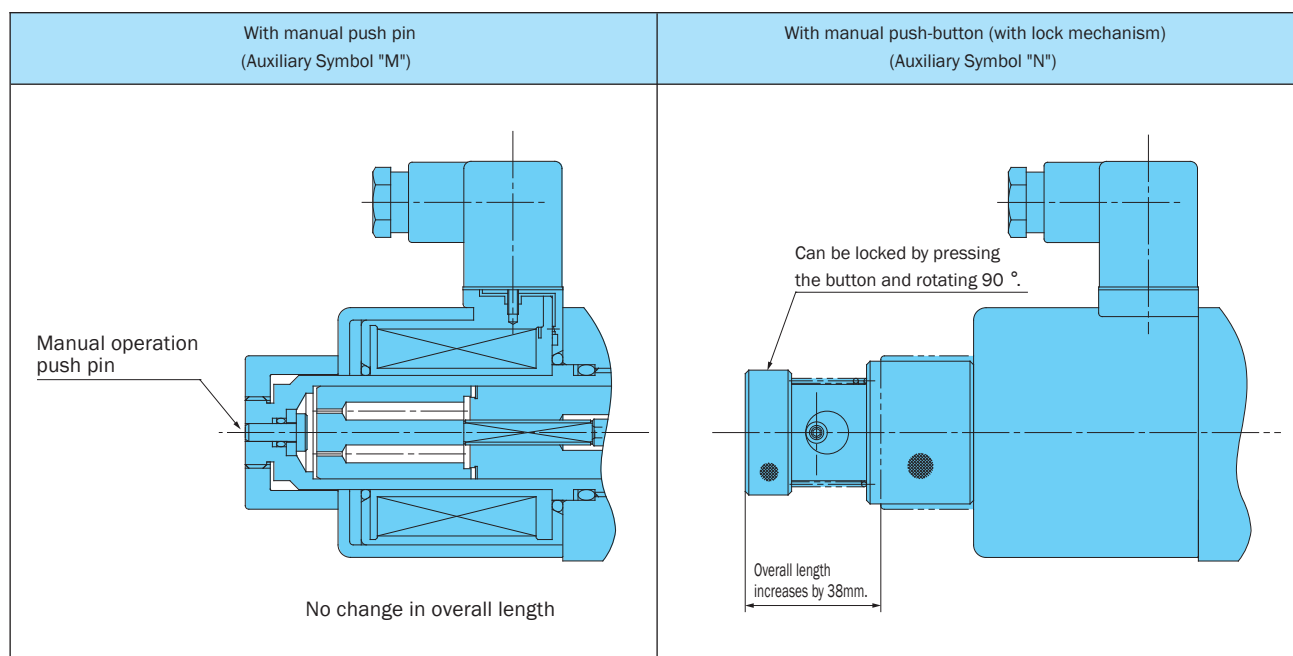


Options

(Auxiliary Symbol)

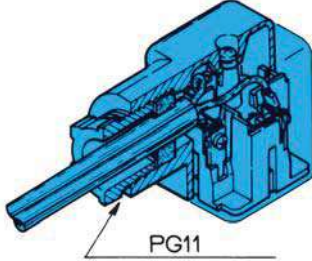
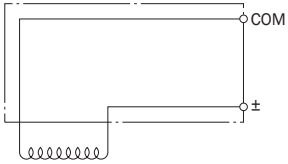
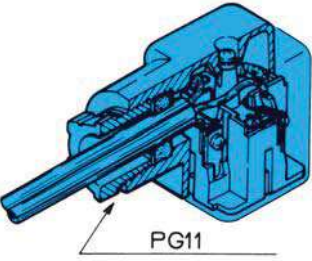
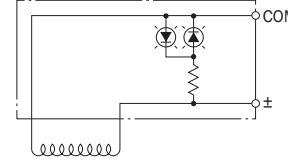
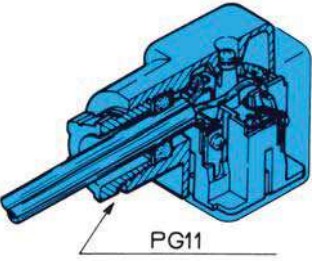
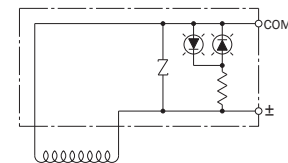
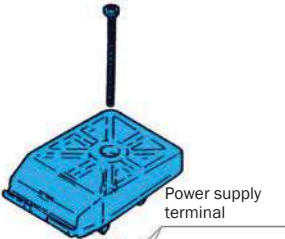
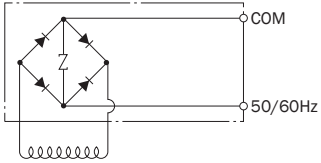
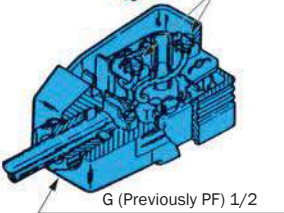
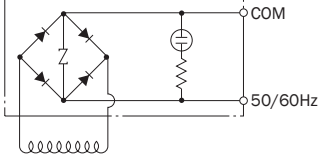
- Select options in accordance with size, as shown in the table to the right.
- (1) The 06 size has an EC connector and a built in surge killer as standard. However, an indicator light is not provided because of space considerations.
- (2) Option N increases the measurement by the size of the pushbutton only.

Auxiliary symbol Size	M	N	R	GR
01	TM	TM	TM	TM
03	TM	TM	TM	TM
04	TM	TM	TM	TM
06	TM	TM	☒	☒



Electrical Circuits

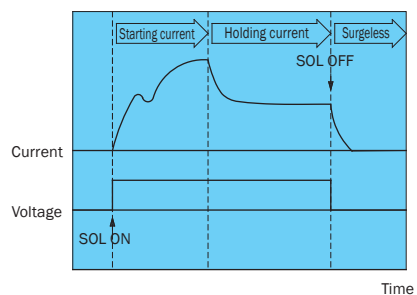
• These electrical circuits are for sizes 01, 03, 04. An EC connector is used for size 06. See the next page for more information

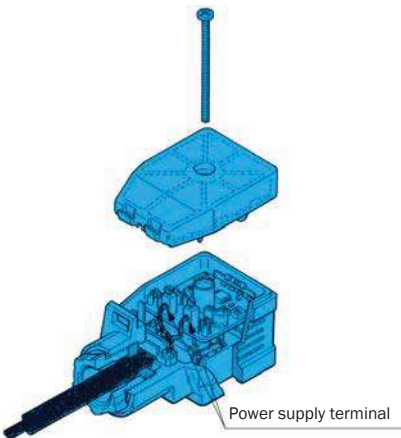
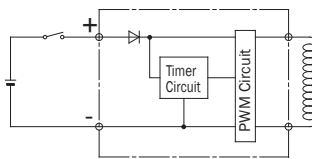
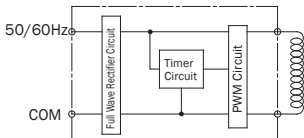
Valve	Connector Type	Wiring	Electrical Circuit Diagram
G01 G03 G04 Size	EA41-1A (Standard for power supply type D*)	 Connect the power supply to terminals No.1 and No. 2. The ⊕ terminal is ground. Use this terminal as required.	
	EA41-DR1/2-1C (D* option: R)	 Connect the power supply to terminals No.1 and No. 2. The ⊕ terminal is ground. Use this terminal as required.	
	EA41-GRD1/2-1C (D* option: GR)		
	EA42-1B (For power supply type E*)	 Connect the power supply to the terminals on the board. When ground connection is required, remove the board and use the ⊕ terminal. In this case, do not connect the power supply to the No. 1 and No. 2 terminals.	
	EA42-R1/2-1B (E* option: R)		

- Note: 1.Connector types 1 and 2 indicate voltage. (1: 100V AC or 12V DC; 2: 200V AC or 24V DC)
 2.Use a connector cord with a diameter that is in the range of φ8 to φ10.
 3.The orientation of the connectors can be changed in 90° increments by modifying the terminal block.
 4.The cover cannot be removed unless the installation screws are removed.
 5.Use an M3 type as a solderless terminal.
 6.Tighten the M3 screws that secure connectors and terminals to a torque of 2.6 to 4.4 in lbs.

- 06 Size EC Connector

SNH-G06 provides large switching power, so an EC connector is used. During switching, this EC connector supplies twice the current (starting current) that normally flows to the coil (holding current), and drops the current back to normal after switching is complete.

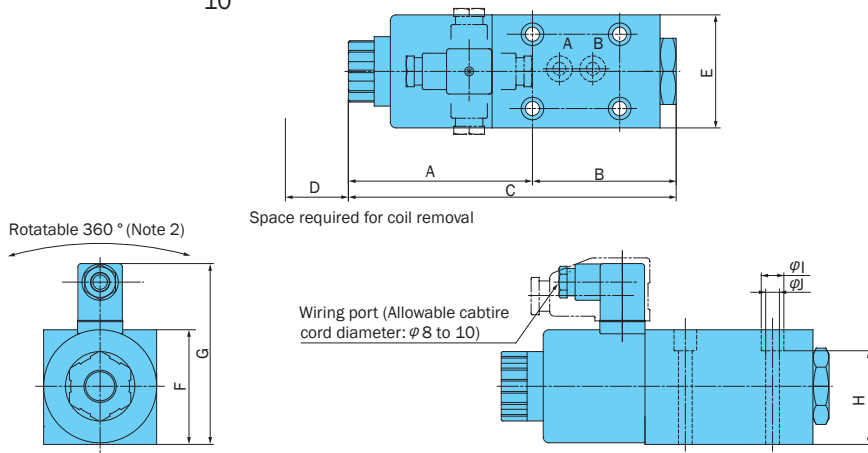


Valve	Connector Type	Wiring	Electrical Circuit Diagram
06 Size	Surgeless Type (24V DC) EC Connector EN41 – 06D2		 Note that correct polarity must be maintained with the power supply.
	Built-in Rectifier EC Connector EN41 – 06E1/E2		

Note: The orientation of the EN41-06** connector cannot be changed at 90° intervals by modifying the terminal block.

Installation Dimension Drawings

SNH-G**-AR**-¹¹
10

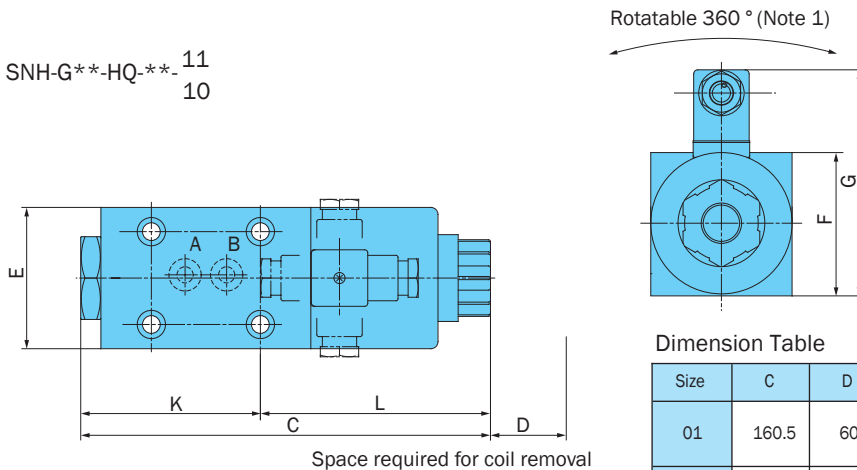


Dimension Table

Size	A	B	C	D	E	F	G (Note) 2	H	I	J
01	100	60.5	160.5	60.5	46	48	91 (94.5)	37.5	9	5.5
03	114	89	203	63	70	72	112 (115.5)	58	14	8.5
04	132	71	203	63	75	71	112 (115.5)	58	14	8.5
06	137	82	219	63	85	71	115.5	60	18	11

- Note: 1. The 01, 03, 04 size power supply type E* allows rotation at 90° intervals, but the 06 size cannot be rotated.
 2. Values in parentheses are for 01, 03, 04 size power supply type E*.
 3. The P and T ports of the 01, 03 sizes do not have O-ring grooves, so if the manifold has P and T ports, use end plates to close off the valve P and T ports. Contact your agent for information about end plates.

SNH-G**-HQ**-¹¹
10

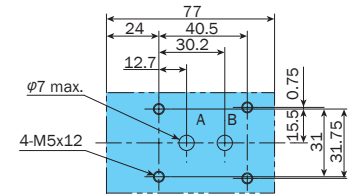


Dimension Table

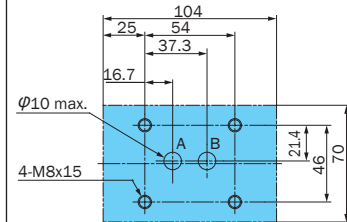
Size	C	D	E	F	G (Note) 2	K	L
01	160.5	60.5	46	48	91 (94.5)	70.5	90
03	203	63	70	72	112 (115.5)	89	114
04	203	63	75	71	112 (115.5)	83	120
06	219	63	85	71	115.5	100	119

Valve Mounting Surface Dimensions

01-AR/HQ (Conforms to ISO 4401-03-02-0-94)
MSA-01X-E10

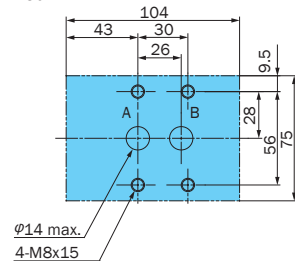


03-AR/HQ (Conforms to ISO 4401-05-04-0-94)
MS-03-E30

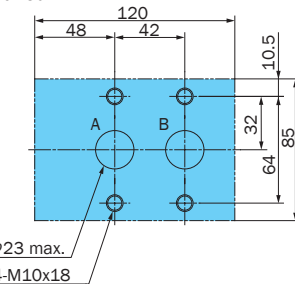


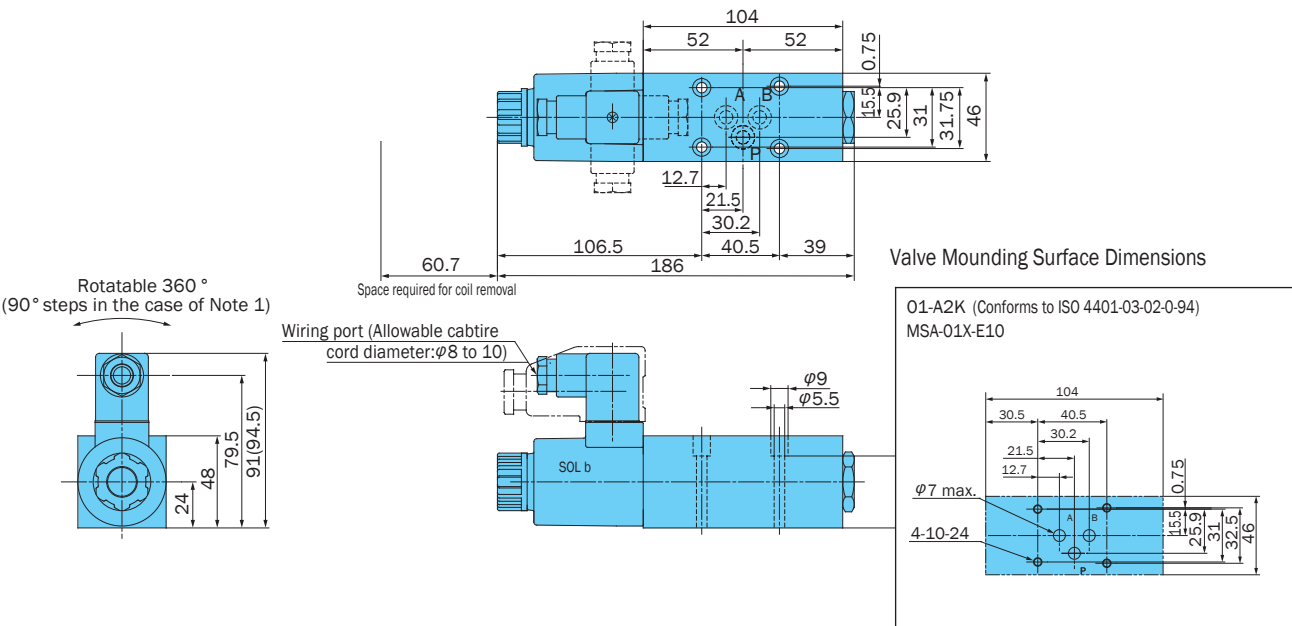
Note: An M6 mounting screw type is not yet available.

04-AR/HQ
MS-04-E30-D



06-AR/HQ
MS-06-E30-D



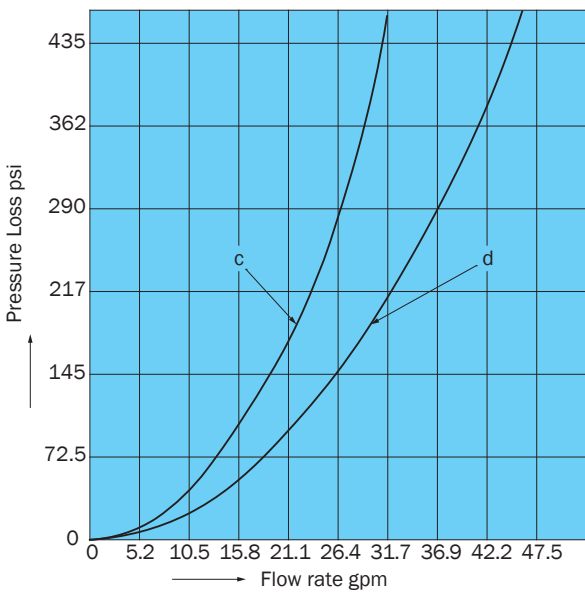
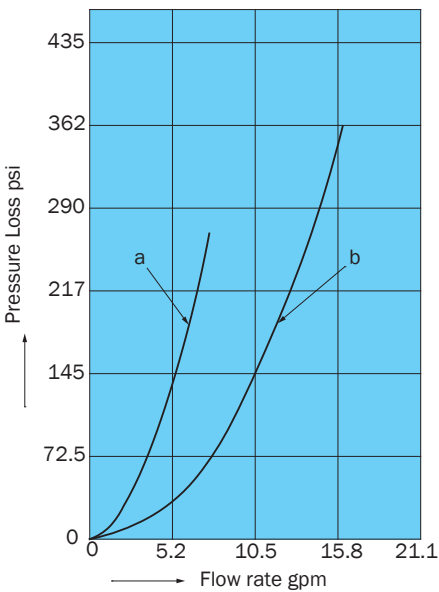


Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

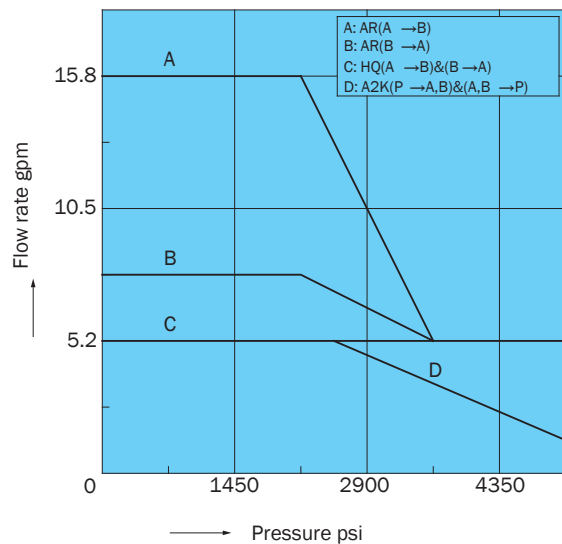
Pressure Loss Characteristics

Size	01	03	04	06
Flow Path				
A ↔ B	a	b	c	d
P ↔ A, P ↔ B	a	--	--	--

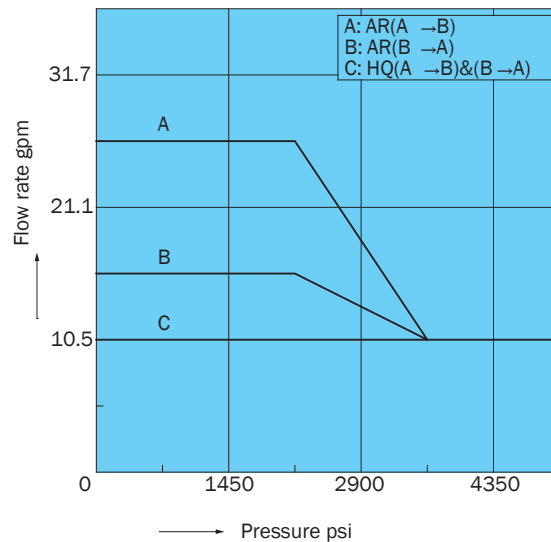


Pressure - Flow Volume Allowable Value

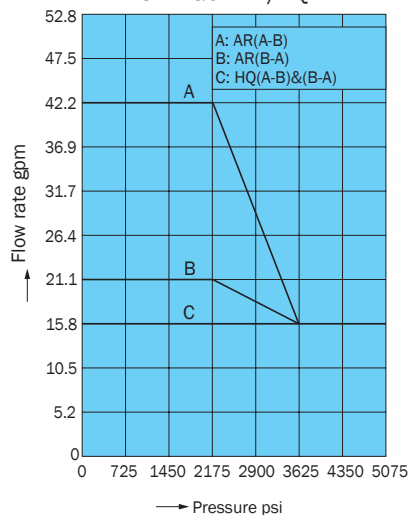
G01 Size



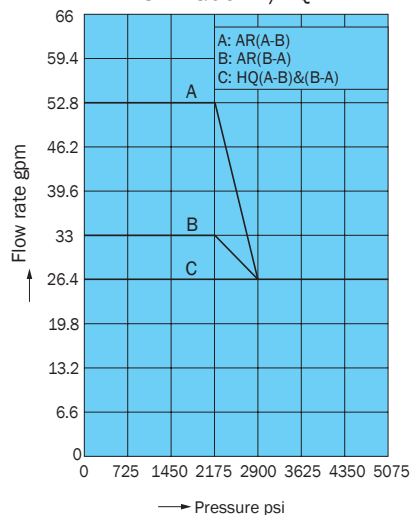
G03 Size



SNH-G04-AR/HQ



SNH-G06-AR/HQ



Note: Available flow rate values depend on pressure and fluid flow direction. The following shows how to read the data.

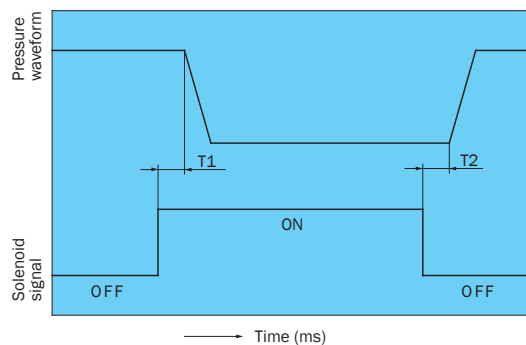
A : AR (A → B)

Oil flow from A port to B port

Valve operation symbol

Indicates curve

Switching Response Time



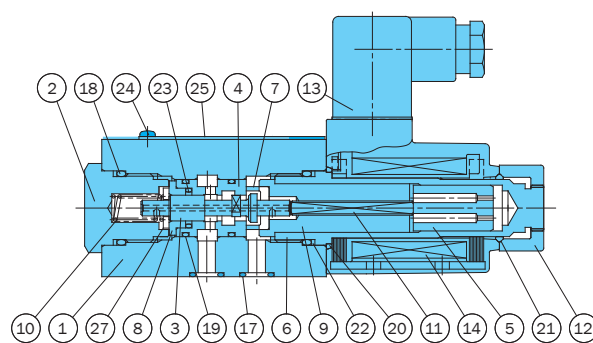
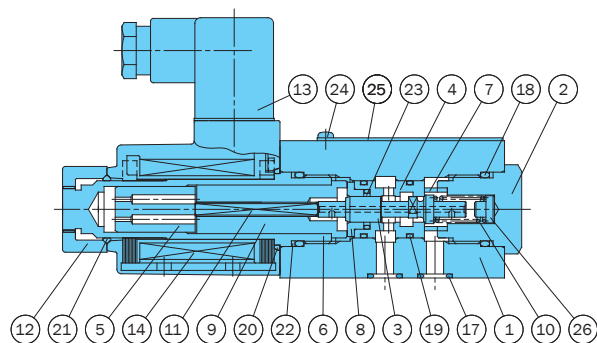
Pressure : 5075 psi
Flow Rate : 01 : 5.2 gpm
03 : 10.5 gpm
04 : 15.8 gpm
06 : 26.4 gpm
Operating Fluid : ISO VG68

Size	Power supply	Response Time (sec)	
		T1(ON)	T2(OFF)
01	D*	0.03 to 0.05	0.04 to 0.06
	E*	0.04 to 0.06	0.08 to 0.10
03	D*	0.06 to 0.08	0.04 to 0.06
	E*	0.07 to 0.09	0.08 to 0.10
04	D*	0.09 to 0.11	0.06 to 0.08
	E*	0.12 to 0.14	0.14 to 0.16
06	D*	0.04 to 0.06	0.06 to 0.08
	E*	0.09 to 0.11	0.14 to 0.16

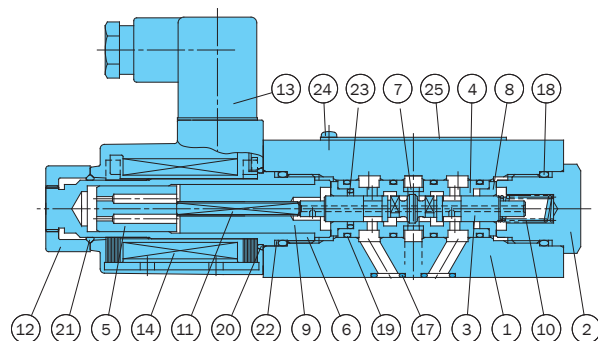
Note: The switching response time changes slightly with operating conditions (pressure, flow rate, viscosity, etc.)

Cross-sectional Drawing

SNH-G01-HQ-**-11

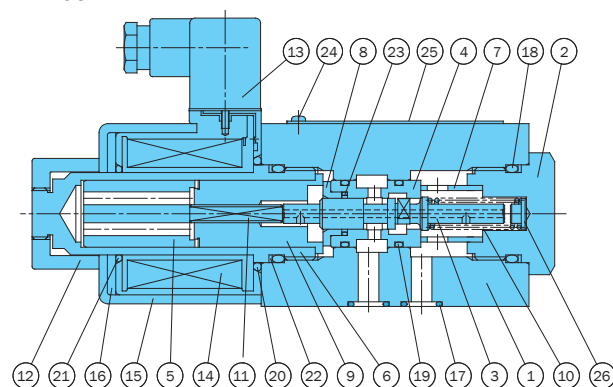


SNH-G01-A2K-**-11

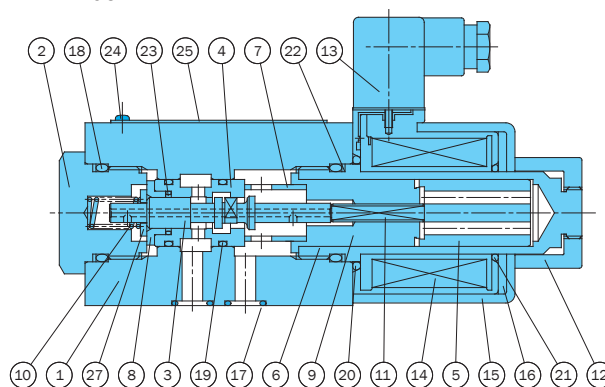


Part No.	Part Name	Part No.	Part Name
1	Body	15	Coil case
2	Plug	16	Coil yoke
3	Poppet	17	O-ring
4	Sleeve	18	O-ring
5	Plunger	19	O-ring
6	Solenoid guide	20	O-ring
7	Ring	21	O-ring
8	Collar	22	Backup ring
9	Solenoid stopper	23	Cap seal
10	Spring	24	Cross recessed head small screw
11	Rod	25	Nameplate
12	Nut	26	Stopper
13	Connector	27	Retainer
14	Solenoid coil		

03
SNH-G04-AR-**-10
06



03
SNH-G04-HQ-**-10
06

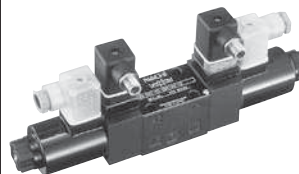


List of Sealing Parts

Part No.	Part Name	01	03	04	06	Q'ty	
						AR, HQ	A2K
17	O-ring	AS568-012 (HS90)	IB-P12	IB-P16	IB-P28	2	3
18	O-ring	IB-P22	IB-P32	IB-P32	IB-P32	2	2
19	O-ring	AS568-017(HS90)	IB-P22	AS568-120 (HS90)	IB-P26	2	4
20	O-ring	S-25	AS568-029	AS568-029	AS568-029	1	1
21	O-ring	1A-P20	AS568-026	AS568-026	AS568-026	1	1
22	Backup ring	T2-P22	T2-P32	T2-P32	T2-P32	2	2
23	Cap seal	*	*	*	*	1	1

Note: O-ring 1B-**- refers to JIS B2401-1B. Backup ring T2 indicates JIS B 2407-T2.

Parts marked by an asterisk "" are not available on the market. Contact your agent for more information.



SAW Series Directional Control Valve with Monitoring Switch

26.4 gpm
5075 psi

Features

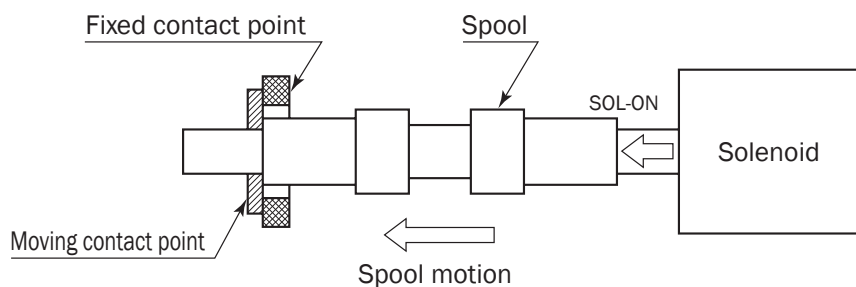
This valve is a spool activated directional control valve that uses mechanical detection to operate a switch to send an electric ON/OFF signal. This makes it possible, by monitoring the status of the spool operations, to use it as an information source for safety checks by using the ON/OFF signal as a basis for sequence control. In the future, they will be used in machinery that is compatible with inter-

national machine safety (ISO 12100) and JIS standards (JIS B 9700) standards. The directional control valve with monitoring switch was developed as a valve to support this demand. The switch contact has little dead zone and almost no temperature drift (variable motion caused by changes in temperature) or hysteresis because the

reaction of the spool action is mechanical. All valve functions, except for the monitoring function, are equivalent to the standard solenoid operated directional control valve (SA-G01). DIN connectors are used for the switches and solenoid coil wiring so connections are easy when installing or replacing valves.

Operational Principle

When the spool is in the center position, the fixed and moving parts are in contact forming an electric circuit. Operating the solenoid moves the spool so the moving part moves breaking the electric connection between the fixed and moving parts. PAT. PEND.



Specifications

Model No.		Standard Type		Shockless Type	
JIS Symbol	Operation Symbol	Maximum Working Pressure psi	Maximum Flow Rate gpm	Maximum Working Pressure psi	Maximum Flow Rate gpm
	-A2X-	5075	7.9	3625	7.9
	-A3X-		21.1		13.2
	-A5-		26.4		
	-C1-		21.1		
	-C5-		26.4		
	-C6-		21.1		
	-C1S-		26.4		
	-C6S-		26.4		

Note: The maximum flow rate of each valve depends on the pressure. For details, see page D-68.

• Valve Specifications

		AC Solenoid	DC Solenoid	
			Built-in Rectifier	
Maximum Working Pressure P, A, B ports	Standard Type	5075 psi		
	Shockless Type	3625 psi		
Maximum Allowable Backpressure T port		3045 psi		
Maximum Flow Rate		See pressure-flow characteristics on page D-68 for more information.		
Switching Frequency		120/minute		
Weight	Double Solenoid	6.1 lbs	6.6 lbs	
	Single Solenoid	4.6 lbs	4.8 lbs	
Operating Environment	Dust Resistance/Water Resistance Rank	JISC 0920 IP65		
	Operating Fluid	Oil-based operating fluid (Note 1)		
	Ambient Temperature Range	-4 to 122° F		
	Operating Fluid Temperature Range	-4 to 158° F		
	Operating Viscosity Range	15 to 300 centistokes		
	Filtration	10 µm or less		
Mounting bolt (Note2)	Size × Length	Socket hex head bolt (grade 8 equivalent) 10-24 x 1 3/4		
	Tightening Torque	3.6 to 5 ft lbs		

- Note: 1. Use a petroleum based operating fluid because the ON/OFF mechanism of the valve's monitoring switch is immersed in oil and the oil must be a non-conducting fluid.
 Use only petroleum based operating fluid (do not use fluids that are water, glycol, W/O emulsion, phosphate, or fatty ester based).
 Petroleum based operating fluids must also have a water content that is less than 0.1% by volume.
 2. Installation bolts are not provided with valves. Use the specified bolts.

• Monitoring Switch Specifications

Voltage Rating	24VDC
Allowable Voltage Range	± 20% of voltage rating
Maximum Current Load	100mA
Residual Voltage (Note 3)	Max. 1.2V
Wiring for Connector for Switch	Connect with wires or M12-4 pin connector

- Note: 1. See page D-67 for the procedure to wire the connector for the switch.
 2. The programmable controller input circuits are positive (+) common mode and negative (-) common mode.
 The directional control valve with monitoring switch uses a source circuit [switch on the positive (+) side of the load and power source] for safety purposes.
 Because of this, it is necessary to use a negative (-) common mode programmable controller to receive input from the monitoring switch output.
 3. Set the voltage of the power supply to the monitoring switch within a range that satisfies the following conditions.
 Load ON voltage + residual voltage ≤ switch supply voltage ≤ 28.8 V (+20% voltage rating)
 4. The switch element (photocoupler) in the connector's internal circuit for the monitoring switch may malfunction in the ON state because of over voltage or over current.
 Therefore, in addition to checking the ON output of the monitoring switch, monitor the current at the solenoid and the internal circuits of the connector and valve in conjunction with the switch output.

Condition of monitoring switch output and valve

		Current to Solenoid	
		ON	OFF
Monitoring Switch Output	ON	Abnormal Malfunction at internal circuit of connector or valve	Normal Spool returns to middle position
	OFF	Normal Spool is switching	Abnormal Valve malfunction or signal wire is cut

The monitoring switch outputs according to the motion of the spool, so the solenoid turns on and off according to the output signal which is delayed only as much as the spool operation is delayed.
 Set a 0.3 second delay, including leeway, to monitor the output of the switch.

• Solenoid Specifications

Same specifications as the SA-G01 series (31 design).

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
AC	C1	AC100	50	EAC64-C1	2.2	0.52	25	80 to 110
			60		2.0	0.38	22	90 to 120
		AC110	60		2.2	0.46	28	
	C115	AC110	50	EAC64-C115	2.0	0.47	25	90 to 120
			60		1.8	0.35	22	100 to 130
		AC115	60		2.0	0.42	28	
	C2	AC200	50	EAC64-C2	1.1	0.26	25	160 to 220
			60		1.0	0.19	22	180 to 240
		AC220	60		1.1	0.23	28	
	C230	AC220	50	EAC64-C230	1.0	0.24	25	180 to 240
			60		0.91	0.17	22	200 to 260
		AC230	60		1.0	0.21	28	
DC with Built-in Rectifier	E1	AC100	50/60	EAC64-E1-1A	0.31		27	90 to 110
	E115	AC110	50/60	EAC64-E115-1A	0.26		25	100 to 125
		AC115			0.27		27	
	E2	AC200	50/60	EAC64-E2-1A	0.15		26	180 to 220
	E230	AC220	50/60	EAC64-E230-1A	0.12		24	200 to 250
		AC230			0.13		27	
DC	D1	DC12	—	EAC64-D1-1A	2.2		26	10.8 to 13.2
	D2	DC24	—	EAC64-D2-1A	1.1		26	21.6 to 26.4

• Handling

- 1 In order to realize the full benefits of the wet type solenoid valve, configure piping so oil is constantly supplied to the T port. Never use a stopper plug in the T port.
- 2 Ensure that surge pressure in excess of the maximum allowable back pressure does not reach the T port.
- 3 Note that the maximum flow rate is limited when used as a four-way valve, or by blocking ports for use as a two-way valve or one-way valve.
- 4 Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.
- 5 Use a ISO VG 32 petroleum-based operating fluid, or an equivalent, that has a water content that is less than 0.1% by volume.
- 6 Do not use fire-resistant operating fluid.
- 7 Use this valve only within the allowable voltage range.
- 8 Do not allow the AC solenoid to become

charged until you install the coil into the valve.

- 9 In the case of operation symbol A2X, run drain piping from the valve T port.
- 10 Maintaining a switching position under high pressure for a long period can cause abnormal operation due to hydraulic lockup. Contact your agent when you need to maintain a switching position for a long period.
- 11 Note that manual pin operating pressure changes in accordance with tank line back pressure.
- 12 The solenoid has a pin for switching the spool manually. However, use the cap (option symbol: D) to prevent manual operation for jobs where manual operation would cause a safety problem.
- 13 The only way to prevent misoperation of the monitoring switch caused by noise generated by the solenoid turning on and off is to install the surgeless

directional control valve with monitoring switch (option symbol: GR). (If the solenoid power source is C* and D*)

- 14 Use surgeless specification (with varistor diode) directional control valves with monitoring switches for all electric valves on the same machine to prevent mis-operation of the monitoring switch caused by noise when the solenoid turns on and off.
- 15 The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.
- 16 The connector for the solenoid is the same as for the SA series solenoid valve. See page D-22 for electrical circuit drawings and wiring procedures.
- 17 Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs	Dimension Drawings Page
MSA-01X-E10	1/4	3625	5.2	2.6	D-20
MSA-01Y-E10	3/8		10.5		
MSA-01Y-TE10	3/8		10.5	1.9	H-4

Understanding Model Numbers

SAW - G 01 - A3X - FGR V - D2 - 10

Design number

Solenoid power supply

C1 : AC100V 50/60Hz, AC110V 60Hz

C115: AC110V 50/60Hz, AC115V 60Hz

C2 : AC200V 50/60Hz, AC220V 60Hz

C230: AC220V 50/60Hz, AC230V 60Hz

D1: DC12V

D2 : DC24V

E1: AC100V 50/60Hz

E115: AC110/115V 50/60Hz

E2: AC200V 50/60Hz

E230: AC220/230V 50/60Hz

Wiring for connector for switch

None: With 350mm wire

V : With M12-4 pin connector

(Example of connector with cable provided by customer: Omron XS2F-D421-D80-A)

Option symbols

None: No options (available with power supply E*)

D : With cap to prevent operation of manual push pin

F : Shockless type (available with power supply D* and E*)

GR : Surgeless type, with indicator light (must be installed with power supply C* and D*)

R : With indicator light (available with power supply E*)

Possible option symbol combinations

Power Supply	Option Symbols
C*	GR, DGR
D*	GR, DGR, FGR, DFGR
E*	None, D, F, DF, R, DR, FR, DFR

Note:

The only way to prevent misoperation of the monitoring switch caused by noise generated by the solenoid turning on and off is to install the surgeless directional control valve with monitoring switch.

(Power supply E is the standard surgeless type, option symbol G is not needed.)

Operation Symbol

A2X		C5	
A3X		C6	
A5		C1S	
C1		C6S	

Nominal diameter
01 size (D03)

Mounting method
G: Cascade mounting

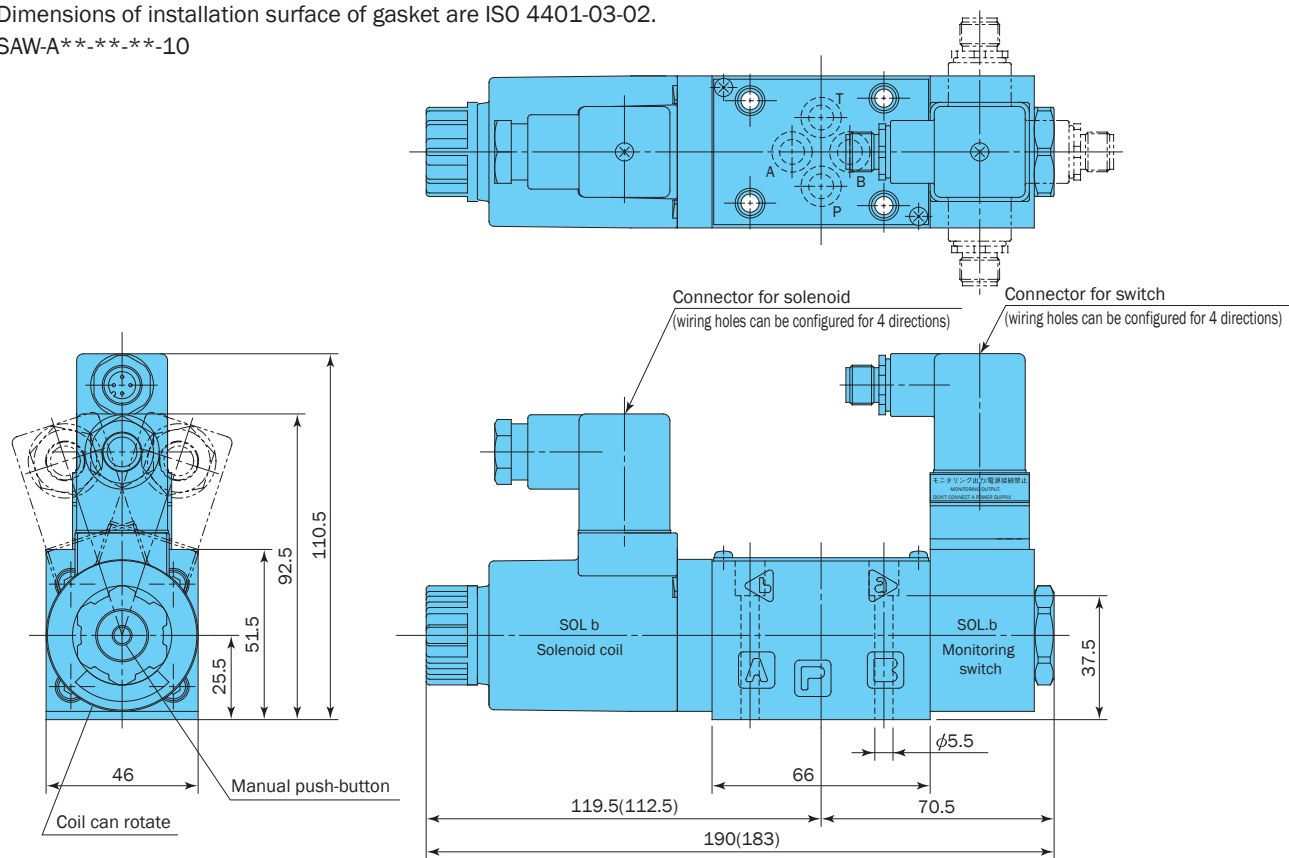
Directional control valve with monitoring switch (DIN connector type)

Note: See page D-7 for an explanation of the shockless type (option symbol F) and surgeless type (option symbol G).

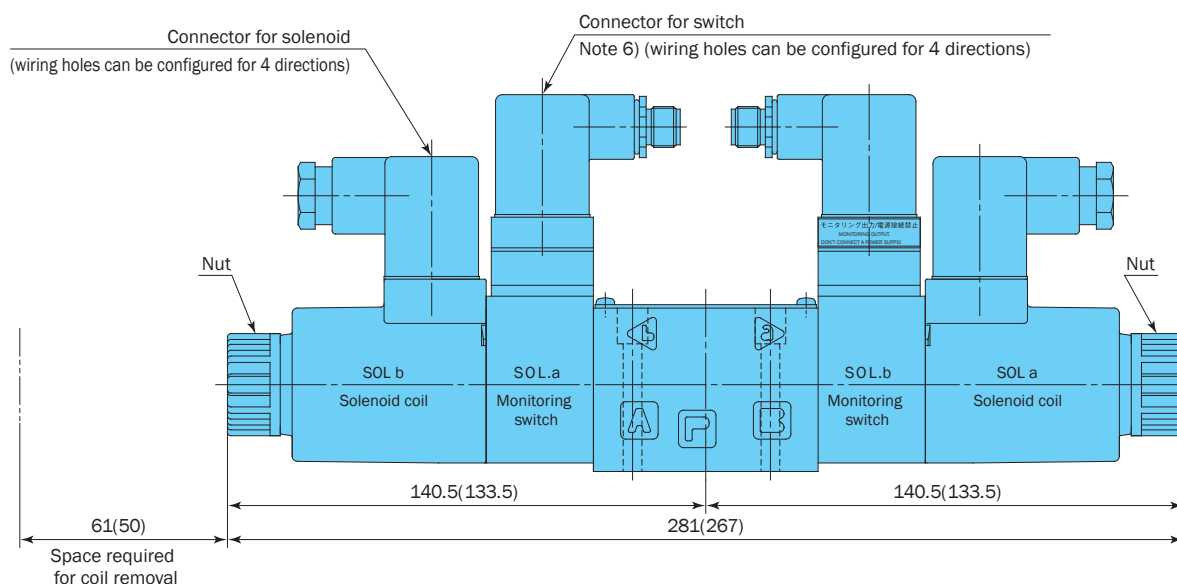
Installation Dimension Drawings

Dimensions of installation surface of gasket are ISO 4401-03-02.

SAW-A**-**-10



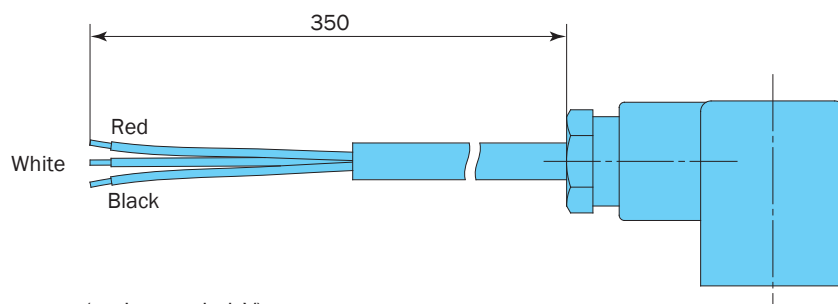
SAW-G01-C**-**-10



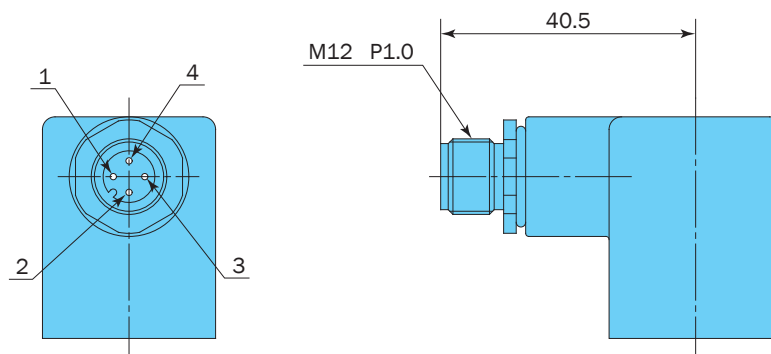
- Note:
1. Dimensions in parentheses apply in the case of an AC solenoid.
 2. For option symbol D (with cap to prevent manual operation), the nut for fixing coil is 5mm long. Include this length when calculating the total length of the valve.
 3. The connector for the switch in the drawing above is the M12-4 pin connector. In addition there are wire connections also. See page D-67 for more detailed information.
 4. The wiring hole for the connector is oriented as shown in the diagram for packaging purposes. The orientation can be changed according to the direction of the wiring.
 5. Use surgeless directional control valves with monitoring switches for all electric valves on the same machine to prevent misoperation of the monitoring switch caused by noise when the solenoid turns on and off.
 6. To orient the wiring hole for the connector for the switch towards the solenoid coil, loosen the nut and rotate the solenoid coil so the connector for the switch does not interfere with the connector for the solenoid.

- Details about the Connector for the Switch

(1) With wiring (option symbol: none)

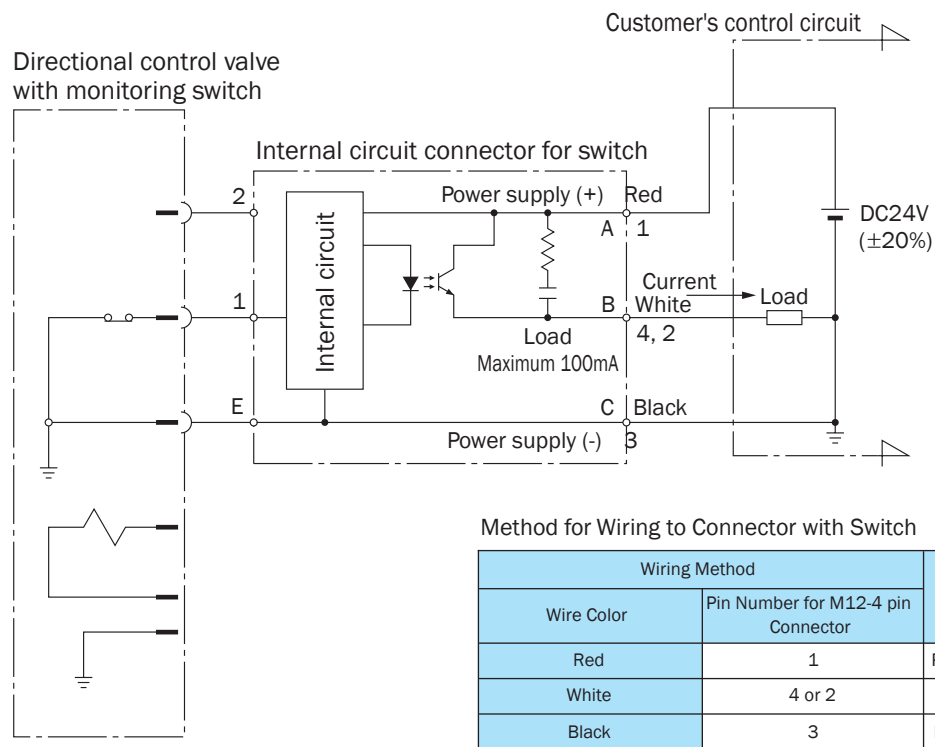


(2) With M12-4 pin connector (option symbol: V)



Note: 1. The pin connector is screwed to the housing so it is rotated a certain amount compared to the drawing.
Refer to the electrical circuit diagram below for how to connect it.
2. The connector that the M12-4 pin connector connects to is not provided.
(Example of connector with cable provided by customer: Omron XS2F-D421-D80-A)

(3) Electrical circuit diagram



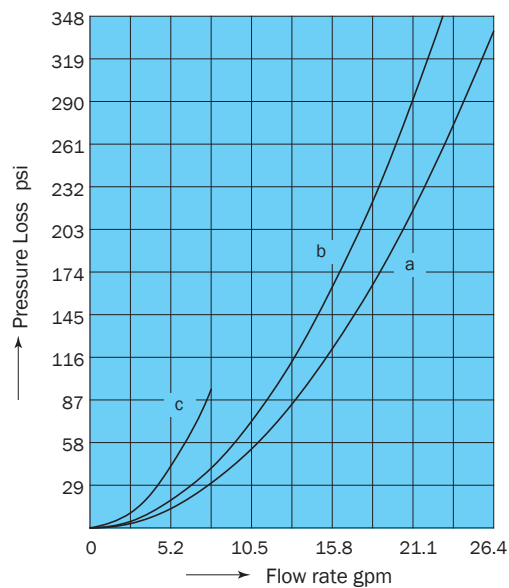
Note: 3. Always install a diode to prevent surges in the current when connecting an inductive load, such as a relay, to the monitoring switch.
4. Do not modify or replace the lead wires.
5. Connect the load for the M12-4 pin connector to either pin number 4 or 2.
6. When connecting monitoring switches in sequence, use the negative (-) common mode (type that current runs to sequence side).

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

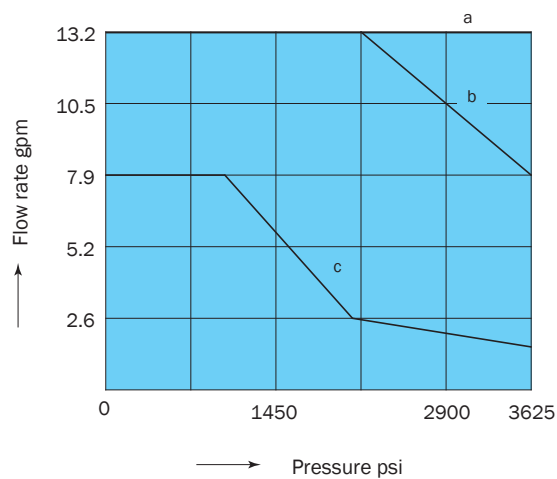
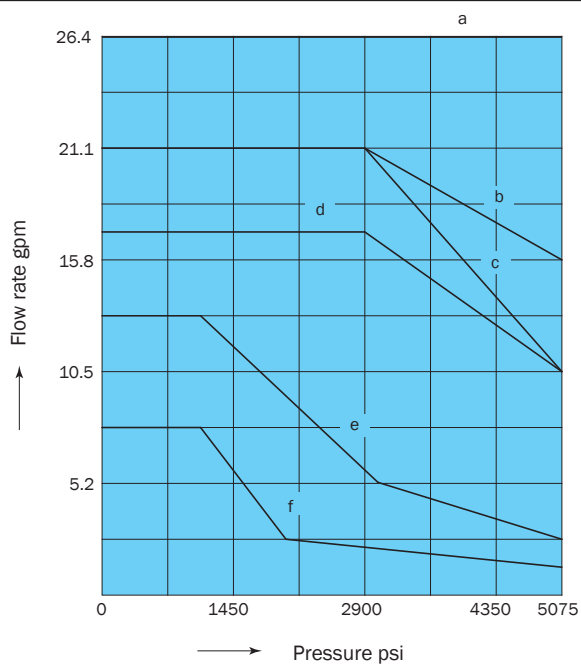
Operation Symbol	P → A	P → B	A → T	B → T
A2X	c	c	—	—
A3X	b	b	b	b
A5	—	b	b	—
C1	b	b	a	b
C5	b	b	b	b
C6	b	b	a	a
C1S	b	b	b	b
C6S	b	b	b	b



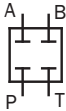
Pressure — Flow Volume Allowable Value

Operation Symbol	Standard Form, with AC, DC solenoid		
A2X	—	f	f
A3X	b	f	f
A5	a	—	e
C1	AC SOL. d DC SOL. c	e	e
C5	a	e	e
C6	AC SOL. d DC SOL. c	e	e
C1S	a	e	e
C6S	a	e	e

Operation Symbol	Shockless Type, with DC solenoid		
A2X	—	c	c
A3X	a	c	c
A5	a	—	c
C1	b	c	c
C5	a	c	c
C6	b	c	c
C1S	a	c	c
C6S	a	c	c

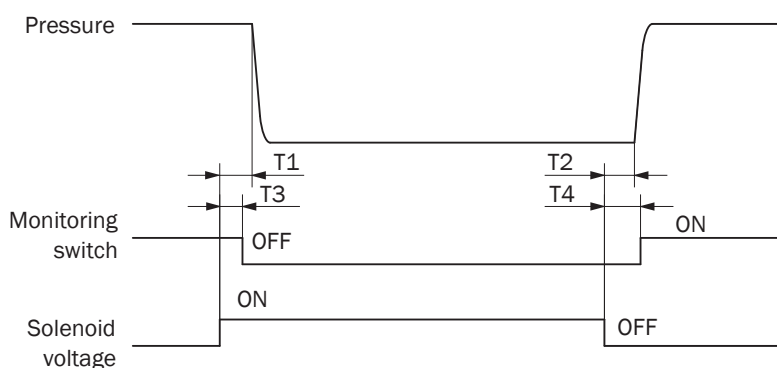


Range of Motion of Switch

Positions		Stroke of Spool		
		SOL.b ON	Center	SOL.a ON
Flow Path				
Motion of Switch	SOL.b Monitoring Switch	OFF	ON	
	SOL.a Monitoring Switch	ON		OFF

Note: 1. Flow path is C5 type (all-port-block), other flow paths also activate switch in middle position.
 2. ON and OFF indicate the state of the output transistor on the circuit board in the connector.

Switching Responsiveness



Type of Machine		Model	Response Time (s)			
			Pressure		Switch	
			T1	T2	T3	T4
AC Solenoid		SAW-G01-C5-GR-C1-10	0.02 to 0.03	0.02 to 0.03	0.01 to T1	T2 to 0.05
DC Solenoid	Standard Type	SAW-G01-C5-GR-D2-10	0.03 to 0.04	0.02 to 0.04	0.01 to T1	T2 to 0.06
	Built-in Rectifier	SAW-G01-E1-10	0.03 to 0.04	0.07 to 0.10	0.01 to T1	T2 to 0.15
	Shockless Type	SAW-G01-C5-FGR-D2-10	0.07 to 0.10	0.04 to 0.07	0.02 to T1	T2 to 0.10
	Built-in Rectifier Type Shockless Type	SAW-G01-C5-F-E1-10	0.07 to 0.10	0.10 to 0.15	0.02 to T1	T2 to 0.20

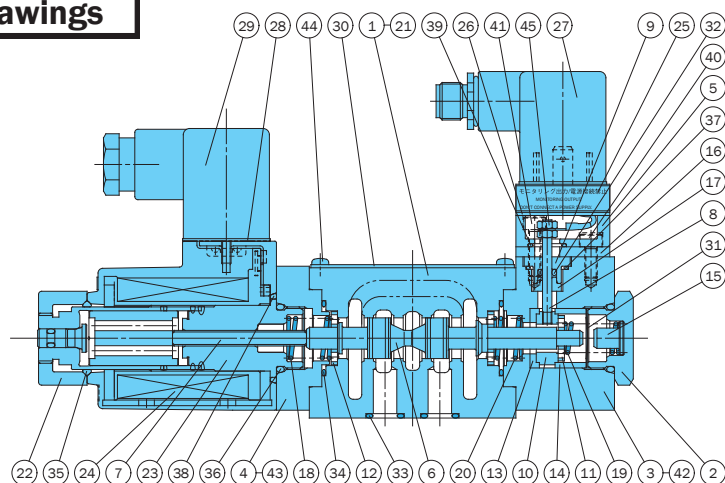
Note: May vary depending on switching response time and operating conditions (pressure, flow rate, and oil temperature).

[Measurement Conditions]

Pressure 2030 psi
 Flow Rate 7.9 gpm
 Operating fluid ISO VG32 104° F

Cross-sectional Drawings

SAW-G01-A**-**-10



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	16	Plate (connector)	31	Wave washer
2	Plug	17	Collar (insulated)	32	O-ring *
3	Cover (switch)	18	Spring (one SOL. guide side)	33	O-ring *
4	Cover (one SOL.)	19	Spring (one SOL. contact side)	34	O-ring *
5	Cover (connector)	20	Spring (main unit)	35	O-ring *
6	Spool	21	Spacer	36	O-ring *
7	Rod (guide)	22	Nut	37	O-ring *
8	Rod (conductor)	23	Solenoid guide	38	O-ring *
9	Bush (insulated)	24	Solenoid coil	39	O-ring *
10	Retainer (fixed contact)	25	Connector with lead wire	40	Hexagon socket head bolt
11	Retainer (movable contact)	26	Packing	41	Hexagon socket head bolt
12	Retainer (main unit)	27	Connector with built-in photo-coupler	42	Hexagon socket head bolt
13	Ring (insulation inside)	28	Connector packing	43	Hexagon socket head bolt
14	Ring (insulation outside)	29	Connector	44	Philips pan head screw
15	Stopper	30	Nameplate	45	Hexagon nut

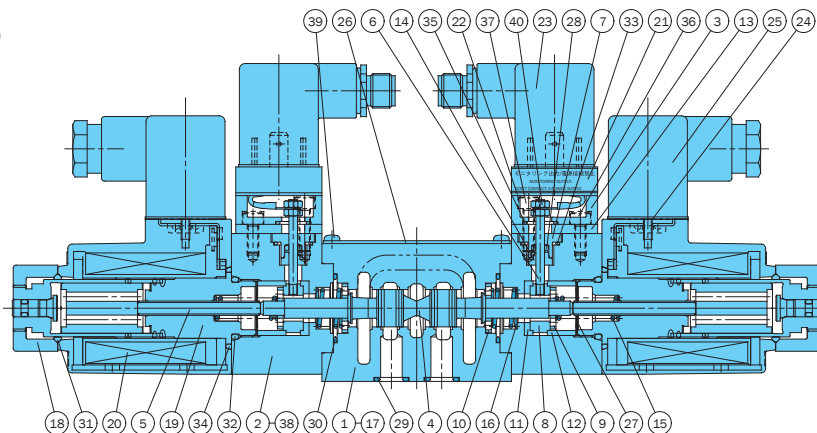
Seal Part List (Kit Model Number EQS-01A)

Part No.	Part Name	Part Number	Q'ty
32	O-ring	1B-P3	1
33	O-ring	AS568-012 (Hs90)	4
34	O-ring	AS568-019 (Hs90)	2
35	O-ring	1A-P20	1
36	O-ring	1B-P18	2
37	O-ring	S-11.2 (Hs90)	1
38	O-ring	S-25 (Hs70)	1
39	O-ring	S-9 (Hs70)	1

Note: 1A and 1B are JIS Standard B 2401, while AS568 is SAE standard.

For details about parts marked with an asterisk "**", refer to the list of seals in the table on the right.

SAW-G01-C**-**-10



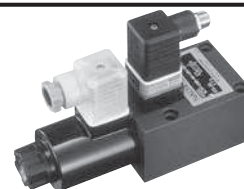
Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	16	Spring (main unit)	31	O-ring *
2	Cover (sensor)	17	Spacer	32	O-ring *
3	Cover (connector)	18	Nut	33	O-ring *
4	Spool	19	Solenoid guide	34	O-ring *
5	Rod (DC guide)	20	Solenoid coil	35	O-ring *
6	Rod (conductor)	21	Connector with lead wire	36	Hexagon socket head bolt
7	Bush (insulated)	22	Packing	37	Hexagon socket head bolt
8	Retainer (fixed contact)	23	Connector with built-in photo-coupler	38	Hexagon socket head bolt
9	Retainer (movable contact)	24	Connector packing	39	Philips pan head screw
10	Retainer (main unit)	25	Connector	40	Hexagon nut
11	Ring (insulation inside)	26	Nameplate		
12	Ring (insulation outside)	27	Wave washer		
13	Plate (connector)	28	O-ring *		
14	Collar (insulated)	29	O-ring *		
15	Spring (one SOL. contact side)	30	O-ring *		

Seal Part List (Kit Model Number EQS-01C)

Part No.	Part Name	Part Number	Q'ty
28	O-ring	1B-P3	2
29	O-ring	AS568-012 (Hs90)	4
30	O-ring	AS568-019 (Hs90)	2
31	O-ring	1A-P20	2
32	O-ring	1B-P18	2
33	O-ring	S-11.2 (Hs90)	2
34	O-ring	S-25 (Hs70)	2
35	O-ring	S-9 (Hs70)	2

Note: 1A and 1B are JIS Standard B 2401, while AS568 is SAE standard.

For details about parts marked with an asterisk "**", refer to the list of seals in the table on the right.



SCW Series

Poppet Type Directional Control Valve with Monitoring Switch 3045 psi

13.2 gpm

3045 psi

Features

This valve is a poppet activated directional control valve that uses mechanical detection to operate a switch to send an electric ON/OFF signal. This makes it possible, by monitoring the status of the spool operations, to use it as an information source for safety checks by using the ON/OFF signal as a basis for sequence control. In the future, they will be used in machinery that is compatible with

international machine safety (ISO 12100) and JIS standards (JIS B 9700) standards.

The poppet type directional control valve with monitoring switch was developed as a valve to support this demand.

The switch contact has little dead zone and almost no temperature drift (variable motion caused by changes in temperature) or hysteresis because the reaction of the poppet action is

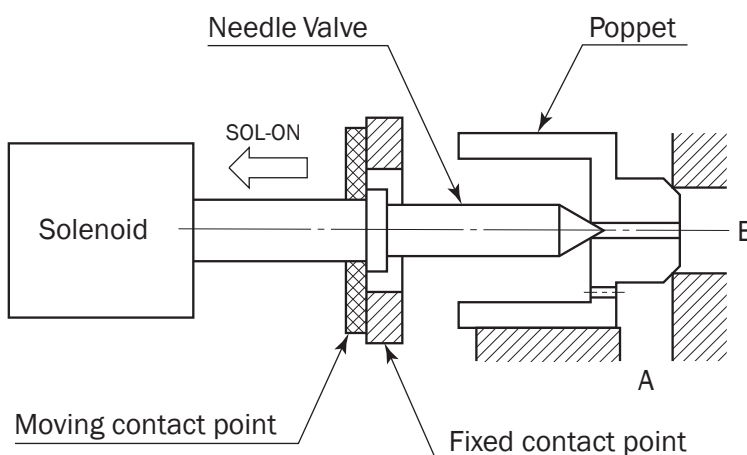
mechanical.

All valve functions, except for the monitoring function, are equivalent to the standard poppet type directional control valve.

DIN connectors are used for the switches and solenoid coil wiring so connections are easy when installing or replacing valves.

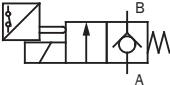
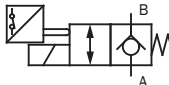
Operational Principle

Operational Principles
When the needle valve is in the center position, the fixed and moving parts are in contact forming an electric circuit. The solenoid turns on, the needle valve operates so there is no circuit between the fixed and moving parts.



Specifications

- Valve Specifications

Operation Symbol		-AR-	-ARC-
JIS Symbol			
Maximum Working Pressure (A, B ports)		3045 psi	
Maximum Flow Rate	A → B	13.2 gpm	13.2 gpm
	B → A	—	
Cracking Pressure of Check Valve		29 psi	
Switching Frequency		120/minute	
Weight		5 lbs	
Operating Environment	Dust Resistance/Water Resistance Rank	JIS C 0920 IP65	
	Operating Fluid	Oil-based operating fluid (Note 1)	
	Ambient Temperature Range	-4 to 122° F	
	Operating Fluid Temperature Range	-4 to 158° F	
	Operating Viscosity Range	15 to 300 centistokes	
	Filtration	10μm or less	
Mounting bolt (Note2)	Size × Length	Socket hex head bolt (grade 8 equivalent) 10-24 x 1 3/4	
	Tightening Torque	7.3 to 9.5 ft lbs	

Note: 1. Use a petroleum based operating fluid because the ON/OFF mechanism of the valve's monitoring switch is immersed in oil and the oil must be a non-conducting fluid.

Use only petroleum based operating fluid (do not use fluids that are water, glycol, W/O emulsion, phosphate, or fatty ester based).

Petroleum based operating fluids must also have a water content that is less than 0.1% by volume.

2. Installation bolts are provided with valves.

• Monitoring Switch Specifications

Voltage Rating	24VDC
Allowable Voltage Range	± 20% of voltage rating
Maximum Current Load	100mA
Residual Voltage (Note 3)	Max. 1.2V
Wiring for Connector for Switch	Connect with wires or M12-4 pin connector

Note: 1. See page D-74 for the procedure to wire the connector for the switch.

2. The programmable controller input circuits are positive (+) common mode and negative (-) common mode.

The directional control valve with monitoring switch uses a source circuit [switch on the positive (+) side of the load and power source] for safety purposes.

Because of this, it is necessary to use a negative (-) common mode programmable controller to receive input from the monitoring switch output.

3. Set the voltage of the power supply to the monitoring switch within a range that satisfies the following conditions.

Load ON voltage + residual voltage ≤ switch supply voltage ≤ 28.8 V (+20% voltage rating)

4. The switch element (photocoupler) in the connector's internal circuit for the monitoring switch may malfunction in the ON state because of over voltage or over current.

Therefore, in addition to checking the ON output of the monitoring switch, monitor the current at the solenoid and the internal circuits of the connector and valve in conjunction with the switch output.

Condition of monitoring switch output and valve

		Current to Solenoid	
		ON	OFF
Monitoring Switch Output	ON	Abnormal Malfunction at internal circuit of connector or valve	Normal Needle valve returns to middle position
	OFF	Normal Needle valve is switching	Pressure from A port (Closed) Abnormal Valve malfunction or signal wire is cut
			Pressure from B port (Flows from B → A port) Normal Poppet opens and needle valve operates
	OFF		

The monitoring switch outputs according to the motion of the spool, so the solenoid turns on and off according to the output signal which is delayed only as much as the spool operation is delayed.

Set a 0.3 second delay, including leeway, to monitor the output of the switch.

• Solenoid Specifications

Same specifications as the SA-G01 series (31 design).

Solenoid Type	Power Supply Type	Voltage (V)	Frequency (Hz)	Solenoid Coil Type	Drive Current (A)	Holding Current (A)	Holding Power (W)	Allowable Voltage Range (V)
DC with Built-in Rectifier	E1	AC100	50/60	EAC64-E1-1A	0.31		27	90 to 110
	E 115	AC110	50/60	EAC64-E 115- 1A	0.26		25	100 to 125
		AC115			0.27		27	
	E2	AC200	50/60	EAC64-E2-1A	0.15		26	180 to 220
	E 230	AC220	50/60	EAC64-E230-1A	0.12		24	200 to 250
		AC230			0.13		27	
DC	D1	DC12	—	EAC64-D1-1A	2.2		26	10.8 to 13.2
	D2	DC24	—	EAC64-D2-1A	1.1		26	21.6 to 26.4

• Handling

- Do not allow abnormal surges greater than the maximum operating pressure to occur because pressure from the B port is used for the solenoid.
- Always keep the operating fluid clean. Allowable contamination is class NAS12 or less.
- Use a ISO VG 32 petroleum-based operating fluid, or an equivalent, that has a water content that is less than 0.1% by volume.
- Do not use fire-resistant operating fluid.
- Use this valve only within the allowable voltage range.
- The only way to prevent misoperation of the monitoring switch caused by noise generated by the solenoid turning on and off is to install the surgeless directional

control valve with monitoring switch (option symbol: GR). (If the solenoid power source is C* and D*)

- Use surgeless specification (with varistor diode) directional control valves with monitoring switches for all electric valves on the same machine to prevent misoperation of the monitoring switch caused by noise when the solenoid turns on and off.

- The coil surface temperature increases if this valve is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.

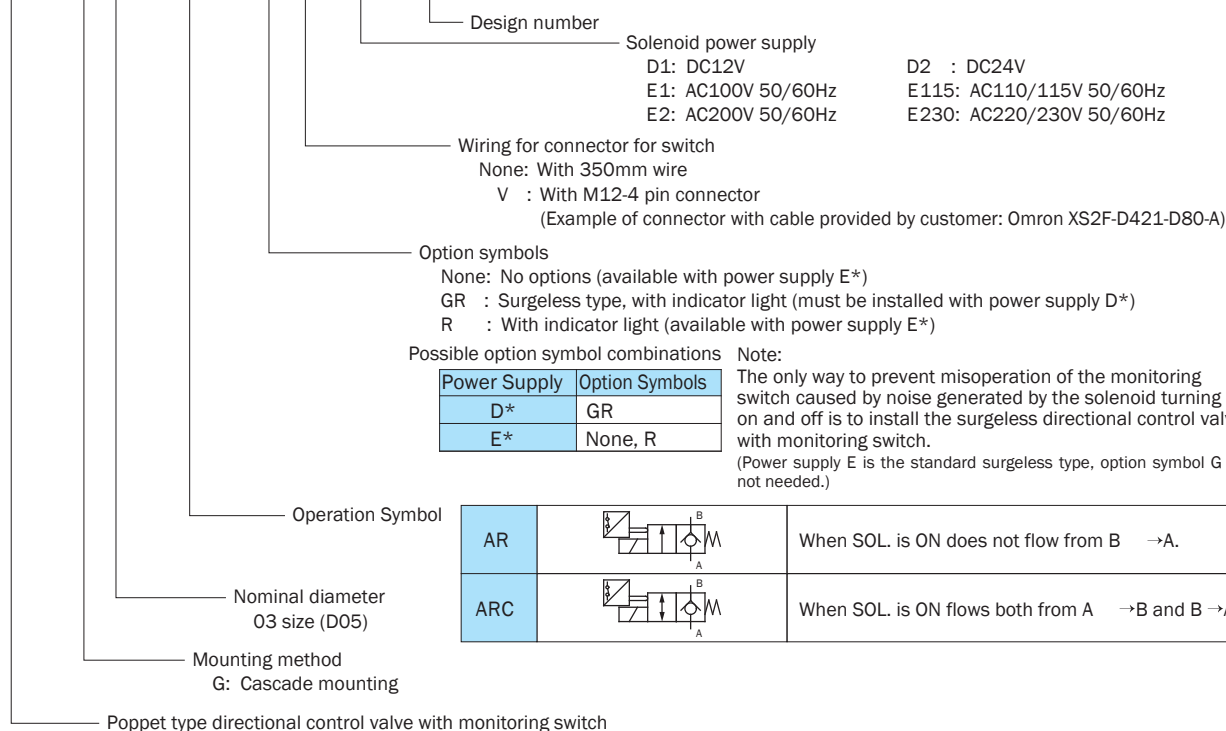
- The connector for the solenoid is the same as for the SA series solenoid valve. See page D-22 for electrical circuit drawings and wiring procedures.

- Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs	Dimension Drawings Page
MSA-03-E10	3/8	3625	11.8	5	D-21
MSA-03X-E10	1/2		21.1		
MSA-03-TE10	3/8		11.8	8.3	H-4
MSA-03X-TE10	1/2		21.1		

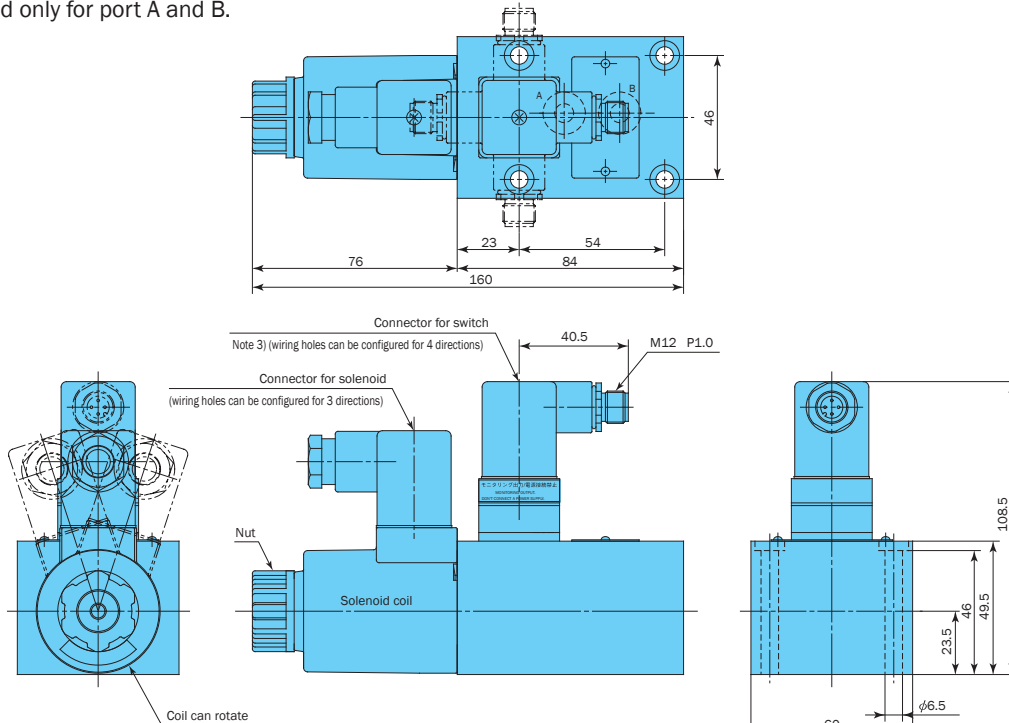
Understanding Model Numbers

SCW - G 03 - ARC - GR V - D2 - J10



Installation Dimension Drawings

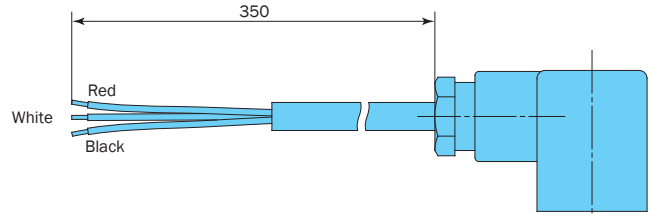
Dimensions of installation surface of gasket are ISO 4401-05-04.
However, used only for port A and B.



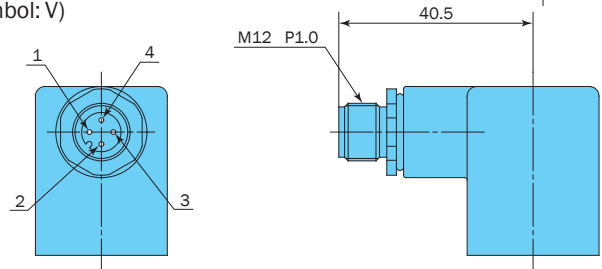
- Note: 1. The connector for the switch in the drawing above is the M12-4 pin connector. In addition there are wire connections also.
See page D-74 for more detailed information.
2. Use surgeless directional control valves with monitoring switches for all electric valves on the same machine to prevent misoperation of the monitoring switch caused by noise when the solenoid turns on and off.
3. To orient the wiring hole for the connector for the switch towards the solenoid coil, loosen the nut and rotate the solenoid coil so the connector for the switch does not interfere with the connector for the solenoid.

• Details about the Connector for the Switch

(1) With wiring (option symbol: none)

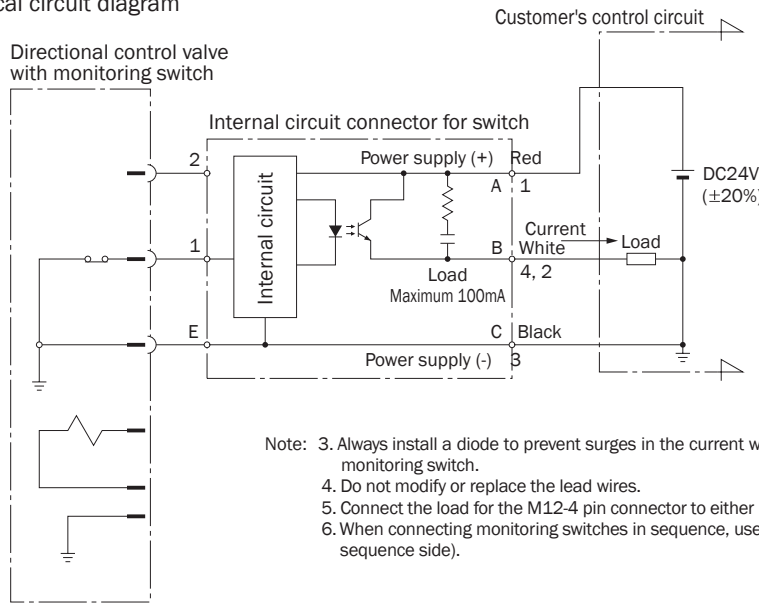


(2) With M12-4 pin connector (option symbol: V)



Note: 1. The pin connector is screwed to the housing so it is rotated a certain amount compared to the drawing. Refer to the electrical circuit diagram below for how to connect it.
2. The connector that the M12-4 pin connector connects to is not provided.
(Example of connector with cable provided by customer: Omron XS2F-D421-D80-A)

(3) Electrical circuit diagram



Method for Wiring to Connector with Switch

Wiring Method		Connection
Wire Color	Pin Number for M12-4 pin Connector	
Red	1	Power supply (+)
White	4 or 2	Load
Black	3	Power supply (-)

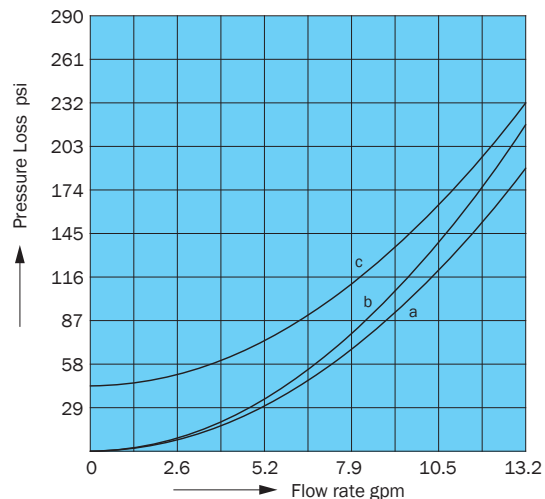
Note: 3. Always install a diode to prevent surges in the current when connecting an inductive load, such as a relay, to the monitoring switch.
4. Do not modify or replace the lead wires.
5. Connect the load for the M12-4 pin connector to either pin number 4 or 2.
6. When connecting monitoring switches in sequence, use the negative (-) common mode (type that current runs to sequence side).

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

Operation Symbol	JIS Symbol	SOL OFF B → A	SOL ON	
			A → B	B → A
AR		c	a	—
ARC		c	a	b



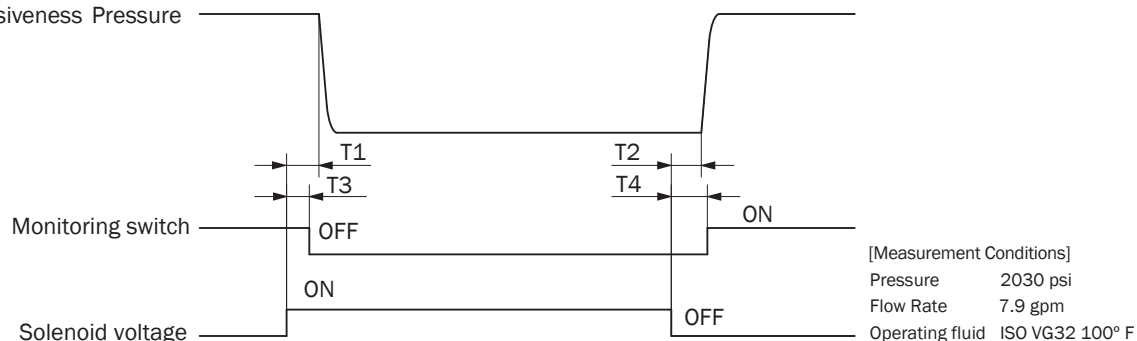
Range of Motion of Switch

Positions	Stroke of Poppet		
	SOL. ON	Switching Transition	Center
Flow Path			
Motion of Switch	OFF		ON

Note: 1. Internal leak exists at of switching transition period.

2. ON and OFF indicate the state of the output transistor on the circuit board in the connector.

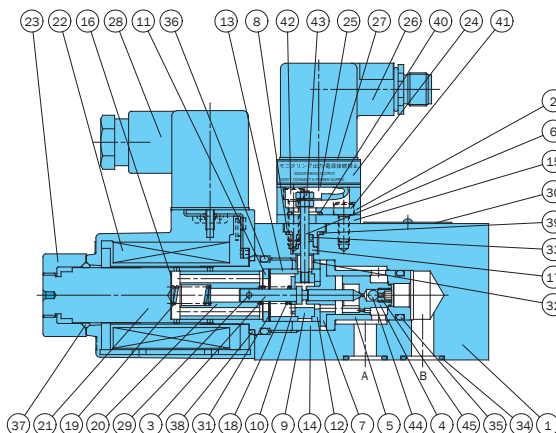
Switching Responsiveness Pressure



Type of Machine	Model	Response Time (s)			
		Pressure		Switch	
		T1	T2	T3	T4
DC Solenoid	SCW-G03-AR-GR-D2-J10	0.03 to 0.04	0.02 to 0.03	0.01 to T1	T2 to 0.05
DC Solenoid with Built-in Rectifier	SCW-G03-AR-E1-J10	0.03 to 0.04	0.08 to 0.11	0.01 to T1	T2 to 0.20

Note: May vary depending on switching response time and operating conditions (pressure, flow rate, and oil temperature).

Cross-sectional Drawing



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	16	Spacer (sealing prevention)	31	Wave washer
2	Cover (connector)	17	Collar (insulated)	32	Spacer (ring rotation prevention)
3	Needle Valve	18	Spring (contact side)	33	O-ring *
4	Poppet	19	Spring (guide side)	34	O-ring *
5	Sleeve	20	Solenoid plunger	35	O-ring *
6	Rod (conductor)	21	Solenoid guide	36	O-ring *
7	Bush (needle valve support)	22	Solenoid coil	37	O-ring *
8	Bush (insulated)	23	Nut	38	O-ring *
9	Retainer (fixed contact)	24	Connector with lead wire	39	O-ring *
10	Retainer (movable contact)	25	Packing	40	O-ring *
11	Retainer (flange side)	26	Connector with built-in photo-coupler	41	Hexagon socket head bolt
12	Ring (insulation inside)	27	Connector packing	42	Hexagon socket head bolt
13	Ring (insulation outside)	28	Connector	43	Hexagon nut
14	Ring (fixed by sleeve)	29	Parallel pin	44	Steel ball ★
15	Plate (connector)	30	Nameplate	45	Set screw ★

Seal Part List (Kit Model Number EQS-SC)

Part No.	Part Name	Part Number	Q'ty
33	O-ring	1B-P3	1
34	O-ring	AS568-014 (Hs90)	2
35	O-ring	1B-P14	2
36	O-ring	AS568-119 (Hs90)	1
37	O-ring	1A-P20	1
38	O-ring	S-25 (Hs70)	1
39	O-ring	S-11.2 (Hs9)	1
40	O-ring	S-9 (Hs70)	1

Note) 1A and 1B are JIS Standard B 2401, while AS568 is SAE standard.

Note: 1. For details about parts marked with an asterisk "*", refer to the list of seals in the table on the right.
2. Products marked with a ★ use only SCW-G03-ARC-**-**-J10 and do not use SCW-G03-AR-**-**-J10.

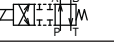
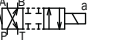
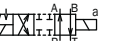
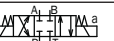
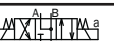
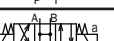
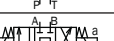


SK-G01 Series Wet Type Solenoid Valve

Features

- High pressure, large capacity with minimal pressure loss
- High dust and water resistance (JIS C 0920 IP67)
- High vibration proof (JIS D 1601 3 D Grade 90 Division 400)
- Shockless type available (Option: F)
- Diode built in coil available (Option: G)
- Low switching noise and very long life

Specifications

Model Number		SK-G01			
		Standard Type		Shockless Type	
JIS Symbol	Operation	Maximum Flow Rate L/min(gpm)	Maximum Working Pressure MPa(psi)	Maximum Flow Rate L/min(gpm)	Maximum Working Pressure MPa(psi)
	A3X	80 (21.1)	35 (5075)	50.0 (13.2)	25 (3625)
	H3X				
	E3X	100 (26.4)			
	C5				
	C6	80 (21.1)			
	C4	50.0 (13.2)			
	C7Y			40 (10.6)	

Maximum Working Pressure MPa(psi) P, A, B ports	Standard Type	35 (5075)
	Shockless Type	25 (3625)
Maximum Allowable Back Pressure MPa(psi) T port	Standard Type	21 (3045)
	Shockless Type	
Switches/min	Standard Type	120
	Shockless Type	
Option	Shockless	F
	Surgeless (Diode built in coil)	G
Weight kg (lbs)	Double solenoid	2.0 (4.41)
	Single solenoid	1.5 (3.31)
Operating Environment	Dust Resistance/Water Resistance Rank	JIS C 0920 IP67
	Vibration Proof	JIS D 1601 3 D Grade 90 Division 400
	Ambient Temperature	-30~+50°C (-22~+122°F)
Operating Fluid	Temperature Range	-25~+80°C (-13~+176°F)
	Viscosity Range	15~300mm ² /s(cSt)
	Filtration	10 μm or less
Mounting Bolts	Size x Length	M5x45 or #10x1 3/4, four bolts
	Tightening Torque	Hexagon socket head bolts 10-24 x 1 3/4 5~7N•m (3.69~5.16lbf•ft)

Note: 1. Maximum operating pressure depends on the valve type. For details, see "Permissible pressure-flow rate values."
 2. A protective cover is recommended to avoid splashing the valve directly.
 3. For mounting bolts, use grade 8.
 4. Mounting bolts are not included.

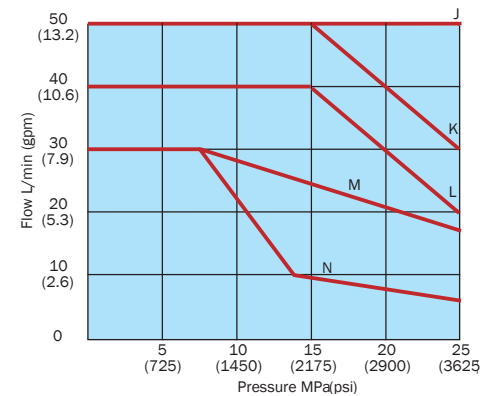
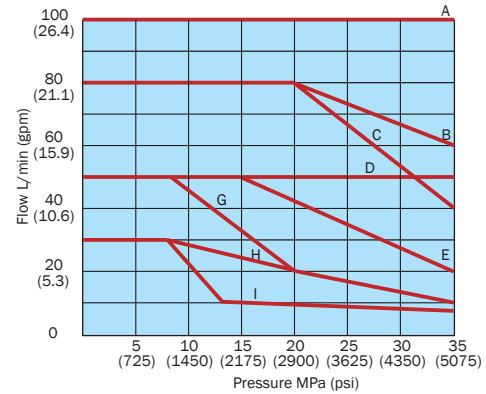
Permissible Pressure-Flow Rate Values

•Standard type

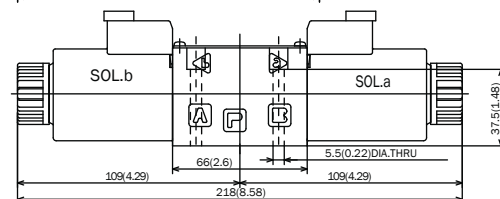
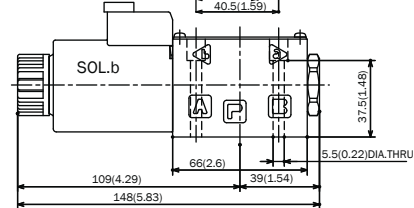
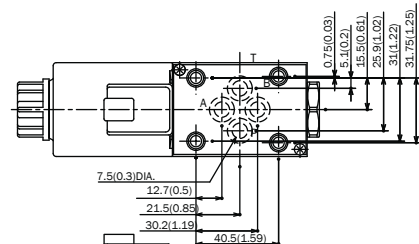
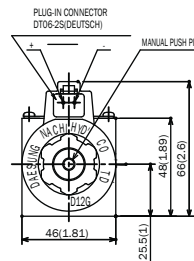
Type	Standard Type		
Operation Example Operation Symbol			
A3X	B	I	I
H3X	B	I	I
E3X	A	H	H
C4	D	D	D
C5	A	G	G
C6	C	G	G
C7Y	E	I	I

•Shockless type

Type	Shockless Type		
Operation Example Operation Symbol			
A3X	J	N	N
H3X	J	N	N
E3X	J	M	M
C4	J	J	J
C5	J	N	N
C6	K	N	N
C7Y	L	N	N



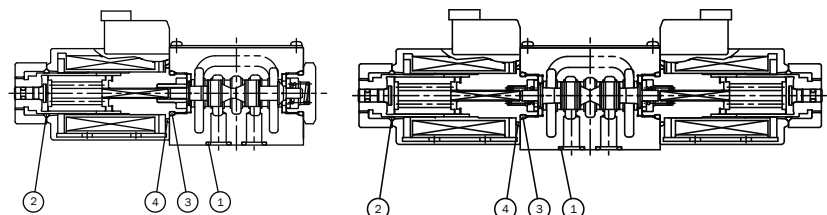
Dimensional Drawings



Sealing Parts

Part No.	Part Name	Part No.	Quantity	
			Single Solenoid	Double Solenoid
1	O-ring	AS568-012(Hs90)	4	4
2	O-ring	1A-P20	1	2
3	O-ring	1B-P18	2	2
4	O-ring	S-25	1	2

Note: 1A and 1B are JIS Standard B 2401, while AS568 is SAE Standard.



DMA Type Manual Valve

10.5 to 26.4 gpm
5075 psi



Features

The compact O1 and O3 sizes are perfect for small flow rate control. Since a balanced type valve is used, there is no need for drain piping, and use

use with back pressures up to 2320 psi is possible. Mounting methods are the same as SAG01/O3, and the O1, O3 size modular

the reaction of the poppet action is valve can be used, so circuit configuration is quick and easy.

Specifications

Model No.	Nominal Diameter (size)	Maximum Working Pressure psi	Tank Port Back Pressure psi	Maximum Flow Rate gpm	Spool Stroke (in)		Weight lbs
					2-position	3-position	
DMA-G01-***-20	1/8	5075	2320	10.5	.16	.16 × 2	2.8
DMA-G03-***-(J)20	3/8	3625		26.4	.24	.24 × 2	7.2

Positions	Type	JIS Symbol	Model No.	Maximum Working Pressure psi
2-position	Closed Cross		DMA- G01 -A3X- 20 G03 -A3Z- (J)20	5075
	Open Cross		DMA- G01 -A3Z- 20 G03 -A3Z- (J)20	
	Closed Cross		DMA- G01 -E3X- 20 G03 -E3Z- (J)20	
	Open Cross		DMA- G01 -E3Z- 20 G03 -E3Z- (J)20	
3-position	All Ports Open		DMA- G01 -C4- 20 G03 -C4- (J)20	5075
			DMA- G01 -F4- 20 G03 -F4- (J)20	
	All Ports Blocked		DMA- G01 -C5- 20 G03 -C5- (J)20	
			DMA- G01 -F5- 20 G03 -F5- (J)20	
	ABT Connection		DMA- G01 -C6- 20 G03 -C6- (J)20	3625
			DMA- G01 -F6- 20 G03 -F6- (J)20	
	PT Connection		DMA- G01 -C7X- 20 G03 -C7Y- (J)20	
			DMA- G01 -C7Y- 20 G03 -C7Y- (J)20	
	Closed Cross		DMA- G01 -F7X- 20 G03 -F7Y- (J)20	5075
			DMA- G01 -F7Y- 20 G03 -F7Y- (J)20	
	Restricted Open Cross		DMA- G01 -C8- 20 G03 -C8- (J)20	
			DMA- G01 -F8- 20 G03 -F8- (J)20	
	PAT Connection		DMA- G01 -C8- 20 G03 -C8- (J)20	5075
			DMA- G01 -F8- 20 G03 -F8- (J)20	

• Handling

1 The following are the three types of lever operations.

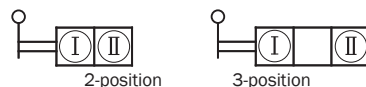
- Spring Offset Type (Type A)
The lever is normally kept in the end position by the spring. Raising the lever performs switching, and the lever returns to its original position when released.
- Spring Center Type (Type C)
The spool is normally in the center of position 3. After switching to either end, the spring returns the lever to its center position when the lever is released.
- Detent Type (Type F, Type E)
A notch at spool position 3 or as a stop.

2 Pressure loss is the same as that for the SAG01/G03, so see SA-G01/G03 for more information.

3 The lever mounting orientation can be positioned at 90° increments by changing the orientation of the lever side cover.

4 For PT connection type DMA-G01/G03 -*7*-(J)20, closed cross DMA-G01/G03 -*7X-(J)20 is the standard type.

5 The relationship between the lever switching positions and JIS symbols is shown below. (See the installation dimension diagrams for symbols & I and & II.)



6 Mounting bolts are not included with the O1 size.

DMA-G01-***-20	10-24 x 1 3/4	4
DMA-G03-***-20	1/4-20 x 2 3/4	4

Note: For mounting bolts, use grade 8 or equivalent.

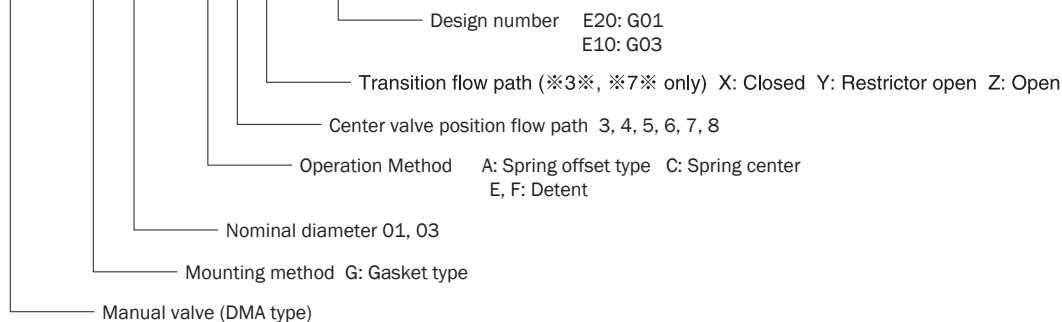
7 The following shows the sub plates.

Model No.	Pipe Diameter	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MSA-01Y-E10	3/8	3625	10.5	2.6	DMA-G01-***-20
MS-03-E30	3/8		10.5	5	DMA-G03-***-E10
MS-03X-E30	1/2		11.8		

These sub plates can also be used with SA (SS)-G01/G03, so see SA (SS)-G01/G03 for mounting methods.

Understanding Model Numbers

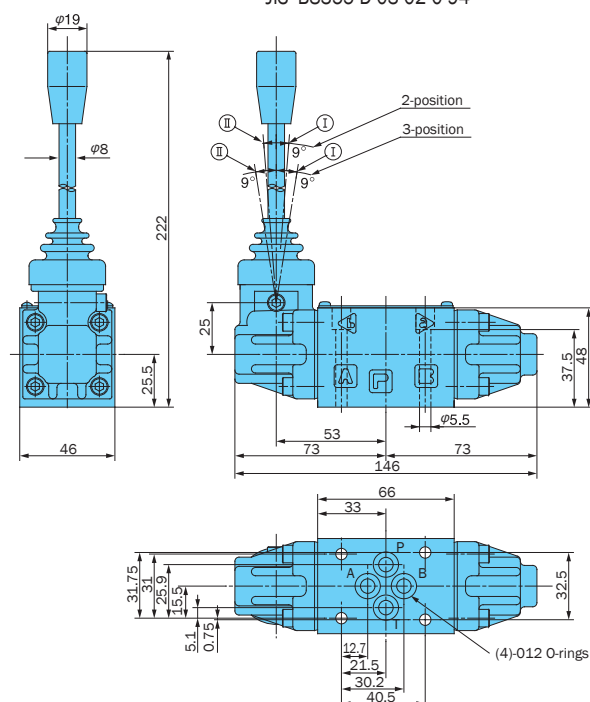
DMA - G 01 - A 3 X - 20



Installation Dimension Drawings

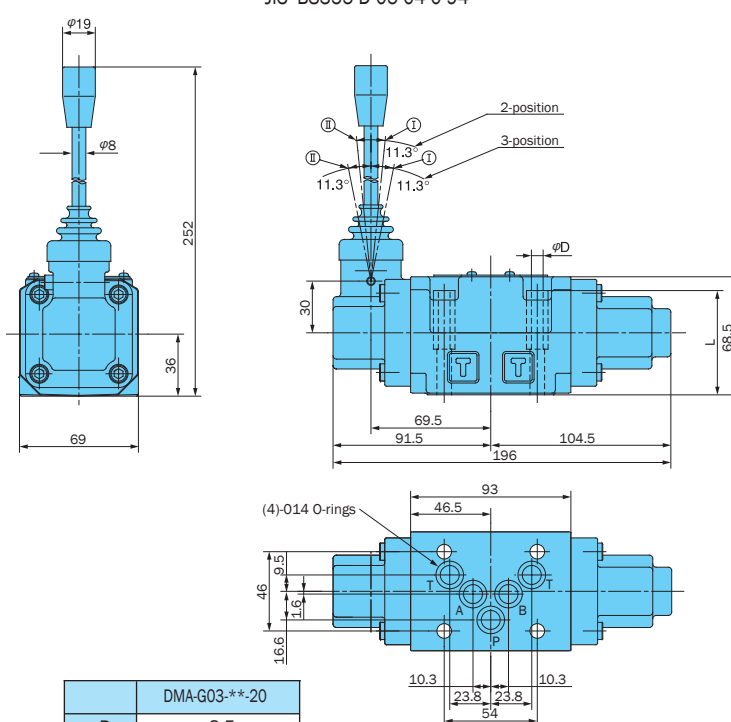
DMA-G01-*E-20 (D03)

Gasket Surface Dimensions (ISO 4401-03-02-0-94
JIS B8355 D-03-02-0-94)



DMA-G03-***-E-10 (D05)

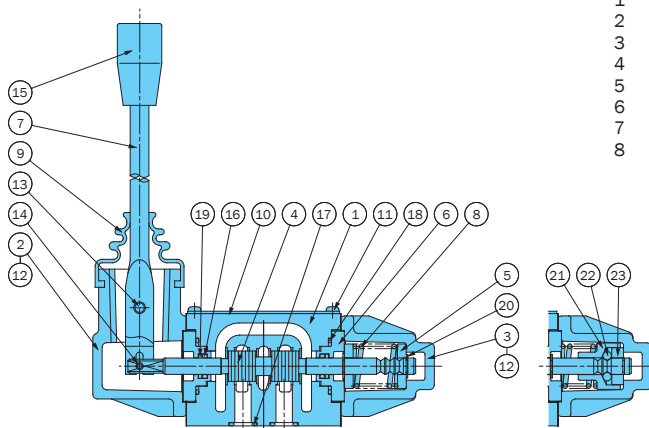
Gasket Surface Dimensions (ISO 4401-05-04-0-94
JIS B8355 D-05-04-0-94)



DMA-G03-**-20	
ϕD	$\phi 8.5$
L	58

Cross-sectional Drawing

DMA-G01-***-20



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	9	Rod cover	17	O-ring
2	Cover A	10	Nameplate	18	O-ring
3	Cover B	11	Stopper screw	19	Backup ring
4	Spool	12	Screw	20	Snap ring
5	Ring	13	Screw	21	Guide
6	Bush	14	Pin	22	Ball
7	Lever	15	Knob	23	Retainer
8	Spring	16	O-ring		

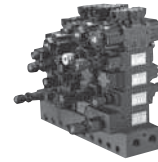
Seal Part List

Part No.	Part Name	Model No.			
		DMA-G01	Q'ty	DMA-G03	Q'ty
16	O-ring	1A-P7	2	1A-P10	2
17	O-ring	AS568-012 (Hs90)	4	AS568-014 (Hs90)	5
18	O-ring	AS568-019 (Hs90)	2	1B-P28	2
19	Backup ring	T2-P7	2	T2-P10	2

Note) 1.O-ring 1A/B-** refers to JIS B2401-1A/B.
2.Backup ring indicates JIS B2407-T2-**.

Modular Valve Series

5.2 to 79 gpm
3000, 3600, 5000 psi



Overview

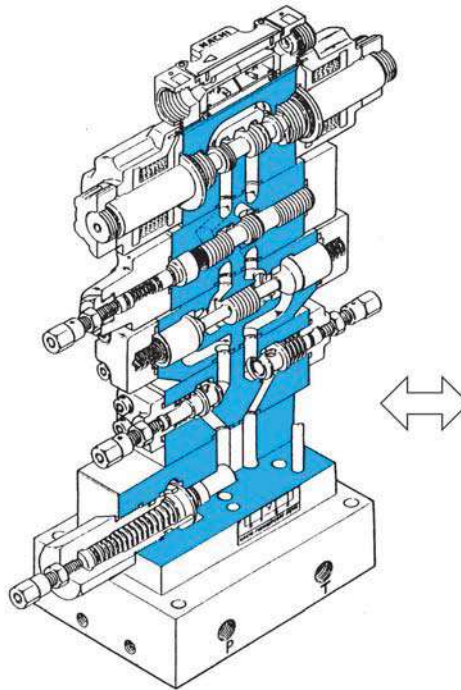
The modular valve is designed and engineered to integrate multiple hydraulic valve operations into a single unit, which eliminates the need for piping between valves and enables configuration of a

circuit using a single modular valve. The result is an innovative valve system whose energy and materials efficiency provide advantages in terms of

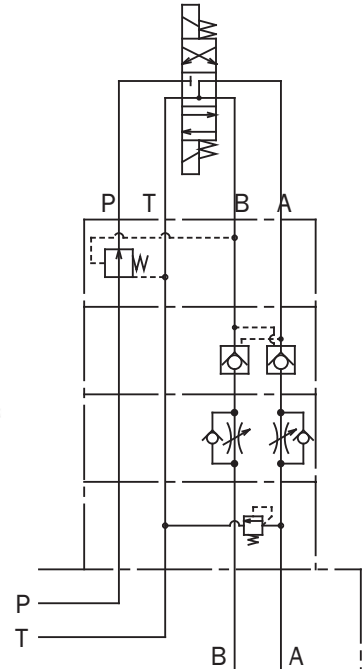
compact configuration, reliability, and more. The illustrations below show one example of a circuit configuration using this system.

Features

- 1 High pressure and high volume. Available maximum operating pressure operations are 3000, 3600, and 5000 psi, while maximum control flow rates are G01 13 gpm, G03 26 gpm, G04 79 gpm.
- 2 Ganging and bolting format allows for quick and easy circuit configuration as well as circuit changes and additions.
- 3 Compact module configurations greatly reduce space requirements.
- 4 Maintenance costs are also reduced because less piping and fewer couplings mean less need for acid rinsing and flushing of pipes.
- 5 Fewer fluid leak problems due to pipe resonance, noise, and loose couplings.
- 6 Circuit configuration is simple yet exact. Nameplates on the side of the valve show ISO codes that make it quick and easy to determine its performance.
- 7 A full lineup of models is available to meet a wide range of needs and circuit configurations: Model G01 (D03), G03 (D05), G04 (D07).



Integrated Structural Diagram



Integrated Circuit Diagram

Specifications

Name	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Gasket Surface Dimensions	Possible Number of Ganged Valves (Note 2)
01 Series	1/8	3600 (Note 1)	13	ISO 4401-03-02-0-94	1 to 4
03 Series	3/8	3600 (Note 1)	26	ISO 4401-05-04-0-94	1 to 4
04 Series	1/2	5000	79	ISO 4401-07-06-0-94	1 to 3 (Note 3)

- Note) 1. The M35 Series is available as a 5000 psi maximum operating pressure version of the 01 and 03 Series. For details, see pages F92 and F93.
2. The number of ganged valves does not include solenoid valves.
3. Up to four valves can be ganged together if the maximum operating pressure is less than 3000 psi.

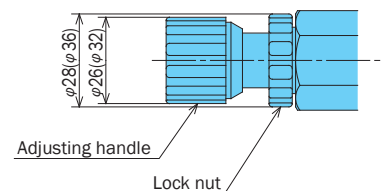
K Series Modular Valve

The valve shown in the photograph is available with nominal diameter 01 and 03 size adjusting bolts. Use the following format for specification.

Example: OCY-G01-W-Y-K-20



Auxiliary symbol
K: With handle



Dimensions in parentheses indicate nominal diameter 03.

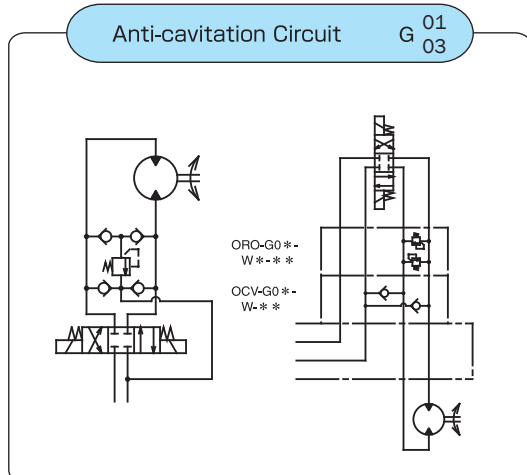
Precautions when Ganging Modular Valves

Note the following precautions when ganging modular valves together in the applicable example circuits.

Circuit Diagram	Description	Incorrect	Correct
Locking Circuit and Pressure Reducing Circuit	●Cylinder position not maintained ○Leaks occur because, during the pilot check, the line being maintained flows into the pilot line of the reducing valve.	Solenoid Pilot Operate Check Modular Valve (AB Line) Pressure Reducing Modular Valve (B Line)	
Pressure Reduction Circuit with Speed Control	●Insufficient cylinder output and drop in speed ○Pressure increases due to the restrictor effect of the flow regulator. Since the pilot runs from that line, pressure reduction makes smooth operation impossible.	Solenoid Flow Regulator Modular Valve (A, B Line, Meter Out) Pressure Reducing Modular Valve (B Line)	
Locking Circuit and Speed Control Circuit	●Cylinder knocking ○Pressure is increased by the restrictor effect of the flow regulator. That pressure moves the pilot check in the closed direction, which causes the valve to repeatedly open and close.	Solenoid Flow Regulator Modular Valve (A, B Line, Meter Out) Pilot Operate Check Modular Valve (AB Line)	

Valve Ganging Configuration Examples

Anti-cavitation Circuit

G⁰¹₀₃

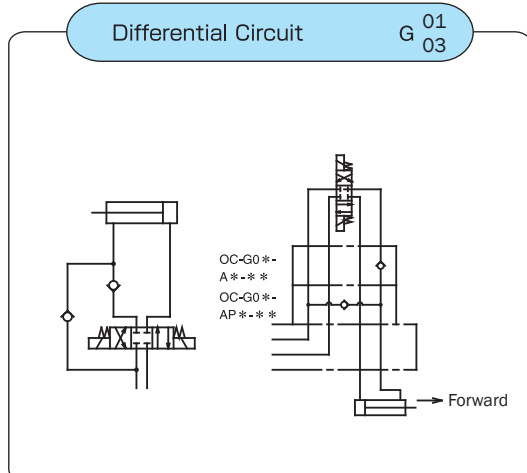
- Surge pressure is prevented by the inertia of the actuator, and cavitation by fluid being sucked in through the opposite port, which is in negative pressure, is prevented.

- Example Valve Model Numbers (G03)

Relief Valve ——— ORO-G03-W-J50

Vacuum Check Valve ——— OCV-G03-W-J50

Differential Circuit

G⁰¹₀₃

- When the cylinder advances, the rod side return fluid returns to the P port and the pump discharge rate and confluence are advanced at high speed (differential).

- Example Valve Model Numbers (G03)

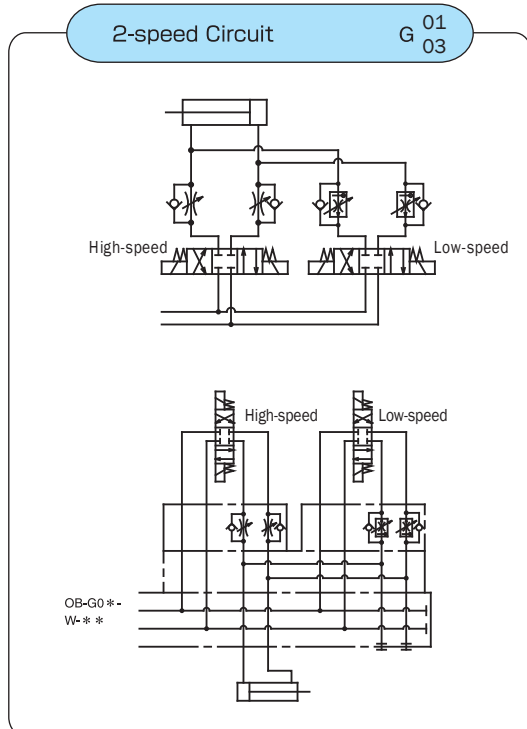
Check valve ——— OC-G03-A-J50

Differential check valve ——— OC-G03-AP-J50

Important:

Cylinder effective output is the rod surface area portion only.

2-speed Circuit

G⁰¹₀₃

- This type of circuit allows variation between two actuator speeds. It prevents low-speed shock when the actuator starts up or stops, and it is used when the intermediate stroke is operated at high speed.

- Example Valve Model Numbers (G03)

2-speed Plate ——— OB-G03-W-(H)-J30

High-speed Flow Regulator Valve ——— OCY-G03-W-Y-J51

Low-speed Flow Control Valve ——— OCF-G03-W60-Y-J50

G01 Modular Valve Series

Type	Name	Valve Model Number	Pressure Adjustment Range (Check Valve Cracking Pressure) psi	Maximum Flow Rate gpm	JIS Symbol	Height in	Weight lbs	Catalog Page
Solenoid Valves	Solenoid Valve	SS-G01-**-R**-31 SA-G01-**-**-31		13				D-4 D-16
Pressure Control Valves	Relief Valves (Balance Type)	OR-G01-P 1/3-20	1: 145 to 1000 3: 500 to 3600	13		1.57	3.3	F-10
		-W 1/3-20			5.0			
		-A 1/3-21			3.5			
		-B 1/3-21						
	Brake Valves (Direct Type)	ORO-G01-W 1/3-20	1: 115 to 1000 3: 500 to 3600	5.2		1.57	3.3	F-16
		-A 1/3-20			3.0			
		-B 1/3-20						
	Direct Relief Valves (Direct Type)	ORD-G01-W 1/3-20	1: 115 to 1000 3: 500 to 3600	5.2		1.57	3.3	F-20
		-A 1/3-20			3.0			
		-B 1/3-20						
	Reducing Valves (Direct Type)	OG-G01-P C 1-21 2/2	C: 20 to 500	13		1.57	2.8	F-25
		C 1-21 2/2	1: 115 to 1000					
		C 1-21 2/2	2: 500 to 3000					
	Balance Type Reducing Valves	OGB-G01-P C 1-20 3/3	C: 20 to 500	10.5		1.57	4.1	F-32
		-A 1-20 3/3	1: 115 to 1000					
		-B 1-20 3/3	3: 500 to 3000					
	Reducing Valves (Direct Type)	OG-G01-A C 1-E21 2/2	C: 20 to 500			1.57	2.8	F-34
		OG-G01-B C 1-E21 2/2	2: 500 to 3000					
	Pressure Control Valves (Sequence Valves)	OQ-G01-P2 1/3-20	1: 115 to 1000 3: 500 to 3000	10.5		1.57	2.4	F-44
	Pressure Control Valves (Counter Balance Valves)	OCQ-G01-A1 1/2-20	1: 115 to 1000 2: 500 to 2000					F-47
		-B1 1/2-20						
	Pressure Switches	OW-G01-P C 1-R**-30 3/3	C: 72 to 500	13		1.57	3.9	F-52
		-W C 1-R**-30 3/3	1: 115 to 1000 3: 500 to 3000				5.7	
		-A C 1-R**-30 3/3	Contact Capacitance AC 125V:5A DC 12V:2.2A DC 24V:1.1A				3.9	
		-B C 1-R**-30 3/3						
Flow Control Valve	Flow Regulator Valve	OY-G01-T-20		13		1.57	2.2	F-55
	Flow Regulator Valves with Check	OCY-G01-P-20	5.8					
	Meter-Out Flow Regulator Valves	OCY-G01-W-Y-20	11.6	13		1.57	2.8	F-55
		-A-Y-20			2.6		F-63	
		-B-Y-20						

G01 Modular Valve Series

Type	Name	Valve Model Number	Pressure Adjustment Range (Check Valve Cracking Pressure) psi		Maximum Flow Rate gpm	JIS Symbol	Height in	Weight lbs	Catalog Page
Flow Control Valves	Meter-in Flow Regulator Valve	OCY-G01-W-X-20	11.6	13		1.57	2.8	F-55	
		-A-X-20					2.6		
		-B-X-20							
	Flow Control Valve (compensated)	OF-G01-P20-20	(Control Flow Rate) Differential Pressure 1000: 2.6 to 10.5 Differential Pressure 3000: .13 to 10.5	10.5		1.57	2.6	F-63	
	Meter-out Flow Control Valves (compensated)	OCF-G01-W40-Y-30	(Control Flow Rate) Differential Pressure 1000: 2.6 to 10.5 Differential Pressure 3600: .13 to 10.5				3.7		
		-A40-Y-30					3.3		
		-B40-Y-30							
	Meter-in Flow Control Valves (compensated)	OCF-G01-W40-X-30					3.7		
		-A40-X-30					3.3		
		-B40-X-30							
Direction Control Valve	Check Valves	OC-G01-P $\frac{1}{2}$ -20 3	Cracking pressure 1: 5.8 2: 50 3: 72 *For differential circuit	13		1.57	2.2	F-69	
		T $\frac{1}{2}$ -20 3					2.6		
		A $\frac{1}{2}$ -21 * 3							
		AP $\frac{1}{2}$ -20 * 3							
	Vacuum Check Valves	OCV-G01-W-20	2	13			2.2		
	Pilot Check Valves	OCP-G01-W $\frac{1}{2}$ -(F)-21	Cracking pressure 1: 29 2: 72 (Auxiliary Symbol) Open Valve Ratio Standard: Parent Valve 37% F: Child Valve 6% : Parent Valve 51%	13		1.57	2.6	F-76	
		-A $\frac{1}{2}$ -(F)-21							
		-B $\frac{1}{2}$ -(F)-21							
Composite Valves	2-pressure Reducing Valves	OGS-G01-P $\frac{C}{1}$ C-K(R)-**22 High pressure side Low pressure side Power supply : C1, C2, D1, D2	C: 29 to 500 1: 115 to 1000 2: 500 to 2000	10.5		3.5	10.5	F-41	
Other	Gauge Modular Blocks	OK-G01-P-(H)-E20	13		1	1.41	1.3	F-81	
		-T-(H)-E20							
		-W-(H)-E20							
	2-speed Plates	OB-G01-W-(H)-20	13		1	1.41	0.3	F-85	
	End Plates	MOB-G01-(H)-10	-		20	1.41	0.6		
	Free-flow plate	MOB-G01-A-10	13		1.41	1.41	0.6	F-90	
		-B-10							
	Base Blocks (Multi-block)	MOB -01X-B*-10	B: A, B ports *: Sequential number from 2 to 6 Single side outlet		SAE	SAE	-	F-90	
		-01Y-W*-10	W: A, B ports Sequential number from 1 to 6 Dual side outlet						
	Sub Plate	MSA-01Y-10 MSA-01Y-T-10	None: Back side outlet T: Side outlet		SAE	SAE		H-4	

G03 Modular Valve Series

Type	Name	Valve Model Number	Pressure Adjustment Range (Check Valve Cracking Pressure) psi	Maximum Flow Rate gpm	JIS Symbol	Height in	Weight lbs	Catalog Page
Solenoid Valves	Solenoid Valves	SS-G03-**-R-**-E21-21 SA-G03-**-*** -E21-21		26				D-4 D-16
Pressure Control Valve	Relief Valves (Balance Type)	OR-G03-P $\frac{1}{3}$ -E50	1: 1000 3: 500 to 3600 (Auxiliary Symbol) V: With vent port	21		2.1	6.8	F-10
		-W $\frac{1}{3}$ -E50					8.5	
		-A $\frac{1}{3}$ -E50					6.8	
		-B $\frac{1}{3}$ -E50					6.8	
		OR-G03-P $\frac{1}{3}$ -V-J50					6.8	
	Brake Valves (Direct Type)	ORO-G03-W $\frac{1}{3}$ -J50	1: 115 to 1000 3: 500 to 3600	7.9		2.1	10.5	F-16
		-A $\frac{1}{3}$ -J50					8.8	
		-B $\frac{1}{3}$ -J50						
	Direct Relief Valves (Direct Type)	ORD-G03-W $\frac{1}{3}$ -J50	1: 115 to 1000 3: 500 to 3600	7.9		2.1	8.5	F-20
		-A $\frac{1}{3}$ -J50					6.8	
		-B $\frac{1}{3}$ -J50						
	Reducing valve	OG-G03-P $\frac{C}{3}$ 1-(B)-E51	C: 36 to 500	21 However, C: 13		2.1	7.9	F-25
		-A $\frac{C}{3}$ 1-(B)-E51	1: 115 to 1000 3: 500 to 3000					F-34
		-B $\frac{C}{3}$ 1-(B)-E51						
	Pressure Control Valves (Sequence Valves)	OQ-G03-P2 $\frac{A}{E}$ C-J50	A: 36 to 125	21		2.1		F-44
	Pressure Control Valves (Counter Balance Valves)	OCQ-G03-A1 $\frac{A}{E}$ C-J50	C: 125 to 500			2.1	7.7	F-47
		-B1 $\frac{A}{E}$ C-J50	E: 500 to 2000					
Flow Control Valve	Flow Regulator Valve	OCY-G03 $\frac{-P}{-P-H}$ -J50		26		2.1	6.3	F-55
	Meter-Out Flow Regulator Valves	-W-Y $\frac{-W-HY}{-J51}$	(Function) H: High differential pressure regulator 14.5				6.8	
		-A-Y $\frac{-A-HY}{-J51}$						
		-B-Y $\frac{-B-HY}{-J51}$					6.6	

*There is no problem with seals and other parts when mixing these valves with NACHI G03 modular valve design number (J) 30 valves.

*G03 module valve installation bolts
For M6: Design number J50
For M8: Design number 50
For E: 1/4 - 20UNC
Unit has commonality. Also, two J-pins have been inserted diagonally for M6 applications.

Note: G03 series modular valves have two T port locations: one on the A port side T_(A) and one on the B port side T_(B). The port that is used depends on the model number.

G03 Modular Valve Series

Type	Name	Valve Model Number	Pressure Adjustment Range (Check Valve Cracking Pressure) psi	Maximum Flow Rate gpm	ISO Symbol	Height in	Weight lbs	Catalog Page
Flow Control Valve	Meter-in Flow Regulator Valve	OCY-G03 -W-X -J51 -W-HX -J51	(Function) H: High differential pressure regulator 14.5	26		2.16	6.8	F-55
		-A-X -J51 -A-HX -J51					6.6	
		-B-X -J51 -B-HX -J51						
	Flow Control Valve (compensated)	OF-G03-P60-J50	(Control Flow Rate) Differential Pressure 1000: .07 to 15.8 Differential Pressure 3600: .13 to 15.8				6.8	F-63
	Meter-out Flow Control Valves (compensated)	OCF-G03-W60-Y-J50	15.8			2.16	11	
		-A60-Y-J50					10.1	
		-B60-Y-J50						
	Meter-in Flow Control Valves (compensated)	OCF-G03-W60-X-J50	(Volume control flow rate) Differential Pressure 1000: .13 to 15.8 Differential Pressure 3600: .02 to 15.8			2.16	11	
		-A60-X-J50					10.1	
		-B60-X-J50						
Direction Control Valve	Check Valves	1 OC-G03-P 2-J50 3	Cracking pressure 1: 5.8 2: 50 3: 72 *For differential circuit 	26		2.16	5.9	F-69
		1 T 2-J50 3						
		1 -A 2-J50 *						
		1 -AP 2-J50 *						
	Vacuum Check Valves	OCV-G03-W-J50	2.1	26		2.16	7.7	F-69
	Pilot Check Valves	OCP-G03-W 1/2 (D)-J50	Cracking pressure 1: 29 2: 72 (Auxiliary Symbol) Open Valve Ratio Standard : Child Valve 7% : Parent Valve 49% D : Parent Valve 49%	26		2.16	7.9	F-76
		-A 1/2 (D)-J50						
		-B 1/2 (D)-J50						
Other	Gauge Block	OK-G03-E50		26		2.16	5.0	F-81
	2-speed Plates	OB-G03-W-(H)-J30		26				F-83
	End Plates	MOB-G03-J50: For M6 MOB-G03-(H)-50: For M8		-		1.25 (H:58)	1.4 (H:2.5)	F-85
	Free Flow	MOB-G03-A-J50: For M6 MOB-G03-A-(H)-50: For M8		26		1.25 (H:58)	1.3 (H:2.3)	
		MOB-G03-B-J50: For M6 MOB-G03-B-(H)-50: For M8						
	Conversion plate (For 03/01 conversion)	MOB-G03-AA-50 MOB-G03-AA-J50		13		1.77	5.0	
	Base Blocks	MOB-03-B*-J30	*: Sequential number from 2 to 5 A, B port dual side outlet					F-91
	Sub Plate	MSA-03-E10 MS-03(X)-E10 MSA-03(X)-T-E10 MS-03(X)-T-E10	Bottom Outlet Bottom Outlet Side outlet Side outlet			-	-	D-9 H-5

F

Modular Valves

G03 Modular Valve Series Detailed ISO Symbols

Type	Valve Model Number	Detailed ISO Symbols	Type	Valve Model Number	Detailed ISO Symbols
Solenoid Valves	For M6, M8 SS-G03-**-R-**-E21 -21 SA-G03-**-*** -E21 -21		Flow Control Valve	OF-G03-P60-J50	
				OCF-G03-W60-Y-J50	
Pressure Control Valve	OR-G03-P 1/3-E50			OCF-G03-A60-Y-J50	
	OR-G03-W 1/3-E50			OCF-G03-B60-Y-J50	
	OR-G03-A 1/3-E50			OCF-G03-W60-X-J50	
	OR-G03-B 1/3-E50			OCF-G03-A60-X-J50	
	OR-G03-P 1/3-V-J50			OCF-G03-B60-X-J50	
	ORO-G03-W 1/3-E50		Direction Control Valve	OC-G03-P 1/2-J50	
	ORO-G03-A 1/3-J50			OC-G03-T 1/2-J50	
	ORO-G03-B 1/3-J50			OC-G03-A 1/2-J50	
	ORD-G03-W 1/3-J50			OC-G03-AP 1/2-J50	
	ORD-G03-A 1/3-J50			OCV-G03-W-J50	
	ORD-G03-B 1/3-J50			OCP-G03-W 1/2-J50	
	OG-G03-P C 1-(B)-E51			OCP-G03-A 1/2-J50	
	OG-G03-A C 1-(B)-E51			OCP-G03-B 1/2-J50	
	OG-G03-B C 1-(B)-E51		Other	OK-G03-J50	
	OG-G03-P C 1-(B)-V-J51			OB-G03-W-J30	
	OQ-G03-P2 A C-J50 E			MOB-G03-(H)-50	
	OCQ-G03-A1 A C-J50 E			MOB-G03-J50	
	OCQ-G03-B1 A C-J50 E			MOB-G03-A-(H)-50	
Flow Control Valve	OCY-G03-P-J50			MOB-G03-A-J50	
	OCY-G03-W-Y-J51			MOB-G03-B-(H)-50	
	OCY-G03-A-Y-J51			MOB-G03-B-J50	
	OCY-G03-B-Y-J51			MOB-G03-AA-50	
	OCY-G03-W-X-J51			MOB-G03-AA-J50	
	OCY-G03-A-X-J51			MOB-03X-B*-50	
	OCY-G03-B-X-J51			MOB-03X-B*-J50	
				MS-03(X)-30	
				MSA-03(X)-10	
				MS-03(X)-T-10	
				MSA-03(X)-T-10	

G04 Modular Valve Series

Type	Name	Valve Model Number	Maximum Working psi	Maximum Flow Rate gpm	Pressure Adjustment Range (Check Valve Cracking Pressure) psi	JIS Symbol	Weight lbs	Catalog Page
Solenoid Valves	Solenoid Control Valves	DSS-G04-****-R**-21	35MPa 5000	79			33	D-41
Pressure Control Valve	Relief valve	ORH-G04-P $\frac{1}{3-10}$ ₅	35MPa 5000	79	1: 115 to 1000 3: 500 to 3600		15.4	F-10
	Direct Relief Valves	ORH-G04-DW- $\frac{1}{3-10}$ ₅		13.2	1: 115 to 1000 3: 500 to 3600 5: 1000 to 5000		14.3	F-20
		ORH-G04-DA $\frac{1}{3-10}$ ₅						
		ORH-G04-DB $\frac{1}{3-10}$ ₅						
	Reducing valve	OGH-G04-P $\frac{1}{3}$ (B)-10		79	1: 115 to 1000 3: 500 to 3600 (Auxiliary Symbol) B: External drain		17.6	F-25
		OGH-G04-A $\frac{1}{3}$ (B)-10					17.6	F-32
		OGH-G04-B $\frac{1}{3}$ (B)-10						
	Counter Balance Valves	OQH-G04-A1 $\frac{A}{C-10}$ _E		79	A: 36 to 125 C: 72 to 500 E: 290 to 2000		17.6	F-47
		OQH-G04-B1 $\frac{A}{C-10}$ _E					17.6	
Flow Control Valve	Flow Regulator Valves	OYH-G04-P-10	35MPa 5000	79	Check Valve Cracking Pressure 5.8		10.3	F-55
	Meter-in Flow Regulator Valve	OYH-G04-W-X-10		79	Check Valve Cracking Pressure 14.5		14.3	F-55
		OYH-G04-A-X-10					14.3	
		OYH-G04-B-X-10					14.3	
	Meter-Out Flow Regulator Valves	OYH-G04-W-Y-10					14.3	
		OYH-G04-A-Y-10					14.3	
		OYH-G04-B-Y-10					14.3	
	Meter-in Flow Control Valves	OFH-G04-W200-X-10		52.8	Check Valve Cracking Pressure 14.5		24.4	F-63
		OFH-G04-A200-X-10					22.5	
		OFH-G04-B200-X-10					22.5	
	Meter-out Flow Control Valves	OFH-G04-W200-Y-10					24.4	
		OFH-G04-A200-Y-10					22.5	
		OFH-G04-B200-Y-10					22.5	
Direction Control Valve	Check Valves	OCH-G04-P $\frac{1}{2-10}$ ₃	35MPa 5000	79	1: 5.8 2: 50 3: 72		9.9	F-69
		OCH-G04-T $\frac{1}{2-10}$ ₃					14.3	
		OCH-G04-A $\frac{1}{2-10}$ ₃					9.9	
		OCH-G04-AP $\frac{1}{2-10}$ ₃					9.9	
	Vacuum Check Valves	OVH-G04-W-10		79	14.5		14.3	F-69
	Pilot Check Valves	OPH-G04-W $\frac{1}{2}$ (D)-10		79	1: 29 2: 72 (Auxiliary Symbol) Open Valve Ratio Standard : Child Valve 7% : Parent Valve 50% D : Parent Valve 50%		15	F-76
		OPH-G04-A $\frac{1}{2}$ (D)-10						
		OPH-G04-B $\frac{1}{2}$ (D)-10						

The G04 series modular valves do not have an L (DR₂) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).



Relief Modular Valve

13 to 79 gpm
3600 to 5000 psi

Features

This modular relief valve provides maximum pressure control for a hydraulic circuit.

Wide ranging applicability Maximum Operating Pressure: 3600 to 5000 psi Pressure Adjustment Range: 115 to 3600, 5000.

Shockless unload, 2-pressure control, and other configurations are possible by switching the solenoid valve. Contact your agent for details.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OR-G01-P1-20 P3	1/8	3600	13	* to 1000 500 - 3600	3.3	ISO 4401-03-02-0-94
OR-G01-W1-20 W3				* to 1000 500 - 3600	5	
OR-G01-A1-21 A3				* to 1000 500 - 3600	3.5	
OR-G01-B1-21 B3				* to 1000 500 - 3600	3.5	
OR-G03-P1-(V)-J50 P3	3/8	3600	21	* to 1000 500 - 3600	6.8	ISO 4401-05-04-0-94
OR-G03-W1-J50 W3				* to 1000 500 - 3600	8.6	
OR-G03-A1-J50 A3				* to 1000 500 - 3600	6.8	
OR-G03-B1-J50 B3				* to 1000 500 - 3600	6.8	
ORH-G04-P1-10 P3 P5	1/2	5000	79	* to 1000 500 - 3600 1000 - 5000	15.4	ISO 4401-07-06-0-94

Note: *See the Flow Rate - Low Pressure characteristics on page D-17 for information about items marked with an asterisk.

• Handling

- When using a remote control valve in a vent circuit, certain vent circuit pipe capacities can cause vibration. Because of this, thick steel pipe with an inside diameter of .15 in that is no longer than three meters is recommended. Vent piping cannot be used with the 01 size. If a vent port is required for the 03 size, add the auxiliary code "V".
- For use as a safety valve, use a pressure override that is higher than the required circuit pressure.

- Make sure that tank port back pressure is no greater than 29 psi.
- A small control flow rate can cause pressure instability. Use a control flow rate that is in accordance with the values shown below.
 - 01 size: At least 1.3 gpm
 - 03 size: At least 2.1 gpm
 - 04 size: At least 2.1 gpm

For applications that require a flow rate that is less than the minimum flow rate, use an ORD-G** direct type relieve modular valve.

- Note that a sub plate and installation bolts are not included. See pages H4 or F-87-89 if these items are required.
- 04 series modular valves do not have an L (DR drain port, so they cannot be used in combination with pressure center type solenoid valves (D).
- Connect OR-G03-W*-(J) 50 to the two T-ports on the tanks.

Understanding Model Numbers

01: 03 size

OR - G 03 - P 1 - (K) - J50

Design number Note: For 03 size, relationship between mounting bolts and design number is indicated as J50: M6, 50: M8 E50: 1/4 - 20
For 01 size 20 or 21

Auxiliary symbol K: With handle (01, 03 size) V: With vent port (03 size only)

Pressure adjustment range 1, 3

Control port P: P port W: A, B ports A: A port B: B port

Nominal diameter (size) 01, 03

Mounting method G: Gasket type

Relief modular valve

04 size

ORH - G 04 - P 5 - 10

Design number

Pressure adjustment range 1, 3, 5

Control port P: P port

Nominal diameter (size) 04

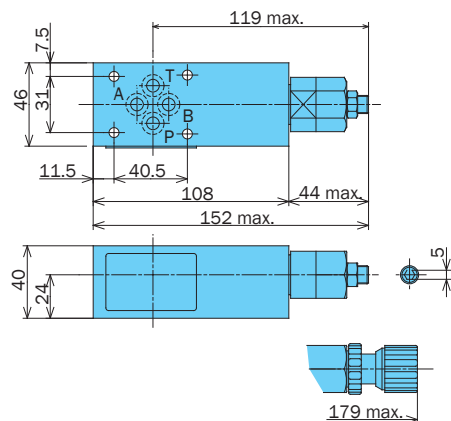
Mounting method G: Gasket type

M35 Series relief modular valve

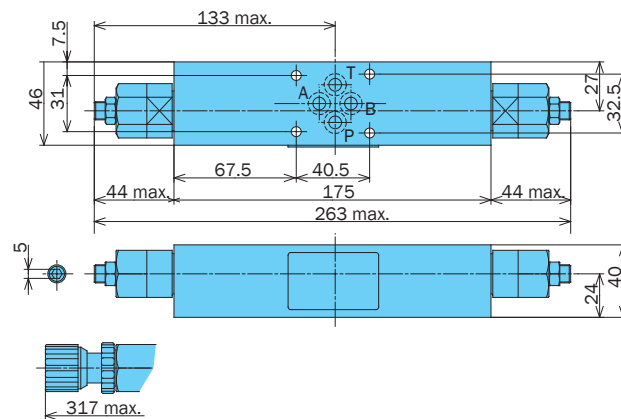
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

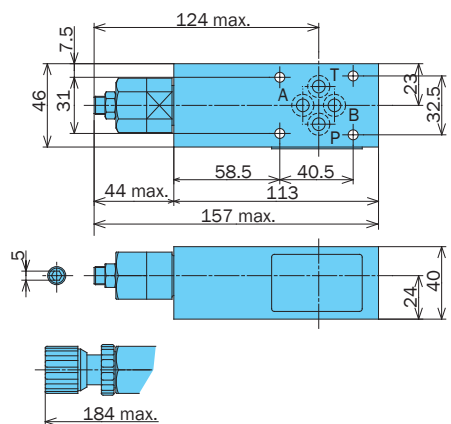
OR-G01-P*-20



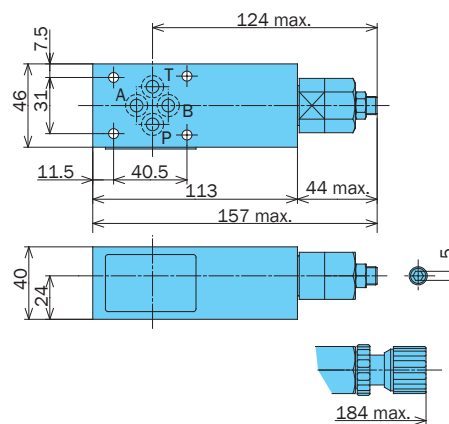
OR-G01-W*-20



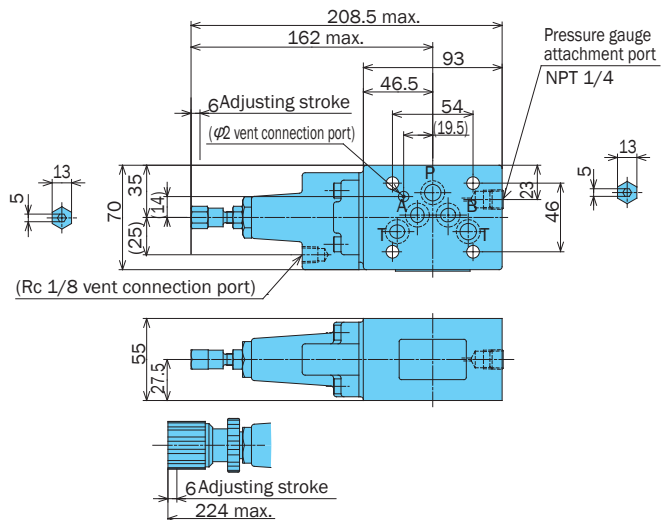
OR-G01-A*-21



OR-G01-B*-21

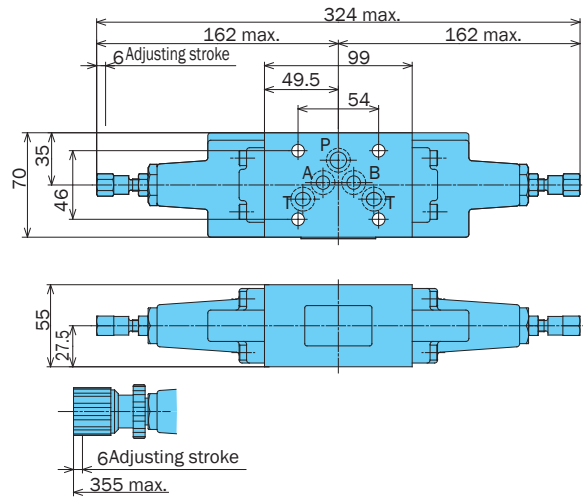


OR-G03-P*-(V)-J50

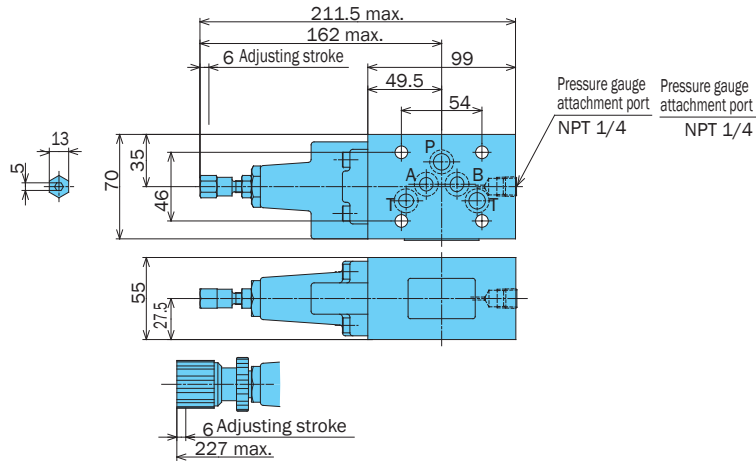


Note: Dimensions in parentheses show dimensions with vent port installed (V type)

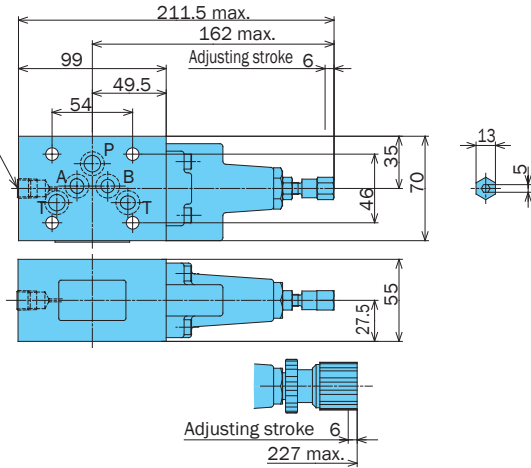
OR-G03-W*-J50



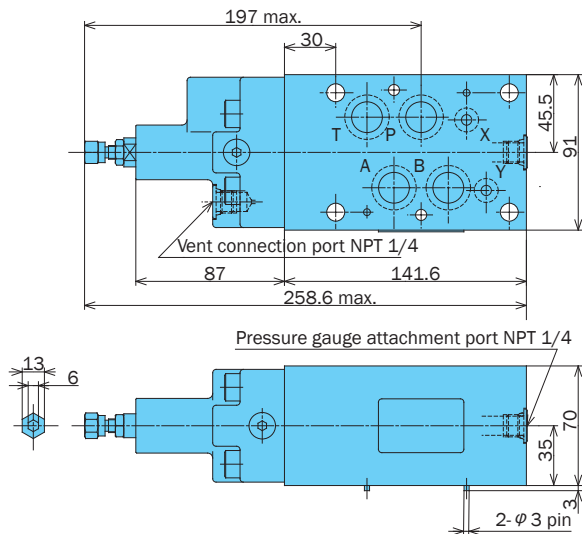
OR-G03-A*-J50



OR-G03-B*-J50



ORH-G04-P*-10

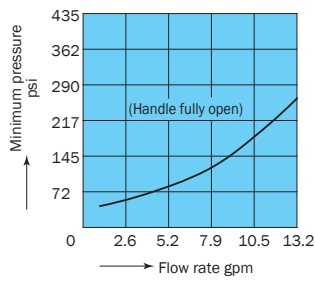


Performance Curves

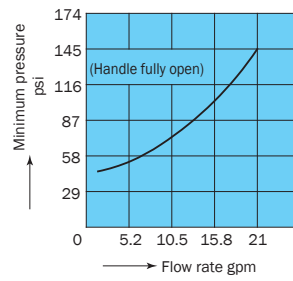
Differential Hydraulic Fluid Viscosity 32 centistokes

Flow Rate - Minimum Pressure Characteristics

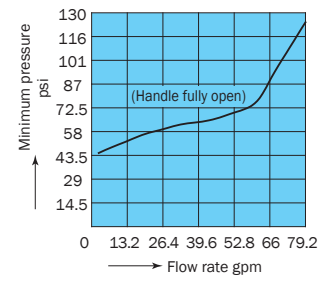
OR-G01-*1-20(21)



OR-G03-P1-J50

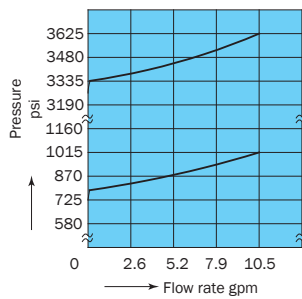


ORH-G04-P*-10

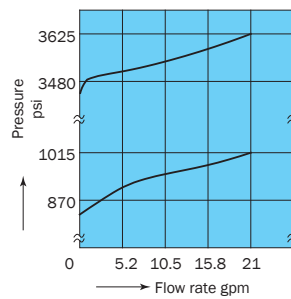


Pressure - Flow Rate Characteristics

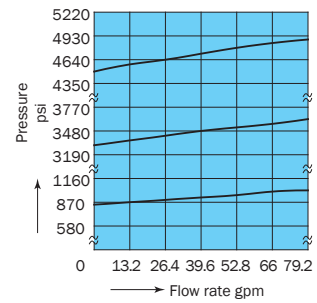
OR-G01-*1-20(21)



OR-G03-P*-J50

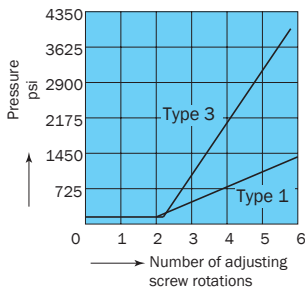


ORH-G04-P*-10

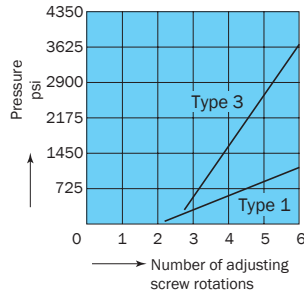


Number of Adjusting Screw Rotations - Pressure Characteristics

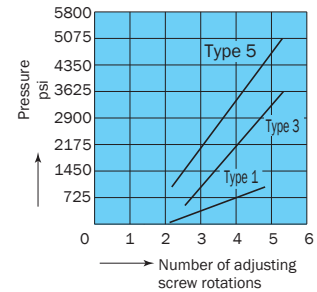
OR-G01-P*-20



OR-G03-P*-(J)50

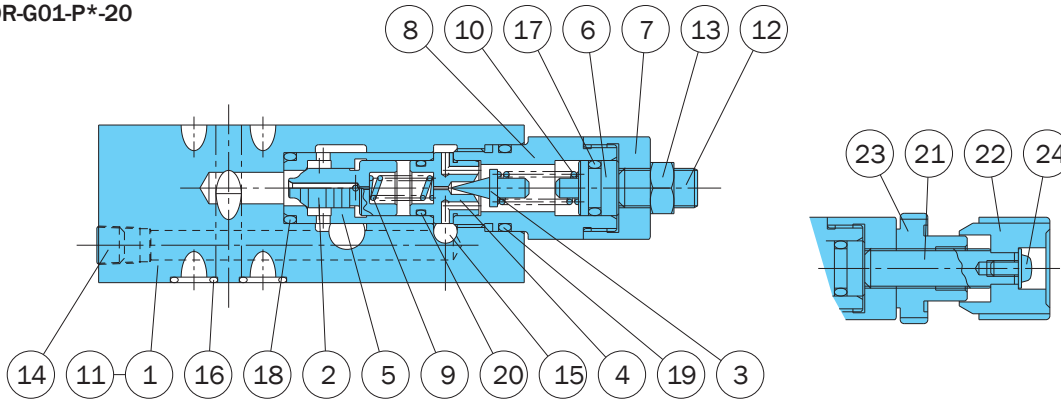


ORH-G04-P*-10



Cross-sectional Drawing

OR-G01-P*-20



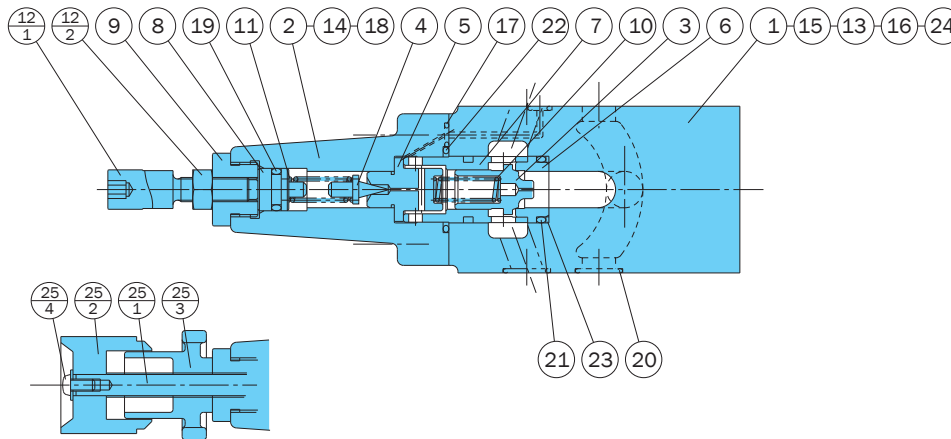
Part No.	Part Name
1	Body
2	Spool
3	Poppet
4	Seat
5	Sleeve
6	Plunger
7	Bushing
8	Retainer
9	Spring
10	Spring
11	Plate
12	Screw
13	Nut
14	Plug
15	Plug
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	O-ring
21	Screw
22	Knob
23	Nut
24	Screw

Seal Part List (Kit Model Number BRBS-01R*)

Part No.	Part Name	Part Number	Q'ty			
			P	W	A	B
16	O-ring	1B-P9	4	4	4	4
17	O-ring	1A-P10A	1	2	1	1
18	O-ring	1B-P14	1	2	1	1
19	O-ring	1B-P18	1	2	1	1
20	O-ring	AS568-013(Hs90)	1	2	1	1

Note) 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify P, W, A, or B for the asterisk (*) in the kit model number.

OR-G03-P*-V-J50



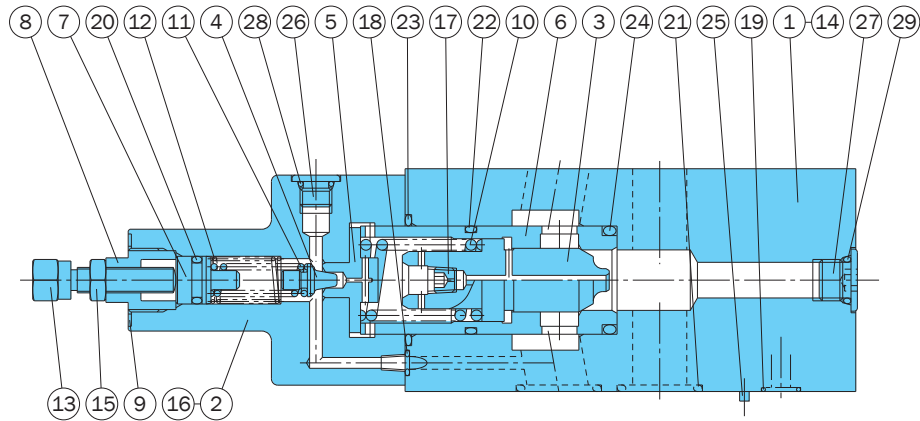
Part No.	Part Name
1	Body
2	Cover
3	Spool
4	Poppet
5	Seat
6	Seat
7	Sleeve
8	Plunger
9	Retainer
10	Spring
11	Spring
12	Screw kit
12.1	Screw
12.2	Nut
13	Plate
14	Screw
15	Plug
16	Plug
17	O-ring
18	O-ring
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	Backup ring
24	Pin
25	Handle kit
25.1	Screw
25.2	Knob
25.3	Nut
25.4	Screw

Seal Part List (Kit Model Number BRES-03R*)

Part No.	Part Name	Part Number	Q'ty		
			P/A/B	W	PV
17	O-ring	1B-P5	—	—	2
18	O-ring	1B-P7	1	2	1
19	O-ring	1A-P10A	1	2	1
20	O-ring	AS568-014(Hs90)	5	5	5
21	O-ring	1B-P18	2	4	2
22	O-ring	AS568-119(Hs90)	1	2	1
23	Backup ring	T2-P18	1	2	1

Note) 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS B2407-T2-**.
3. Specify P, W, or PV for the asterisk (*) in the kit model number.

ORH-G04-P*-10



Seal Part List (Kit Model Number BRKS-04RP)

Part No.	Part Name	Part Number	Q'ty
18	O-ring	1B-P5	1
19	O-ring	AS568-012(Hs90)	2
20	O-ring	1A-P11	1
21	O-ring	AS568-118(Hs90)	4
22	O-ring	AS568-122(Hs90)	1
23	O-ring	AS568-127(Hs90)	1
24	O-ring	1B-P28	1
28	O-ring	1B-P8	3
29	O-ring	1B-P11	3

Note) O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name
1	Body
2	Cover
3	Spool
4	Poppet
5	Seat
6	Sleeve
7	Plunger
8	Retainer
9	Plate
10	Spring
11	Spring
12	Spring
13	Screw
14	Plate
15	Nut
16	Screw
17	Choke
18	O-ring
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	O-ring
24	O-ring
25	Pin
26	Plug
27	Plug
28	O-ring
29	O-ring



Brake Modular Valve

5.2 to 7.9 gpm
115 to 3045, 3625 psi

Features

This modular pressure control valve prevents abnormal pressure when the actuator stops, enabling smooth stops.

Wide ranging applicability Maximum Operating Pressure: 3625 psi.

Pressure Adjustment Range: 115 to 3045, 3625 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
ORO-G01-W1-20 W3	1/8	3625	5.2	115 to 1000 500 to 3045	3.3	ISO 4401-03-02-0-94
ORO-G01-A1-20 A3				115 to 1000 500 to 3045	3.0	
ORO-G01-B1-20 B3				115 to 1000 500 to 3045	3.0	
ORO-G03-W1-J50 W3	3/8	3625	7.9	115 to 1000 500 to 3045	10.5	ISO 4401-05-04-0-94
ORO-G03-A1-J50 A3				115 to 1000 500 to 3045	8.8	
ORO-G03-B1-J50 B3				115 to 1000 500 to 3045	8.8	

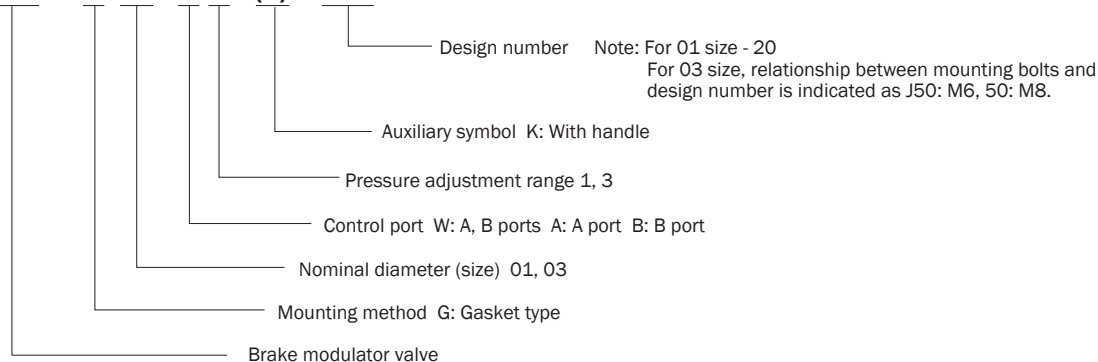
• Handling

- 1 The pressure adjustment range is expressed using cracking pressure.
- 2 For use as a safety valve, use a pressure override that is higher than the required circuit pressure.

3 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

Understanding Model Numbers

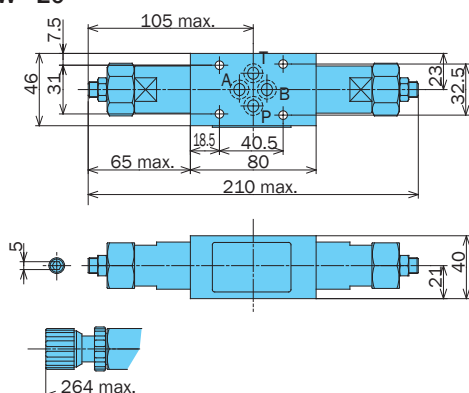
ORO - G 03 - A 3 - (K) - J50



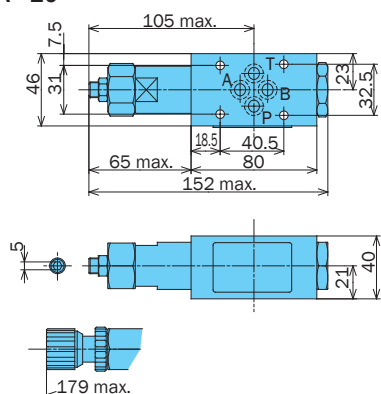
Specifications

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

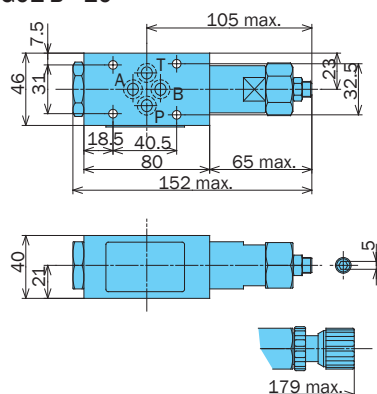
ORO-G01-W*-20



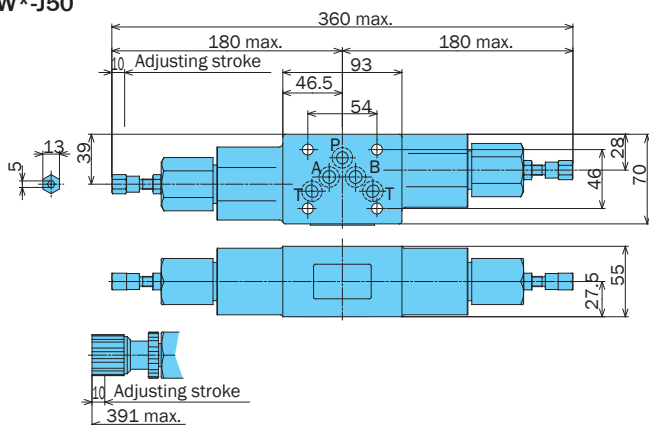
ORO-G01-A*-20



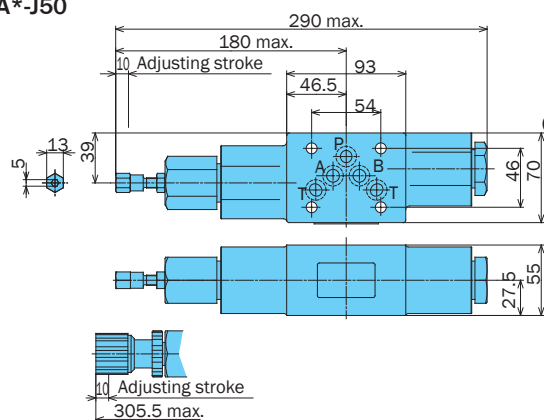
ORO-G01-B*-20



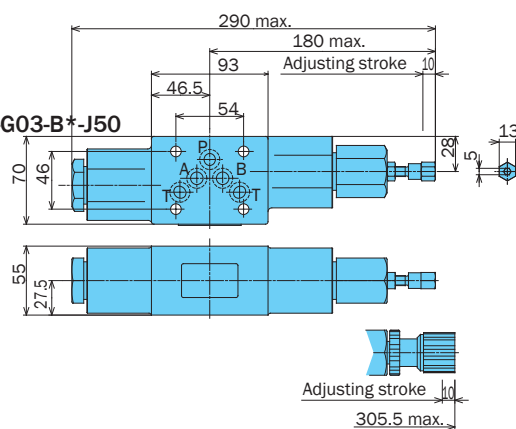
ORO-G03-W*-J50



ORO-G03-A*-J50



ORO-G03-B*-J50

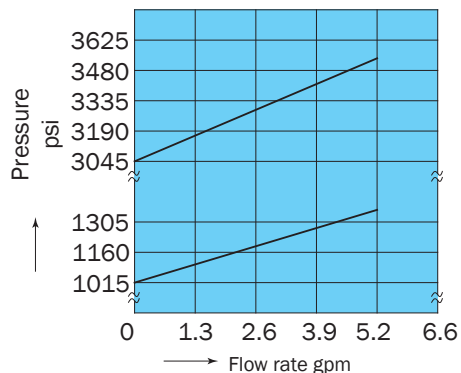


Performance Curves

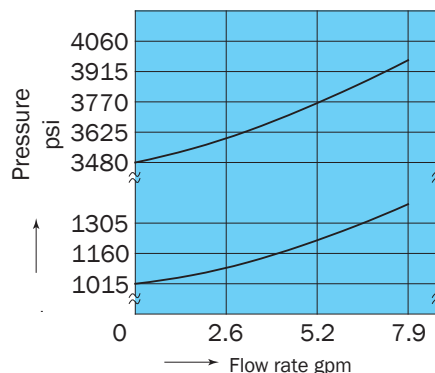
Differential Hydraulic Fluid Viscosity 32 centistokes

Pressure - Flow Rate Characteristics

ORO-G01-**-20

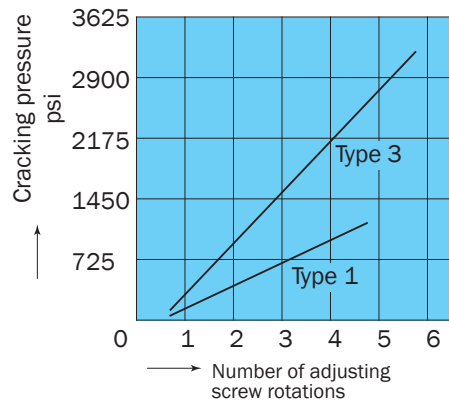


ORO-G03-**-J50

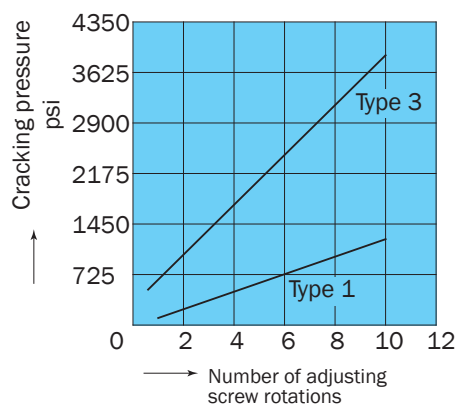


Number of Adjusting Screw Rotations - Pressure Characteristics

ORO-G01-**-20

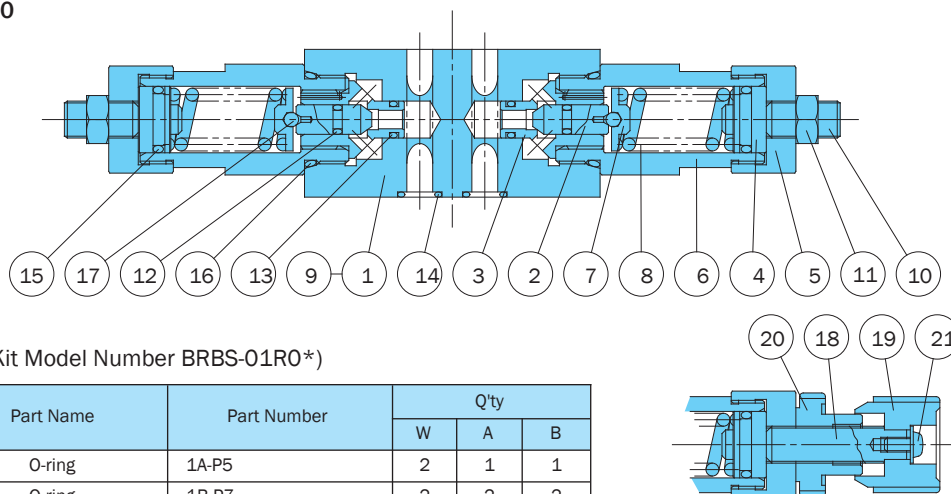


ORO-G03-**-J50



Cross-sectional Drawing

ORO-G01-W*-20



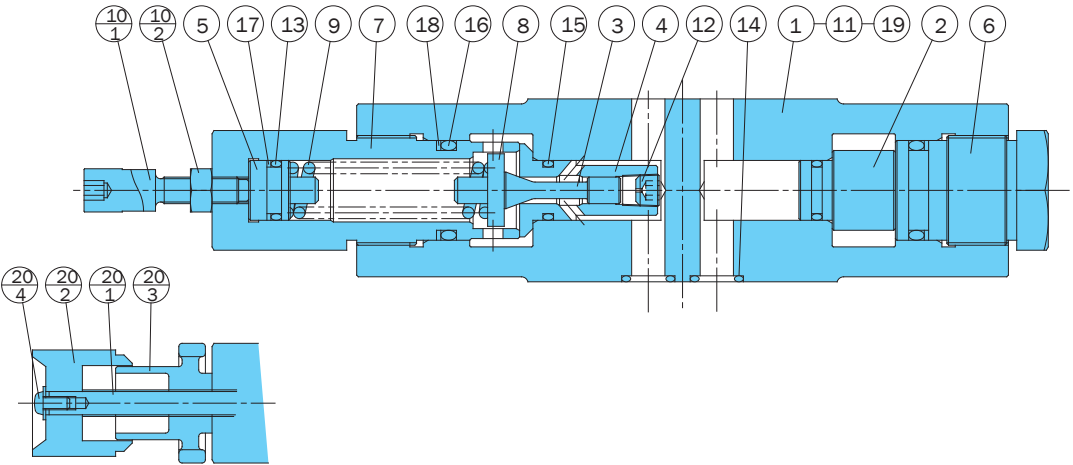
Part No.	Part Name
1	Body
2	Poppet
3	Seat
4	Plunger
5	Bushing
6	Retainer
7	Guide
8	Spring
9	Plate
10	Screw
11	Nut
12	O-ring
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	Ball
18	Screw
19	Knob
20	Nut
21	Screw

Seal Part List (Kit Model Number BRBS-01R0*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
12	O-ring	1A-P5	2	1	1
13	O-ring	1B-P7	2	2	2
14	O-ring	1B-P9	4	4	4
15	O-ring	1B-P14	2	1	1
16	O-ring	1B-P22	2	2	2

Note: 1. O-ring 1A/B-**-** refers to JIS B2401-1A/B.
2. Specify W, A, or B for the asterisk (*) in the kit model number.

ORO-G03-A*-J50



Seal Part List (Kit Model Number BRES-03R0*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
13	O-ring	1A-P14	2	1	1
14	O-ring	AS568-014(Hs90)	5	5	5
15	O-ring	1B-P14	2	2	2
16	O-ring	1B-P24	2	2	2
17	Backup ring	T2-P14	2	1	1
18	Backup ring	T2-P24	2	2	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS B2407-T2-**.
3. Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Plug
3	Poppet
4	Seat
5	Plunger
6	Bushing
7	Retainer
8	Guide
9	Spring
10	Screw kit
10 ₁	Screw
10 ₂	Nut
11	Plate
12	Orifice
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	Backup ring
18	Backup ring
19	Pin
20	Handle kit
20 ₁	Screw
20 ₂	Knob
20 ₃	Nut
20 ₄	Screw



Direct Relief Modular Valve

5.2 to 13.2 gpm
115 to 3045, 3625, 5075 psi

Features

- 1 This modular relief valve provides maximum pressure control for a hydraulic circuit.
- 2 Wide ranging applicability Maximum Working Pressure: 3625, 5075 psi.
- 3 Pressure Adjustment Range: 115 to 3045, 3625, 5075 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
ORD-G01-W1-20 W3	1/8	3625	5.2	115 to 1000 500 to 3045	3.3	ISO 4401-03-02-0-94
ORD-G01-A1-20 A3				115 to 1000 500 to 3045	3.0	
ORD-G01-B1-20 B3				115 to 1000 500 to 3045	3.0	
ORD-G03-W1-J50 W3	3/8	3625	7.9	115 to 1000 500 to 3625	10.5	ISO 4401-05-04-0-94
ORD-G03-A1-J50 A3				115 to 1000 500 to 3625	8.8	
ORD-G03-B1-J50 B3				115 to 1000 500 to 3625	8.8	
ORH-G04-DW1-10 DW3 DW5	1/2	5075	13.2	115 to 1000 500 to 3625 1000 to 5075	14.3	ISO 4401-07-06-0-94
ORH-G04-DA1-10 DA3 DA5				115 to 1000 500 to 3625 1000 to 5075	14.3	
ORH-G04-DB1-10 DB3 DB5				115 to 1000 500 to 3625 1000 to 5075	14.3	

• Handling

- 1 The pressure adjustment range is expressed using cracking pressure.
- 2 For use as a safety valve, use a pressure override that is higher than the required circuit pressure.
- 3 Tank port back pressure changes cracking pressure by the corresponding amount.
- 4 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- 5 04 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).

Understanding Model Numbers

01, 03 size

ORD - G 03 - W 3 - (K) - J50

Design number

Note: E - NPT

For 01 size, 20

For 03 size, relationship between mounting bolts and design number is indicated as J50: M6, 50: M8.

Auxiliary symbol K: With handle

Pressure adjustment range 1, 3

Control port W: A, B ports A: A port B: B port

Nominal diameter (size) 01, 03

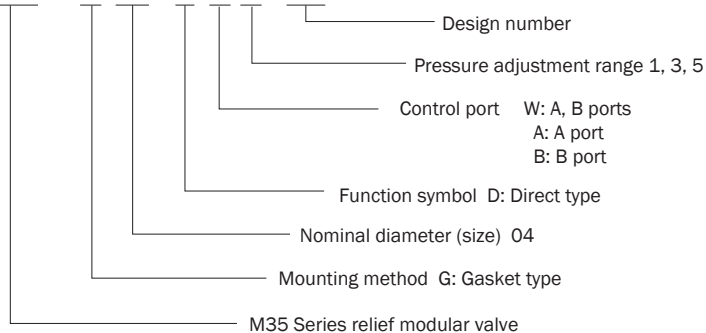
Mounting method G: Gasket type

Direct relieve modular valve

Understanding Model Numbers

04 size

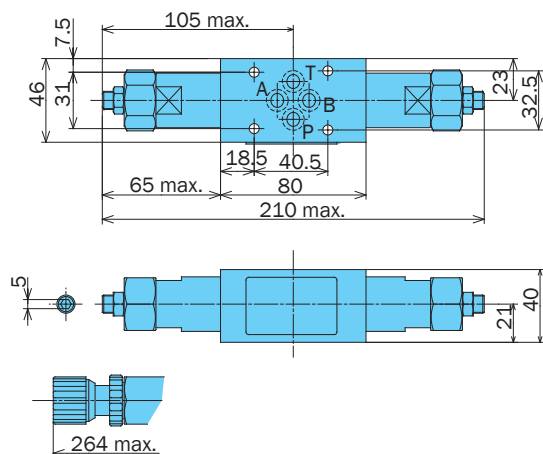
ORH - G 04 - D W 5 - 10



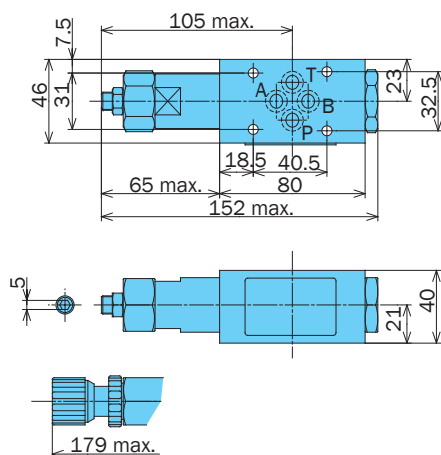
Understanding Model Numbers

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation

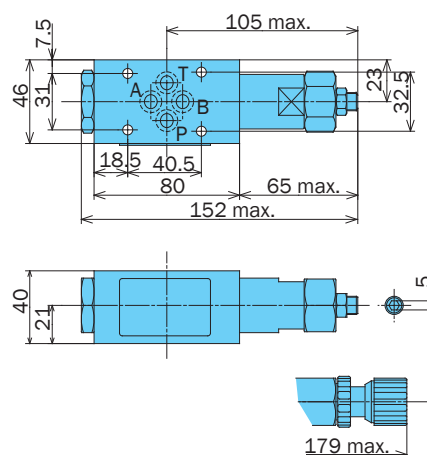
ORD-G01-W*-20



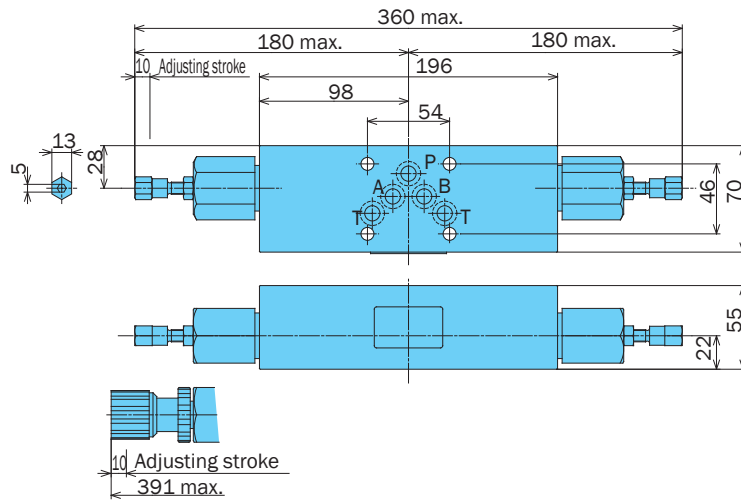
ORD-G01-A*-20



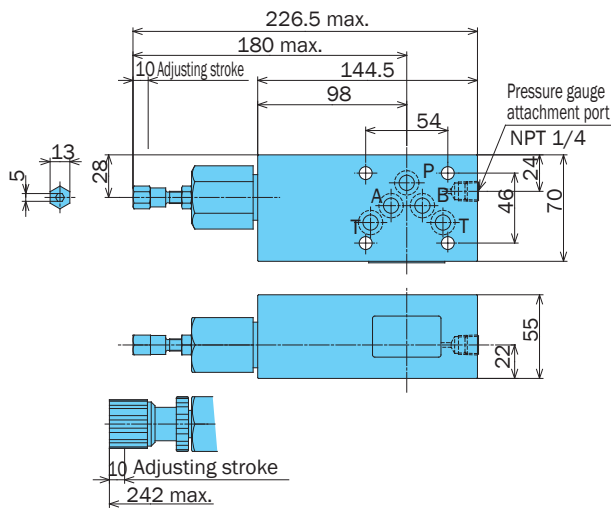
ORD-G01-B*-20



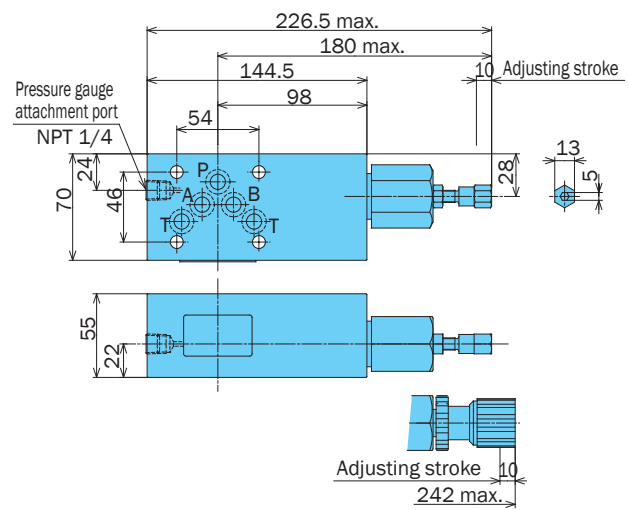
ORD-G03-W*-J50



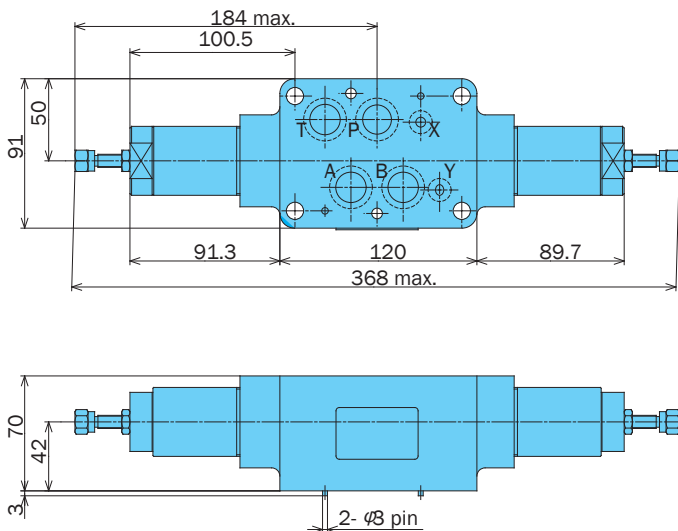
ORD-G03-A*-E50



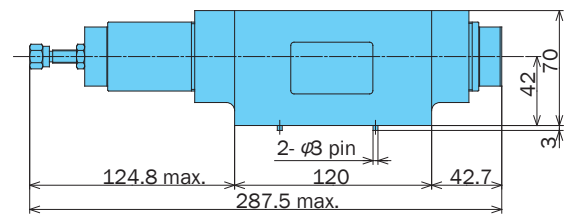
ORD-G03-B*-E50



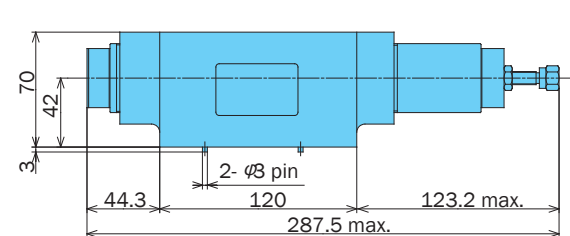
ORH-G04-DW*-10



ORH-G04-DA*-10



ORH-G04-DB*-10

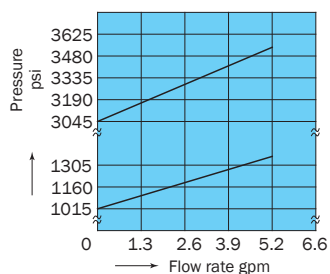


Performance Curves

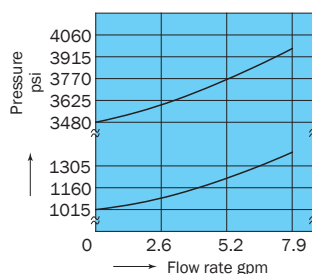
Differential Hydraulic Fluid Viscosity 32 centistokes

Pressure - Flow Rate Characteristics

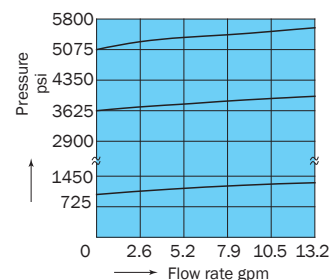
ORD-G01-**-20



ORD-G03-**-J50

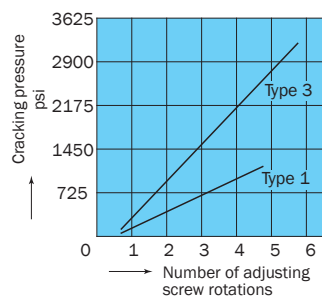


ORH-G04-DW*-10

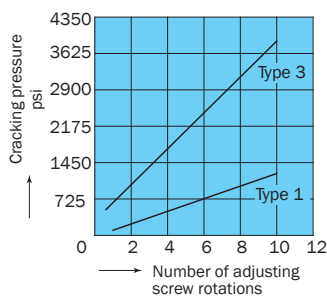


Number of Adjusting Screw Rotations - Pressure Characteristics

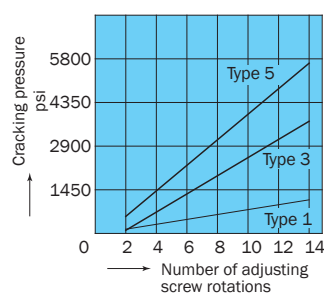
ORD-G01-**-20



ORD-G03-**-J50

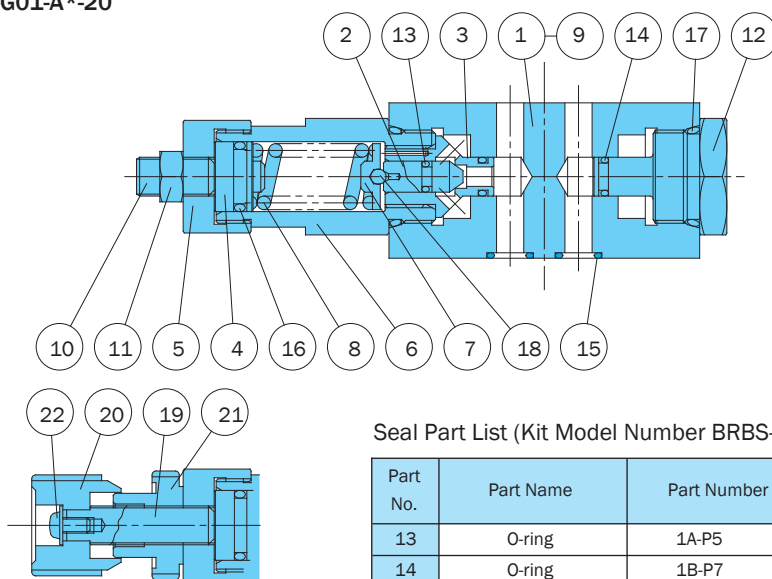


ORH-G04-DW*-10



Cross-sectional Drawing

ORD-G01-A*-20



Seal Part List (Kit Model Number BRBS-01RD*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
13	O-ring	1A-P5	2	1	1
14	O-ring	1B-P7	2	2	2
15	O-ring	1B-P9	4	4	4
16	O-ring	1B-P14	2	1	1
17	O-ring	1B-P22	2	2	2

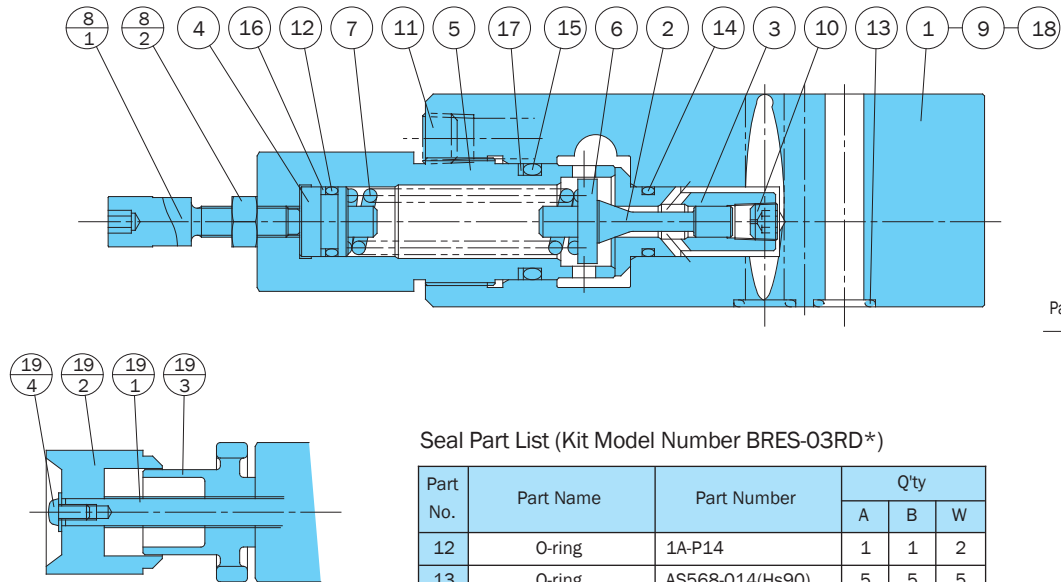
Note: 1.O-ring 1A/B-**- refers to JIS B2401-1A/B.
2.Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Poppet
3	Seat
4	Plunger
5	Bushing
6	Retainer
7	Guide
8	Spring
9	Plate
10	Screw
11	Nut
12	Bushing
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	O-ring
18	Ball
19	Screw
20	Knob
21	Nut
22	Screw

F

Modular Valves

ORD-G03-A*-J50



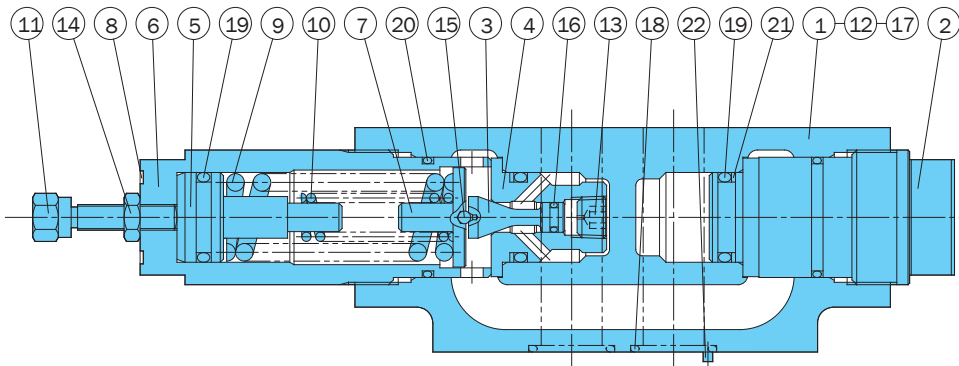
Seal Part List (Kit Model Number BRES-03RD*)

Part No.	Part Name	Part Number	Q'ty		
			A	B	W
12	O-ring	1A-P14	1	1	2
13	O-ring	AS568-014(Hs90)	5	5	5
14	O-ring	1B-P14	1	1	2
15	O-ring	1B-P24	1	1	2
16	Backup ring	T2-P14	1	1	2
17	Backup ring	T2-P24	1	1	2

Note) 1.O-ring 1A/B-** refers to JIS B2401-1A/B.
2.Backup ring indicates JIS B2407-T2-**.
3.Specify W, A, or B for the asterisk (*) in the kit model number

Part No.	Part Name
1	Body
2	Poppet
3	Seat
4	Plunger
5	Retainer
6	Guide
7	Spring
8	Screw kit
8 ₁	Screw
8 ₂	Nut
9	Plate
10	Orifice
11	Plug
12	O-ring
13	O-ring
14	O-ring
15	O-ring
16	Backup ring
17	Backup ring
18	Pin
19	Handle kit
19 ₁	Screw
19 ₂	Knob
19 ₃	Nut
19 ₄	Screw

ORH-G04-DA*-10



Seal Part List (Kit Model Number BRKS-04RD*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
16	O-ring	1A-P6	2	1	1
17	O-ring	AS568-012(Hs90)	2	2	2
18	O-ring	AS568-118(Hs90)	4	4	4
19	O-ring	1B-P22A	4	3	3
20	O-ring	AS568-125(Hs70)	2	2	2
21	Backup ring	T2-P22A	2	2	2

Note) 1.O-ring 1A/B-** refers to JIS B2401-1A/B.
2.Backup ring indicates JIS B2407-T2-**.
3.Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Plug
3	Poppet
4	Seat
5	Plunger
6	Retainer
7	Guide
8	Plate
9	Spring
10	Spring
11	Screw
12	Plate
13	Choke
14	Nut
15	Ball
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	O-ring
21	Backup ring
22	Pin



Pressure Reducing Modular Valve

10.5 to 79.2 gpm
3625, 5000 psi

Features

This modular valve makes the pressure in part of the circuit lower than that of the main circuit.

Even when pressure changes in the primary main circuit, the reduced secondary pressure is maintained at a

constant level.
Maximum Operating Pressure: 3625, 5075 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OG-G01-PC-21 P1 P2	1/8	3625	13.2	21.7 to 500 115 to 1000 500 to 2320	2.8	ISO 4401-03-02-0-94
OG-G03-PC-(V)-J51 P1 P3	3/8	3625	21 but C : 13.2	36 to 500 115 to 1000 500 to 3045	8.3	ISO 4401-05-04-0-94
OGH-G04-P1-10 P3	1/2	5075	79.2	115 to 1000 500 to 3625	17.6	ISO 4401-07-06-0-94

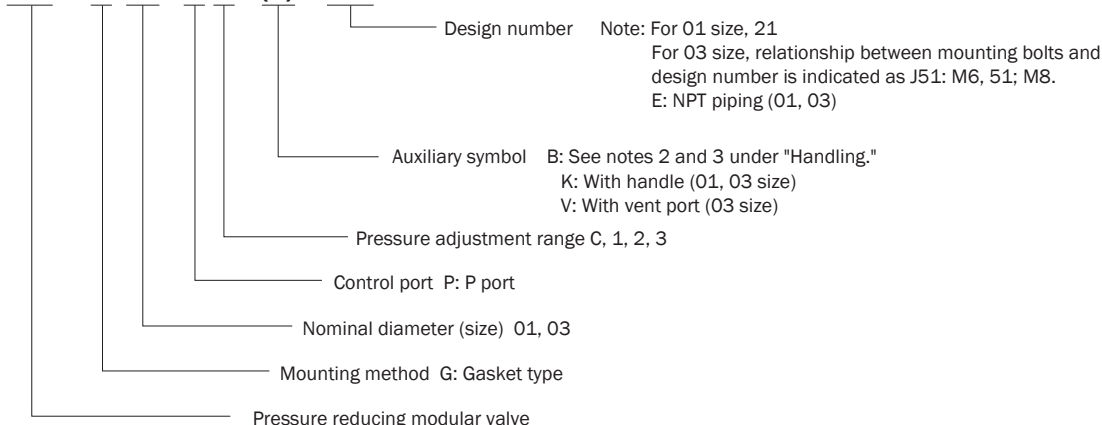
• Handling

- When using a remote control valve in a vent circuit, certain vent circuit pipe capacities can cause vibration. Because of this, thick steel pipe with an inside diameter of .15 in that is no longer than three meters is recommended. Vent piping cannot be used with the 01 size. If a vent port is required for the 03 size, add the auxiliary code "V".
- For the 03 size, the drainage can be allowed to escape through the T port. In the case of a valve with the auxiliary symbol B, however, run a return pipe from the drain discharge port directly to the tank.
- With the 04 sizes, piping is not required because drainage can be allowed to escape from the gasket side drain port. In the case of a valve with the auxiliary symbol B, however, run a return pipe from the drain discharge port directly to the tank.
- Note that a change in drain back pressure causes a change in setting pressure.
- With the 01, 03 sizes, the flow rate is limited at low pressures. See the Pressure-Flow Rate Characteristics on pages F-27 for more information.
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- 04 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).
- With the 03, 04 sizes, the control port can be changed by altering the attachment orientation of the back cover. See the installation diagram for more information. After making this change, be sure also to make the other changes in accordance with the model number indicated on the nameplate.

Understanding Model Numbers

01, 03, size

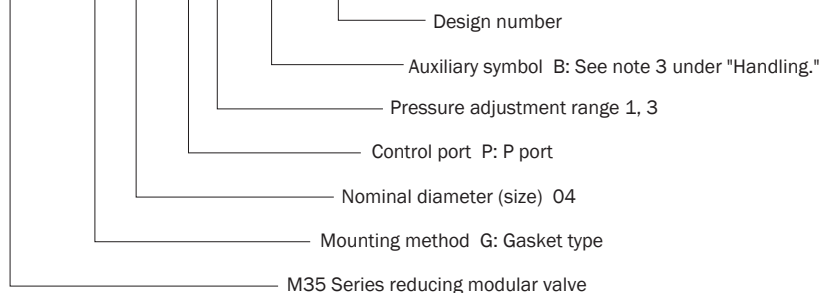
OG - G 03 - P 1 - (B) - J51



Understanding Model Numbers

04 size

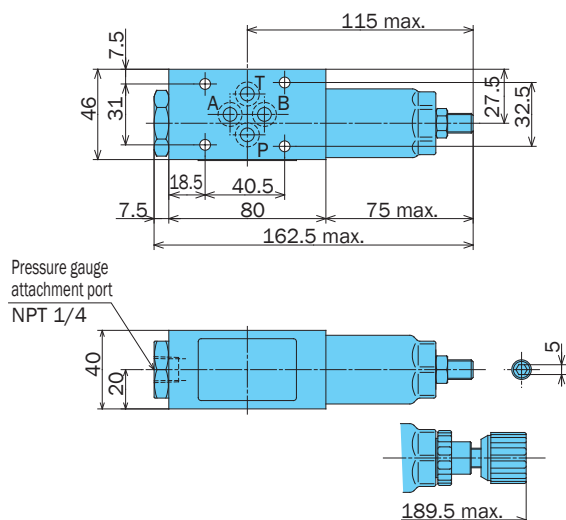
OGH - G 04 - P 1 - (B) - 10



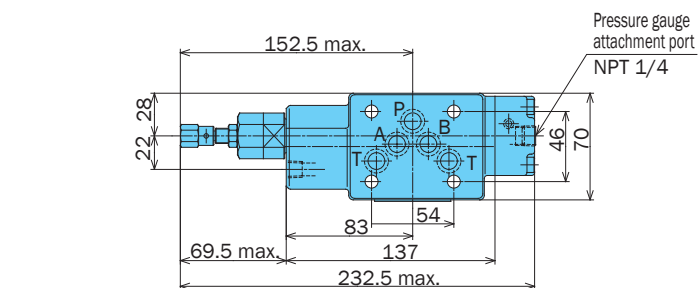
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

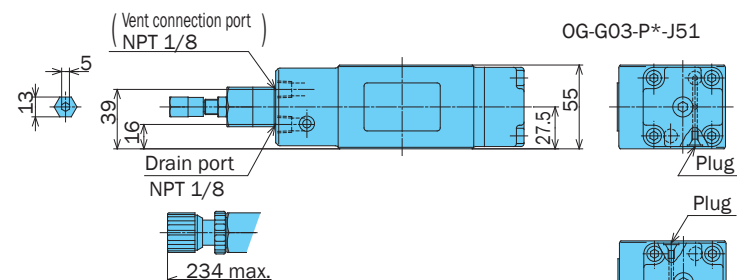
OG-G01-P*-E21



OG-G03-P*-(V)-E51



OG-G03-P*-J51

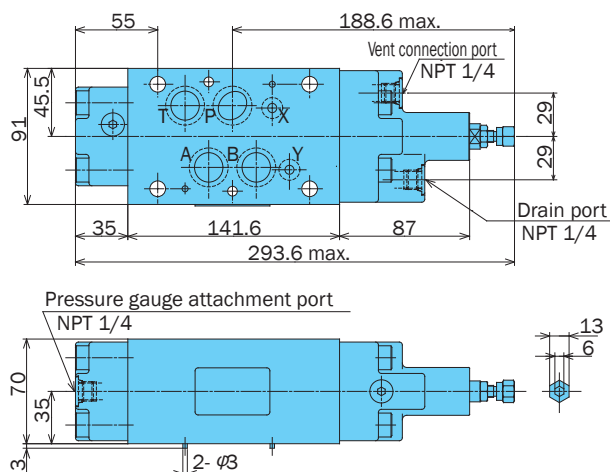


OG-G03-B*-J51

- Note: 1. Conversion to B port control is possible by changing the back cover. Port control is determined by plug orientation.
2. When replacing the back cover, be sure also to change the nameplate to the applicable model type.
3. The tightening torque of the back cover bolts is: (M6) 7.3 to 9.5 ft lbs.

OGH-G04-P*-10

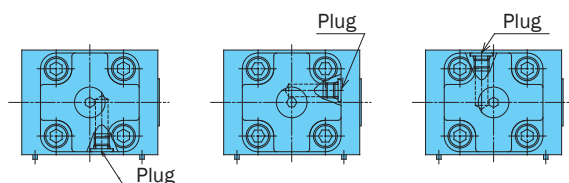
- Note: 1. Conversion to A, B port control is possible by changing the back cover. Port control is determined by plug orientation.
2. When replacing the back cover, be sure also to change the nameplate to the applicable model type.
3. The tightening torque of the back cover bolts is: (M10) 33 to 40 ft lbs.



OGH-G04-B*-10

OGH-G04-A*-10

OGH-G04-P*-10

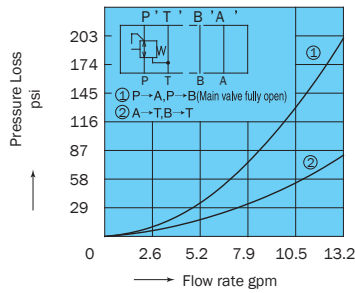


Performance Curves

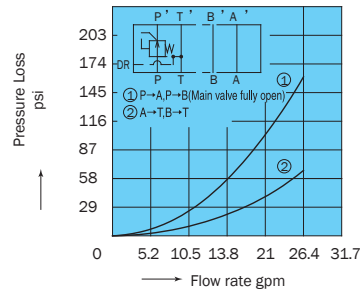
Differential Hydraulic Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

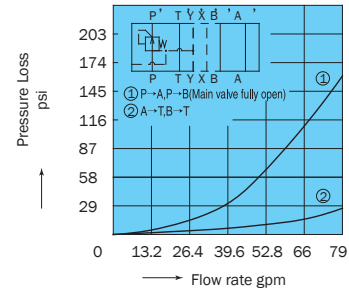
OG-G01-P*-21



OG-G03-P*-J51

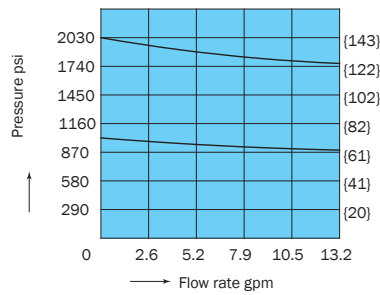


OGH-G04-**-10

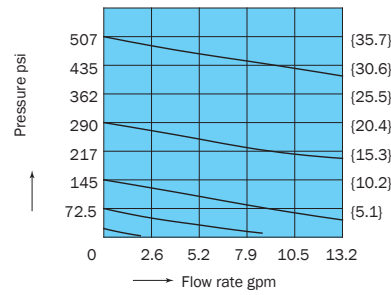


Pressure - Flow Rate Characteristics

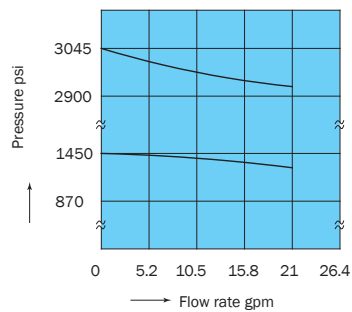
OG-G01-P $\frac{1}{2}$ -21



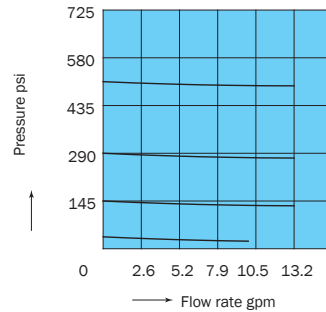
OG-G01-PC-21



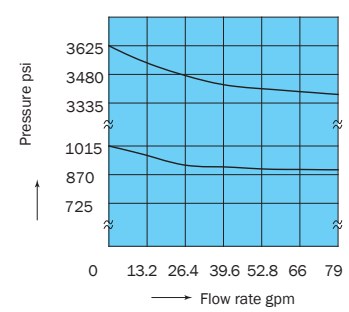
OG-G03-P $\frac{1}{3}$ -J51



OG-G03-PC-J51



OGH-G04-**-10

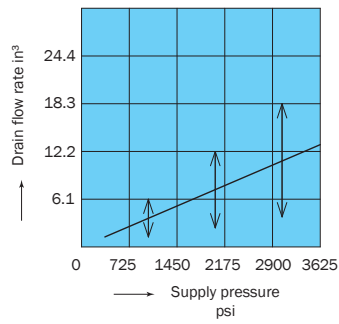


F

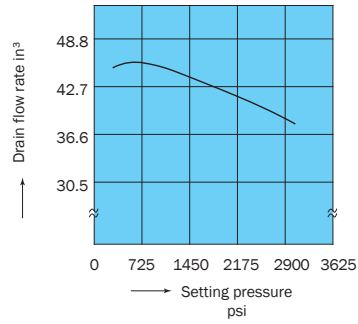
Modular Valves

Pressure - Drain Rate Characteristics

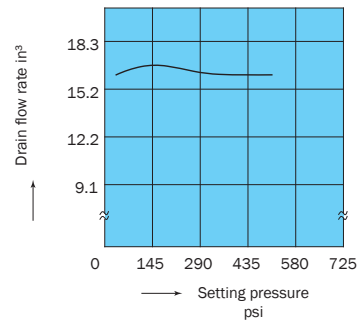
OG-G01-P*-21



OG-G03-P*-J51

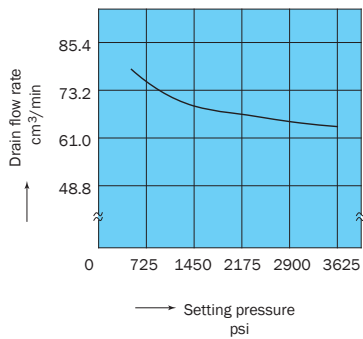


OG-G03-PC-J51



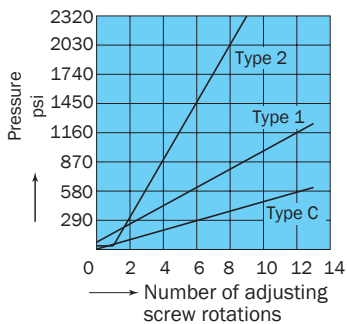
Determine it through the maximum value when designing the circuit.

OGH-G04-P3-10

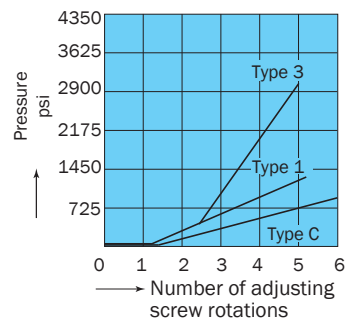


Number of Adjusting Screw Rotations - Pressure Characteristics

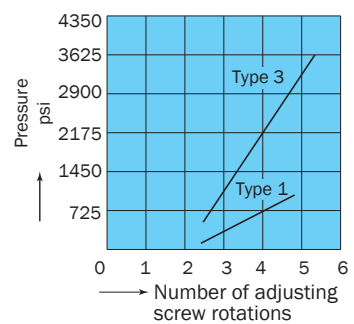
OG-G01-P*-21



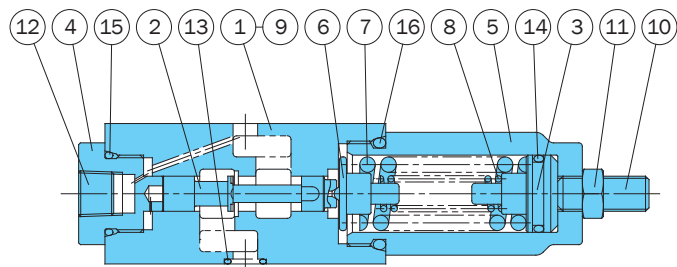
OG-G03-P*-51



OGH-G04-P*-10



OG-G01-P2-21

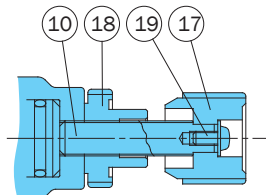


Part No.	Part Name
1	Body
2	Spool
3	Push rod
4	Bushing
5	Retainer
6	Guide
7	Spring
8	Spring
9	Plate
10	Screw
11	Nut
12	Plug
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	Knob
18	Nut
19	Screw

Seal Part List (Kit Model Number BRBS-01GP*)

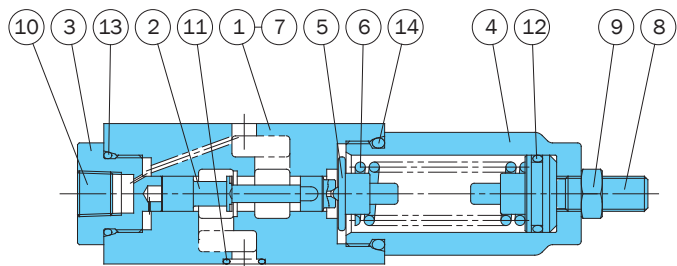
Part No.	Part Name	Part Number	Q'ty
			P
13	O-ring	1B-P9	4
14	O-ring	1A-P18	1
15	O-ring	1B-P20	1
16	O-ring	1B-P26	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



Note:
Part number 8 is used in the case of pressure
adjustment range type 2 only.

OG-G01-PC-21

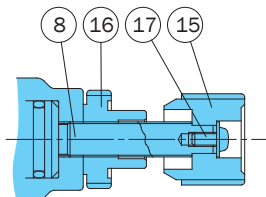


Part No.	Part Name
1	Body
2	Spool
3	Bushing
4	Retainer
5	Guide
6	Spring
7	Plate
8	Screw
9	Nut
10	Plug
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Knob
16	Nut
17	Screw

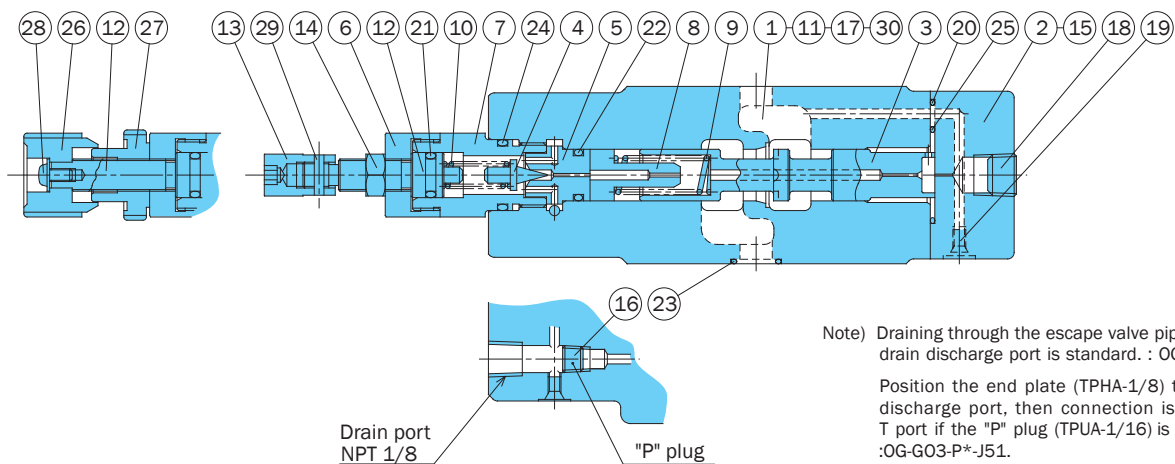
Seal Part List (Kit Model Number BRBS-01GP*)

Part No.	Part Name	Part Number	Q'ty
			P
11	O-ring	1B-P9	4
12	O-ring	1A-P18	1
13	O-ring	1B-P20	1
14	O-ring	1B-P26	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



OG-G03-P*-E51



Note) Draining through the escape valve piped to the drain discharge port is standard. : OG-G03-P*-B-J51

Position the end plate (TPHA-1/8) to the drain discharge port, then connection is made to the T port if the "P" plug (TPUA-1/16) is removed. :OG-G03-P*-J51.

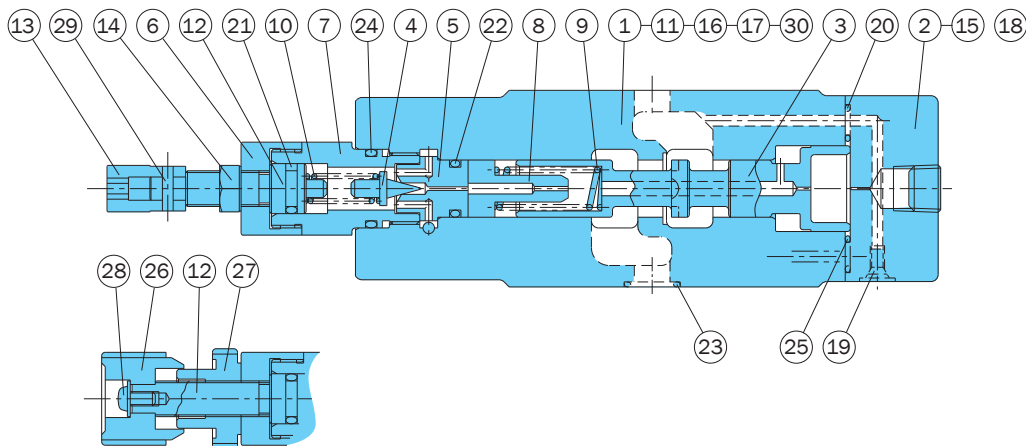
Seal Part List (Kit Model Number BRES-03GP-1A)

Part No.	Part Name	Part Number	Q'ty
			P
20	O-ring	1B-P6	2
21	O-ring	1A-P10A	1
22	O-ring	1B-P12	1
23	O-ring	AS568-014(Hs90)	5
24	O-ring	1B-P18	1
25	O-ring	AS568-023(Hs90)	1

Note) O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name	Part No.	Part Name
1	Body	14	Nut
2	Cover	15	Screw
3	Spool	16	Plug
4	Poppet	17	Plug
5	Seat	18	Plug
6	Bushing	19	Plug
7	Retainer	20	O-ring
8	Choke	21	O-ring
9	Spring	22	O-ring
10	Spring	23	O-ring
11	Plate	24	O-ring
12	Screw	25	O-ring
13	Nut	26	Knob
		27	Nut
		28	Screw
		29	Pin
		30	Pin

OG-G03-PC-E51



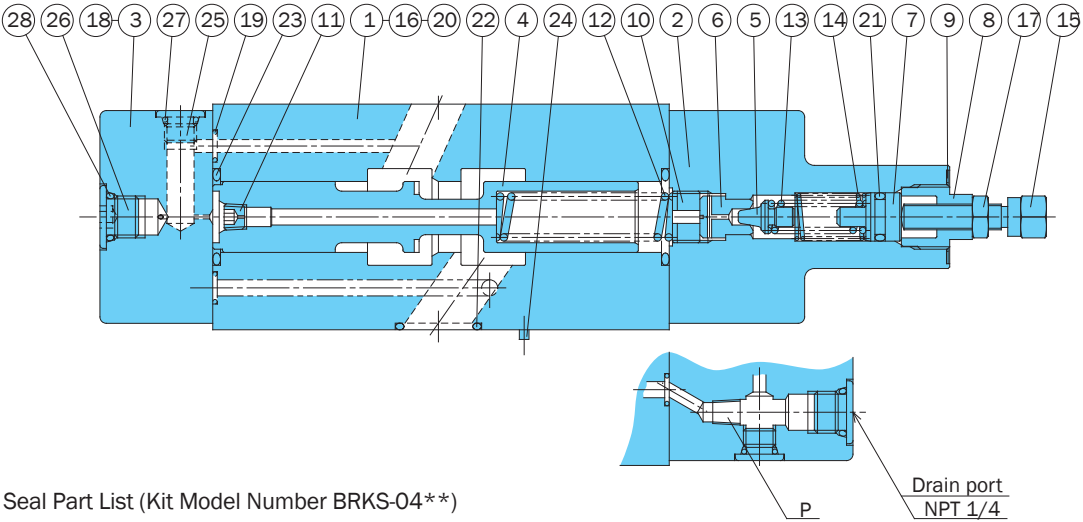
Seal Part List (Kit Model Number BRES-03GP*-1A)

Part No.	Part Name	Part Number	Q'ty
			P
20	O-ring	1B-P6	2
21	O-ring	1A-P10A	1
22	O-ring	1B-P12	1
23	O-ring	AS568-014(Hs90)	5
24	O-ring	1B-P18	1
25	O-ring	AS568-023(Hs90)	1

Note) O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name	Part No.	Part Name
1	Body	16	Plug
2	Cover	17	Plug
3	Spool	18	Plug
4	Poppet	19	Plug
5	Seat	20	O-ring
6	Bushing	21	O-ring
7	Retainer	22	O-ring
8	Choke	23	O-ring
9	Spring	24	O-ring
10	Spring	25	O-ring
11	Plate	26	Knob
12	Screw	27	Nut
13	Nut	28	Screw
14	Nut	29	Pin
15	Screw	30	Pin

OGH-G04-P*-E10



Seal Part List (Kit Model Number BRKS-04**)

Part No.	Part Name	Part Number	Q'ty	
			G	GB
19	O-ring	1B-P7	4	4
20	O-ring	AS568-012(Hs90)	2	2
21	O-ring	1A-P11	1	1
22	O-ring	AS568-118(Hs90)	4	4
23	O-ring	1B-G25	2	2
27	O-ring	1B-P8	4	4
28	O-ring	1B-P11	3	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify G (internal drain) or GB (external drain) for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Spool
5	Poppet
6	Seat
7	Plunger
8	Retainer
9	Plate
10	Collar
11	Choke
12	Spring
13	Spring
14	Spring
15	Screw
16	Plate
17	Nut
18	Screw
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	O-ring
24	Pin
25	Plug
26	Plug
27	O-ring
28	O-ring

Note:
In the standard configuration, OGH-G04-P*-10 does not require a P plug, while OGH-G04-P*-B-10 requires a P plug (TPUA-1/16) and drain pipe from the cover.



Balanced Piston Type Pressure Reducing Modular Valve

10.5 gpm
21 to 3625 psi

Features

This modular valve makes the pressure in part of the circuit lower than the main circuit. Even when pressure changes in the primary main circuit, the reduced

secondary pressure is maintained at a constant level. Compared with the direct type, this type of valve has outstanding

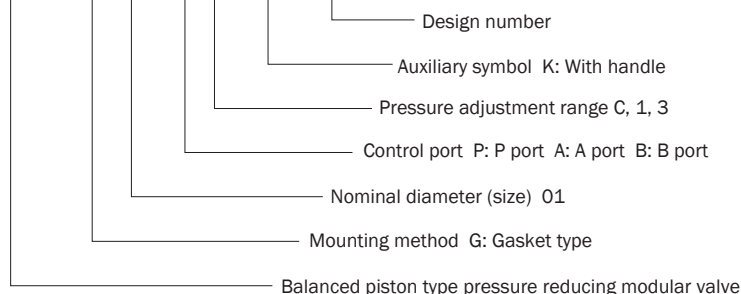
Pressure-Flow Rate Characteristics, and a superior flow rate in the low pressure control range. Maximum operating pressure: 3625 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OGB-G01-PC-20 P1 P3	1/8	3625	10.5	21 to 500 115 to 1000 500 to 3000	4.1	ISO 4401-03-02-0-94
OGB-G01-AC-20 A1 A3				21 to 500 115 to 1000 500 to 3000	4.1	
OGB-G01-BC-20 B1 B3				21 to 500 115 to 1000 500 to 3000	4.1	

Understanding Model Numbers

OGB - G 01 - P 1 - (K) - 20



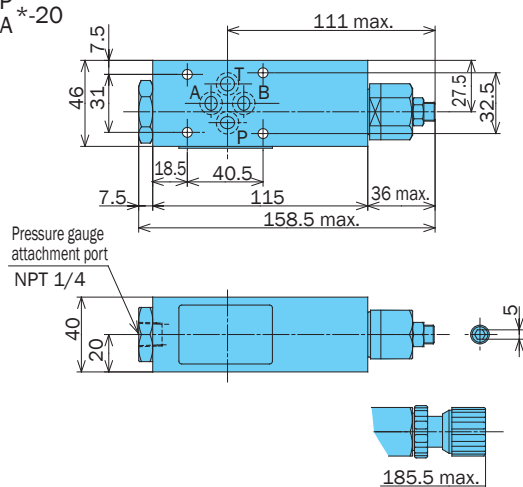
• Handling

- 1 See the Pressure-Flow Rate Characteristics for information about how the flow rate is controlled at low pressures.
- 2 Note that a change in tank port back pressure causes a change in setting pressure.
- 3 Vent piping is not possible.
- 4 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

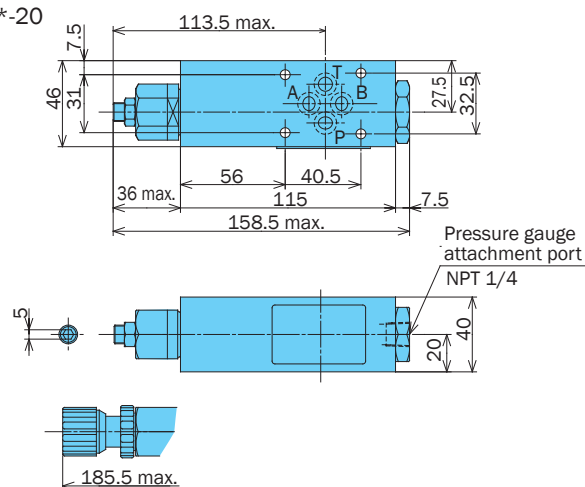
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

OGB-G01-^P_A*-20



OGB-G01-B*-20

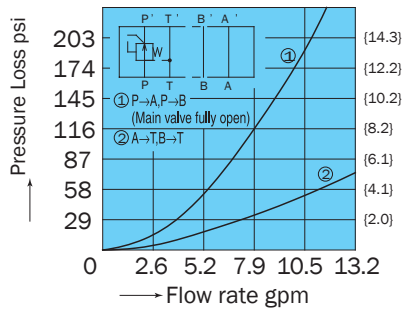


Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

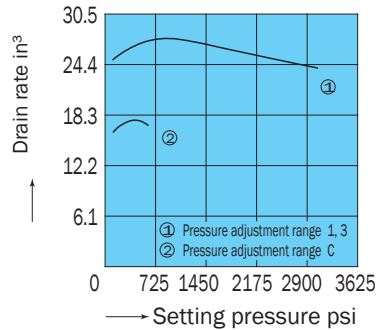
Pressure Loss Characteristics

OGB-G01-P*-20



Pressure - Drain Rate Characteristics

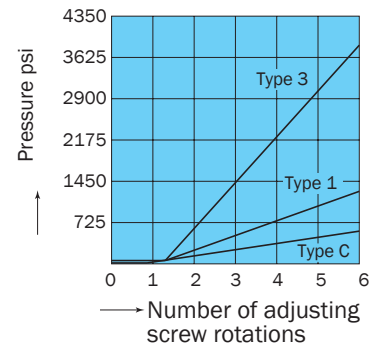
OGB-G01-**-20



Number of Adjusting Screw Rotations

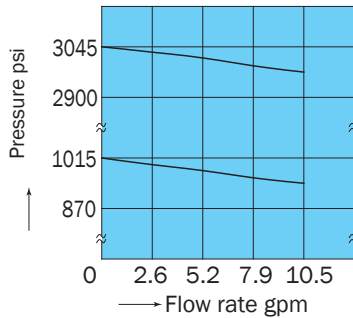
- Pressure Characteristics

OGB-G01-P*-20

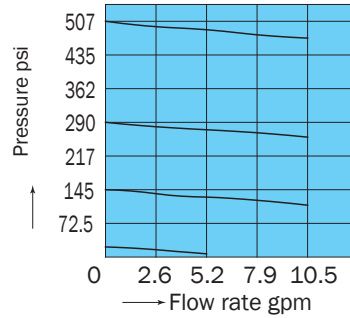


Pressure - Flow Rate Characteristics

OGB-G01-* $\frac{1}{3}$ -20

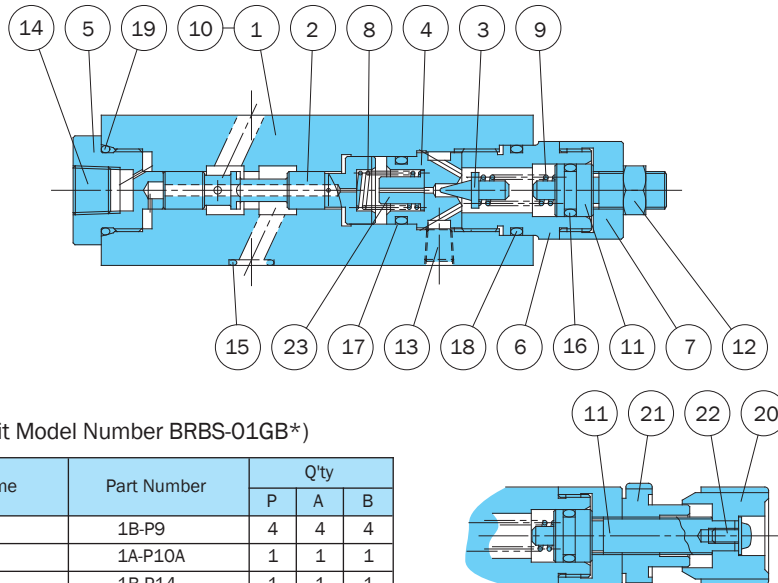


OGB-G01-*C-20



Cross-sectional Drawing

OGB-G01-P*-20



Seal Part List (Kit Model Number BRBS-01GB*)

Part No.	Part Name	Part Number	Q'ty		
			P	A	B
15	O-ring	1B-P9	4	4	4
16	O-ring	1A-P10A	1	1	1
17	O-ring	1B-P14	1	1	1
18	O-ring	1B-P20	1	1	1
19	O-ring	1B-P20	1	1	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify P, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Spool
3	Poppet
4	Seat
5	Bushing
6	Retainer
7	Bushing
8	Spring
9	Spring
10	Plate
11	Screw
12	Nut
13	Plug
14	Plug
15	O-ring
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	Knob
21	Nut
22	Screw
23	Choke

F

Modular Valves



Pressure Reducing Modular Valve

10.5 to 79 gpm
3625 to 5075 psi

Features

This modular valve makes the pressure in part of the circuit lower than the main circuit.

Even when pressure changes in the primary main circuit, the reduced secondary pressure is maintained at a

constant level.
Maximum Operating Pressure: 3625 to 5075 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OG-G01-AC-21 A1 A2	1/8	3625	10.5	21 to 500 115 to 1000 500 to 2320	2.8	ISO 4401-03-02-0-94
OG-G01-BC-21 B1 B2				21 to 500 115 to 1000 500 to 2320	2.8	
OG-G03-AC-J51 A1 A3	3/8	3625	21.1 but C : 13.2	36 to 500 115 to 1000 500 to 3000	8.3	ISO 4401-05-04-0-94
OG-G03-BC-J51 B1 B3				36 to 500 115 to 1000 500 to 3000	8.3	
OGH-G04-A1-10 A3	1/2	5075	79.2	115 to 1000 500 to 3625	17.6	ISO 4401-07-06-0-94
OGH-G04-B1-10 B3				115 to 1000 500 to 3625	17.6	

• Handling

- When using a remote control valve in a vent circuit, certain vent circuit pipe capacities can cause vibration. Because of this, thick steel pipe with an inside diameter of ϕ 4mm that is no longer than three meters is recommended. Vent piping cannot be used with the 01, 03 sizes.
- With the 01, 03 sizes, the flow rate is limited at low pressures. See the Pressure-

Flow Rate Characteristics on page F-37 and F-38 for more information.

- For the 03 size, the drainage can be allowed to escape through the T port. In the case of a valve with the auxiliary symbol B, however, run a return pipe from the drain discharge port directly to the tank.
- With the 04 sizes, piping is not required because drainage can be

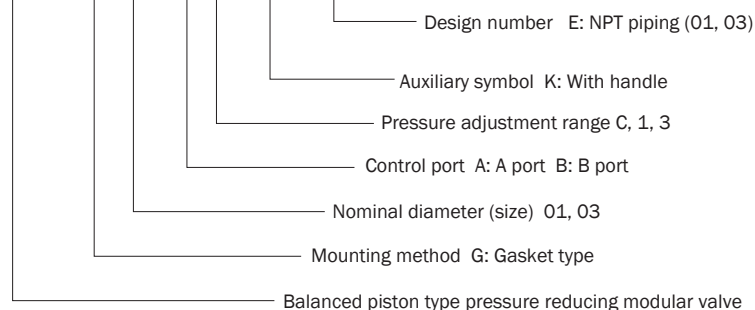
allowed to escape from the gasket side drain port. In the case of a valve with the auxiliary symbol B, however, run a return pipe from the drain discharge port directly to the tank.

- Note that a change in drain back pressure causes a change in setting pressure.
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- 04 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).
- With the 03, 04 sizes, the control port can be changed by altering the attachment orientation of the back cover. See the installation diagram for more information. After making this change, be sure also to make the other changes as in accordance with the model number indicated on the nameplate.
- Use the P port control valve concurrently with the 01 size central all-port-block (C5) solenoid valve if when the valve is in the central position and external pressure may cause the pressure at the control port to exceed the set pressure.

Understanding Model Numbers

01, 03 size

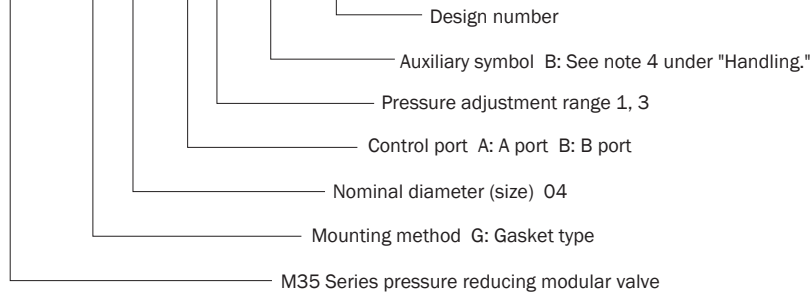
OG - G 01 - P 1 - (K) - 20



Understanding Model Numbers

04 size

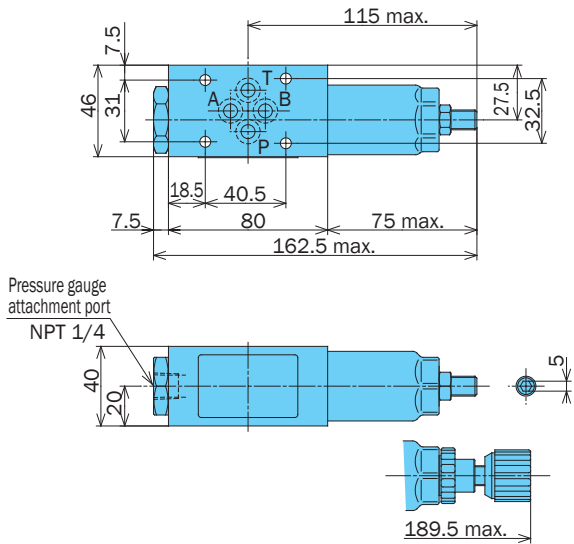
OGH - G 04 - A 1 - (B) - 10



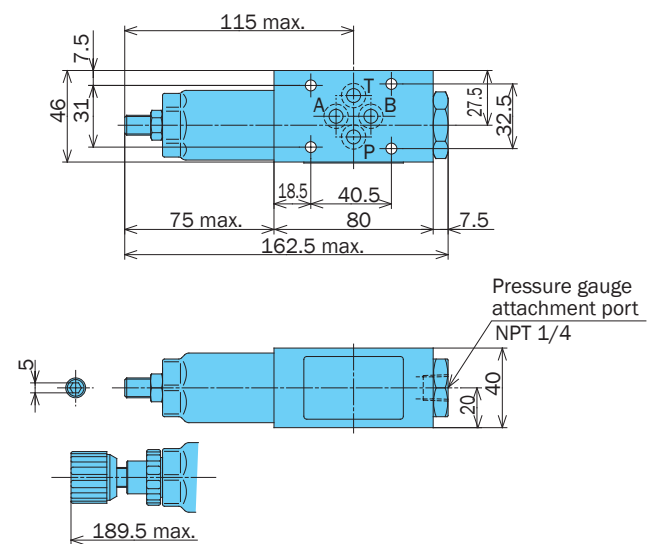
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

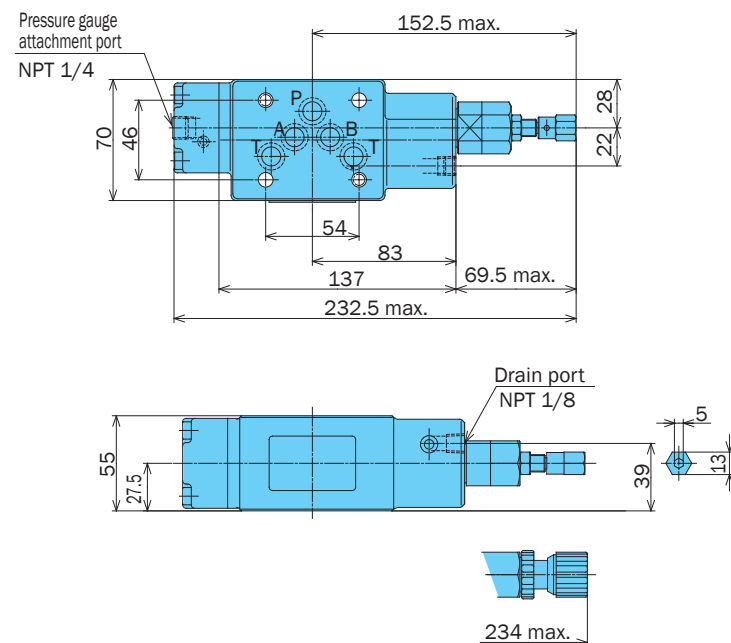
OG-G01-A*-E21



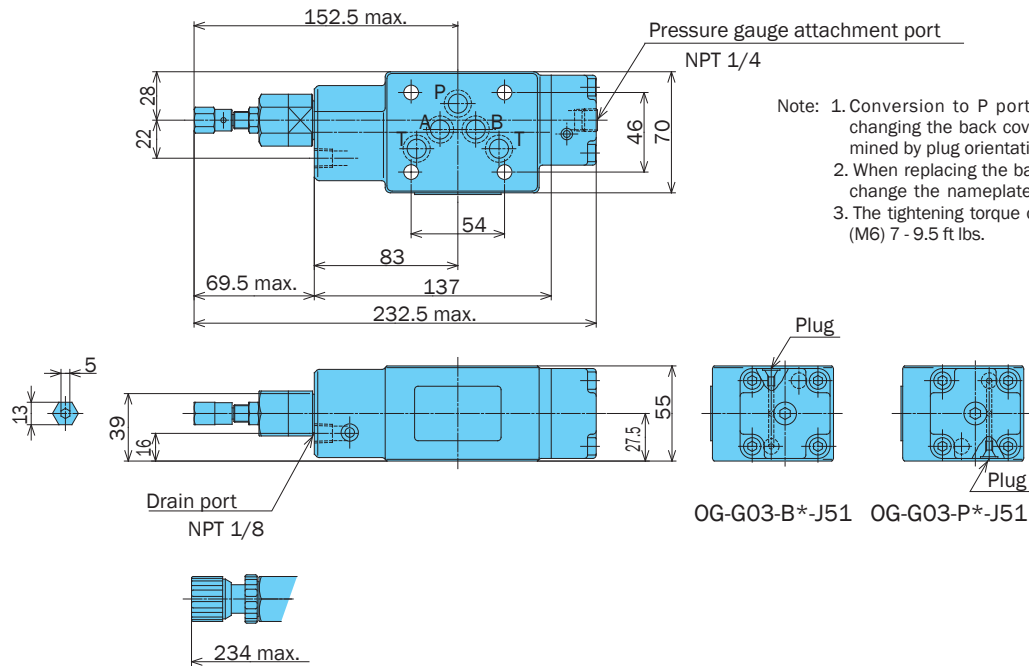
OG-G01-B*-E21



OG-G03-A*-E51

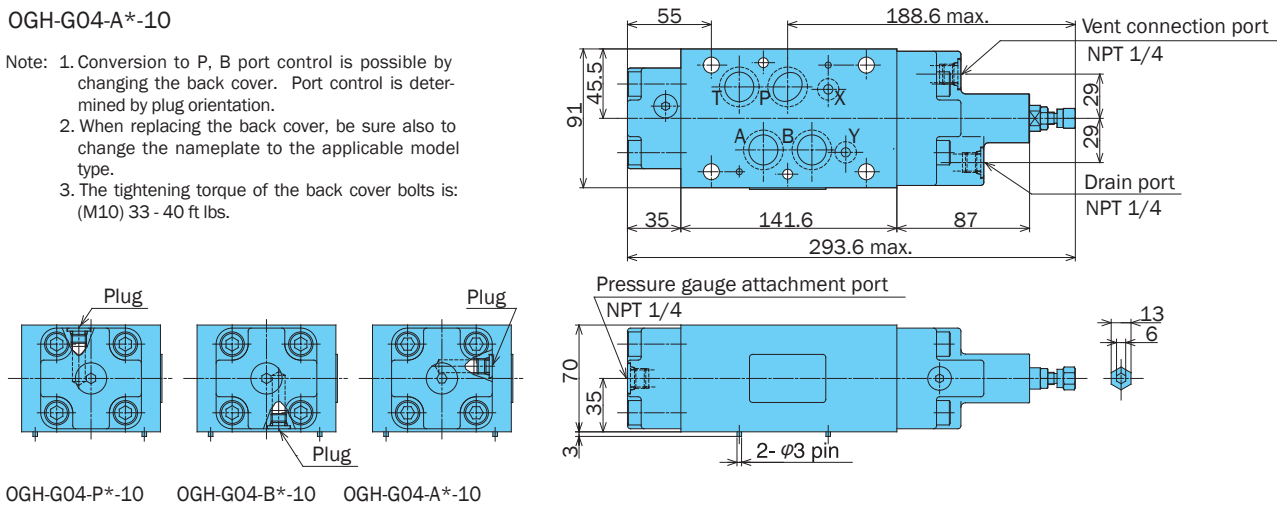


OG-G03-B*-E51



OGH-G04-A*-10

- Note: 1. Conversion to P, B port control is possible by changing the back cover. Port control is determined by plug orientation.
2. When replacing the back cover, be sure also to change the nameplate to the applicable model type.
3. The tightening torque of the back cover bolts is: (M10) 33 - 40 ft lbs.

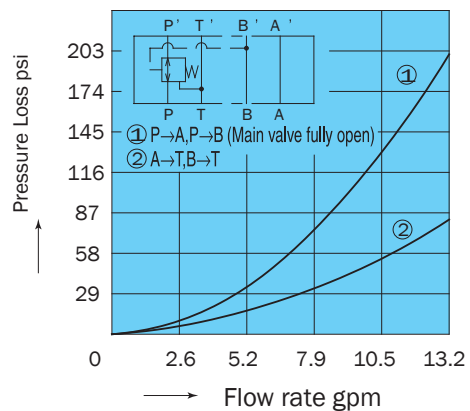


Performance Curves

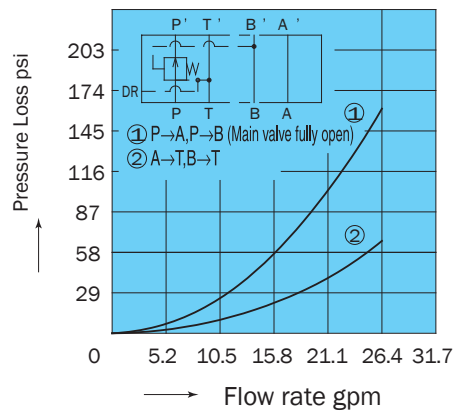
Hydraulic Operating Fluid Viscosity 32 centistokes.

Pressure Loss Curve

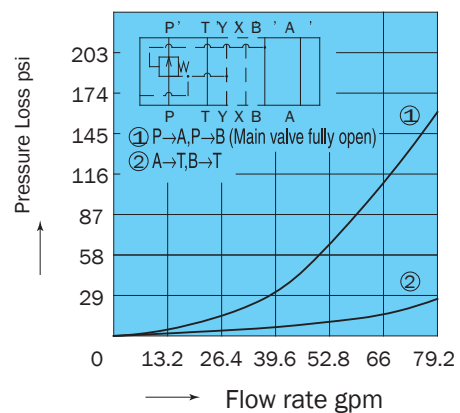
OG-G01-B*-21



OG-G03-B*-J51

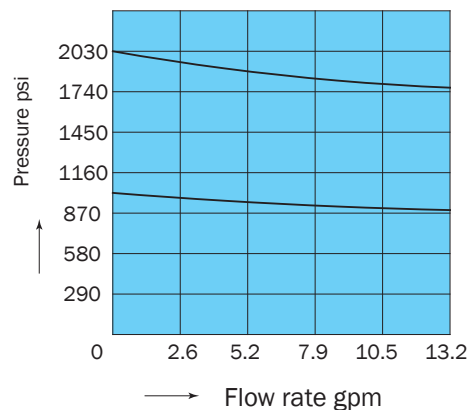


OGH-G04-**-10

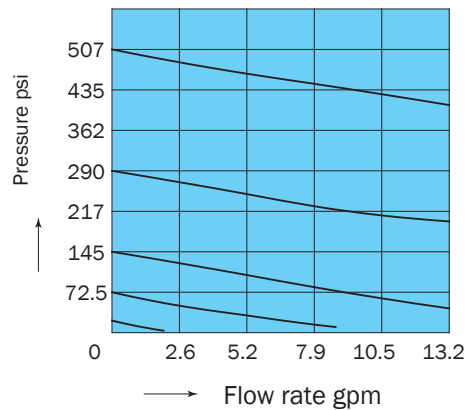


Pressure - Flow Rate Characteristics

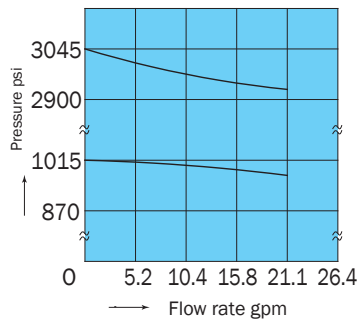
OG-G01-B $\frac{1}{2}$ -21



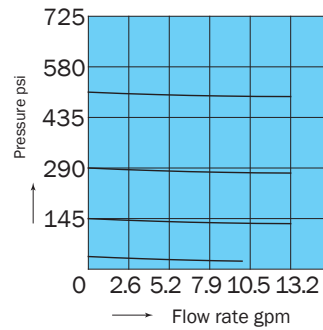
OG-G01-BC-21



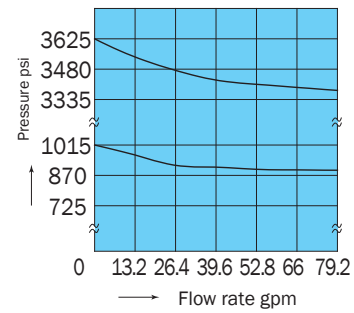
OG-G03-B $\frac{1}{3}$ -J51



OG-G03-BC-J51

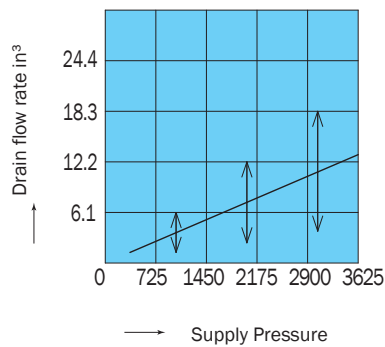


OGH-G04-**-10

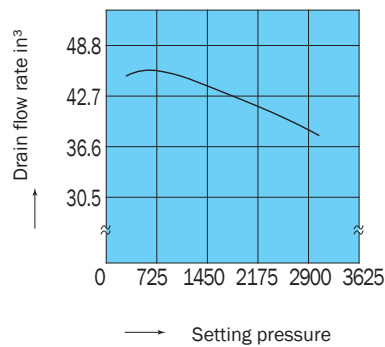


Pressure - Drain Rate Characteristics

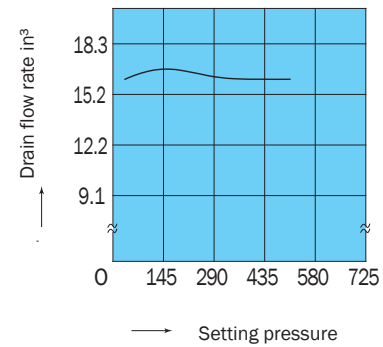
OG-G01-B*-21



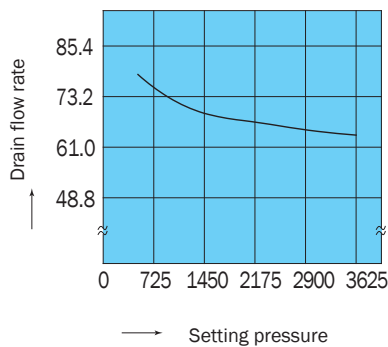
OG-G03-B*-J51



OG-G03-BC-J51

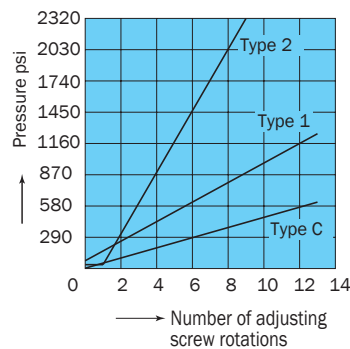


OGH-G04-*3-10

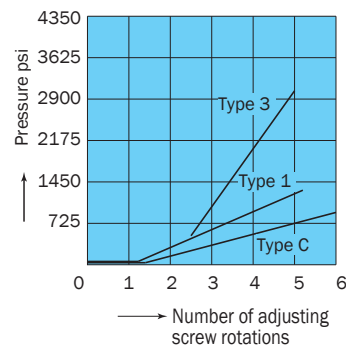


Number of Adjusting Screw Rotations - Pressure Characteristics

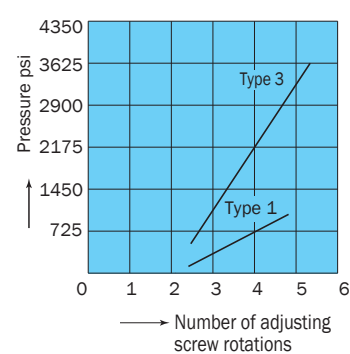
OG-G01-**-21



OG-G03-**-51

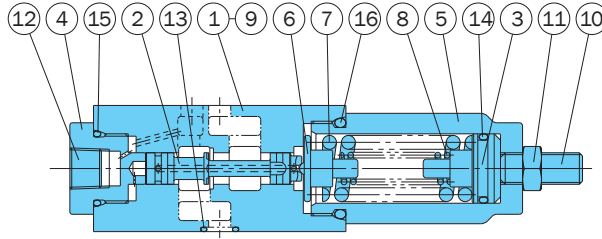


OGH-G04-**-10



Cross-sectional Drawing

OG-G01-A2-21



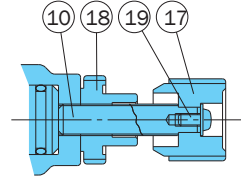
Part No.	Part Name
1	Body
2	Spool
3	Push rod
4	Bushing
5	Retainer
6	Guide
7	Spring
8	Spring
9	Plate
10	Screw
11	Nut
12	Plug
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	Knob
18	Nut
19	Screw

Seal Part List (Kit Model Number BRBS-01GP*)

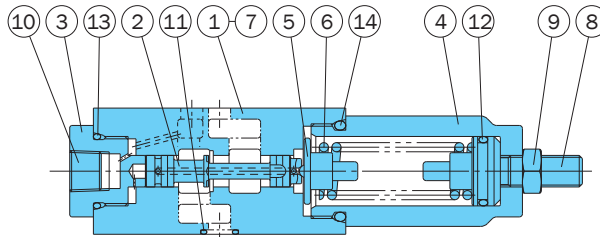
Part No.	Part Name	Part Number	Q'ty
13	O-ring	1B-P9	4
14	O-ring	1A-P18	1
15	O-ring	1B-P20	1
16	O-ring	1B-P26	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Note: Part number 8 is used in the case of pressure adjustment range type 2 only.



OG-G01-AC-21

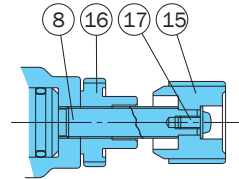


Part No.	Part Name
1	Body
2	Spool
3	Bushing
4	Retainer
5	Guide
6	Spring
7	Plate
8	Screw
9	Nut
10	Plug
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Knob
16	Nut
17	Screw

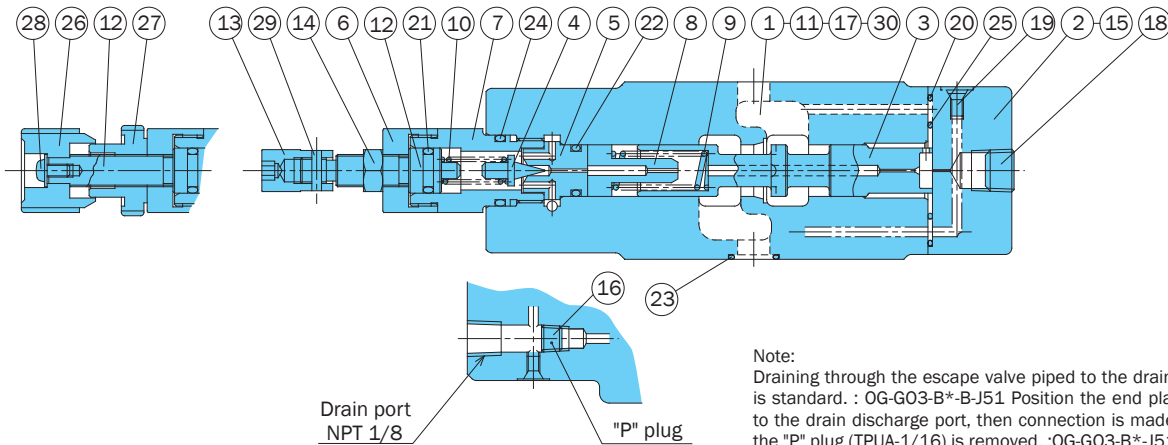
Seal Part List (Kit Model Number BRBS-01GP*)

Part No.	Part Name	Part Number	Q'ty
11	O-ring	1B-P9	4
12	O-ring	1A-P18	1
13	O-ring	1B-P20	1
14	O-ring	1B-P26	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



OG-G03-B*-J51



Note:
Draining through the escape valve piped to the drain discharge port is standard. : OG-G03-B*-B-J51 Position the end plate (TPHA-1/8) to the drain discharge port, then connection is made to the T port if the "P" plug (TPUA-1/16) is removed. :OG-G03-B*-J51.

Seal Part List (Kit Model Number BRES-03G*-1A)

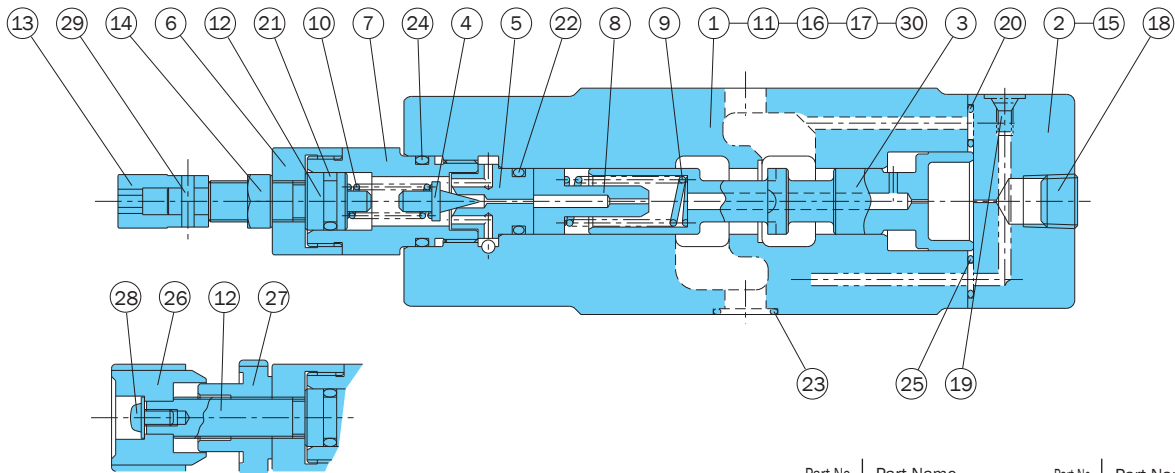
Part No.	Part Name	Part Number	Q'ty	
			A	B
20	O-ring	1B-P6	2	2
21	O-ring	1A-P10A	1	1
22	O-ring	1B-P12	1	1
23	O-ring	AS568-014(Hs90)	5	5
24	O-ring	1B-P18	1	1
25	O-ring	AS568-023(Hs90)	1	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.

2. Specify A or B for the asterisk (*) in the kit model number.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	11	Plate	21	O-ring
2	Cover	12	Screw	22	O-ring
3	Spool	13	Nut	23	O-ring
4	Poppet	14	Nut	24	O-ring
5	Seat	15	Screw	25	O-ring
6	Bushing	16	Plug	26	Knob
7	Retainer	17	Plug	27	Nut
8	Choke	18	Plug	28	Screw
9	Spring	19	Plug	29	Pin
10	Spring	20	O-ring	30	Pin

OG-G03-BC-J51



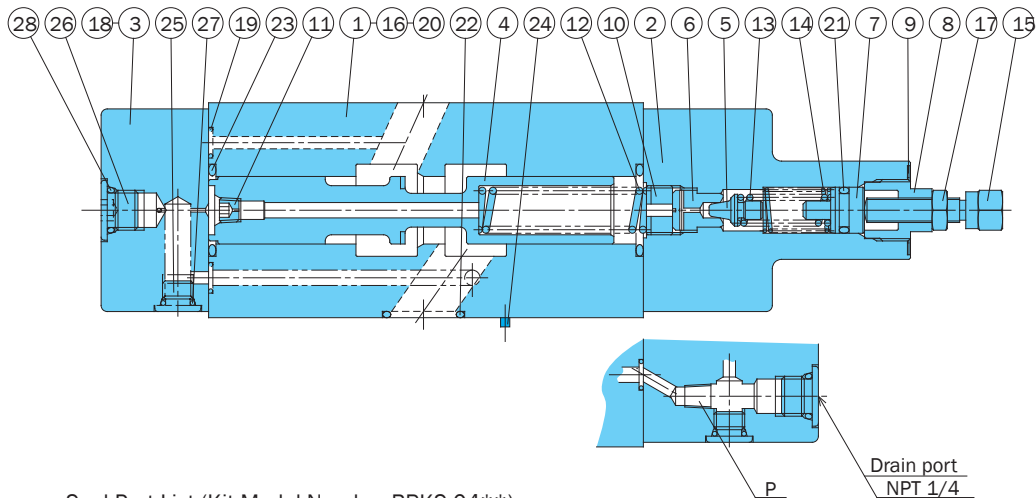
Seal Part List (Kit Model Number BRES-03GC*-1A)

Part No.	Part Name	Part Number	Q'ty	
			A	B
20	O-ring	1B-P6	2	2
21	O-ring	1A-P10A	1	1
22	O-ring	1B-P12	1	1
23	O-ring	AS568-014(Hs90)	5	5
24	O-ring	1B-P18	1	1
25	O-ring	AS568-023(Hs90)	1	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify A or B for the asterisk (*) in the kit model number.

Part No.	Part Name	Part No.	Part Name
1	Body	16	Plug
2	Cover	17	Plug
3	Spool	18	Plug
4	Poppet	19	Plug
5	Seat	20	O-ring
6	Bushing	21	O-ring
7	Retainer	22	O-ring
8	Choke	23	O-ring
9	Spring	24	O-ring
10	Spring	25	O-ring
11	Plate	26	Knob
12	Screw	27	Nut
13	Nut	28	Screw
14	Nut	29	Pin
15	Screw	30	Pin

OGH-G04-**-10



Seal Part List (Kit Model Number BRKS-04**)

Part No.	Part Name	Part Number	Q'ty	
			G	GB
19	O-ring	1B-P7	4	4
20	O-ring	AS568-012(Hs90)	2	2
21	O-ring	1A-P11	1	1
22	O-ring	AS568-118(Hs90)	4	4
23	O-ring	1B-G25	2	2
27	O-ring	1B-P8	4	4
28	O-ring	1B-P11	3	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify G (internal drain) or GB (external drain) for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Spool
5	Poppet
6	Seat
7	Plunger
8	Retainer
9	Plate
10	Collar
11	Choke
12	Spring
13	Spring
14	Spring
15	Screw
16	Plate
17	Nut
18	Screw
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	O-ring
24	Pin
25	Plug
26	Plug
27	O-ring
28	O-ring

Note:
In the standard configuration, OGH-G04-**-10 does not require a P plug, while OGH-G04-**-B-10 requires a P plug (TPUA-1/16) and drain pipe from the cover.



Two-Pressure Reducing Modular Valve

10.5 gpm
29 to 2030 psi

Features

When the pressure in part of the circuit is lower than the main circuit, this modular valve controls pressure by switching the low pressure to secondary pressure (high

pressure, low pressure). Even when pressure changes in the primary main circuit, the reduced secondary pressure is maintained

at a constant level.
Maximum Operating Pressure: 1000, 3625 psi

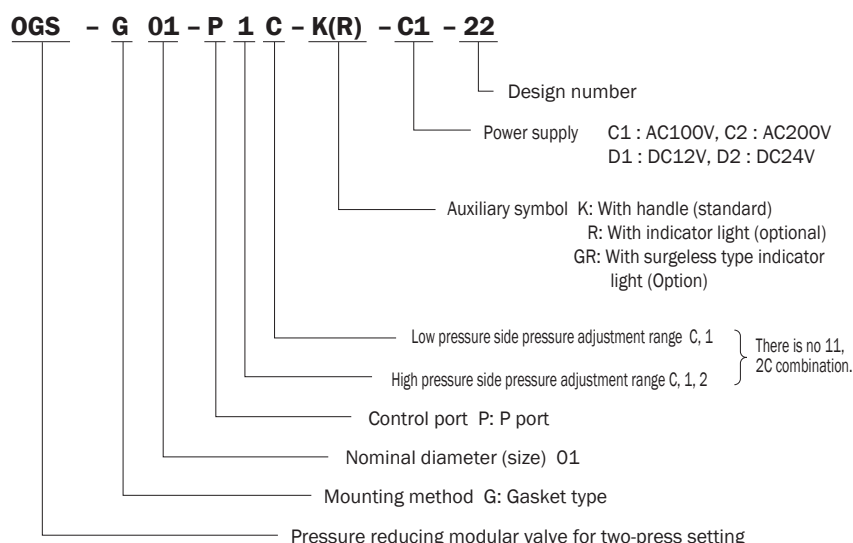
Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi		Weight lbs	Gasket Surface Dimensions
				Low pressure side	High pressure side		
OGS-G01-PCC-K-**-22 P1C	1/8	1000	10.5	29 to 500	29 to 5000 115 to 1000	10.5	ISO 4401-03-02-0-94
P21		3625		115 to 1000	500 to 2030		

Solenoid Specifications

Model No.	Rated Voltage	Starting Current	Holding Current	Holding Power
OGS-G01-P**-K- C1-22	AC100V 50/60HZ	2.2/2.0A	0.52/0.38A	25/22W
C2	AC200V 50/60HZ	1.1/1.0A	0.26/0.19A	25/22W
D1	DC12V	2.2A		26W
D2	DC24V	1.1A		26W

Understanding Model Numbers



• Handling

- See the Pressure-Flow Rate Characteristics for information about how the flow rate is controlled at low pressures.
- Note that a change in tank port back pressure causes a change in setting pressure.
- Instability occurs when there is a small setting pressure differential between the high pressure and low pressure, so be sure to maintain at least the minimum pressure differentials described below.
C Type:
At least 43 psi
1, 2 Type:
At least 72 psi
- Vent piping is not possible.
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- Low pressure is attained when the solenoid is on.
- The coil surface temperature increases if this pump is kept continuously energized. Install the valve so there is no chance of it being touched directly by hand.
- The wiring in the connector is the same as the SA series wet type solenoid valve. (See page D-22)

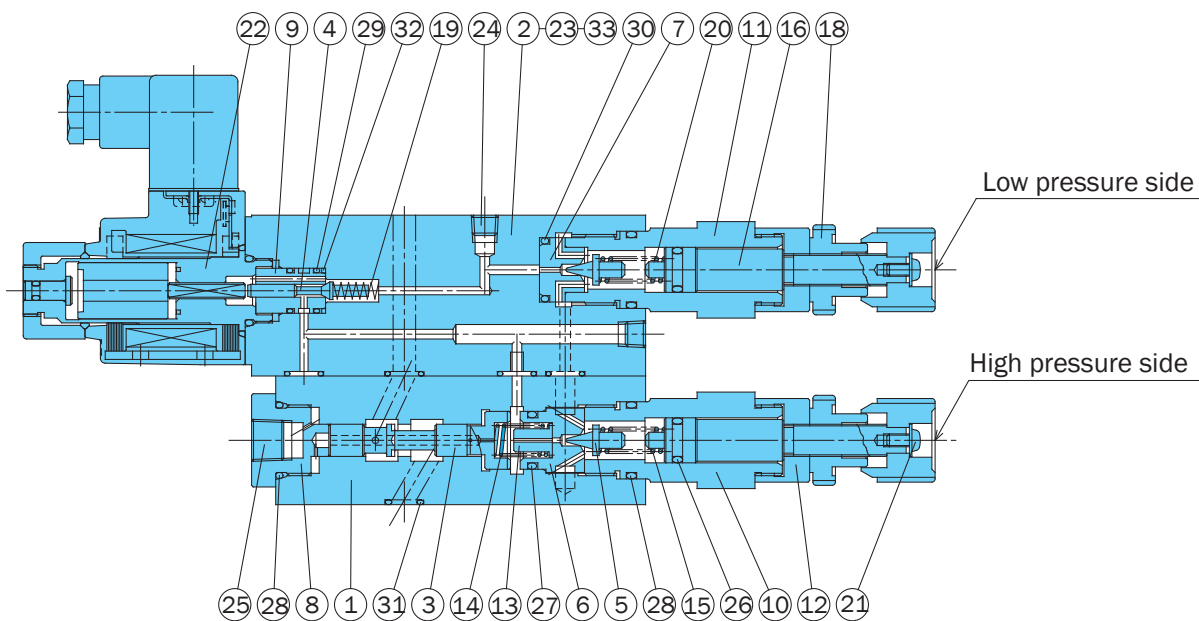
Modular Valves

Note: 1. Dimensions in parentheses apply in the case of a DC solenoid
2. Pressure is increased by clockwise (rightward) rotation of the adjusting handle, and decreased by counterclockwise (leftward) rotation.



Cross-sectional Drawing

OGS-G01-P*C-K(R)-**1-22



Seal Part List (Kit Model Number BRBS-01GSP-1A)

Part No.	Part Name	Part Number	Q'ty
26	O-ring	1A-P10A	2
27	O-ring	1B-P14	1
28	O-ring	1B-P20	3
29	O-ring	AS568-013(Hs90)	2
30	O-ring	1B-P16	1
31	O-ring	1B-P9	11
32	Backup ring	For AS568-013	1

Note: 1.O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name	Part No.	Part Name
1	Body	18	Nut
2	Body	19	Spring
3	Spool	20	Spring
4	Spool	21	Screw
5	Poppet	22	Solenoid assy
6	Seat	23	Screw
7	Seat	24	Plug
8	Bushing	25	Plug
9	Sleeve	26	O-ring
10	Retainer	27	O-ring
11	Retainer	28	O-ring
12	Bushing	29	O-ring
13	Choke	30	O-ring
14	Spring	31	O-ring
15	Spring	32	Backup ring
16	Screw	33	Plate
17	Knob		



Sequence Modular Valve

10.5 to 21 gpm
3625 psi

Features

This modular valve is a pressure control valve used for sequential actuator operations and for maintaining main circuit pressure.

Pressure adjustment is possible across a wide range, from 36 to 3045 psi.

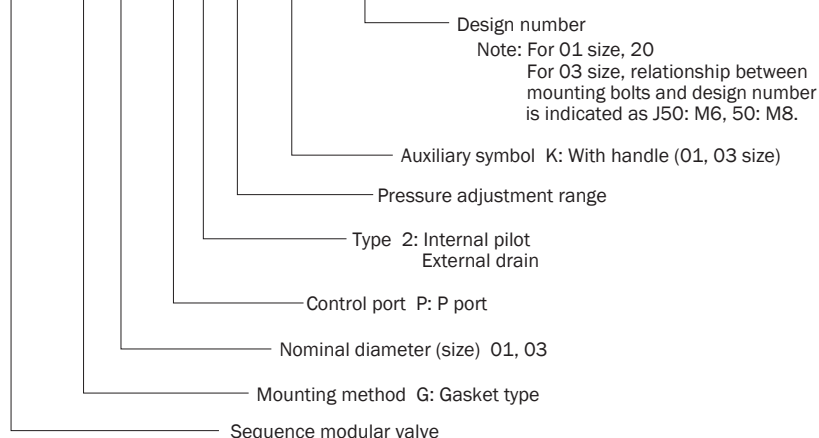
Maximum Operating Pressure: 3625 psi.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OQ-G01-P21-20 P23	1/8	3625	10.5	115 to 1000 500 to 3045	2.4	ISO 4401-03-02-0-94
OQ-G03-P2A-J50 P2C P2E	3/8	3625	21	36 to 123 123 to 500 500 to 2030	7.7	ISO 4401-05-04-0-94

Understanding Model Numbers

OQ - G 03 - P 2 A - (K) - J50



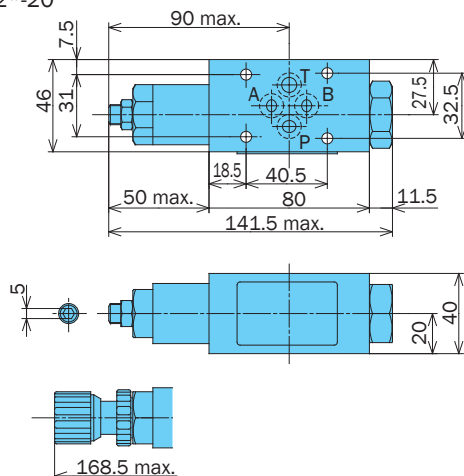
• Handling

- 1 The pressure adjustment range is expressed in terms of cracking pressure.
- 2 Install this valve directly above the sub plate or manifold.
- 3 When two or more of these valves are ganged in sequence, make sure the setting pressure differential between them is at least 145 psi.
- 4 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

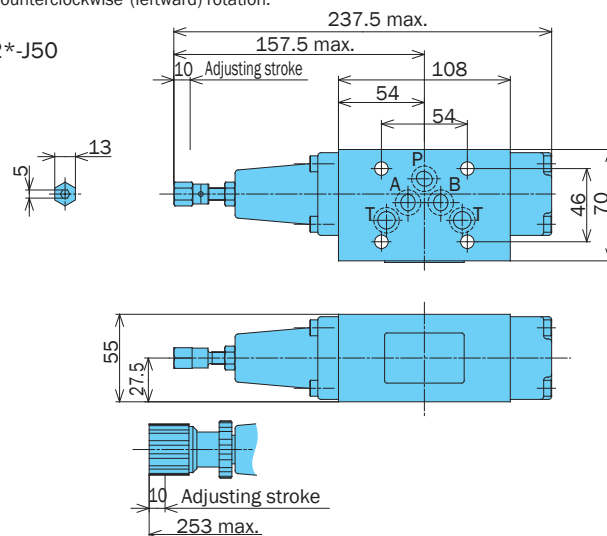
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

OQ-G01-P2*-20



OQ-G03-P2*-J50

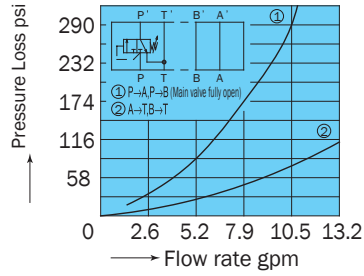


Performance Curves

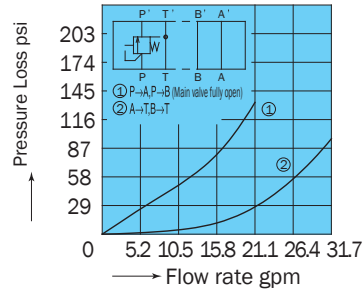
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

OQ-G01-P2*-20

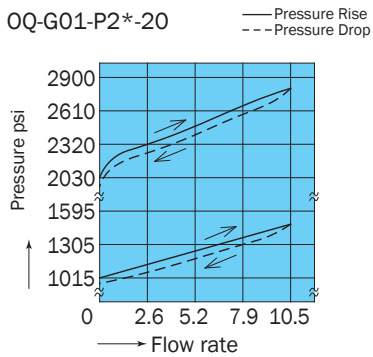


OQ-G03-P2A-J50

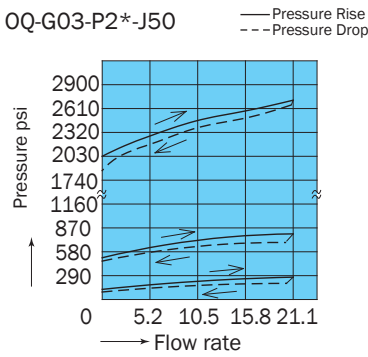


Pressure - Flow Rate Characteristics

OQ-G01-P2*-20

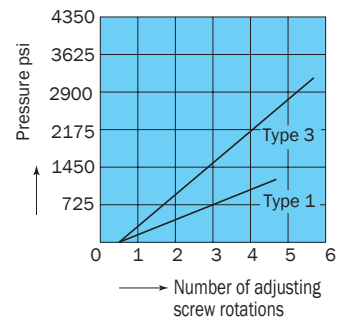


OQ-G03-P2*-J50

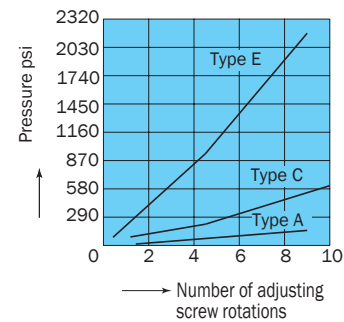


Number of Adjusting Screw Rotations - Pressure Characteristics

OQ-G01-P2*-20

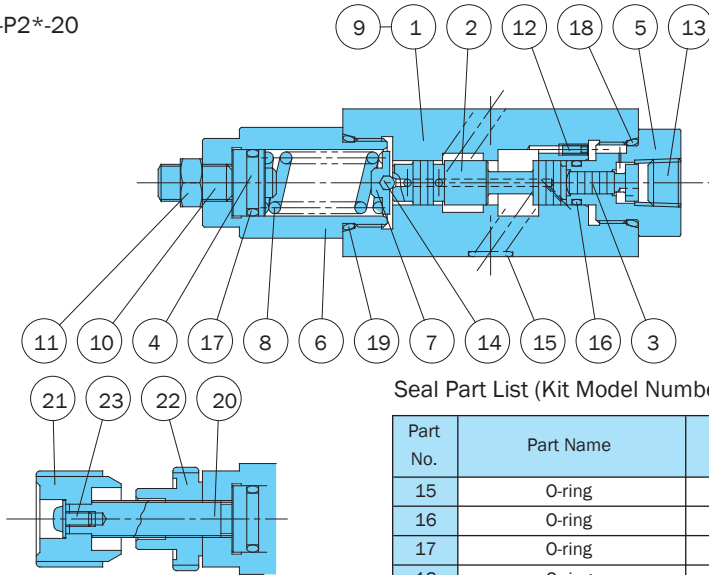


OQ-G03-P2*-J50



Installation Dimension Drawings

OQ-G01-P2*-20



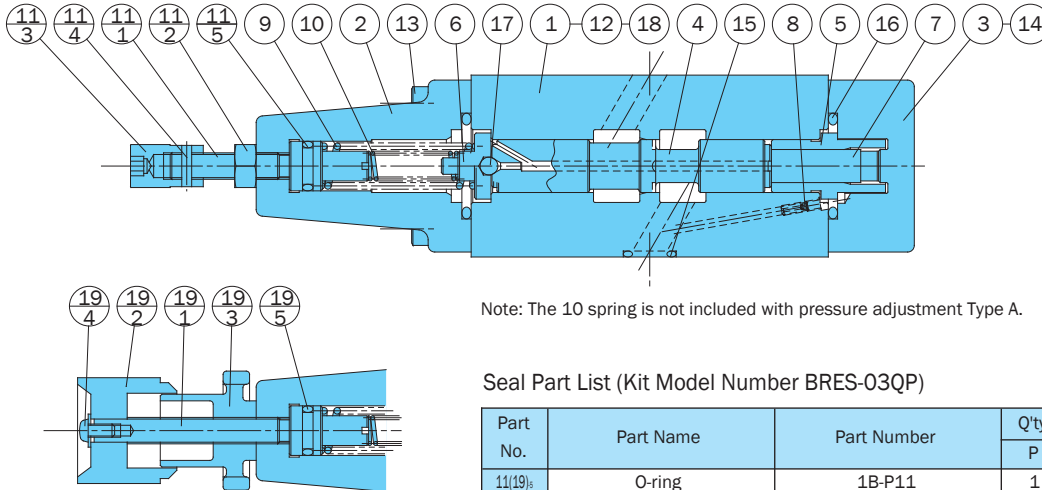
Seal Part List (Kit Model Number BRBS-01QP)

Part No.	Part Name	Part Number	Q'ty	
			P	
15	O-ring	1B-P9	4	
16	O-ring	1B-P9	1	
17	O-ring	1A-P14	1	
18	O-ring	1B-P20	1	
19	O-ring	1B-P22	1	

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name
1	Body
2	Spool
3	Piston
4	Plunger
5	Bushing
6	Retainer
7	Guide
8	Spring
9	Plate
10	Screw
11	Nut
12	Choke
13	Plug
14	Ball
15	O-ring
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	Screw
21	Knob
22	Nut
23	Screw

OQ-G03-P2*-J50



Note: The 10 spring is not included with pressure adjustment Type A.

Seal Part List (Kit Model Number BRES-03QP)

Part No.	Part Name	Part Number	Q'ty	
			P	
11(19) ₁	O-ring	1B-P11	1	
15	O-ring	AS568-014(Hs90)	5	
16	O-ring	1B-P26	2	

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Spool
5	Sleeve
6	Guide
7	Plunger
8	Choke
9	Spring
10	Spring
11	Screw kit
11 ₁	Screw
11 ₂	Nut
11 ₃	Nut
11 ₄	Pin
11 ₅	O-ring
12	Plate
13	Screw
14	Screw
15	O-ring
16	O-ring
17	Ball
18	Pin
19	Handle kit
19 ₁	Screw
19 ₂	Knob
19 ₃	Nut
19 ₄	Screw
19 ₅	O-ring



Counter Balance Modular Valve

10.5 to 79 gpm
2030 psi

Features

This modular valve is used to control actuator back pressure and for other pressure control valve applications.

Pressure adjustment is possible across a wide range, from 36 to 2030 psi

Maximum Operating Pressure: 3625, 5075 psi

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OCQ-G01-A11-20 A12	1/8	3625	10.5	115 to 1000 500 to 2030	2.4	ISO 4401-03-02-0-94
OCQ-G01-B11-20 B12				115 to 1000 500 to 2030	2.4	
OCQ-G03-A1A-J50 A1C A1E	3/8	3625	21	36 to 123 123 to 500 500 to 2030	7.7	ISO 4401-05-04-0-94
OCQ-G03-B1A-J50 B1C B1E				36 to 123 123 to 500 500 to 2030	7.7	
OQH-G04-A1A-10 A1C A1E	1/2	5075	79	36 to 123 72 to 500 290 to 2030	17.6	ISO 4401-07-06-0-94
OQH-G04-B1A-10 B1C B1E				36 to 123 72 to 500 290 to 2030	17.6	

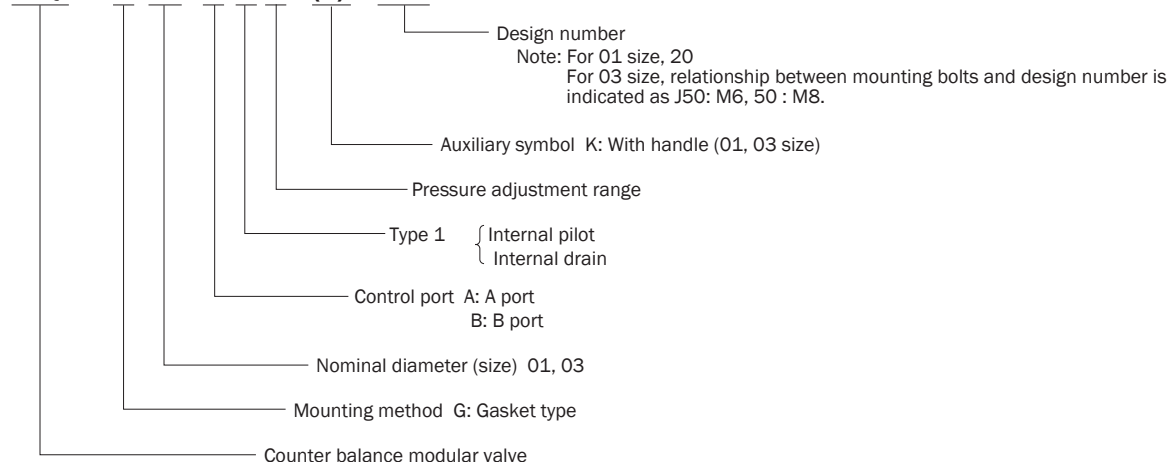
• Handling

- The pressure adjustment range is expressed in terms of cracking pressure.
- Run tank port piping directly to the tank, and ensure that back pressure is as small as possible.
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- O4 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).

Understanding Model Numbers

01, 03 size

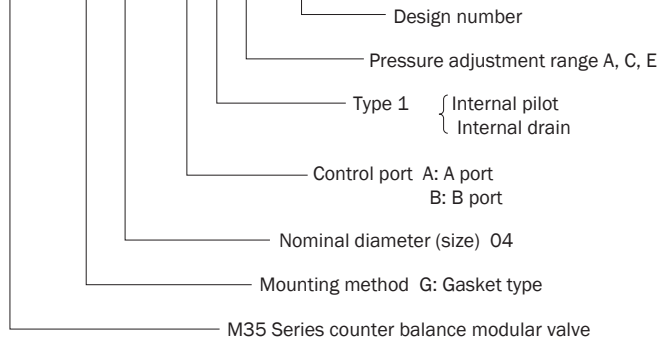
OCQ - G 03 - B 1 A - (K) - J50



Understanding Model Numbers

04 size

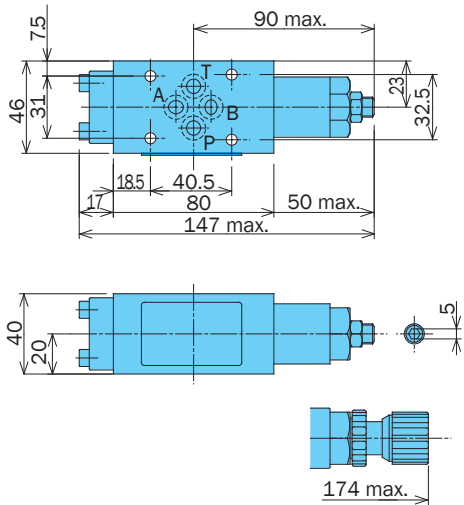
OQH - G 04 - B 1 A - 10



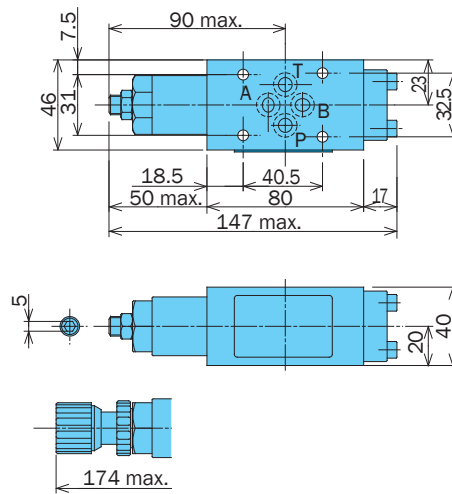
Installation Dimension Drawings

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw (bolt), and decreased by counterclockwise (leftward) rotation.

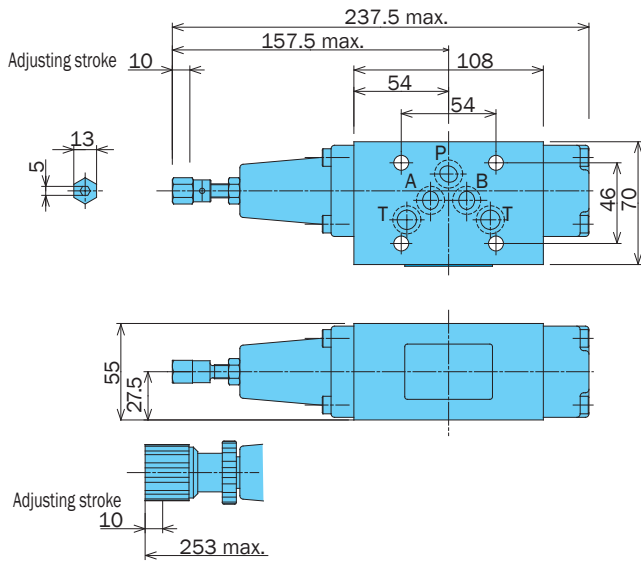
OCQ-G01-A1*-20



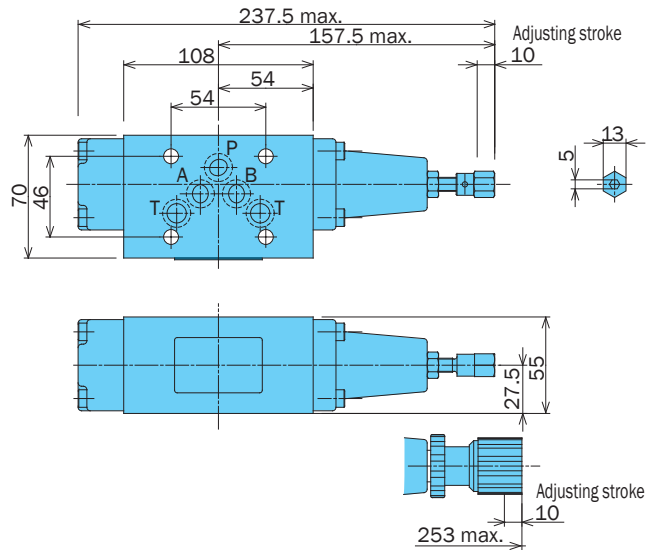
OCQ-G01-B1*-20



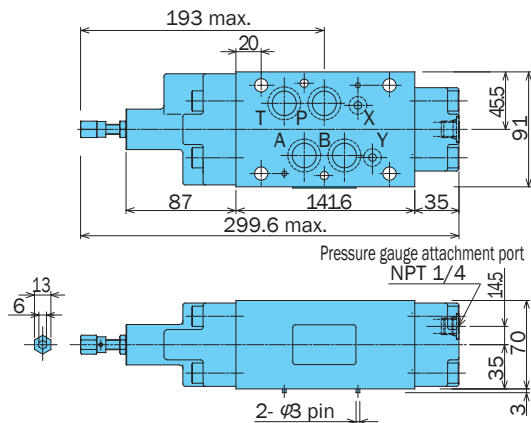
OCQ-G03-A1*-J50



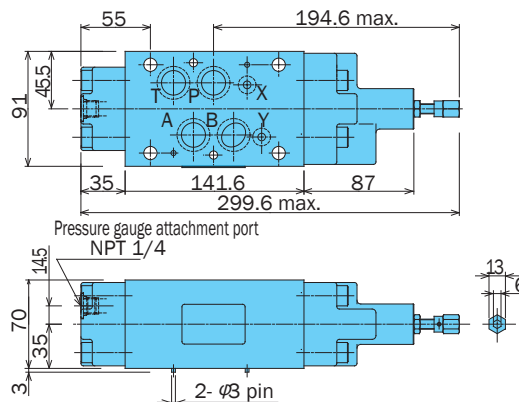
OCQ-G03-B1*-J50



OQH-G04-A1*-10



OQH-G04-B1*-10

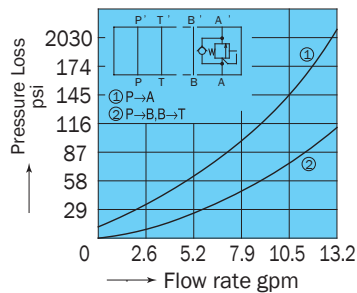


Performance Curves

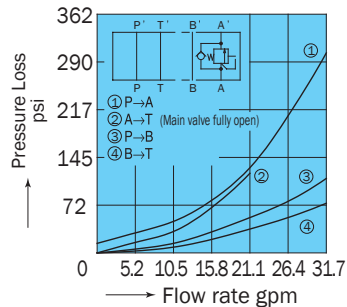
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

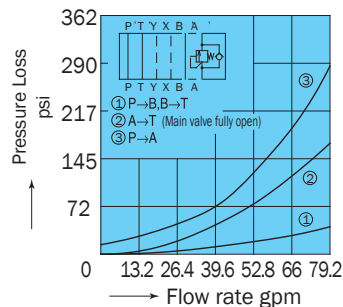
OCQ-G01-A1*-20



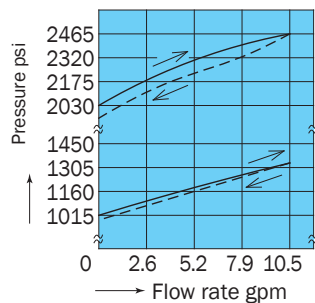
OCQ-G03-A1A-J50



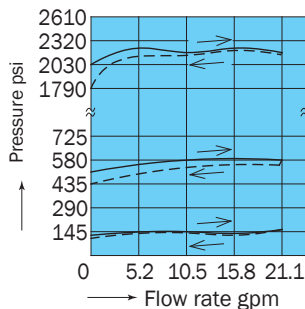
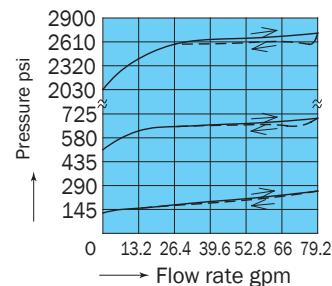
OQH-G04-B1A-10



Pressure - Flow Rate Characteristics

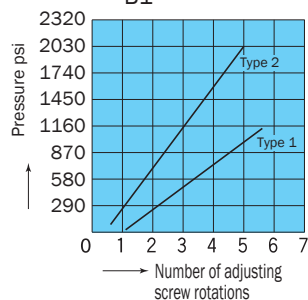
OCQ-G01-A1*
B1*-20

OCQ-G03-A1*-J50

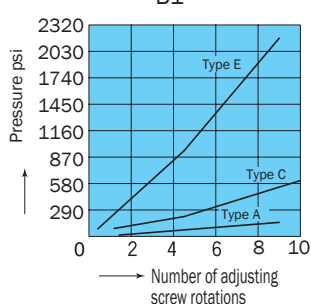
OQH-G04-A1
B1*-10

Number of Adjusting Screw Rotations - Pressure Characteristics

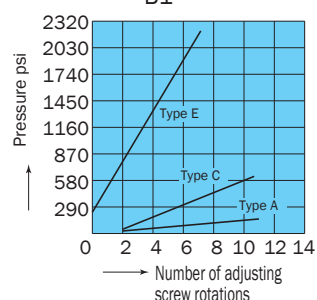
OCG-G01- A1*
B1* - 20



OCG-G03- A1*
B1* - J50

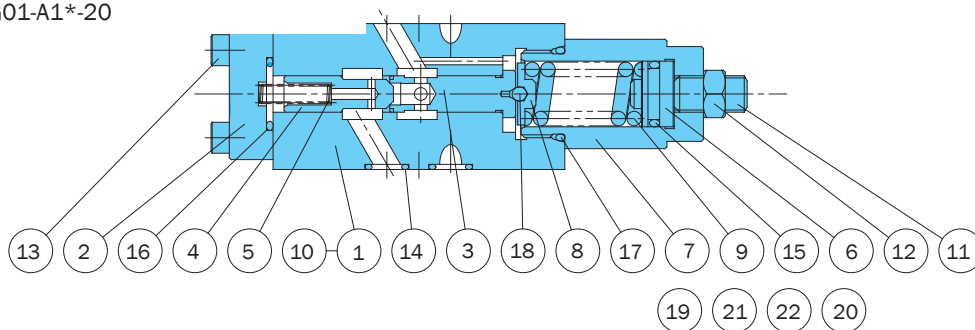


OQH-G04- A1*
B1* - 10



Cross-sectional Drawing

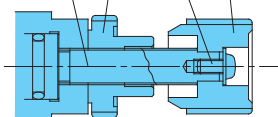
OCQ-G01-A1*-20



Seal Part List (Kit Model Number BRBS-01CQ*)

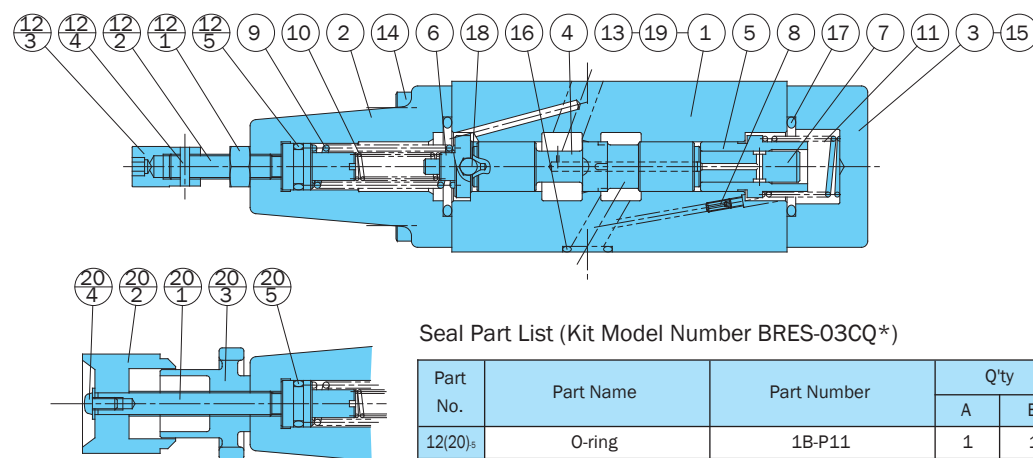
Part No.	Part Name	Part Number	Q'ty	
			A	B
14	O-ring	1B-P9	4	4
15	O-ring	1B-P14	1	1
16	O-ring	1B-P16	1	1
17	O-ring	1B-P22	1	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify A or B for the asterisk (*) in the kit model number.



Part No.	Part Name
1	Body
2	Cover
3	Spool
4	Poppet
5	Spring
6	Plunger
7	Retainer
8	Guide
9	Spring
10	Plate
11	Screw
12	Nut
13	Screw
14	O-ring
15	O-ring
16	O-ring
17	O-ring
18	Ball
19	Screw
20	Knob
21	Nut
22	Screw

OCQ-G03-A1*-J50



Seal Part List (Kit Model Number BRES-03CQ*)

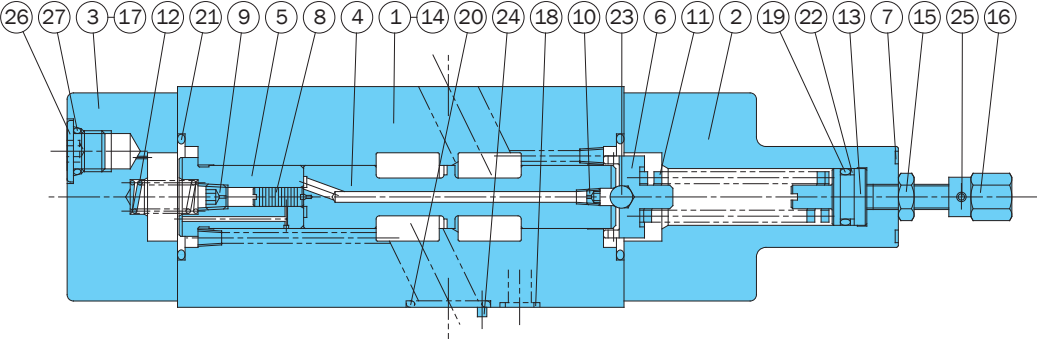
Part No.	Part Name	Part Number	Q'ty	
			A	B
12(20) _s	O-ring	1B-P11	1	1
16	O-ring	AS568-014(Hs90)	5	5
17	O-ring	1B-P26	2	2

Note: The 10 spring is not included with pressure adjustment Type A.

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify A or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Spool
5	Sleeve
6	Guide
7	Plunger
8	Choke
9	Spring
10	Spring
11	Spring
12	Screw kit
12 ₁	Screw
12 ₂	Nut
12 ₃	Nut
12 ₄	Pin
12 ₅	O-ring
13	Plate
14	Screw
15	Screw
16	O-ring
17	O-ring
18	Ball
19	Pin
20	Handle kit
20 ₁	Screw
20 ₂	Knob
20 ₃	Nut
20 ₄	Screw
20 ₅	O-ring

OQH-G04-B1*-10



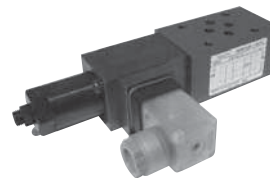
Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Spool
5	Sleeve
6	Guide
7	Plate
8	Plunger
9	Choke
10	Choke
11	Spring
12	Spring
13	Screw
14	Plate
15	Nut
16	Nut
17	Screw
18	O-ring
19	O-ring
20	O-ring
21	O-ring
22	Backup ring
23	Ball
24	Pin
25	Pin
26	Plug
27	O-ring

Seal Part List (Kit Model Number BRKS-04CQ*)

Part No.	Part Name	Part Number	Q'ty	
			A	B
18	O-ring	AS568-012(Hs90)	2	2
19	O-ring	1B-P14	1	1
20	O-ring	AS568-118(Hs90)	4	4
21	O-ring	1B-G35	2	2
22	Backup ring	T2-P14	1	1
27	O-ring	1B-P11	1	1

Note: The illustration shows the configuration for pressure adjustment ranges Type C and Type E. For Type A, there is no #8 piston or #10 choke.

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS 2407-T2-**.
3. Specify A or B for the asterisk (*) in the kit model number.



Pressure Switch Modular Valve

**13.2 gpm
3625 psi**

Features

This modular valve detects pressure changes inside the hydraulic circuit and opens and closes an electrical circuit accordingly.

High precision detection, high precision circuit control, outstanding reliability. Maximum operating pressure: 3625 psi Indicator light built into the DIN connector shows operational status at

a glance. A double type is also available for control of both port A and port B in a compact configuration.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OW-G01-PC-R**-30 P1 P3	1/8	3625	13.2	72 to 500 116 to 1000 500 to 3045	3.9	ISO 4401-03-02-0-94
OW-G01-AC-R**-30 A1 A3				72 to 500 116 to 1000 500 to 3045	3.9	
OW-G01-BC-R**-30 B1 B3				72 to 500 116 to 1000 500 to 3045	3.9	
OW-G01-WC-R**-30 W1 W3				72 to 500 116 to 1000 500 to 3045	5.7	

Electrical Specifications Micro Switch Manufacturer: Omron Model No. SS-5	Contact Capacitance (Resistive Load)		AC	125V	5A
				250V	3A
			DC	12V	2.2A
				24V	1.1A
	Mechanical Life		At least 1 × 10 ⁷		
	Electrical Life		At least 3 × 10 ⁶ (AC,0.1A,cos φ=1)		
	Contact Resistance		30MΩ maximum (initial value)		
	Insulation Resistance		At least 100MΩ		
Allowable Operating Frequency		60 times/minute (electrical)			
Operating Environment	Dust Resistance/Water Resistance Rank		JIS C0920 IP64		
	Ambient Temperature		-4° F to 158° F (non-condensation)		
	Operating Fluid	Fluid Temperature	-4° F to 158°		Use a fluid that is within both ranges.
		Allowable Viscosity Range	15 to 300		
		Filtration	10μm maximum		

- Handling
- 1 See the detailed explanation on the next page for information about wiring inside connectors.
 - 2 Contacts are normally open type only, not normally closed type.
 - 3 In addition to load wiring, power supply wiring is also required to illuminate the indicator light. See the wiring diagram for more information.
 - 4 If the DIN connector interferes with other valves, remove the two switch installation bolts and change the installation orientation. If interference is caused in all orientations, install an interference blanker plate on top of the connector. Contact your agent if an interference blanker plate is required.
 - 5 Note that a special type of DIN connector is required. The DIN connector is not interchangeable with the one for the SA type solenoid valve.
 - 6 If you cannot remove the DIN connector when wiring, remove the switch installation bolts and then remove the DIN connector. The tightening torque for the installation bolts is 3.6 to 5.1 ft lbs.

Understanding Model Numbers

OW - G 01 - P 1 - (K)R - D2 - 30

- Design number
- Power supply specification
C115: 115V; C2: 230V
D1: 12V; D2: 24V
- R: With indicator light (standard)
K: With manual handle (optional)
- Pressure adjustment range C: 72 to 500 psi; 1: 116 to 1000 psi; 3: 500 to 3045 psi
- Control port P: P port; A: A port; B: B port; W: A, B ports
- Nominal diameter (size) 01
- Mounting method G: Gasket type
- Pressure switch modular valve

Note: 1. The DIN connector wiring connector port size is PG11.
2. The compatible cable diameter for the DIN connector is $\phi 8$ to $\phi 10$. Dust resistance and water resistance is lost for any cable outside this range.
3. The connector can be installed in different orientations are 90-degree increments by changing the orientation of the terminal block.
4. The connector is designed so the cover cannot be removed unless the installation screws are removed.
5. Use M3 for round type and Y type solderless terminals.
6. The tightening torque of M3 screws used for securing connectors and for terminals is 42 to 70 in lbs.

Note: Pressure is increased by clockwise (rightward) rotation of the adjusting screw, and decreased by counterclockwise (leftward) rotation.

Technical drawing of the G01-W*-R*-2-30 valve assembly, showing dimensions and part details.

Top View Dimensions:

- Overall width: 300 max.
- Distance from left face to first vertical centerline: 110 max.
- Distance between first and second vertical centerlines: 80.
- Distance from second vertical centerline to right face: 110 max.
- Distance from left face to first horizontal centerline: 150 max.
- Distance between first and second horizontal centerlines: 18.5.
- Distance between second and third horizontal centerlines: 40.5.
- Distance from third horizontal centerline to right face: 150 max.

Side View Dimensions:

- Overall height: 99.
- Distance from top face to first horizontal centerline: 46.
- Distance from first horizontal centerline to second horizontal centerline: 31.
- Distance from second horizontal centerline to third horizontal centerline: 23.
- Distance from third horizontal centerline to bottom face: 32.5.

End View Dimensions:

- Overall width: 354 max.

Part Details:

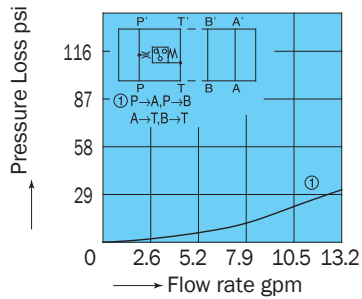
- PG11 Valve diameter $\varnothing 8$ to $\varnothing 10$.
- Part replacement provides variability in 90° increments.

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

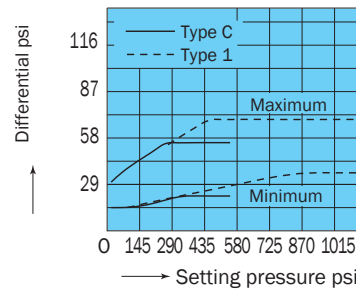
Pressure Loss Characteristics

OW-G01-**-R-**-30

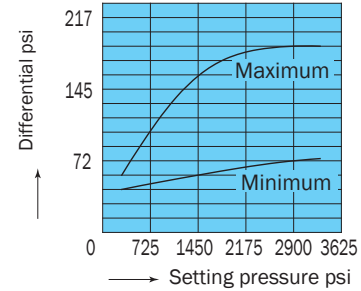


Setting Pressure - Differential Characteristics

OW-G01-^C₁-R-**-30

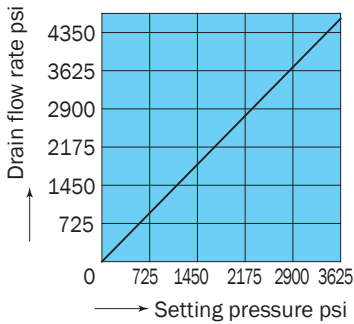


OW-G01-3-R-**-30



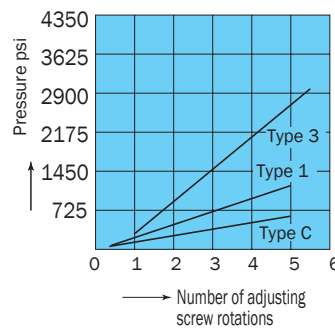
Drain Rate Characteristics

OW-G01-**-R-**-30



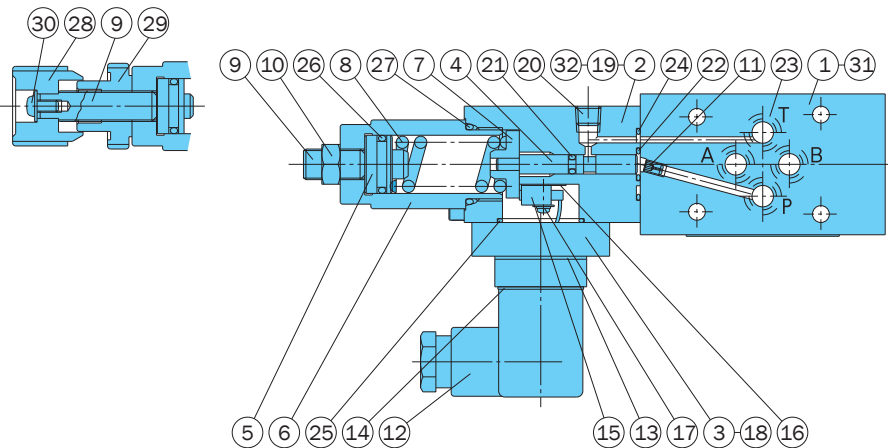
Number of Adjusting Screw Rotations Pressure Characteristics

OW-G01-**-R-**-30



Cross-sectional Drawing

OW-G01-P*-R-2-30



Part No.	Part Name	Part No.	Part Name
1	Body	17	Screw
2	Cover	18	Screw
3	Cover	19	Screw
4	Piston	20	Plug
5	Push rod	21	O-ring
6	Retainer	22	O-ring
7	Guide	23	O-ring
8	Spring	24	O-ring
9	Screw	25	O-ring
10	Nut	26	O-ring
11	Choke	27	O-ring
12	Connector	28	Knob
13	Gasket	29	Nut
14	Gasket	30	Screw
15	Micro switch assy	31	Plate
16	Separator	32	Plate

Seal Part List (Kit Model Number BRCS-01W*)

Part No.	Part Name	Part Number	Q'ty			
			P	W	A	B
21	O-ring	1A-P3	1	2	1	1
22	O-ring	AS568-011(Hs90)	1	2	1	1
23	O-ring	1B-P9	4	4	4	4
24	O-ring	AS568-019(Hs70)	1	2	1	1
25	O-ring	AS568-022(Hs70)	1	2	1	1
26	O-ring	1A-P15	1	2	1	1
27	O-ring	1B-P22	1	2	1	1

Note: Specify P, W, A, or B for the asterisk (*) in the kit model number.



Flow Regulator Modular Valve

13.2 to 79 gpm
3625 to 5075 psi

Features

This modular valve is used to control actuator speed and for other flow control valve applications.

A wide range of models are available for A and B port control, A or B port control, and P or T port control.

Maximum Operating Pressure: 3625, 5075 psi

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure Adjustment Range psi	Weight lbs	Gasket Surface Dimensions
OY-G01-T-20	1/8	3625	50	-	2.2	ISO 4401-03-02-0-94
OCY-G01-P-20				5.7	2.2	
OCY-G01-W-X-20 A B				11.4	2.8 2.6	
OCY-G01-W-Y-20 A B				11.4	2.8 2.6	
OCY-G03-P-J50				5.7	6.4	
OCY-G03-W-X-J51 A B	3/8	3625	100	14.3	6.8 6.6	ISO 4401-05-04-0-94
OCY-G03-W-Y-J51 A B				14.3	6.8 6.6	
OYH-G04-P-10				5.7	10.3	
OYH-G04-W-X-10 A B	1/2	5075	300	14.3	14.3 14.3	ISO 4401-07-06-0-94
OYH-G04-W-Y-10 A B				14.3	14.3 14.3	
				14.3	14.3	

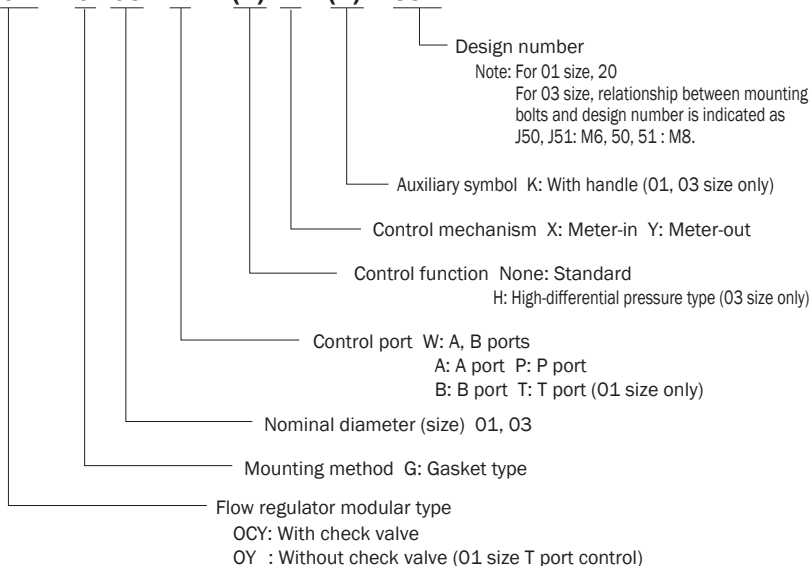
• Handling

- 1 In a 03 size application where control differential pressure is large, use of an H type makes adjustment easier.
- 2 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- 3 O4 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).

Understanding Model Numbers

01, 03 size

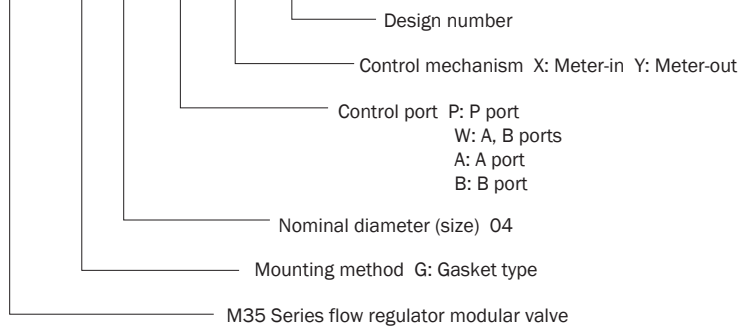
OCY - G 03 - W - (H) Y - (K) - J51



Understanding Model Numbers

04 size

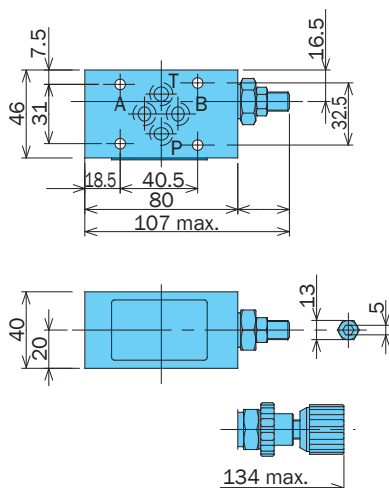
OYH - G 04 - W - Y - 10



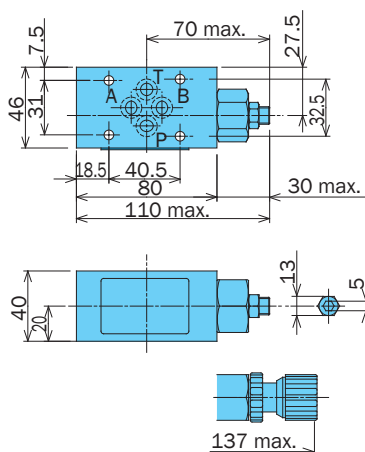
Installation Dimension Drawings

Note: The control flow rate is increased by counter clockwise (leftward) rotation of the adjusting screw.

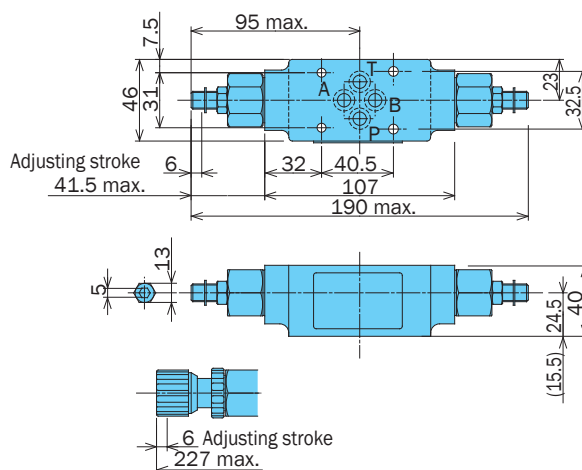
OY-G01-T-20



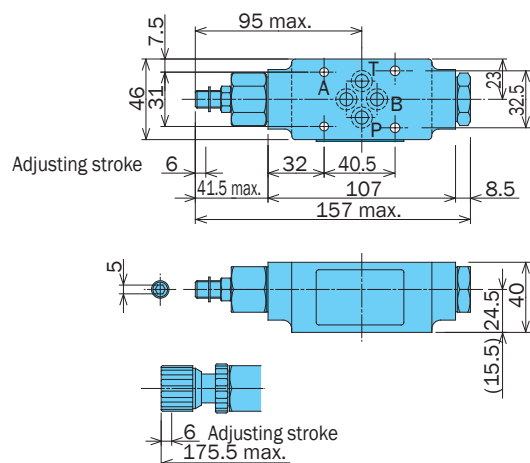
OCY-G01-P-20



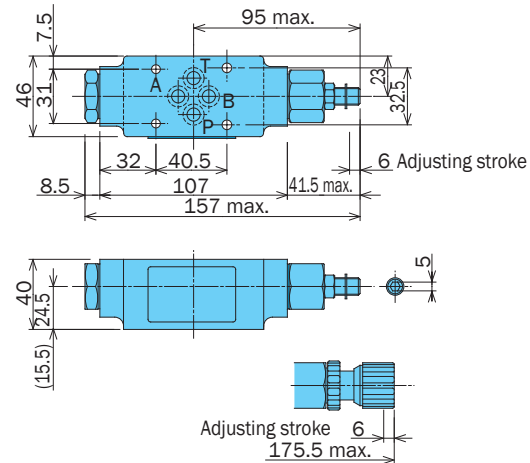
OCY-G01-W-X-Y-20



Note: Dimensions in the parentheses are for the OCY-G01-W-X-20.

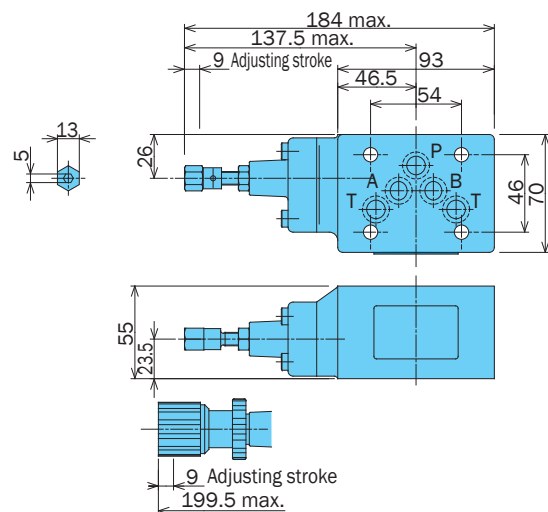
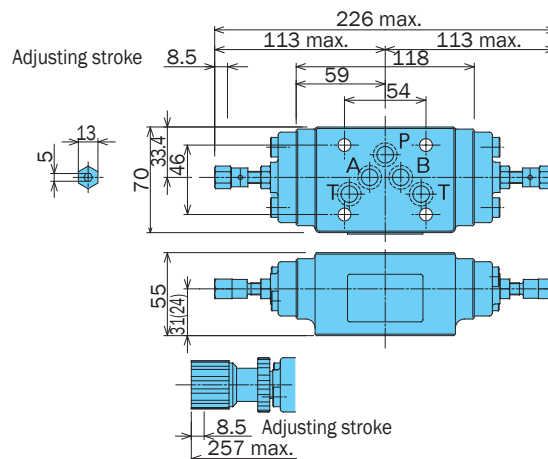
OCY-G01-A-
X
Y-20

Note:
Dimensions in the parentheses are for the OCY-G01-A-X-20.

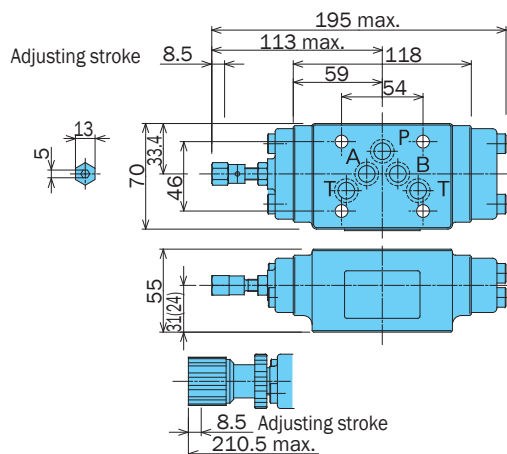
OCY-G01-B-
X
Y-20

Note:
Dimensions in the parentheses are for the OCY-G01-B-X-20.

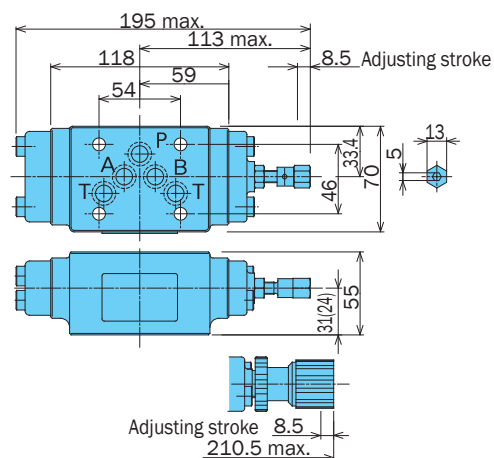
OCY-G03-P-J50

OCY-G03-W-
X
Y-J51

Note:
Dimensions in the parentheses are for the OCY-G03-W-X-J51.

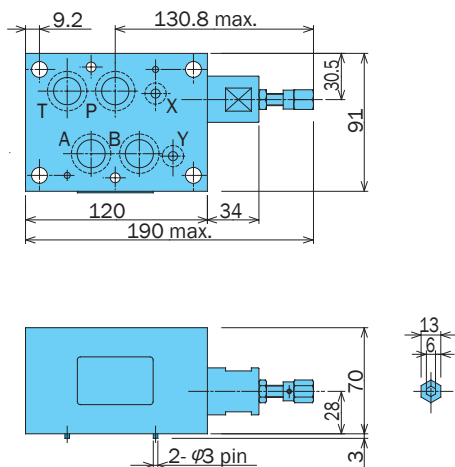
OCY-G03-A-
X
Y-J51

Note:
Dimensions in the parentheses are for the OCY-G03-A-X-J51.

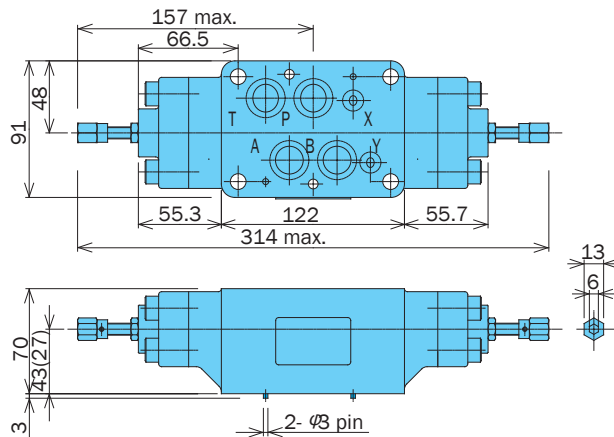
OCY-G03-B-
X
Y-J51

Note:
Dimensions in the parentheses are for the OCY-G03-B-X-J51.

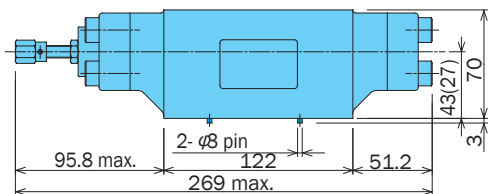
OYH-G04-P-10



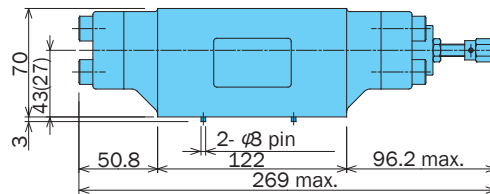
OYH-G04-W-
X-10
Y



OYH-G04-A-
X-10
Y



OYH-G04-B-
X-10
Y



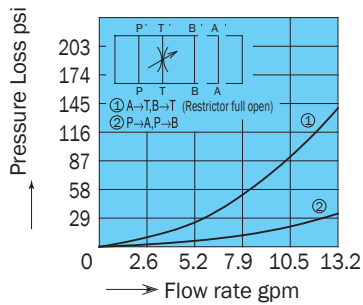
Note: Dimensions in the parentheses are for the OYH-G04-*X-10.

Performance Curves

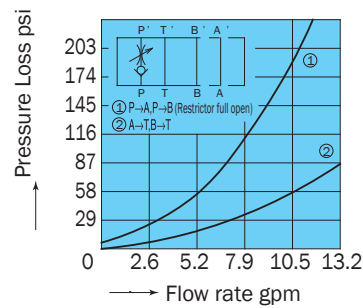
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

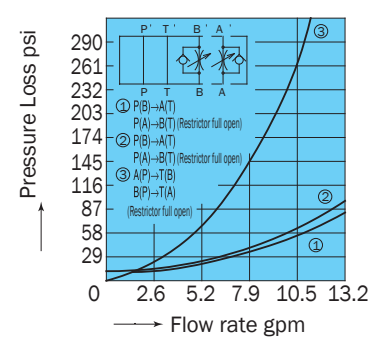
OY-G01-T-20



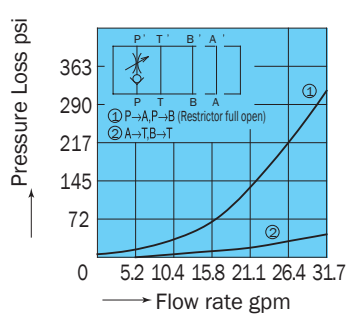
OCY-G01-P-20



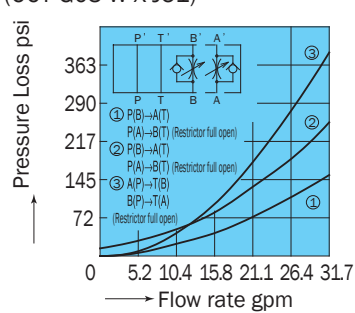
OCY-G01-W-Y-20
(OCY-G01-W-X-20)



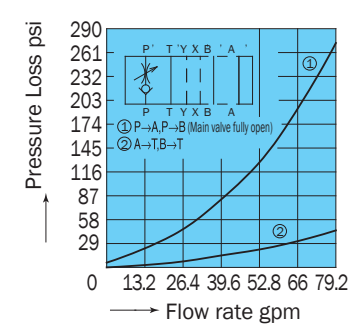
OCY-G03-P-J50



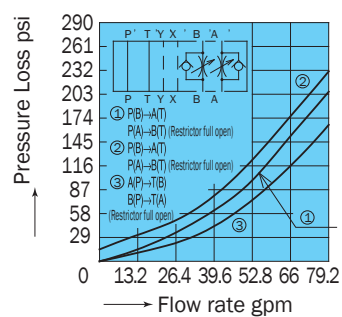
OCY-G03-W-Y-J51
(OCY-G03-W-X-J51)



OYH-G04-P-10

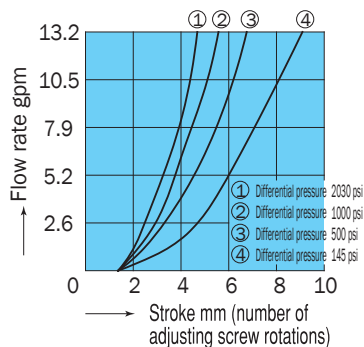


OYH-G04-W-Y-10
(OYH-G04-W-X-10)

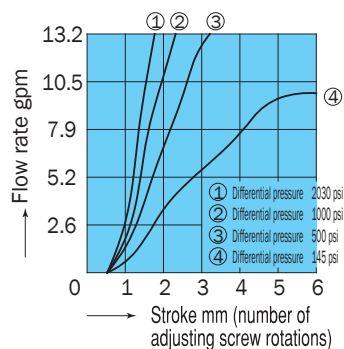


Stroke -- Flow Rate Characteristics

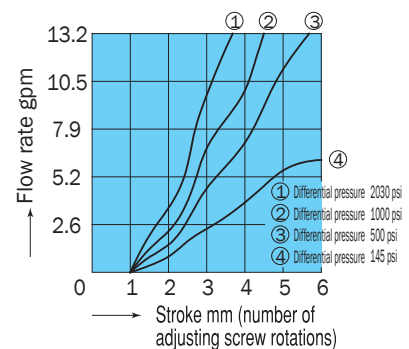
OY-G01-T-20



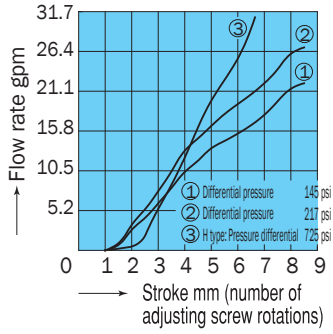
OCY-G01-P-20



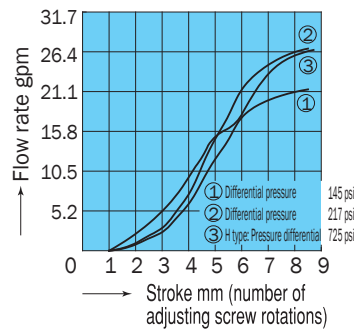
OCY-G01-*-20



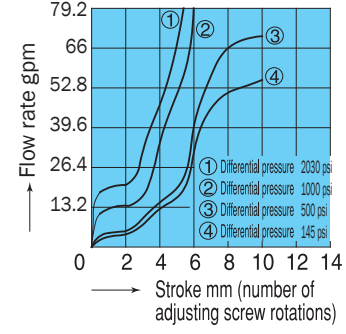
OCY-G03-P-(H)-J50



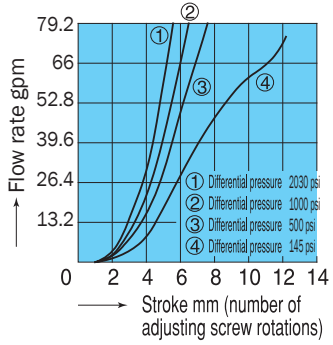
OCY-G03-W-(H)Y-J51



OYH-G04-P-10

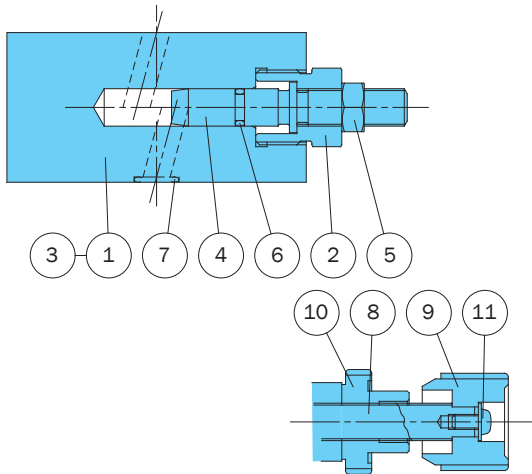


OYH-G04-W-Y-10



Cross-sectional Drawing

OY-G01-T-20



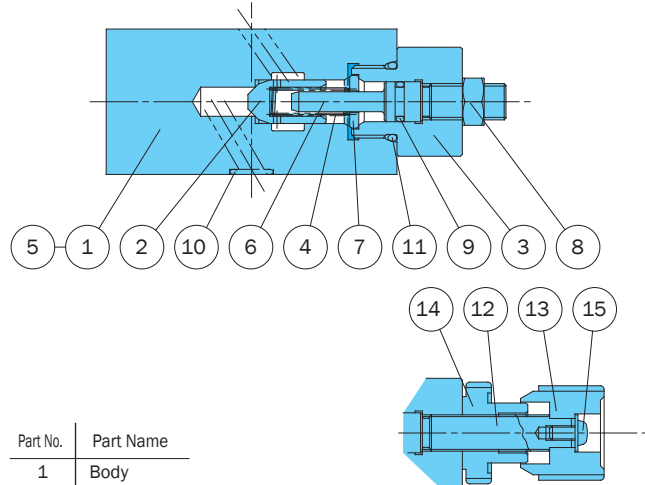
Part No.	Part Name
1	Body
2	Retainer
3	Plate
4	Screw
5	Nut
6	O-ring
7	O-ring
8	Screw
9	Knob
10	Nut
11	Screw

Seal Part List (Kit Model Number BFBS-01YT)

Part No.	Part Name	Part Number	Q'ty
6	O-ring	1B-P7	1
7	O-ring	1B-P9	4

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

OCY-G01-P-20

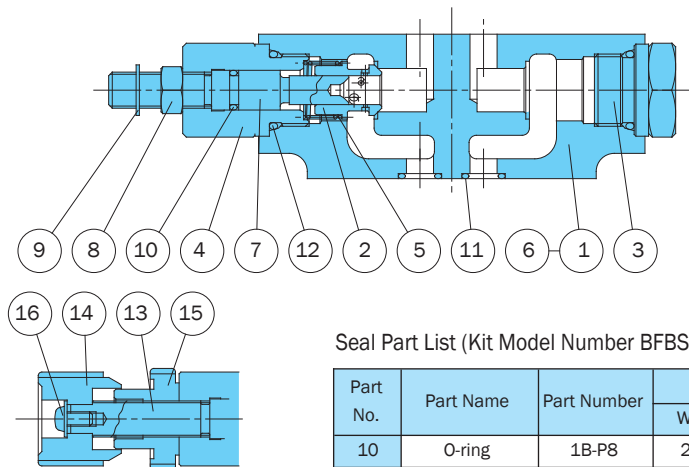


Part No.	Part Name
1	Body
2	Throttle
3	Retainer
4	Spring
5	Plate
6	Screw
7	Ring
8	Nut
9	O-ring
10	O-ring
11	O-ring
12	Screw
13	Knob
14	Nut
15	Screw

Seal Part List (Kit Model Number BFBS-01CYP)

Part No.	Part Name	Part Number	Q'ty
9	O-ring	1B-P8	1
10	O-ring	1B-P9	4
11	O-ring	1B-P18	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



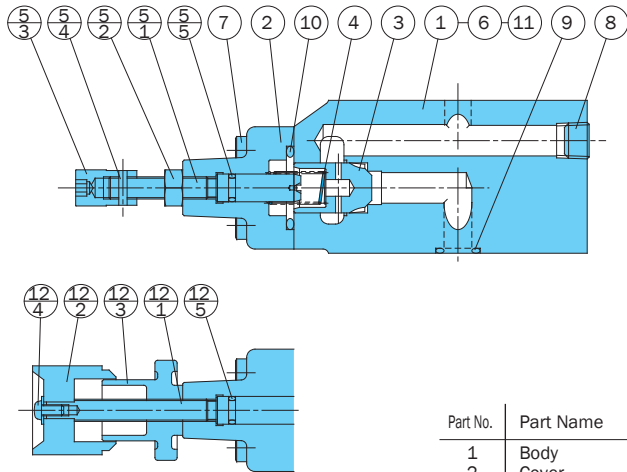
Seal Part List (Kit Model Number BFBS-01CY*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
10	O-ring	1B-P8	2	1	1
11	O-ring	1B-P9	4	4	4
12	O-ring	1B-P18	2	2	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Throttle
3	Bushing
4	Retainer
5	Spring
6	Plate
7	Screw
8	Nut
9	E-ring
10	O-ring
11	O-ring
12	O-ring
13	Screw
14	Knob
15	Nut
16	Screw

OCY-G03-P-J50



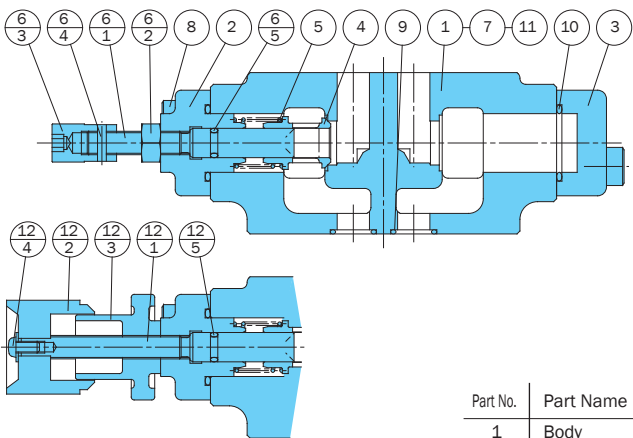
Seal Part List (Kit Model Number BFES-03CYP)

Part No.	Part Name	Part Number	Q'ty
			P
5(12)-s	O-ring	1B-P7	1
9	O-ring	AS568-014(Hs90)	5
10	O-ring	1B-P24	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name
1	Body
2	Cover
3	Throttle
4	Spring
5	Screw kit
5 ₁	Screw
5 ₂	Nut
5 ₃	Nut
5 ₄	Pin
5 ₅	O-ring
6	Plate
7	Screw
8	Plug
9	O-ring
10	O-ring
11	Pin
12	Handle kit
12 ₁	Screw
12 ₂	Knob
12 ₃	Nut
12 ₄	Screw
12 ₅	O-ring

OCY-G03-A-Y-J51



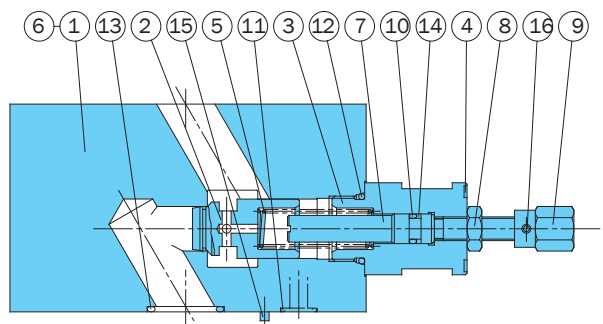
Seal Part List (Kit Model Number BFES-03CY*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
6(12)-s	O-ring	1B-P7	2	1	1
9	O-ring	AS568-014(Hs90)	5	5	5
10	O-ring	1B-P22	2	2	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Throttle
5	Spring
6	Screw kit
6 ₁	Screw
6 ₂	Nut
6 ₃	Nut
6 ₄	Pin
6 ₅	O-ring
7	Plate
8	Screw
9	O-ring
10	O-ring
11	Pin
12	Handle kit
12 ₁	Screw
12 ₂	Knob
12 ₃	Nut
12 ₄	Screw
12 ₅	O-ring

OYH-G04-P-10



Seal Part List

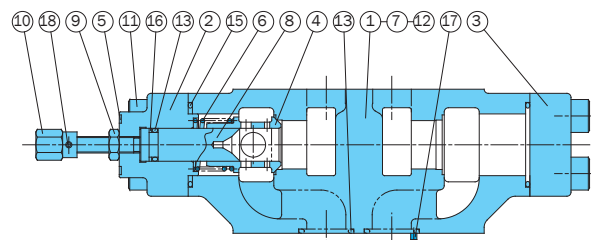
(Kit Model Number BFKS-04CYP)

Part No.	Part Name	Part Number	Q'ty
			P
10	O-ring	1B-P7	1
11	O-ring	AS568-012(Hs90)	2
12	O-ring	1B-P20	1
13	O-ring	AS568-118(Hs90)	4
14	Backup ring	T2-P7	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS B 2407-T2-**.

Part No.	Part Name
1	Body
2	Throttle
3	Retainer
4	Plate
5	Spring
6	Plate
7	Screw
8	Nut
9	Nut
10	O-ring
11	O-ring
12	O-ring
13	O-ring
14	Backup ring
15	Pin
16	Pin

OYH-G04-A-Y-10



Seal Part List

(Kit Model Number BFKS-04CY*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
12	O-ring	AS568-012 (Hs90)	2	2	2
13	O-ring	1A-P12	2	1	1
14	O-ring	AS568-118 (Hs90)	4	4	4
15	O-ring	AS568-127 (Hs90)	2	2	2
16	Backup ring	T2-P12	2	1	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS B 2407-T2-**.
3. Specify W, A, or B for the asterisk (*) in the kit model number.

Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Throttle
5	Plate
6	Spring
7	Plate
8	Screw
9	Nut
10	Nut
11	Screw
12	O-ring
13	O-ring
14	O-ring
15	O-ring
16	Backup ring
17	Pin
18	Pin



Flow Control Modular Valve (Pressure and temperature compensated)

5.2 to 52.8 gpm
3045, 3625, 5075 psi

Features

This modular valve is used to control actuator speed and for other flow control valve applications.

A wide range of models are available for A and B port control, A or B port control, and

P port control.

A pressure compensation mechanism ensures that the control flow rate does not change, even when there is pressure fluctuation.

The control flow rate remains stable, even when fluid temperature changes. Maximum Operating Pressure: 3045, 3625, 5075 psi

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Control Flow Rate gpm	Check Valve Cracking pressure psi	Weight lbs	Gasket Surface Dimensions
OF-G01-P20-20	1/8	3045	.02 to 5.2(differential pressure: 1000 psi) .07 to 5.2(differential pressure: 3045 psi)	--	2.6	ISO 4401-03-02-0-94
OCF-G01-W40-X-30 A40 B40		3625	.02 to 10.5(differential pressure: 1000 psi) .13 to 10.5(differential pressure: 3625 psi)	.02	3.7	
OCF-G01-W40-Y-30 A40 B40				11.6	3.7	
					3.3	
OF-G03-P60-J50	3/8	3625	.07 to 15.8(differential pressure: 1000 psi) .13 to 15.8(differential pressure: 3625 psi)	--	6.8	ISO 4401-05-04-0-94
OCF-G03-W60-X-J50 A60 B60				14.5	11	
OCF-G03-W60-Y-J50 A60 B60					14.5	
				11		
OFH-G04-W200-X-10 A200 B200	1/2	5075	2.6 to 52.8(differential pressure: 3045 psi) 3.9 to 52.8(differential pressure: 3625 psi) 5.2 to 52.8(differential pressure: 5075 psi)	14.5	24.4	ISO 4401-07-06-0-94
OFH-G04-W200-Y-10 A200 B200					14.5	
				24.4		
					22.4	

• Handling

- For flow rate control, make sure that the pressure differential between the input port and output port is at least 145 psi. See the Flow Rate - Minimum Differential Pressure Characteristics for information about the OCF-G01 and OFF-G04 maximum control flow rate.
- The control flow rate is increased by

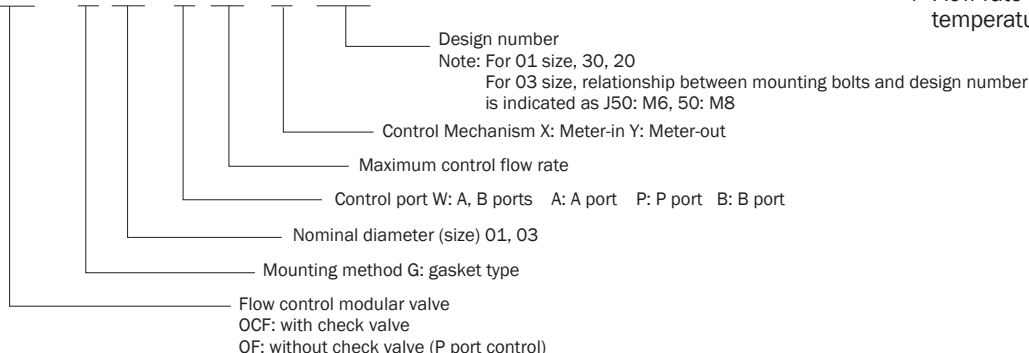
counter clockwise (leftward) rotation of the flow rate control knob.
3 Pressure rate control knob rotation resistance will increase as the pressure increases. However, do not use a spanner or other tool that fits around the knob to turn it. Instead, insert a 5mm hex spanner into the hex hole in the

- center of the knob and rotate it that way.
- After adjusting the flow rate, fix it in place by turning the lock screw on the end of the knob to the right.
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.
- 04 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).
- Flow rate fluctuation is $\pm 5\%$ within the temperature range of 68°F to 140°F.

Understanding Model Numbers

01, 03 size

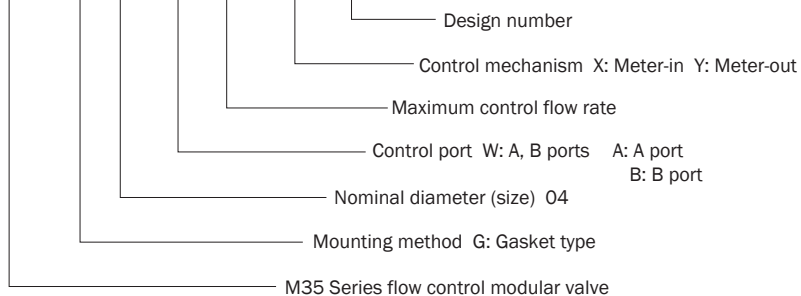
OCF - G 03 - W 60 - Y - J50



Understanding Model Numbers

04 size

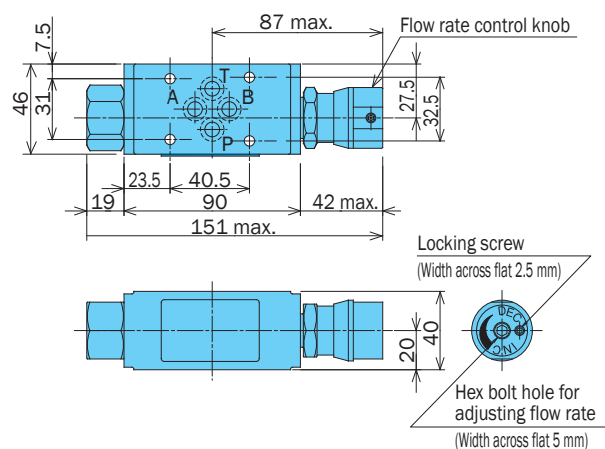
OFH - G 04 - W 200 - Y - 10



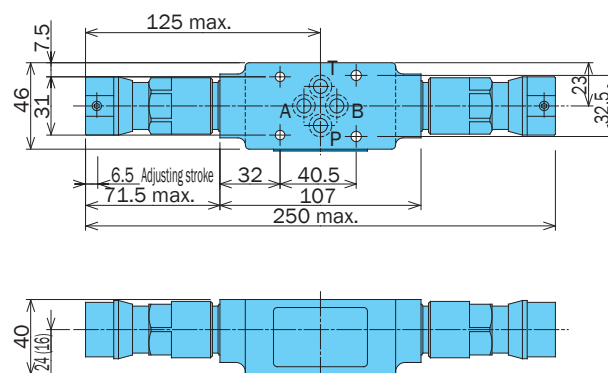
Installation Dimension Drawings

Note: The control flow rate is increased by counter clockwise (leftward) rotation of the flow rate control knob.

OF-G01-P20-20

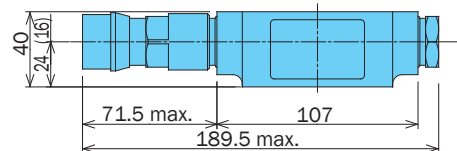


OCF-G01-W40-X/Y-30



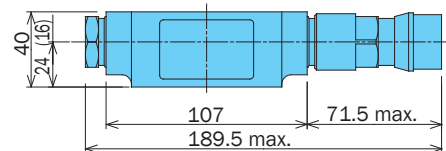
Note:
Dimensions in the parentheses are for the OCF-G01-W40-X-30.

OCF-G01-A40-X/Y-30



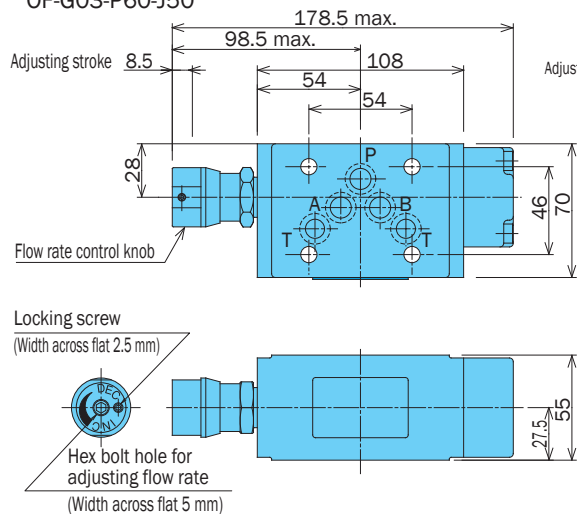
Note:
Dimensions in the parentheses are for the OCF-G01-A40-X-30.

OCF-G01-B40-X/Y-30

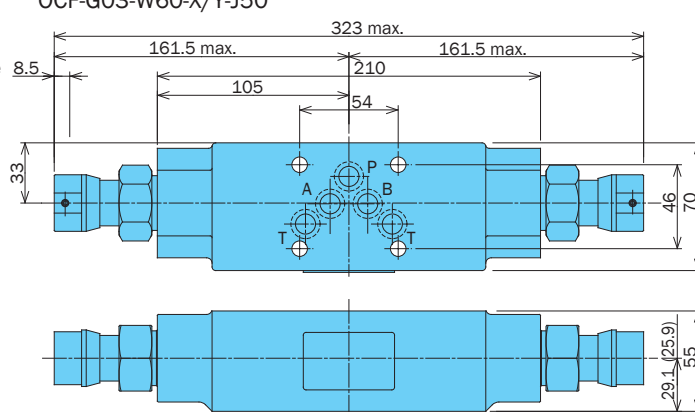


Note:
Dimensions in the parentheses are for the OCF-G01-B40-X-30.

OF-G03-P60-J50

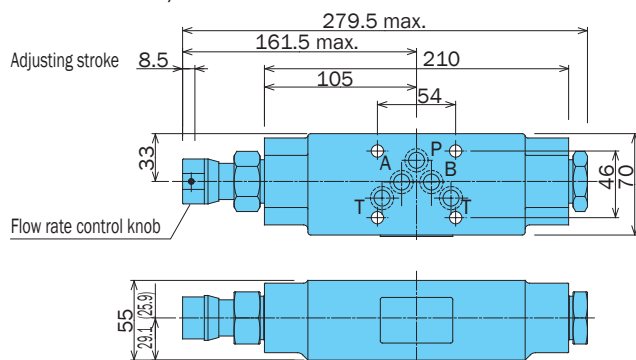


OCF-G03-W60-X/Y-J50



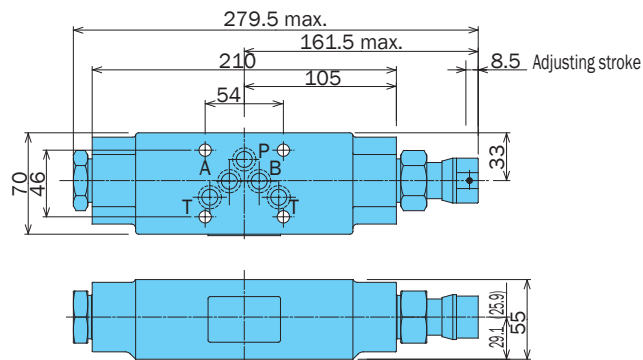
Note:
Dimensions in the parentheses are for the OCF-G03-W60-X-J50.

OCF-G03-A60-X/Y-J50



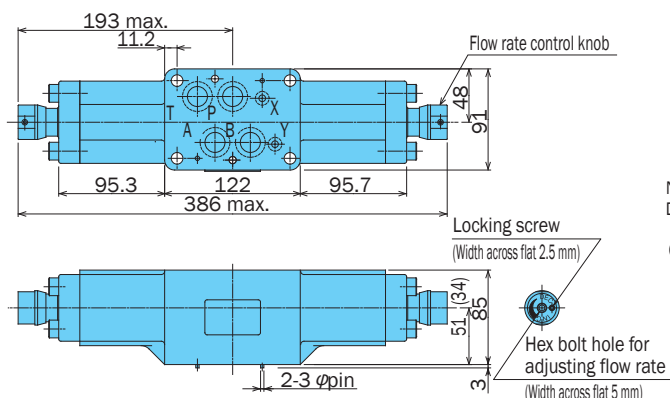
Note:
Dimensions in the parentheses are for the OCF-G03-A60-X-J50.

OCF-G03-B60-X/Y-J50



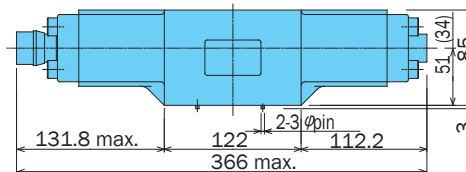
Note:
Dimensions in the parentheses are for the OCF-G03-B60-X-J50.

OFH-G04-W200-X/Y-10



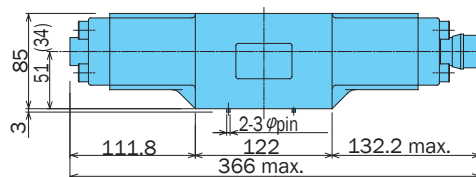
Note:
Dimensions in the parentheses are for the OFH-G04-W200-X-10.

OFH-G04-A200-X/Y-10



Note:
Dimensions in the parentheses are for the OCF-G04-A200-X-10

OFH-G04-B200-X/Y-10



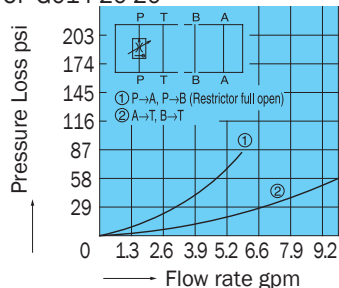
Note:
Dimensions in the parentheses are for the OFH-G04-B200-X-10.

Performance Curves

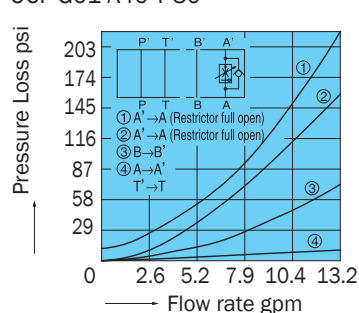
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

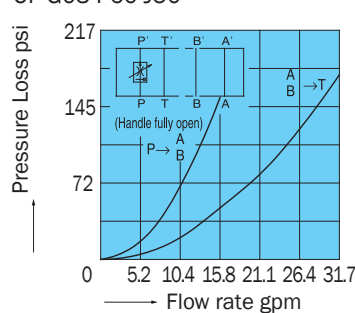
OF-G01-P20-20



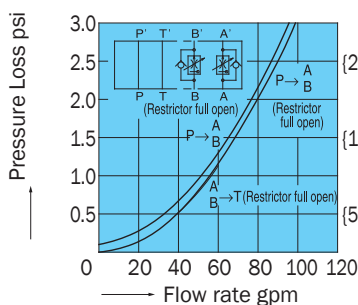
OCF-G01-A40-Y-30



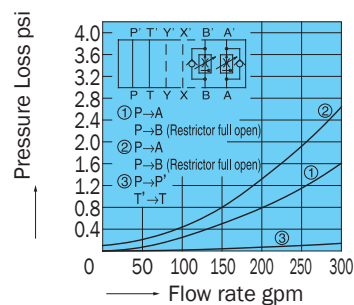
OF-G03-P60-J50



OCF-G03-W60-Y-J50

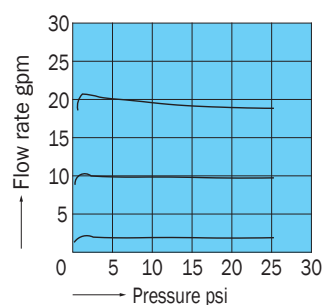


OFH-G04-W200-Y-10

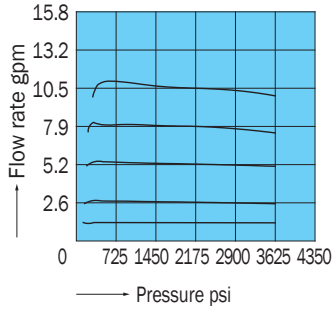


Pressure - Control Flow Rate Characteristics

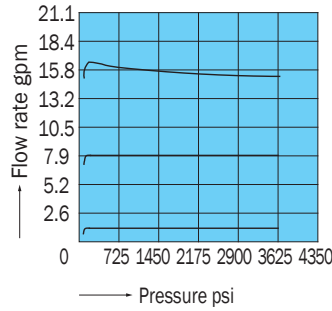
OF-G01-P20-20



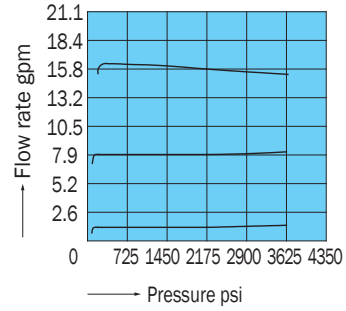
OCF-G01-*40-*-30



OF-G03-P60-J50

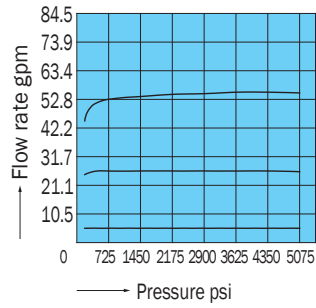


OCF-G03-W60-*-J50

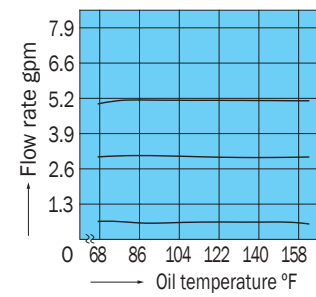


Fluid Temperature - Control Flow Rate Characteristics

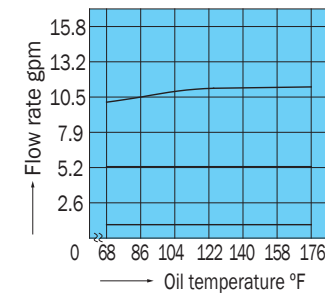
OFH-G04-W200-*-10



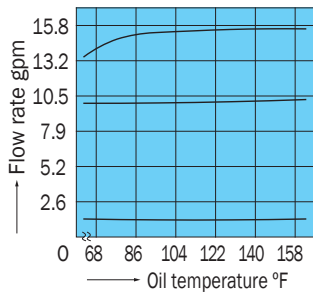
OF-G01-P20-20



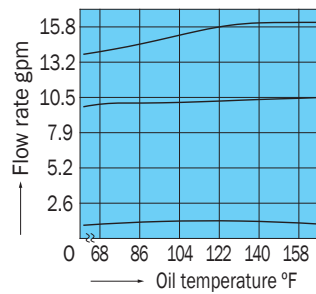
OCF-G01-*40-*-30



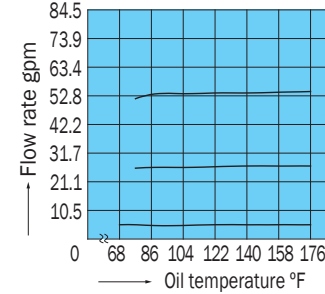
OF-G03-P60-J50



OCF-G03-W60-*-J50

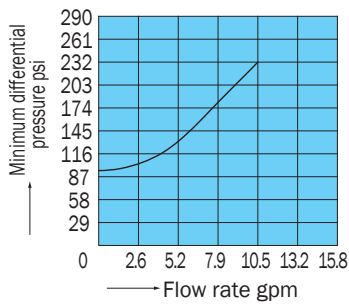


OFH-G04-W200-*-10

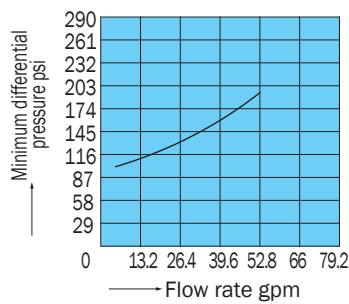


Flow Rate - Minimum Differential Pressure Characteristics

OCF-G01-*40-*-30

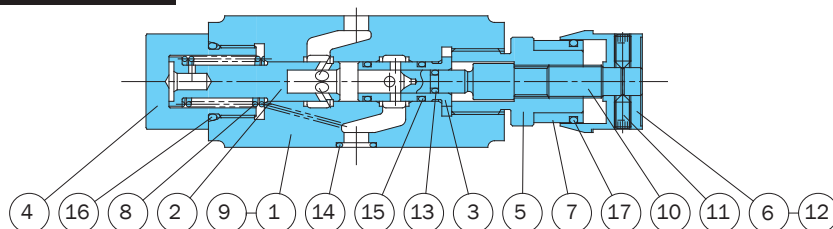


OFH-G04-W200-Y-10



Cross-sectional Drawing

OF-G01-P20-20

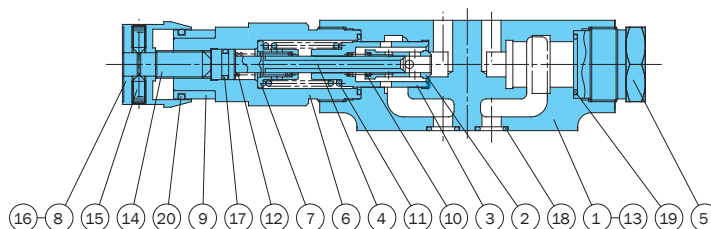


Seal Part List (Kit Model Number BFBS-01FP)

Part No.	Part Name	Part Number	Q'ty
			P
13	O-ring	1B-P4	1
14	O-ring	1B-P9	4
15	O-ring	1B-P9	2
16	O-ring	1B-P20	1
17	O-ring	1A-P21	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

OCF-G01-A40-Y-30



Seal Part List (Kit Model Number BFCS-01CF*)

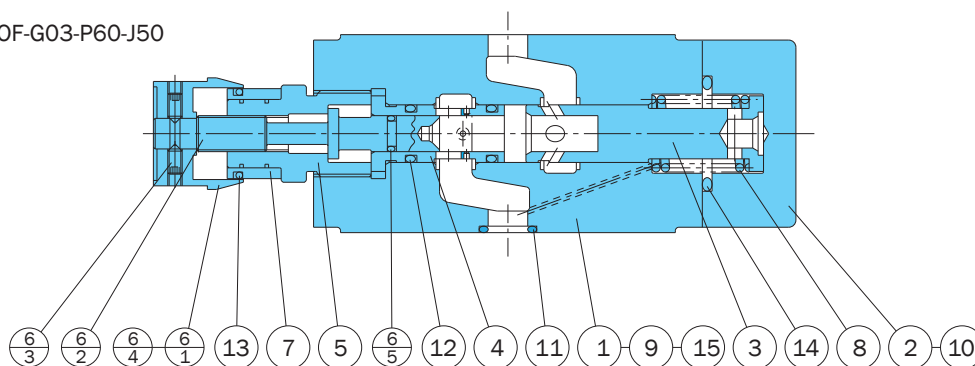
Part No.	Part Name	Part Number	Q'ty		
			W	A	B
17	O-ring	1A-P8	2	1	1
18	O-ring	1B-P9	4	4	4
19	O-ring	AS568-018(Hs90)	2	2	2
20	O-ring	1A-P21	1	1	1

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.

2. Specify W, A, or B for the asterisk (*) in the kit model number.

OF-G03-P60-J50



Seal Part List (Kit Model Number BFES-03FP)

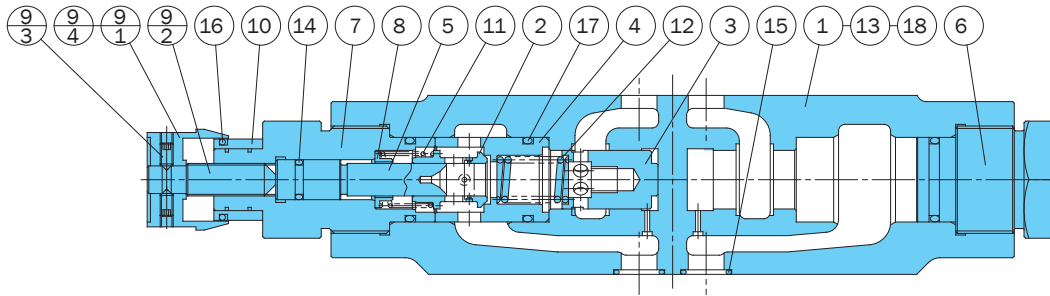
Part No.	Part Name	Part Number	Q'ty
			PC
6-s	O-ring	1A-P7	1
11	O-ring	AS568-014(Hs90)	5
12	O-ring	1B-P12	2
13	O-ring	1A-P21	1
14	O-ring	1B-P26	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Part No.	Part Name
1	Body
2	Piston
3	Sleeve
4	Bushing
5	Retainer
6	Knob
7	Dial
8	Spring
9	Plate
10	Screw
11	Screw
12	Screw
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	O-ring

Part No.	Part Name
1	Body
2	Throttle
3	Piston
4	Rod
5	Bushing
6	Retainer
7	Guide
8	Knob
9	Dial
10	Spring
11	Spring
12	Spring
13	Plate
14	Screw
15	Screw
16	Screw
17	O-ring
18	O-ring
19	O-ring
20	O-ring

Part No.	Part Name
1	Body
2	Cover
3	Piston
4	Sleeve
5	Retainer
6	Screw kit
6-1	Knob
6-2	Screw
6-3	Screw
6-4	Screw
6-5	O-ring
7	Dial
8	Spring
9	Plate
10	Screw
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Pin



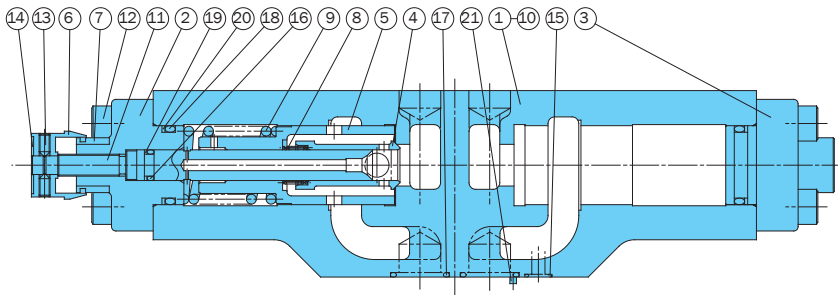
Part No.	Part Name
1	Body
2	Throttle
3	Piston
4	Sleeve
5	Rod
6	Bushing
7	Retainer
8	Guide
9	Screw kit
9 ₁	Knob
9 ₂	Screw
9 ₃	Screw
9 ₄	Screw
10	Dial
11	Spring
12	Spring
13	Plate
14	O-ring
15	O-ring
16	O-ring
17	O-ring
18	Pin

Seal Part List (Kit Model Number BFES-03CF*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
14	O-ring	1A-P10	2	1	1
15	O-ring	AS568-014(Hs90)	5	5	5
16	O-ring	1A-P21	2	1	1
17	O-ring	1B-P22	4	3	3

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify W, A, or B for the asterisk (*) in the kit model number.



Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Throttle
5	Piston
6	Knob
7	Dial
8	Spring
9	Spring
10	Plate
11	Screw
12	Screw
13	Screw
14	Screw
15	O-ring
16	O-ring
17	O-ring
18	O-ring
19	Backup ring
20	Backup ring
21	Pin

Seal Part List (Kit Model Number BFKS-04CF*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
15	O-ring	AS568-012(Hs90)	2	2	2
16	O-ring	1B-P10A	2	1	1
17	O-ring	AS568-118(Hs90)	4	4	4
18	O-ring	1B-P30	2	2	2
19	Backup ring	T2-P10A	2	1	1
20	Backup ring	T2-P30	2	2	2

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Backup ring indicates JIS B 2407-T2-**.
3. Specify W, A, or B for the asterisk (*) in the kit model number.



Check Modular Valve

13.2 to 79.2 gpm
3625, 5075 psi

Features

This modular valve is a check valve that prevents reverse-flow.

The 01, 03, 04 sizes include types that can also be used as suction and differential circuits.

Maximum Operating Pressure: 3625, 5075 psi

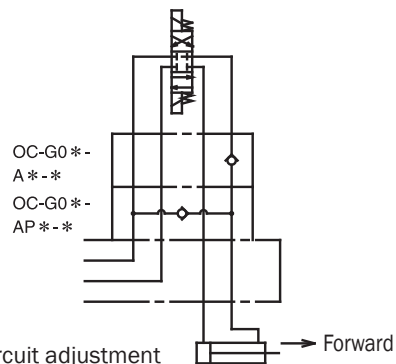
Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Cracking pressure psi	Weight lbs	Gasket Surface Dimensions
OC-G01-P1-20 P2 P3	1/8	3625	13.2	5.8 50.7 72.5	2.2	ISO 4401-03-02-0-94
OC-G01-T1-20 T2 T3				5.8 50.7 72.5	2.2	
OC-G01-A1-21 A2 A3				5.8 50.7 72.5	2.6	
OC-G01-AP1-20 AP2 AP3				5.8 50.7 72.5	2.2	
OCV-G01-W-20				2.1	2.2	
OC-G03-P1-J50 P2 P3	3/8	3625	26.4	5.8 50.7 72.5	5.9	ISO 4401-05-04-0-94
OC-G03-T1-J50 T2 T3				5.8 50.7 72.5	5.9	
OC-G03-A1-J50 A2 A3				5.8 50.7 72.5	5.9	
OC-G03-AP1-J50 AP2 AP3				5.8 50.7 72.5	5.9	
OCV-G03-W-J50				2.1	7.7	
OCH-G04-P1-10 P2 P3	1/2	5075	79.2	5.8 50.7 72.5	9.9	ISO 4401-07-06-0-94
OCH-G04-T1-10 T2 T3				5.8 50.7 72.5	14.3	
OCH-G04-A1-10 A2 A3				5.8 50.7 72.5	9.9	
OCH-G04-AP1-10 AP2 AP3				5.8 50.7 72.5	9.9	
OVH-G04-W-10				1.4	14.3	

• Handling

- Differential circuit can be easily configured at P → B by attaching OC-G**-A* above the OC-G**-AP* on the subplate. (See the figure to the right.)
- Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

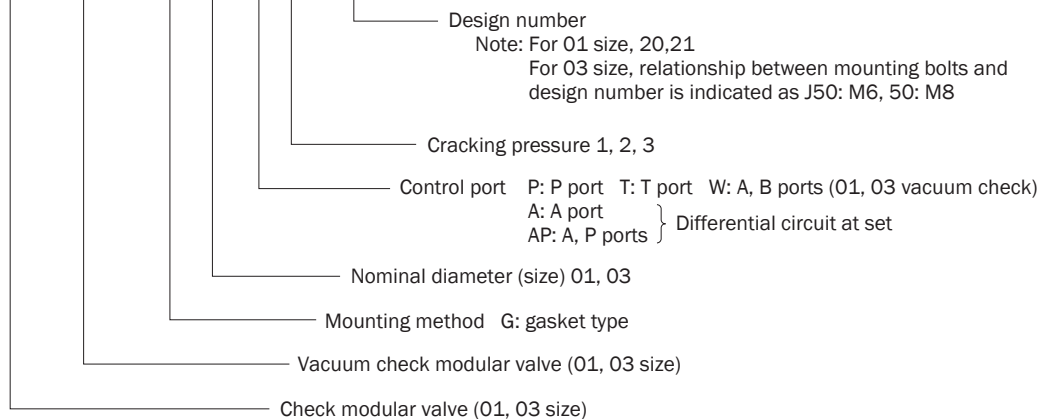
3 04 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).



Understanding Model Numbers

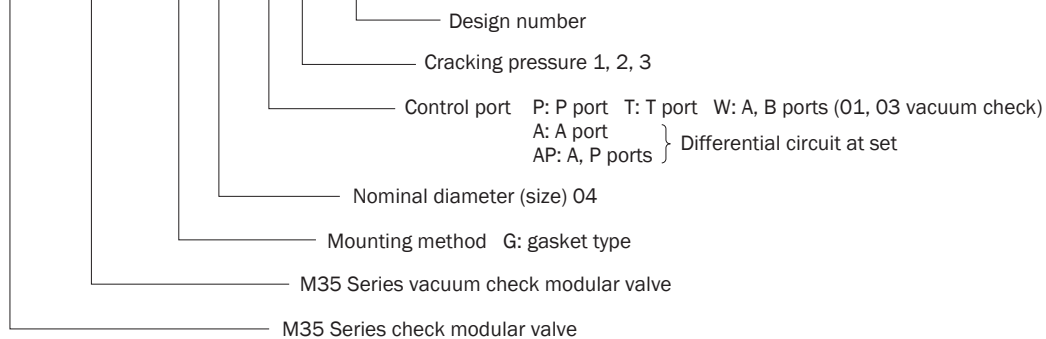
01, 03 size

OC (OCV) - G 03 - P 1 - J50



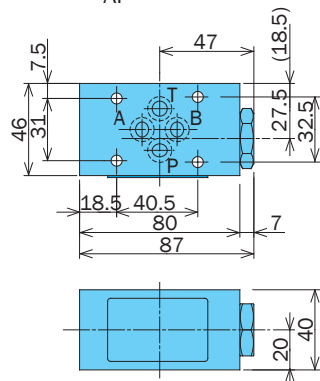
04 size

OCH (OVH) - G 04 - P 1 - 10

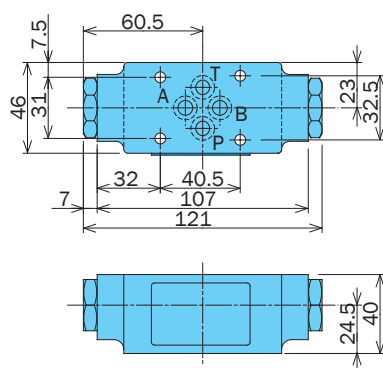


Installation Dimension Drawing

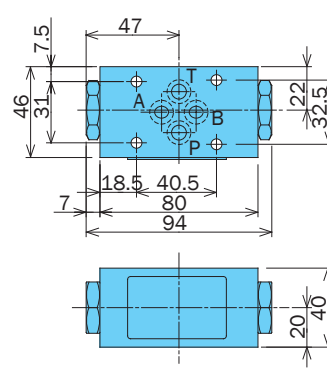
OC-G01-T*-20
P
AP



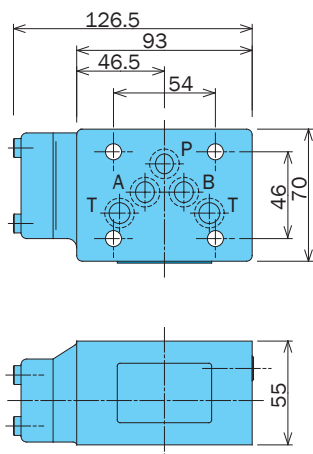
OC-G01-A*-21



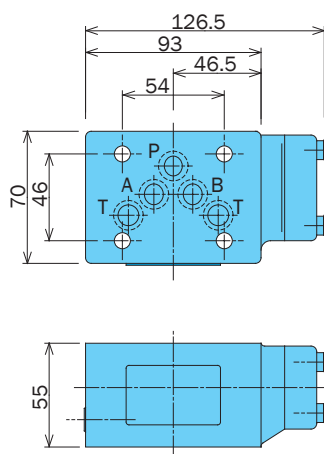
OCV-G01-W-20



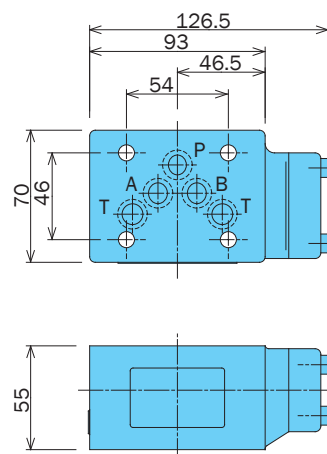
OC-G03-
P
AP *-J50



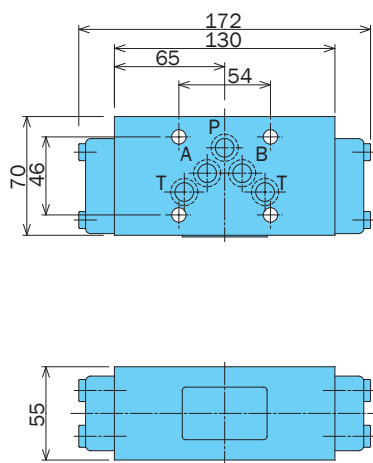
OC-G03-A*-J50



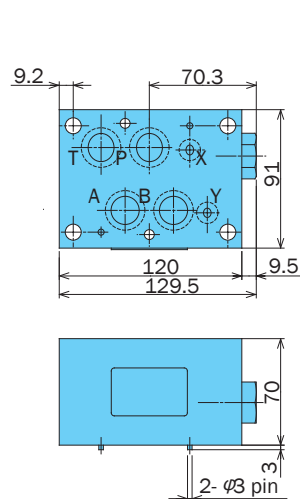
OC-G03-T*-J50



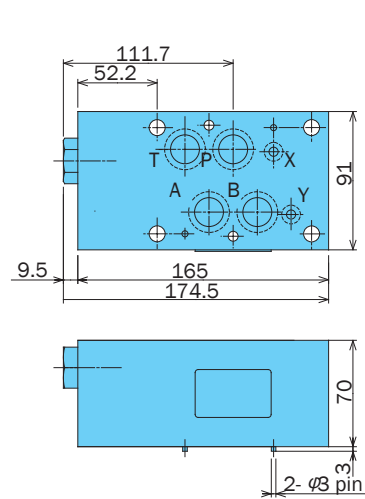
OCV-G03-W-J50



OCH-G04-A*-10
P
AP

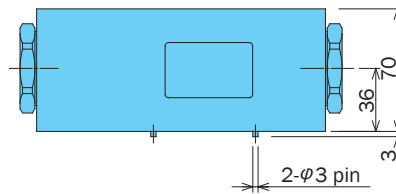
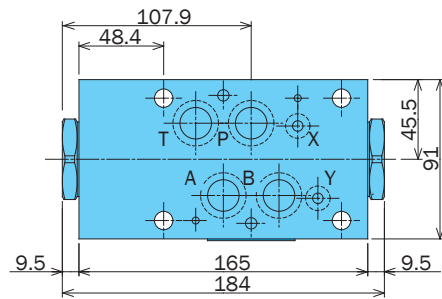


OCH-G04-T*-10



Note: Dimensions in the parentheses are for the OC-G01-T*-20.

OVH-G04-W-10

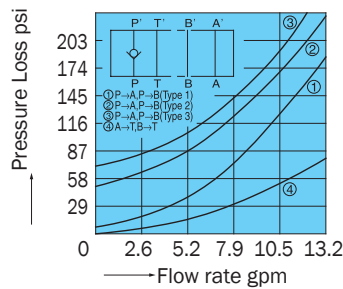


Performance Curves

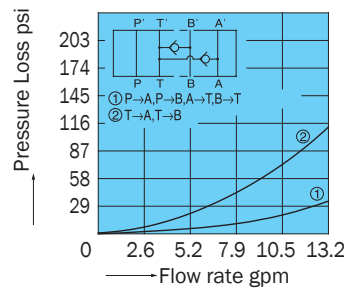
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

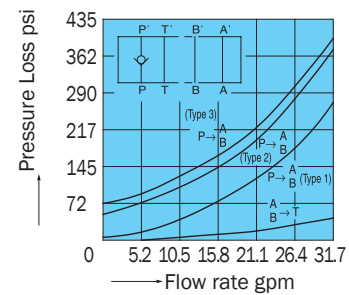
OC-G01-P*-20



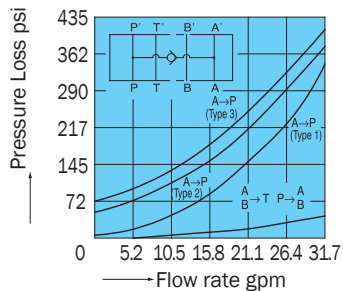
OCV-G01-W-20



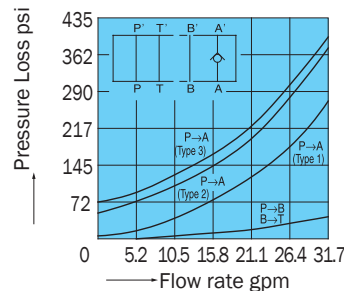
OC-G03-P*-J50



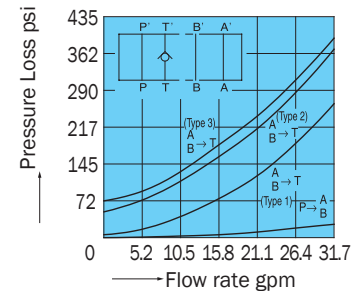
OC-G03-AP*-J50



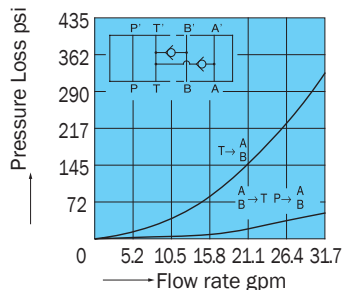
OC-G03-A*-J50



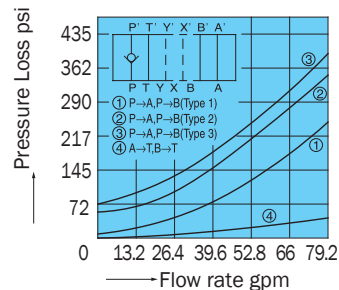
OC-G03-T*-J50



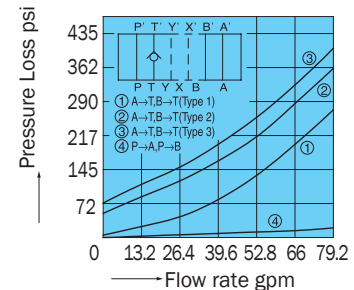
OCV-G03-W-J50



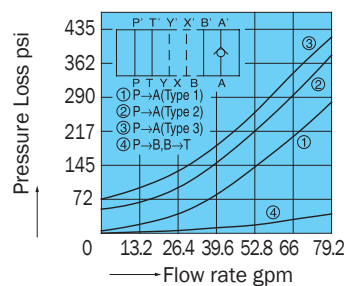
OCH-G04-P*-10



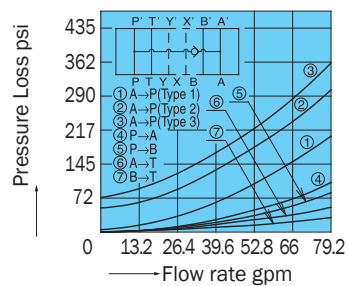
OCH-G04-T*-10



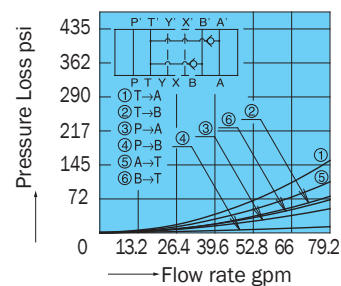
OCH-G04-A*-10



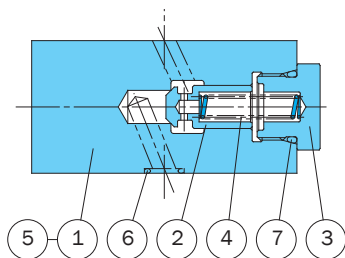
OCH-G04-AP*-10



OVH-G04-W-10

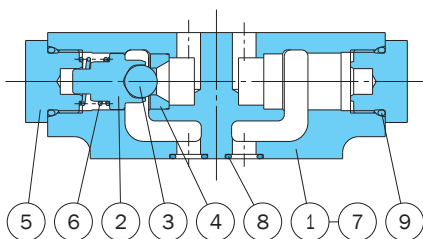


Cross-sectional Drawing

OC-G01-T*-20
AP

Part No.	Part Name
1	Body
2	Poppet
3	Spring seat
4	Spring
5	Plate
6	O-ring
7	O-ring

OC-G01-A*-21



Part No.	Part Name
1	Body
2	Poppet
3	Ball
4	Seat
5	Spring seat
6	Spring
7	Plate
8	O-ring
9	O-ring

Seal Part List (Kit Model Number BRBS-01C*)

Part No.	Part Name	Part Number	Q'ty		
			P	T	AP
6	O-ring	1B-P9	4	4	4
7	O-ring	1B-P18	1	1	1

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify P, T, or AP for the asterisk (*) in the kit model number.

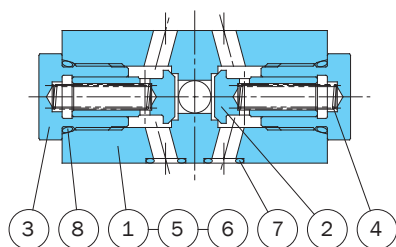
Seal Part List (Kit Model Number BDBS-01CA)

Part No.	Part Name	Part Number	Q'ty
			A
8	O-ring	1B-P9	4
9	O-ring	1B-P18	2

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.

OCV-G01-W-20



Part No.	Part Name
1	Body
2	Poppet
3	Guide
4	Spring
5	Plate
6	Plug
7	O-ring
8	O-ring

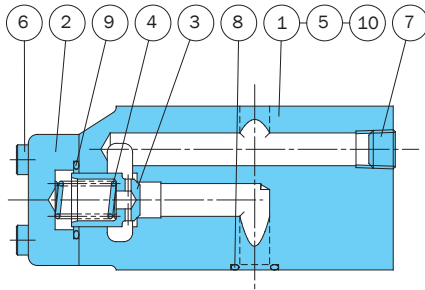
Seal Part List (Kit Model Number BDBS-01CVW)

Part No.	Part Name	Part Number	Q'ty
			W
7	O-ring	1B-P9	4
8	O-ring	1B-P18	2

Note:

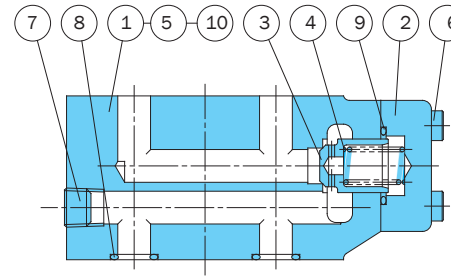
1. O-ring 1A/B-** refers to JIS B2401-1A/B.

OC-G03-P*-J50



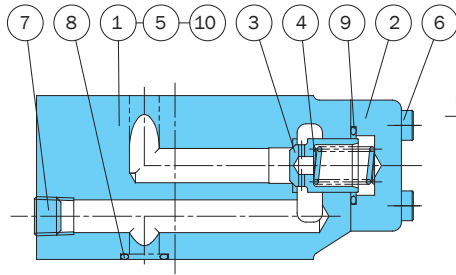
Part No.	Part Name
1	Body
2	Cover
3	Poppet
4	Spring
5	Plate
6	Screw
7	Plug
8	O-ring
9	O-ring
10	Pin

OC-G03-T*-J50



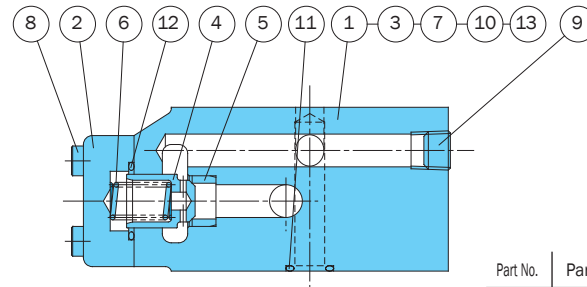
Part No.	Part Name
1	Body
2	Cover
3	Poppet
4	Spring
5	Plate
6	Screw
7	Plug
8	O-ring
9	O-ring
10	Pin

OC-G03-A*-J50



Part No.	Part Name
1	Body
2	Cover
3	Poppet
4	Spring
5	Plate
6	Screw
7	Plug
8	O-ring
9	O-ring
10	Pin

OC-G03-AP*-J50



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

Seal Part List (Kit Model Number BDES-03C*)

Part No.	Part Name	Part Number	Q'ty		
			P	T	A
8	O-ring	AS568-014(Hs90)	5	5	5
9	O-ring	1B-P22	1	1	1

Note:

1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify P, T, or A for the asterisk (*) in the kit model number.

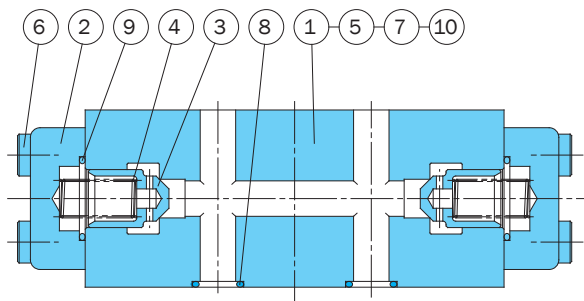
Seal Part List (Kit Model Number BDES-03CAP)

Part No.	Part Name	Part Number	Q'ty
			AP
10	O-ring	1B-P11	1
11	O-ring	AS568-014(Hs90)	5
12	O-ring	1B-P22	1

Note:

O-ring 1A/B-** refers to JIS B2401-1A/B.

OCV-G03-W-J50

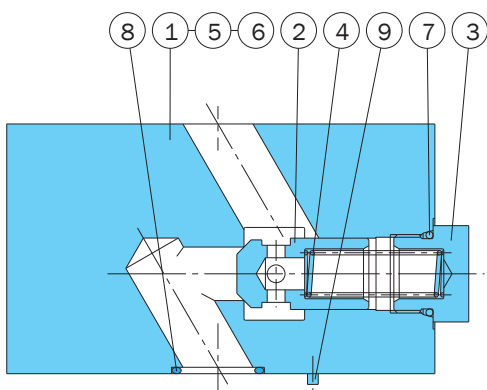


Seal Part List (Kit Model Number BDES-03CVW)

Part No.	Part Name	Part Number	Q'ty
			W
7	O-ring	1B-P10A	2
8	O-ring	AS568-014(Hs90)	5
9	O-ring	1B-P22	2

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	5	Plate	9	O-ring
2	Cover	6	Screw	10	Pin
3	Poppet	7	O-ring		
4	Spring	8	O-ring		

OCH-G04-P*-10



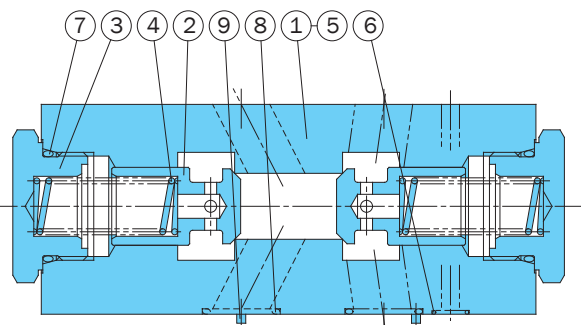
Part No.	Part Name
1	Body
2	Poppet
3	Spring seat
4	Spring Plate
5	O-ring
6	O-ring
7	O-ring
8	O-ring
9	Pin

Seal Part List (Kit Model Number BDKS-04C*)

Part No.	Part Name	Body	Q'ty			
			P	T	A	AP
6	O-ring	AS568-012(Hs90)	2	2	2	2
7	O-ring	1B-P20	1	1	1	1
8	O-ring	AS568-118(Hs90)	4	4	4	4

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify P, T, A, or AP for the asterisk (*) in the kit model number.

OVH-G04-W-10



Part No.	Part Name
1	Body
2	Poppet
3	Spring seat
4	Spring Plate
5	O-ring
6	O-ring
7	O-ring
8	O-ring
9	Pin

Seal Part List (Kit Model Number BDKS-04CVW)

Part No.	Part Name	Part Number	Q'ty
6	O-ring	AS568-012(Hs90)	2
7	O-ring	1B-P32	2
8	O-ring	AS568-118(Hs90)	4

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



Pilot Operated Check Modular Valve

13.2 to 79.2 gpm
3625 to 5075 psi

Features

This modular valve is used to prevent actuator self-running and to maintain actuator position.

Maximum Operating Pressure: 3625, 5075 psi

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Cracking pressure psi	Area Ratio			Weight lbs	Gasket Surface Dimensions
					Pilot Piston	Check Valve Seat	Needle Valve Seat		
OCP-G01-W1-21 W2	1/8	3625	13.2	29 72	1	0.37	--	2.6	ISO 4401-03-02-0-94
OCP-G01-A1-21 A2				29 72					
OCP-G01-B1-21 B2				29 72					
OCP-G01-W1-F-21 W2				29 72	1	0.51	0.06	2.6	
OCP-G01-A1-F-21 A2				29 72					
OCP-G01-B1-F-21 B2				29 72					
OCP-G03-W1-J50 W2	3/8	3625	26.4	29 72	1	0.49	0.07	7.9	ISO 4401-05-04-0-94
OCP-G03-A1-J50 A2				29 72					
OCP-G03-B1-J50 B2				29 72					
OCP-G03-W1-D-J50 W2				29 72	1	0.49	--		
OCP-G03-A1-D-J50 A2				29 72					
OCP-G03-B1-D-J50 B2				29 72					
OPH-G04-W1-10 W2	1/2	5075	79.2	29 72	1	0.50	0.07	14.9	ISO 4401-07-06-0-94
OPH-G04-A1-10 A2				29 72					
OPH-G04-B1-10 B2				29 72					
OPH-G04-W1-D-10 W2				29 72	1	0.50	--		
OPH-G04-A1-D-10 A2				29 72					
OPH-G04-B1-D-10 B2				29 72					

• Handling

- Note that when the O1 size has the auxiliary symbol "F," tank port back pressure can cause the small valve to open, making it impossible to maintain pressure.
- If tank port back pressure causes the small valve to open and make it impossible to maintain pressure with the

03, 04 size, use a direct type with auxiliary symbol "D."

- Minimum pilot pressure fluctuates with the input side pressure during reverse flow. Operate the valve so pressure is at least twice as high as the required pressure obtained using the minimum pilot pressure characteristics graph.

4 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

5 O4 series modular valves do not have an L (DR2) drain port, so they cannot be used in combination with pressure center type solenoid valves (D).

Understanding Model Numbers

OCP - G 03 - W 1 - (D) - J50

01, 03 size

Design number

Note: For 01 size, 21

For 03 size, relationship between mounting bolts and design number is indicated as J50: M6, 50 : M8.

Auxiliary symbol F: With shock-resistant mechanism (01 size only)

D: No small valve poppet (03 size only)

Cracking pressure 1: 29 psi 2: 72 psi

Control port W: A, B ports A: A port
B: B port

Nominal diameter (size) 01, 03

Mounting method G: Gasket type

Pilot operated check modular valve

OPH - G 04 - W 1 - (D) - 10

04 size

Design number

Auxiliary symbol D: No small valve poppet

Cracking pressure 1: 29 psi
2: 72 psi

Control port W: A, B ports A: A port B: B port

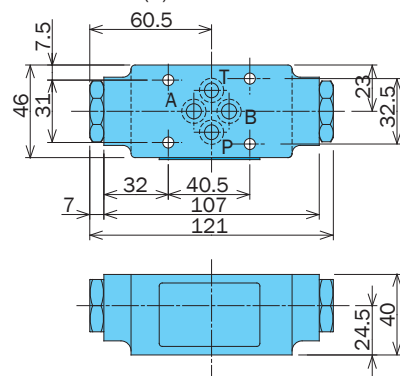
Nominal diameter (size) 04

Mounting method G: Gasket type

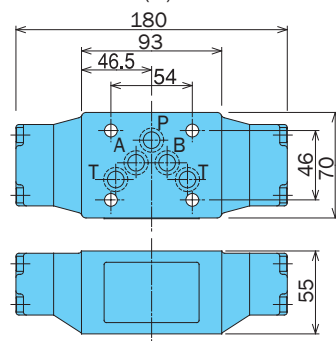
M35 Series pilot operated check modular valve

Installation Dimension Drawings

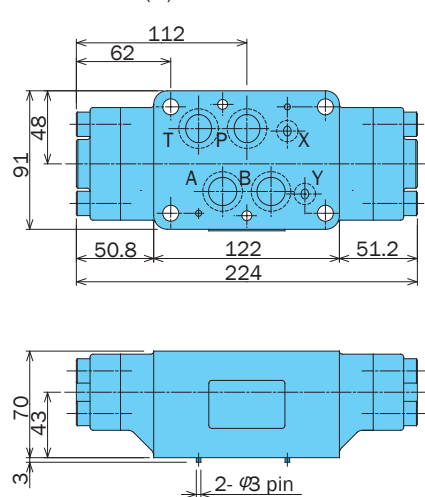
OCP-G01-**-(-F)-21



OCP-G03-**-(-D)-J50



OPH-G04-**-(-D)-10

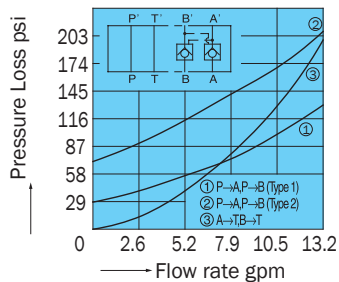


Specifications

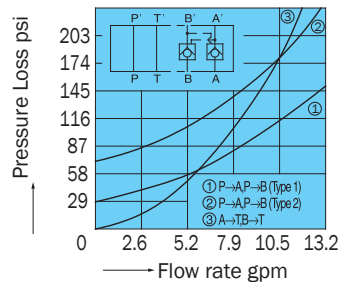
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

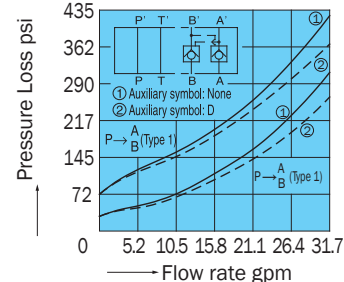
OCP-G01-W*-21



OCP-G01-W*-F-21

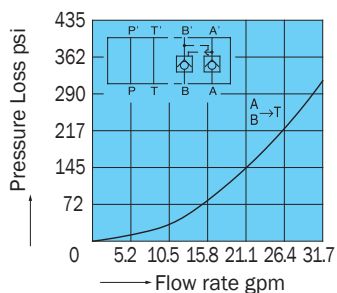


OCP-G03-W*-(D)-J50

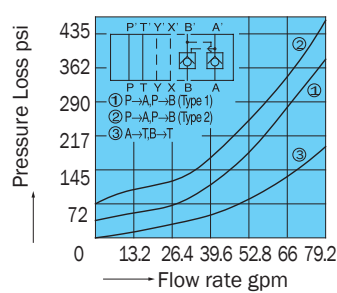


Pressure Loss Characteristics (Reverse Free Flow)

OCP-G03-W*-J50

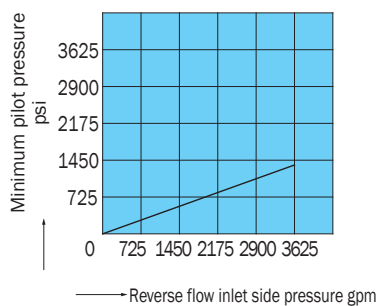


OPH-G04-W*-10

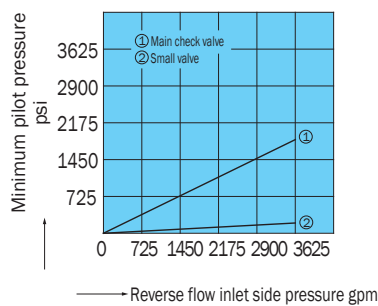


Minimum Pilot Pressure Characteristics

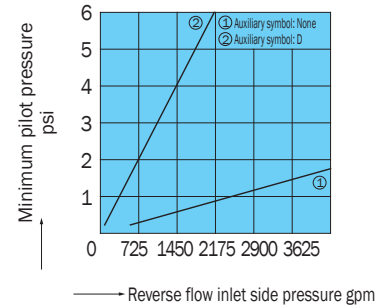
OCP-G01-W*-21



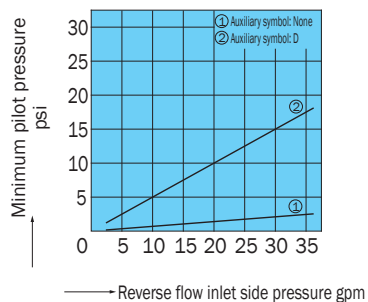
OCP-G01-W*-F-21



OCP-G03-W*-(D)-J50

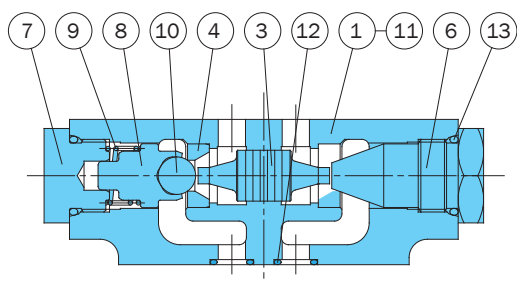


OPH-G04-W*-(D)-10

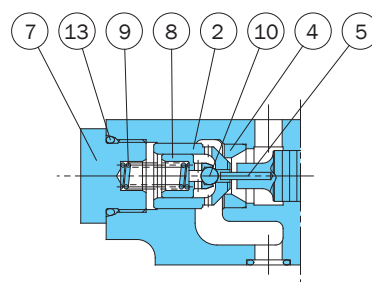


Cross-sectional Drawing

OCP-G01-A*-21



OCP-G01-A*-F-21



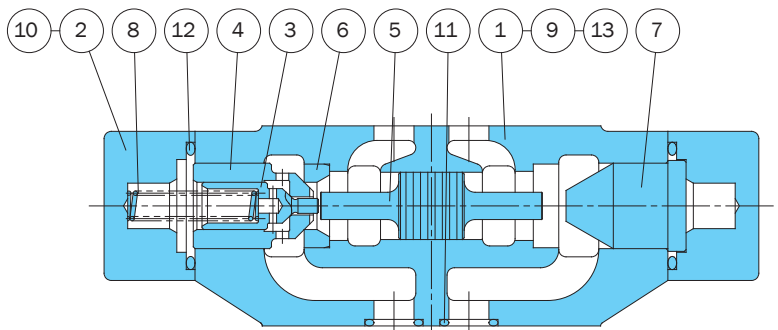
Part No.	Part Name
1	Body
2	Poppet
3	Piston
4	Seat
5	Rod
6	Bushing
7	Spring seat
8	Guide
9	Spring
10	Ball
11	Plate
12	O-ring
13	O-ring

Seal Part List (Kit Model Number BDBS-01CP)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
12	O-ring	1B-P9	4	4	4
13	O-ring	1B-P18	2	2	2

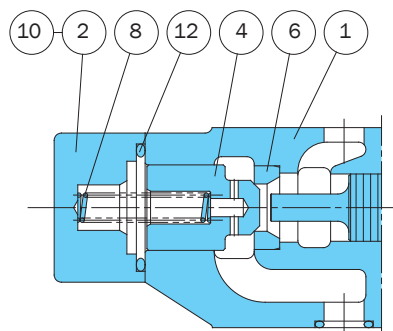
Note: 1.O-ring 1A/B-** refers to JIS B2401-1A/B.
2.Specify W, A, or B for the asterisk (*) in the kit model number.

OCP-G03-A*-J50



Part No.	Part Name
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

OCP-G03-**-D-J50

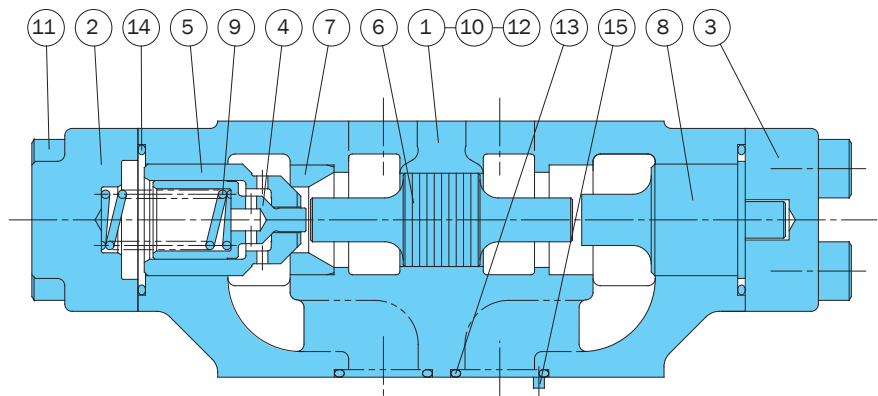


Seal Part List (Kit Model Number BDES-03CP*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
11	O-ring	AS568-014(Hs90)	5	5	5
12	O-ring	1B-P29	2	2	2

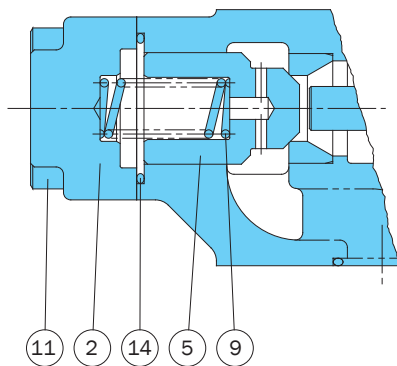
Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. Specify W, A, or B for the asterisk (*) in the kit model number.

OPH-G04-A*-10



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

OPH-G04-**-D-10



Seal Part List (Kit Model Number BDKS-04CP*)

Part No.	Part Name	Part Number	Q'ty		
			W	A	B
12	O-ring	AS568-012(Hs90)	2	2	2
13	O-ring	AS568-118(Hs90)	4	4	4
14	O-ring	AS568-127(Hs90)	2	2	2

Note: 1.Specify W, A, or B for the asterisk (*) in the kit model number.



Gauge Modular Block

13.2 to 26.4 gpm
3625 psi

Features

This modular block makes it possible to attach a pressure gauge to the P and T ports or the A and B ports.

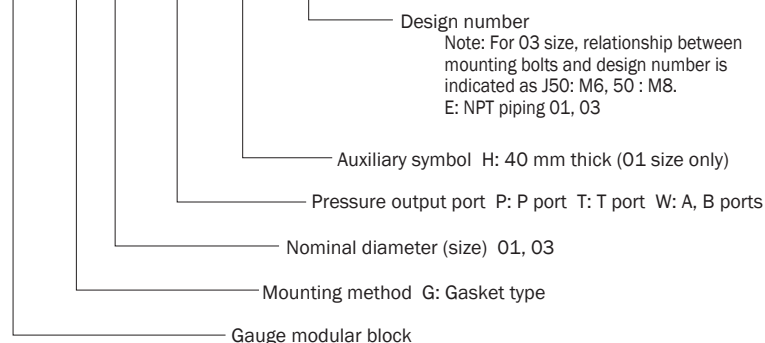
Connection to the ports is extremely simple.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Weight lbs	Gasket Surface Dimensions
OK-G01-P-E20 OK-G01-T-E20	1/8	3625	13.2	1.3	ISO 4401-03-02-0-94
OK-G01-W-E20				1.3	
OK-G01-P-H-E20 OK-G01-T-H-E20				2.2	
OK-G01-W-H-E20				2.2	
OK-G03-E50	3/8	3625	26.4	5.0	ISO 4401-05-04-0-94

Understanding Model Numbers

OK - G 01 - P - (H) - 20

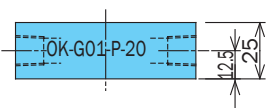
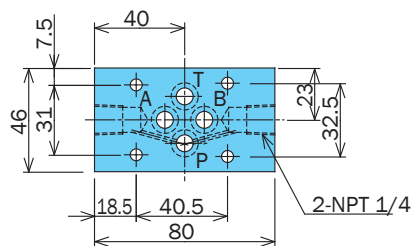


• Handling

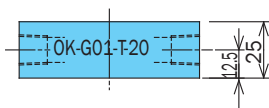
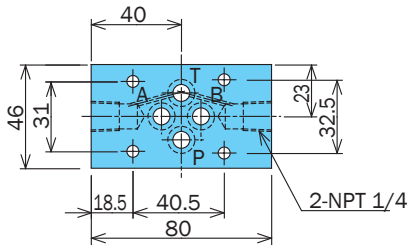
- 1 When installing the OK-G01-P- (H)-E20, OK-G01-T-(H)-E20, or OK-G01-W-(H)-E20, make sure the model number printing is oriented so it can be read correctly from the P port side.
- 2 Note that a sub plate and installation bolts are not included. See pages H4 and F87-89 if these items are required.

Installation Dimension Drawings

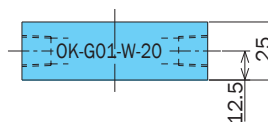
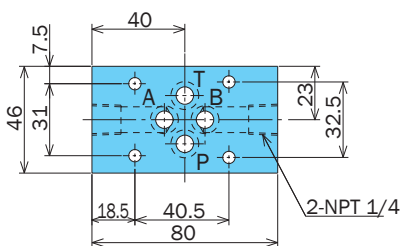
OK-G01-P-E20



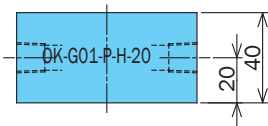
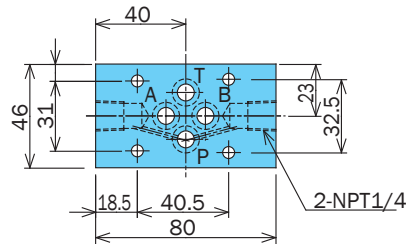
OK-G01-T-E20



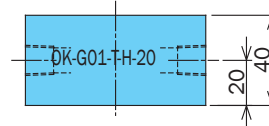
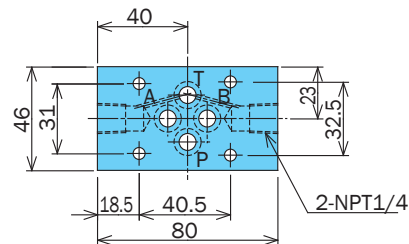
OK-G01-W-E20



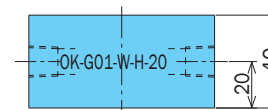
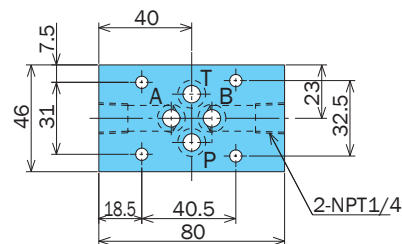
OK-G01-P-H-E20



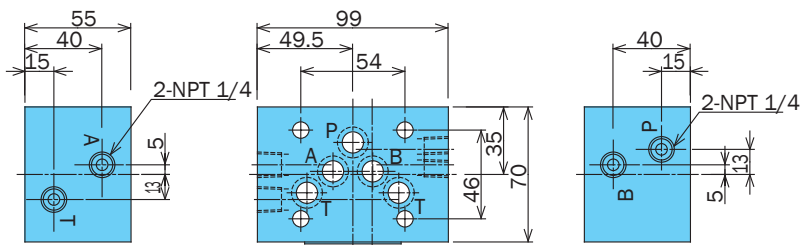
OK-G01-T-H-E20



OK-G01-W-H-E20



OK-G03-E50





High-Low System Block

13.2 to 26.4 gpm
3625 psi

Features

Simple high-low 2-speed control can be attained by stacking this block on top of a high-low base block and manifold, which configures a speed control circuit.

Specifications

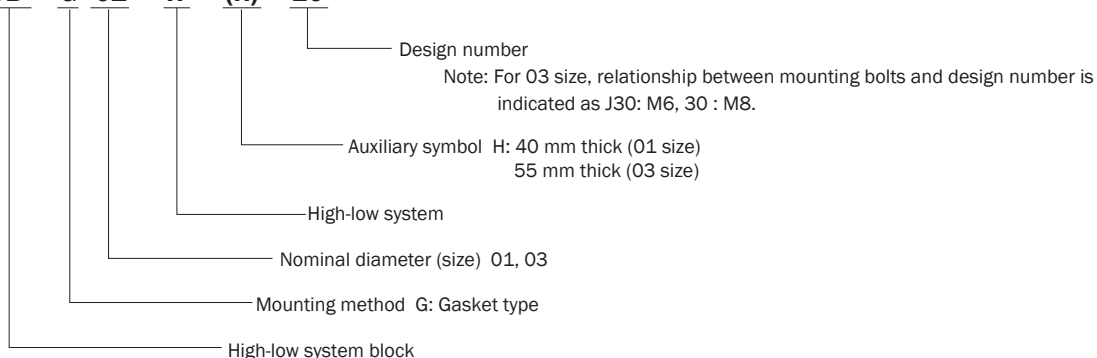
Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Weight lbs
OB-G01-W-20	1/8	3625	13.2	3.3
OB-G01-W-H-20				5.5
OB-G03-W-J30	3/8	3625	26.4	9.9
OB-G03-W-H-J30				15.6

• Handling

- 1 If a base block is required, use MOB-01Y-W*-10 for the 01 size and MOB-03X-B*-J30 for the 03 size, because their valve pitches match. MOB-01X-B*-10 has a different valve pitch, and so cannot be used.
- 2 When installing this block, make sure the nameplate is oriented so it can be read correctly from the A port side.
- 3 Both of the cylinder ports on this block's manifold side (bottom) are open. Because of this, close one of the base block cylinder ports (A1, B1 or A2, B2 on the next page), or modify the manifold so it has a single cylinder port only.
- 4 Note that installation bolts are not included. See pages H4 and F87-89 if these items are required.

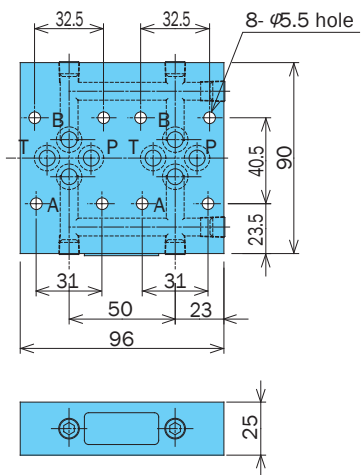
Understanding Model Numbers

OB - G 01 - W - (H) - 20

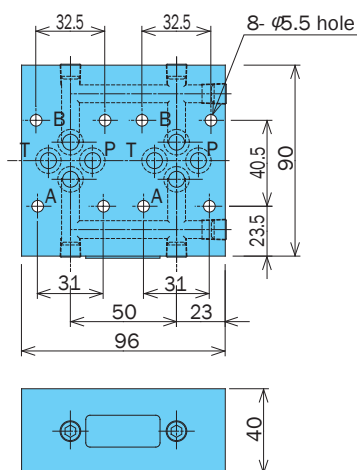


Installation Dimension Drawings

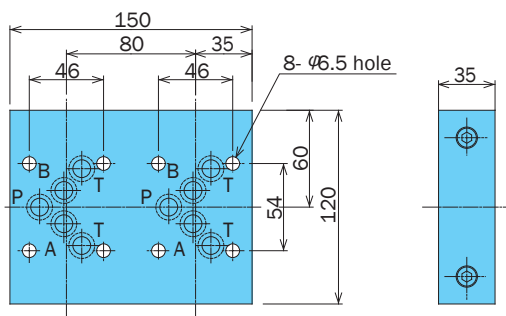
OB-G01-W-20



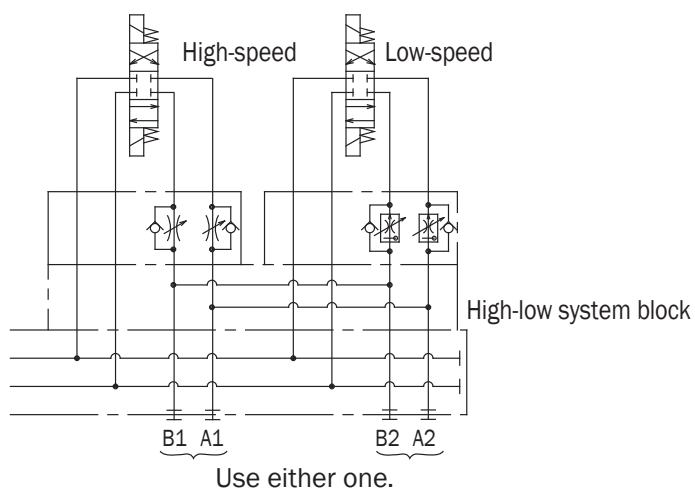
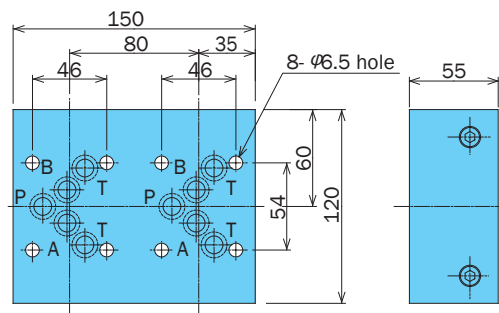
OB-G01-W-H-20



OB-G03-W-J30



OB-G03-W-H-J30



End Plate, Free Flow Plate, 03/01 Change Plate

13.2 to 26.4 gpm
3625 psi

Features

The end plate is a modular valve plate used to close off a circuit that is not required, and when using a relief modular valve in a standalone configuration. The free flow plate is a modular valve

plate is used in a one-way circuit that does not require a solenoid valve. The 03/01 change plate makes it possible to use an 01 size modular valve with an 03 size sub-plate and base block.

The 06/04 change plate makes it possible to use an 04 size modular valve with an 06 size sub-plate and base block.

Specifications

Model No.	Nominal Diameter(Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Weight lbs
MOB-G01-10	1/8	3625	-	.6
MOB-G01-H-10				1.3
MOB-G01-A-10			13.2	1.3
MOB-G01-B-10				1.3
MOB-G03-J50	3/8	3625	-	3.0
MOB-G03-H-50				5.5
MOB-G03-A-J50			26.4	2.8
MOB-G03-B-J50				5.0
MOB-G03-A-H-50				5.0
MOB-G03-B-H-50			13.2	5.0
MOB-G03-AA-J50				5.0
MOB-G06-AA-5411A	3/4	3045	52.8	17.6

Understanding Model Numbers

MOB - G 03 - A - (H) - J50

Design number Note: Auxiliary symbol (tightening height) and design number (G03 size)

J50: M6 type 26.5mm

50: M8 type 23.4mm

H-50: M8 type 58mm (stop plate and relief low plate only)

5411A: 06/04 conversion plate (special item)

Auxiliary symbol H: Tightening height 36mm (01 size), 58mm (03 size)

Port connection status None: All ports blocked (stop plate)

A : P ↔ A, B ↔ T
B : P ↔ B, A ↔ T } (Free-flow plate)

AA : G03 → G01, G06 → G04

P → P
T → T } 03/01 Switching plate
A → A
B → B } 06/04 Conversion plate

Nominal diameter (size) 01, 03

Mounting method G: Gasket type

Modular valve plate

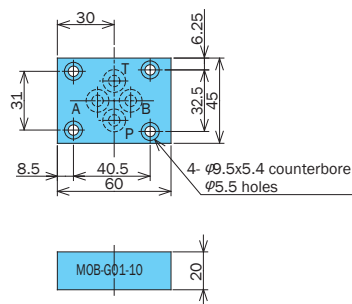
• Handling

- 1 Installation bolts are not included. Use the table to the right to specify bolts for stand-alone use.

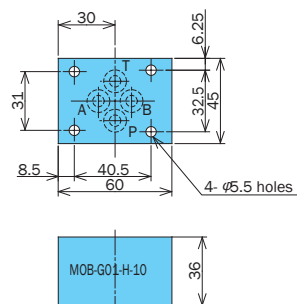
Model No.	Bolt Dimensions	Q'ty
MOB-G01-10	M5 × 25	4
MOB-G01-*.10	M5 × 45	4
MOB-G03-J50	M6 × 35	4
MOB-G03- $\begin{smallmatrix} A \\ B \end{smallmatrix}$ J50		
MOB-G03-AA-J50		
MOB-G03-50	M8 × 35	4
MOB-G03- $\begin{smallmatrix} A \\ B \end{smallmatrix}$ 50		
MOB-G03-AA-50		
MOB-G03-H-50	M8 × 70	4
MOB-G03- $\begin{smallmatrix} A \\ B \end{smallmatrix}$ H-50		
MOB-G06-AA-5411A	M12 × 70	6

Installation Dimension Drawings

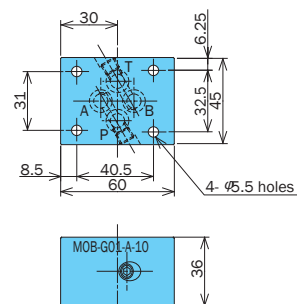
MOB-G01-10



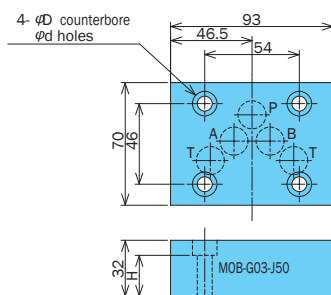
MOB-G01-H-10



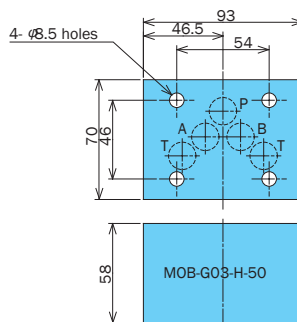
MOB-G01-^A_(B)-10



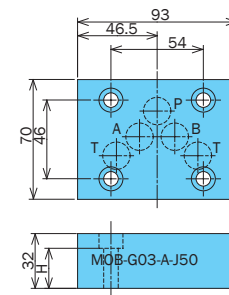
MOB-G03-J50



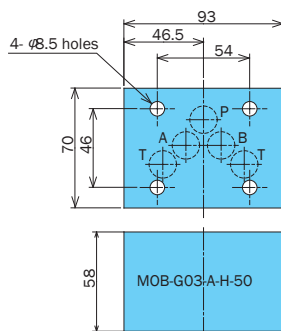
MOB-G03-H-50



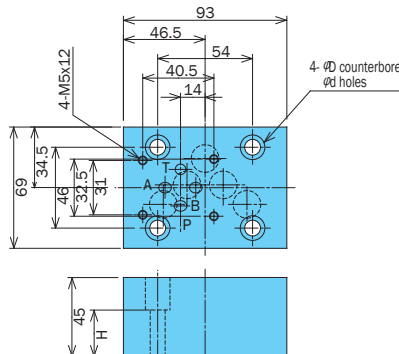
MOB-G03-^A_B-J50



MOB-G03-^A_B-H-50

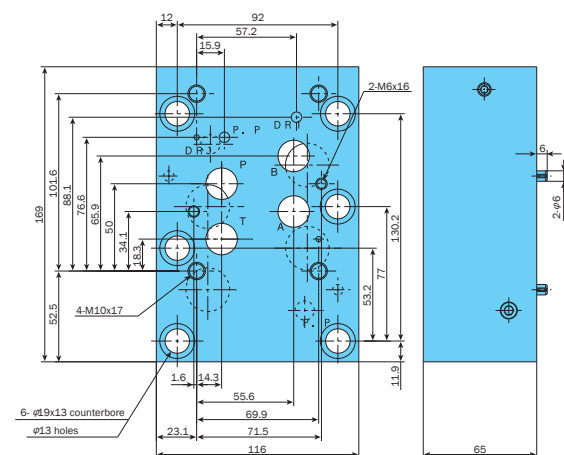


MOB-G03-AA-J50



Model No.	D	H	d
MOB-G03-*-50	14	23.4	8.5
MOB-G03-*-J50	11	26.5	6.5

MOB-G06-AA-5411A

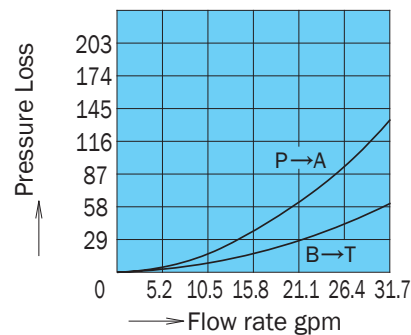


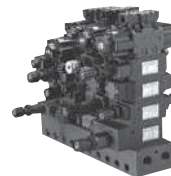
Performance Curves

Hydraulic Operating Fluid
Viscosity 32 centistokes

Pressure Loss Characteristics

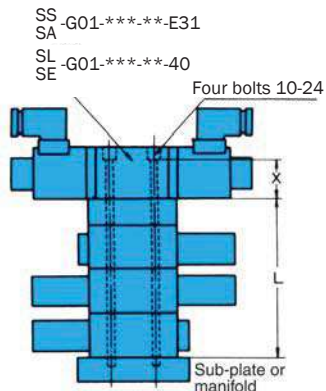
MOB-G03-A-J50





Valve Installation Bolt List

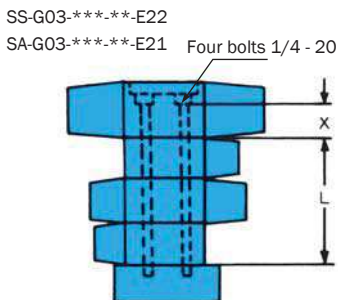
E: UNC Thread
01 (nominal diameter)



Model Number	X
SA-G01-***-E31	37.5
SS-G01-***-R-**-E31	
SL-G01-***-R-**-E31	
SE-G01-***-GR-**-40	

Type	Model Number	Dimension L	Bolt length
Hexagon Socket Head Bolt	OTH-01-70-10	25	70
	85	40	85
	110	65	110
	125	80	125
	150	105	150
	165	120	165
	190	145	190
	205	160	205
Stat Bolt	OTD-01-80-10	25	80
	95	40	95
	120	65	120
	135	80	135
	145	90	145
	160	105	160
	175	120	175
	185	130	185
	200	145	200
	210	155	210
	215	160	215
	225	170	225
	240	185	240
	250	195	250
	265	210	265
	275	220	275

E: UNC Thread
03 (nominal diameter)

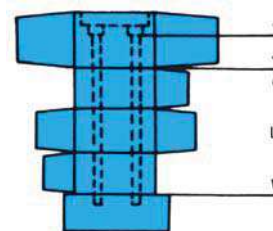


Model Number	X
SS-G03-***-R-**-E22	60.5
SA-G03-***-R-**-E21	

Type	Model Number	Dimension L	Bolt length
Hexagon Socket Head Bolt	OTH-03-125-J30	55	M6 × 125
	-180-	110	M6 × 180
Stat Bolt	OTD-03-135-J30	55	M6 × 135
	-190-	110	M6 × 190
	-245-	165	M6 × 245
	-300-	220	M6 × 300

E: UNC Thread

SS-G03-***-E22
SA-G03-***-E21



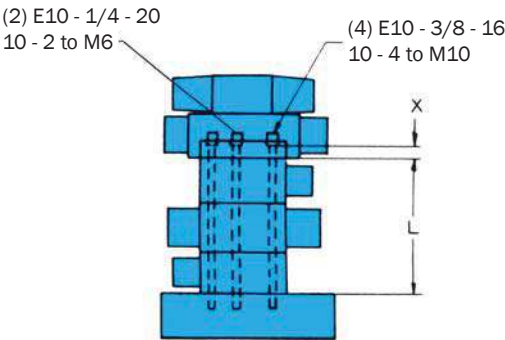
Model Number	X
SS-G03-***-R-**-E22	58
SA-G03-***-R-**-E21	

Type	Model Number	Dimension L	Bolt length
Hexagon Socket Head Bolt	OTH-03-125-30	55	M8 × 125
	-180-	110	M8 × 180
Stat Bolt	OTD-03-135-30	55	M8 × 135
	-190-	110	M8 × 190
	-245-	165	M8 × 245
	-300-	220	M8 × 300

Note:

- 1 Model numbers indicate bolt kits for one solenoid valve.
- 2 Up to four modular valves can be ganged together.
- 3 01 Size Modular valves at a height of 40 + 25 = 65 mm are ganged to one level.
- 4 2-pressure reducing valves at a height of 90 mm are ganged to two levels.

O4 (nominal diameter)

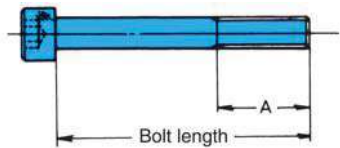


Model Number	X
DSS-G04-***-R-**-22	34
DSA-G04-***-**-22	

Type	Model Number	Dimension L	Bolt Size	Bolt length
Hexagon Socket Head Bolt	OTH-04-120-10	70	M6	115
			M10	120
	-135-	85	M6	130
			M10	135
	-190-	140	M6	185
			M10	190
	-205-	155	M6	200
			M10	205
Stat Bolt	OTD-04-135-10	70	M6	123
			M10	135
	-150-	85	M6	138
			M10	150
	-205-	140	M6	193
			M10	205
	-220-	155	M6	210
			M10	220
	-275-	210	M6	265
			M10	275
	-290-	225	M6	278
			M10	290

Note: 1. The above model numbers indicate bolt kits for one solenoid valve.
2. Up to three modular valves can be ganged together.
3. There is a bolt for ganging four valves, but the maximum operating pressure is limited to 3045 psi. For details, consult your agent. (See page D-4)

Hexagon socket head bolt

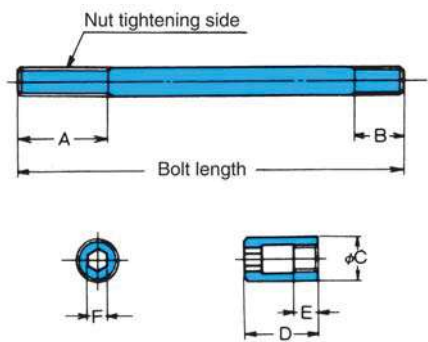


Nominal Diameter	A	Bolt Size
01	15	10 - 24
03	18	1/4 - 20

Tightening Torque

Nominal Diameter	Bolt Size	Tightening Torque N ft lbs
01	10 - 24 UNC	3.6 to 5.1
03	1/4 - 20 UNC	7.3 to 9.5

Stat Bolts and Nuts



Model No.	A	B	C	D	E	F	Bolt Size
OTD-01-***-10	12	9	8.5	16	11	4	M5
OTD-03-***-J30	20	10	10	18	11.5	5	M6
OTD-03-***-30	25	12.5	13	22	15	6	M8
OTD-04-***-10	20	10	10	18	11.5	5	M6
	25	18	16	23	15	8	M10

Stat bolts and nuts are included. The E dimension is the effective screw depth.

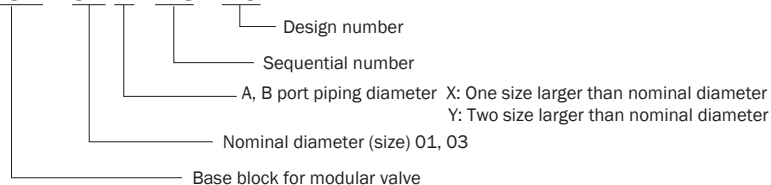
01, 03 Base Block

Features

This block, which allows piping from both sides, is designed for use with combinations of two or more solenoid valves and modular valves.

Understanding Model Numbers

MOB - 01 X - B3 - 10

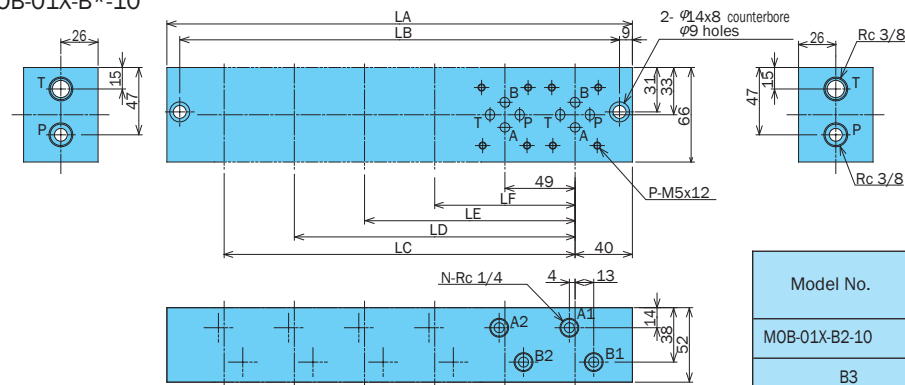


Note: Another series of multi-pump blocks is available for the MBS and MBW Series NACHI PACK. For details, see page L-24.

Installation Dimension Drawings

01 (nominal diameter) base block

MOB-01X-B*-10



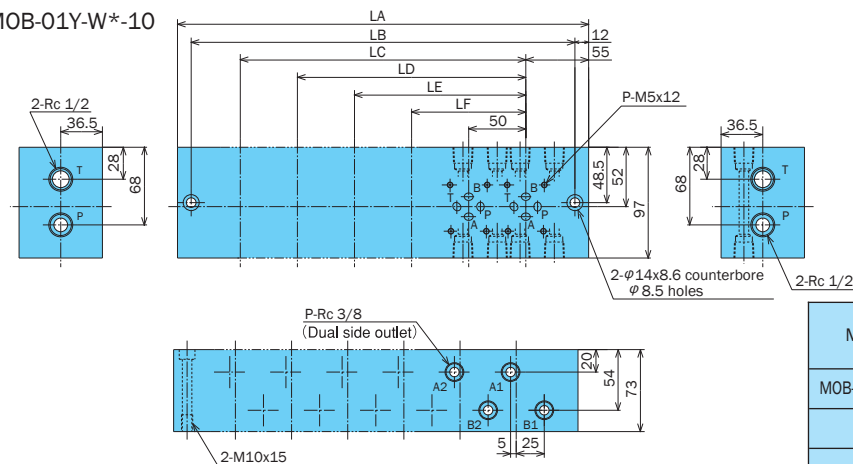
Model No	Pipe Outlet Size (A, B)	Maximum Working Pressure psi	Recommended Flow Rate gpm
MOB-01X-B*-10	1/4	3625	5.2

Plug Tightening Torque

Plug Configuration	Tightening Torque N ft lbs
TPHA-1/4	13.4 to 22
TPHA-3/8	29.5 to 35

Model No.	LA	LB	LC	LD	LE	LF	N	P	Weight lbs
MOB-01X-B2-10	129	111	-	-	-	-	4	8	6.1
B3	178	160	-	-	-	-	6	12	8.3
B4	227	209	-	-	-	-	8	16	10.8
B5	276	258	-	-	147	98	10	20	13.0
B6	325	307	245	196	147	98	12	24	15.2

MOB-01Y-W*-10



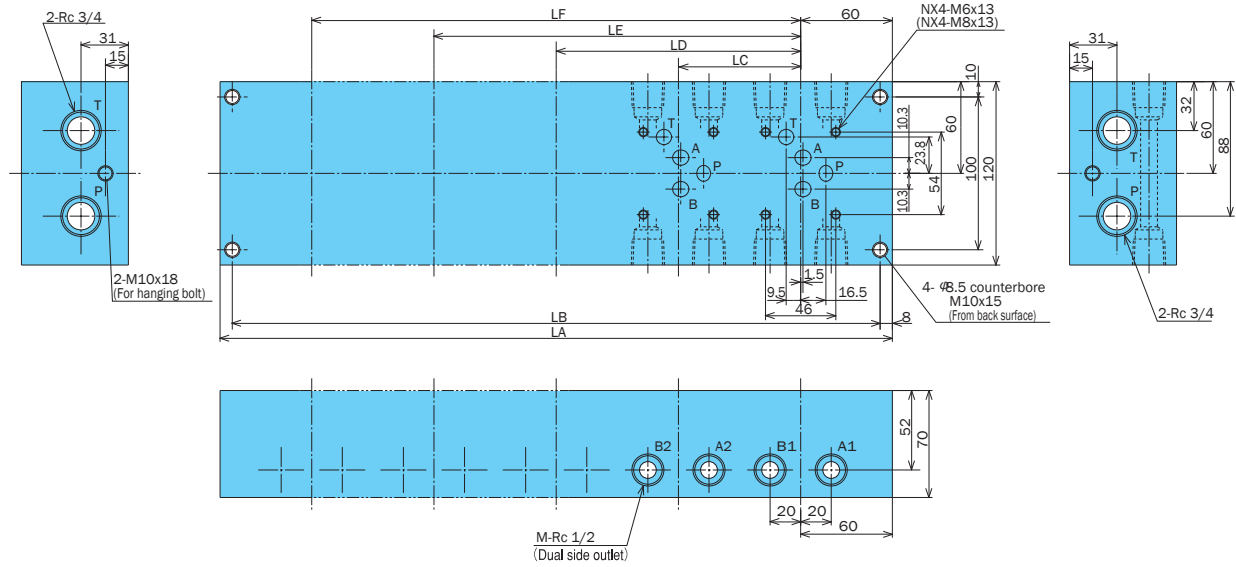
Model No	Pipe Outlet Size (A, B)	Maximum Working Pressure psi	Recommended Flow Rate gpm
MOB-01Y-W*-10	3/8	3625	10.5

Plug Tightening Torque

Plug Configuration	Tightening Torque N ft lbs
TPHA-3/8	29.5 to 35
TPHA-1/2	40.5 to 48

Model No.	LA	LB	LC	LD	LE	LF	P	Weight lbs
MOB-01Y-W1-10	110	86	-	-	-	-	4	11.2
W2	160	136	-	-	-	-	8	16.0
W3	210	186	-	-	-	-	12	21.1
W4	260	236	-	-	-	-	16	26.0
W5	310	286	-	-	150	100	20	30.8
W6	360	336	250	200	150	100	24	35.7

03 (nominal diameter) base block
MOB-03X-B*-(J)30



Plug Tightening Torque

Plug Configuration	Tightening Torque N ft lbs
TPHA-1/2	40.5 to 48
TPHA-3/4	66 to 73.7

Model No	Pipe Outlet Size (A, B)	Maximum Working Pressure psi	Recommended Flow Rate gpm
MOB-03X-B*-(J) 30	1/2	3625	21.1

Model No.	Dimensions								Weight lbs
	LA	LB	LC	LD	LE	LF	M	N	
MOB-03X-B2-(J) 30	200	184	80	-	-	-	8	2	22.7
B3	280	264	80	160	-	-	12	3	31.5
B4	360	344	80	160	240	-	16	4	40.5
B5	440	424	80	160	240	320	20	5	49.3

Note: Dimensions in parentheses are for model number MOB-03X-B*-(J)30, which is the model number when using M8 valve mounting bolts.

High-pressure M35 Series

13 to 80 gpm
5075 psi

Overview

The High-Pressure M35 Series responds to the needs of high density in a variety of fields by enabling higher density hydraulic systems.

This valve incorporates NACHI original flow control technology and heat

treatment, plus precision machining to create high-performance valves with the following features:

- High-pressure 35MPa
- High reliability and compact design

- Press Machinery
Press brakes, punching presses
 - Underground Machinery
Shield tunneling machinery, removal systems, etc.
 - Construction Machinery
From mini vehicles to 6 to 10-ton vehicles, shovels, etc.
 - Environmental Related
Granulators, filter presses, scrap presses
 - Testing Equipment
Impulse, durability, performance testers, etc.
- (For details see catalog number 9265-3.)

- M35 Series Modular Valve (O * H)
By integrating multiple hydraulic devices, this valve can be used when configuring hydraulic circuits even in the high-pressure range. See page F9 for information about the O4 size.

This series consists of pressure, flow rate, and flow direction control valves.
Maximum Working Pressure: 5075 psi
Maximum Flow Rate: to 80 gpm

- M35 Series Non-leak Solenoid Valve (SNH)
A NACHI original structure is used to configure this wettype shutoff valve that isolates internal leaks. Installation conforms to ISO4401 standards, so it can be used in a wide range of applications in combination with modular valves. For more information, see page D-53.
Maximum Working Pressure: 5075 psi
Maximum Flow Rate: to 25 gpm

- M35 Series Related Components
 - Pump (See page A-42.)
Rated Pressure: 5075 psi
Capacity: 1.7 to 2.4 cu in/rev
 - High-response proportional flow control valve
Maximum Working Pressure: 5075 psi
Maximum Flow Rate: to 90 gpm
- M35 Series Industry Specific Components
 - Jack Valve
Maximum Working Pressure: 5075 psi
Maximum Flow Rate: to 25 gpm
 - Logic Cartridge Mono Block
Maximum Working Pressure: 5075 psi
Maximum Flow Rate: to 1850 gpm
- M35 Series Industry Specific Components
 - Hydraulic accessories (stop valves, filters, accumulators, hoses, etc.);
NACHI-MOOG servo level

Specifications

M35 Series Modular Valve

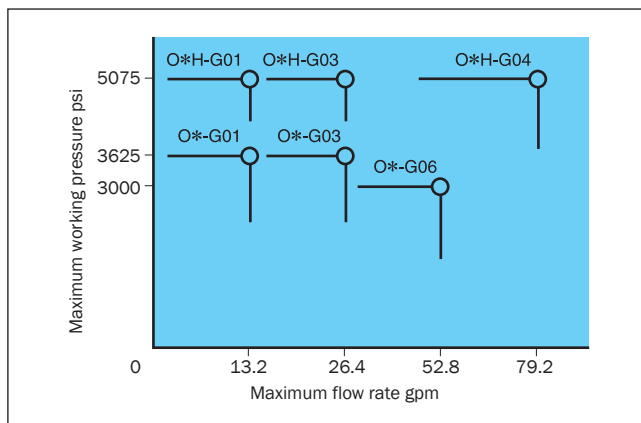
Size	Maximum Working Pressure psi	Maximum Flow Rate gpm	Number of Integration Levels
01	5075	13.2	to 3
03		26.4	
04		79.2	

Dimensions

Size	Height (mm)	Width (mm)	Remarks
01	40	46	Same dimensions as the M25 Series
03	55	70	
04	70	91	

Note: M8 installation bolts only are used for the 03 size.

Modular Valve Product Series



01, 03 Size Specifications

		Valve Model Number	Maximum Operating Power psi	Maximum Flow Rate gpm	Pressure Adjustment Range (Cracking Pressure) psi	ISO Symbol
Solenoid Valves	Solenoid Valves	SA-G***-**-31(21) SS-G***-**-31(22)	5075			
Pressure Control Valves	Relief Valves (Balance Type)	ORH-G01-P*-10 -W*-		G01 10.5	500 - 3625 1000 - 5075	
		ORH-G03-P*-10 -W*-		G03 21.1	P: P (→T) port W: AB (→T) port	
	Relief Valves (Direct Type)	ORH-G01-DW*-10 -DA*- -DB*-		G01 5.2	500 - 3625 1000 - 5075	
		ORH-G03-DW*-10 -DA*- -DB*-		G03 7.9	DW: AB (→T) port DA: A (→T) port DB: B (→T) port	
	Reducing Valve	OGH-G01-P*-10 -B*-		G01 10.5	500 - 3625	
		OGH-G03-P*-(B)-10 -B*-		G03 21.1	P: P port B: B port	
Flow Control Valves	Flow Regulator Valves	OYH-G01-W-Y-10 -A-Y- -B-Y- -W-X- -A-X- -B-X-		G01 13.2	Y: Meter out X: Meter in W: AB port A: A port B: B port	
		OYH-G03-W-Y-10 -A-Y- -B-Y- -W-X- -A-X- -B-X-		G03 26.4		
Direction Control Valves	Check Valves	OCH-G01-P*-10 -T*-		G01 13.2	1: 5.8 2: 50.7 3: 72.5	
		OCH-G03-P*-10 -T*-		G03 26.4	P: P port T: T port	
	Pilot Check Valves	OPH-G01-W*-(F)-10 -A*- -B*- OPH-G03-W*-(D)-10 -A*- -B*-		G01 13.2 G03 26.4	1: 29 2: 72.5 W: AB port A: A port B: B port D: Direct type (no small valve, G03 only) F: Decomp type (with small valve, G01 only)	

ORH : Relief valve

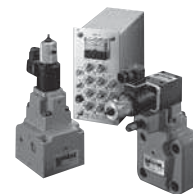


OGH : Reducing valve



OPH : Pilot check valve





Electro-Hydraulic Proportional Valve Series

.5 to 132 gpm
3000, 3600, 4000, 5000 psi

Overview

Today's hydraulic systems demand high levels of automation, power efficiency, and energy efficiency, which is why the use of electro-hydraulic proportional valves is on the rise. Built-in electronic

components deliver outstanding response and fluid pressure that allows high output, as well as superior operation, and control. The NACHI Electrohydraulic Proportional Valve

Series includes the pressure control valves, flow control valves, and direction control valves that make it easy to meet these needs.

Features

1 Pressure Control Valve Series

- EPR Series:** Small-volume direct driver type pilot relief valve
- ER Series:** Large-volume balanced piston type relief valve
- EGB Series:** Large-volume balanced piston type pressure reducing valve with relief function

The pressure control section uses a poppet structure, which is virtually impervious to the effects of dirt in the operating fluid for outstanding pressure stability.

Flow Control Valve Series

- ES Series:** This 3-directional valve provides proportional flow control in accordance with **input current**.
- ESR Series:** With a built-in load sensing function, this 3-way valve is for use in low-energy circuits.

A force feedback mechanism is used for main spool positioning, and amplification is performed by the pilot spool. The result is superior response with small hysteresis

and outstanding flow rate reproduction.

3 Direction Flow Control Valve Series

- ESD Series:** This electro-hydraulic proportional valve provides both direction control and flow control functions. Mounting methods are the same as those for standard directional valves, which allows simple structuring and maintenance.

4 Modular Type Control Valve Series

- EOG-G01:** This reduction valve with relief function can be used in ganged configurations.
- EOF-G01:** This flow control valve combines a restrictor valve with a pressure compensation valve.

This dual configuration provides easy installation along with dramatically reduced space requirements.

5 Power Amplifiers

- EMA Series:** Amplifier type
 - EMC Series:** Controller type
- A **current-feedback** amplifier system is used to virtually eliminate **output current** fluctuation. The same power supply specifications apply to all types.

6 Compact Power Amplifiers

- EBA Series:** Amplifier type
- The highly efficient PWM control system of this new series ensures high reliability in a compact configuration.

7 Compact, Multi-function Power Amplifiers

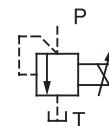
- EDA Series:** Amplifier type
 - EDC Series:** Amplifier controller type
- A choice of inputs: 6-contact or DC 2 input/4-contact compensation valve.

Series List

Name	Maximum Working Pressure psi	Rated Flow Rate gpm								
		.26	.5	2.6	13.2	26.4	52.8	79.2	105	132
Electro-hydraulic Proportional Valve (EPR)	5000	01 — Size								
Electro-hydraulic Proportional Relief Valve (ER)	5000	03 06								
Electro-hydraulic Proportional Relief and Reducing Valve (EGB)	3600	03 06								
Electro-hydraulic Proportional Flow Control Valve (ES)	3000	02 03 06 10								
Load Sensitive Electro-hydraulic Proportional Relief and Flow Control Valve (ESR)	3600	03 06 10								
Electro-hydraulic Proportional Flow Control Valve (ESD)	3600	01 03 04 06								
Modular Type Electro-hydraulic Proportional Reducing Valve (EOG)	3600	01								
Modular Type Electro-hydraulic Flow Control Valve (EOF)	3000	01								
Power Amplifier (EMA) (EMC)										
Compact Power Amplifier (EBA)										
Compact, Multi-function Power Amplifier (EDA) (EDC)										

Electro-Hydraulic Proportional Pilot Relief Valve

0.3 gpm
43 to 4000 psi



Features

This DC solenoid relief valve matches the attraction force of a DC solenoid with fluid pressure. When connected to a

small-volume hydraulic system or the poppet of a balanced piston type pressure control valve, this valve provides

continual pressure control in proportion to **input current**.

Specifications

Item	Model No.	EPR-G01-*-***-12
Rated Flow Rate gpm		0.3
Pressure Control Range psi		B: 43 to 360 1: 100 to 1000 2: 145 to 2000 3: 215 to 3000 4: 215 to 4000 5: 290 to 5000
Rated Current mA		800
Coil Resistance Ω		20 (68° F)
Hysteresis %		3 max. (Note)
Weight lbs		3.5

Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Series List

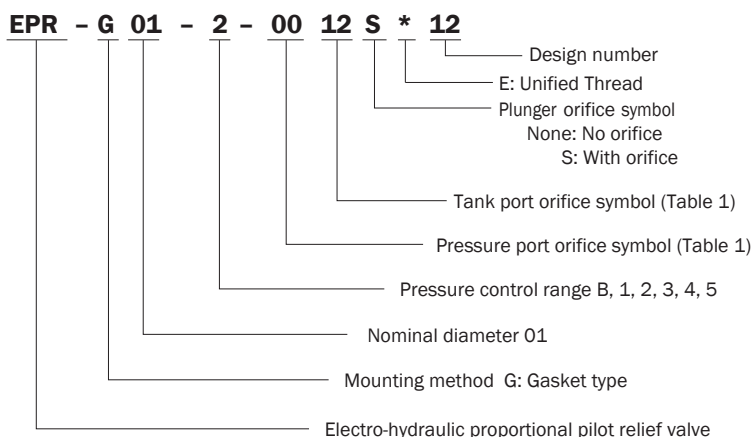


Table 1 Pressure Port and Tank Port Orifice Symbols

Orifice Symbol	00	08	09	10	11	12	13
Orifice Diameter	None	$\phi 0.8$	$\phi 0.9$	$\phi 1.0$	$\phi 1.1$	$\phi 1.2$	$\phi 1.3$

Note: The following are the standards for the orifice auxiliary symbols.

Pressure Control Range	Orifice Auxiliary Symbol
Type B, Type 1	0013S
Type 2, Type 3	0012S
Type 4	1212S
Type 5	1111S

• Handling

1 Air Bleeding

To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the M4 screw and rotating the cover.

2 Mounting Method

Mounting on a vertical surface causes minimum pressure to increase by 14 psi.

3 Manual Pressure Adjusting Screw

For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counter-clockwise) and secured with the lock nut.

4 Minimum Relief Flow Rate

A small flow rate can cause setting pressure to become unstable. Use a flow rate of at least .18 in³/min.

5 Load Capacity

When using this valve to control direct circuit pressure, make sure the load volume (valve P port side volume) is at least 2.4 in³.

6 Bundled Accessories (Valve Mounting Bolts)

10-24 x 1 3/4" (four) Tightening torque: 3.6-7 ft lbs.

7 Sub Plate

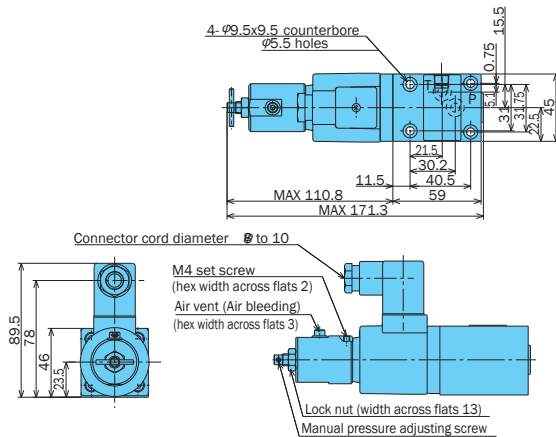
When a sub plate is required, order using the following model number. MSA-01Y-E10 (See the next page for dimensions.)

8 Use an operating fluid that conforms to the both of the following.

Fluid Temperature: 4 °F to 140 °F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

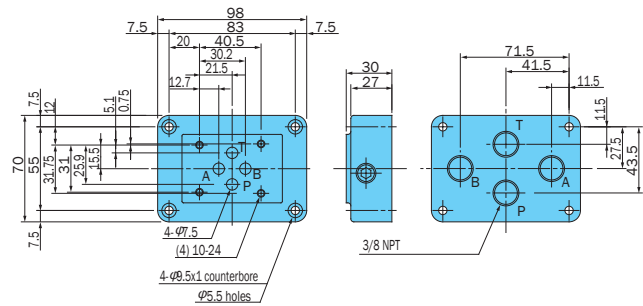
Installation Dimension Drawings

EPR-G01



Sub Plate

MSA-01Y-E10



Note: Install the sub plate so the valve's P port is aligned with the sub plate's B port.

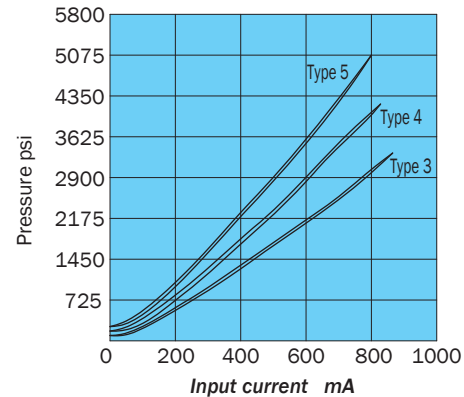
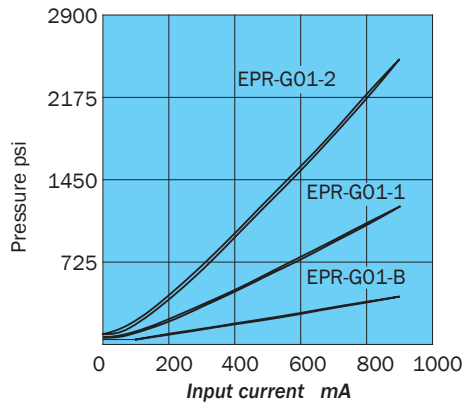
The gasket surface dimensions comply with the ISO standard shown below.

ISO 4401-03-02-0-94

Performance Curves

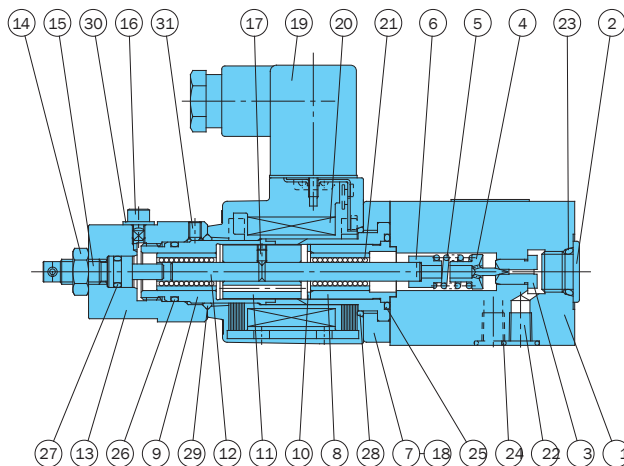
Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Pressure Characteristics



Cross-sectional Drawing

EPR-G01-*-***-12



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	12	Rod	22	Choke
2	Plug	13	Cover	23	O-ring
3	Seat	14	Nut	24	O-ring
4	Poppet	15	Screw	25	O-ring
5	Spring	16	Screw	26	O-ring
6	Retainer	17	Screw	27	O-ring
7	Cover	18	Screw	28	O-ring
8	Stopper	19	Connector	29	O-ring
9	Guide	20	Coil	30	Seal
10	Shim	21	Ball bush	31	Screw
11	Plunger				

Note: Coil model number JD64-D2

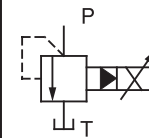
Seal Part List (Kit Model Number JPS-G01-1A)

Part No.	Part Name	Part Number	Q'ty
23	O-ring	1B-P11	1
24	O-ring	1B-P9	2
25	O-ring	1B-P22	1
26	O-ring	AS 568-016(Hs90)	1
27	O-ring	1B-P7	1
28	O-ring	S-25	1
29	O-ring	1A-P20	1
30	Seal	CW1000FO	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.

Electro-Hydraulic Proportional Relief Valve

39 to 84.5 gpm
43 to 5075 psi



Features

This valve combines a compact, high-performance electro-hydraulic proportional pilot relief valve and balanced piston type relief valve to provide pressure control in proportion to **input current**.

Throughput volume and fluid temperature fluctuation has little effect on control pressure, so this valve provides open loop control of even complex pressures (forces).

Specifications

Item	Model No.	ER-G03-*-21	ER-G06-*-21
Rated Flow Rate gpm		39	84
Pressure Control Range psi		B: 43 to 357 1: 100 to 1000 2: 143 to 2000 3: 214 to 3000 4: 214 to 3571 5: 286 to 5000	
Rated Current mA		800	
Coil Resistance Ω		20 (68° F)	
Hysteresis %		3 max. (Note 2)	
Minimum Relief Flow Rate gpm		1.3	2.1
Weight lbs		13.2	15.7

Note: 1. G03 type only Flow rate: 10.5 gpm

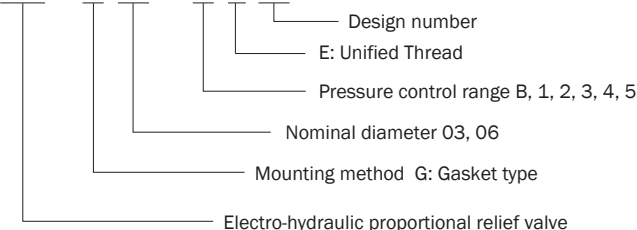
2. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

• Handling

- 1 To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid.
- 2 Manual Pressure Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counter-clockwise) and secured with the lock nut.
- 3 Tank Port Back Pressure
Make sure that tank port back pressure is as small as possible; no greater than 29 psi.
- 4 Safety Valve Setting Pressure
The safety valve is set to maximum adjustment pressure plus 217 to 290 psi. When actually using the valve, adjust in accordance with actual pressure.
- 5 Bundled Accessories (Valve Mounting Bolts)

Understanding Model Numbers

ER - G 03 - 3 * 21

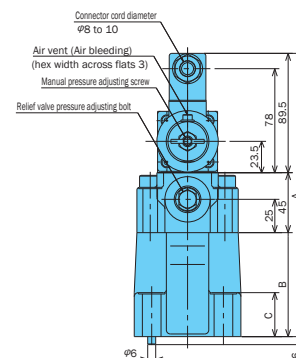
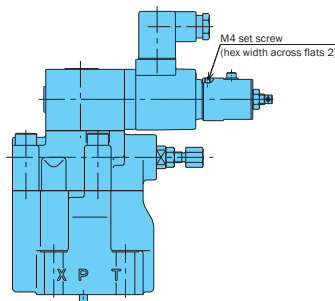
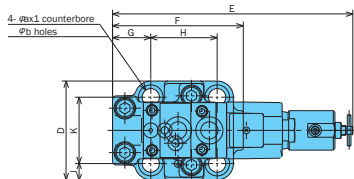


Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ER-G03	1/2-13 x 2"	4	55 to 70
ER-G06	5/8-11 x 2 3/8"	4	140 to 170

- 6 Use an operating fluid that conforms to the both of the following.
Fluid Temperature: 4° F to 140° F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

Installation Dimension Drawings

ER-G**-*-21



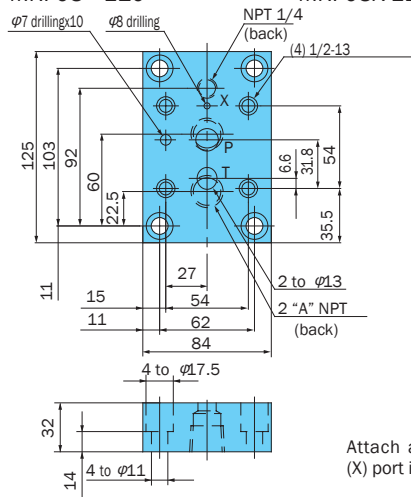
The gasket surface dimensions comply with the ISO standard shown below.
G03-ISO 6264-AR-06-2-A
G06-ISO 6264-AS-08-2-A

Model No.	A	B	C	D	E	F	G	H	J	K	a	b
ER-G03	212.5	78	33	80	194.8	106	31	53.8	13.1	53.8	20	14
ER-G06	217.5	83	37	100	203.8	119	37	66.7	15	70	26	17.5

Sub Plate (Maximum Operating Pressure: 3625 psi)

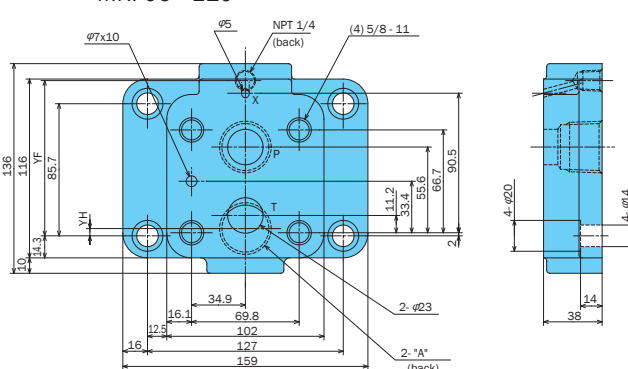
MRI-03*-E10

MRI-03X-E10



Attach a plug when the vent (X) port is not used.

MRI-06*-E10



Model No.	A NPT
MRI-03-E10	3/8
MRI-03X-E10	1/2
MRI-06-E10	3/4
MRI-06X-E10	1

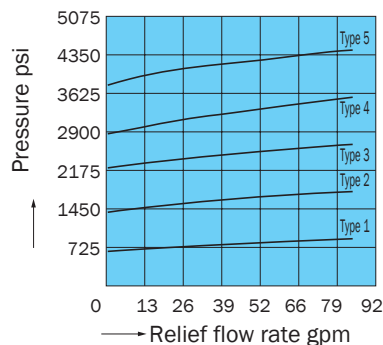
Model No.	YF	YH
MRI-06-E10	92.5	13.2
MRI-06X-E10	100.7	4.7

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

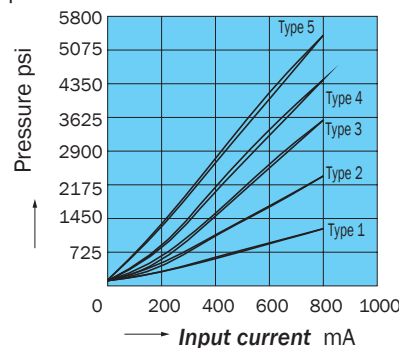
Flow Rate – Pressure Characteristics

ER-G06*-E21



Input Current – Pressure Characteristics

ER-G06*-E21



Cross-sectional Drawing

ER-G**-21

ER Valve Built-in Pilot Relief Valve List

Model No.	Built-in Pilot Relief Valve
ER-G03-B-21	EPR-G01-B-0011S-12
1	1-0011S-12
2	2-1313S-12
3	3-1212S-12
4	4-1111S-12
5	5-1010S-12
ER-G06-1-21	EPR-G01-1-0011S-12
2	2-1313S-12
3	3-1212S-12
4	4-1111S-12
5	5-1010S-12

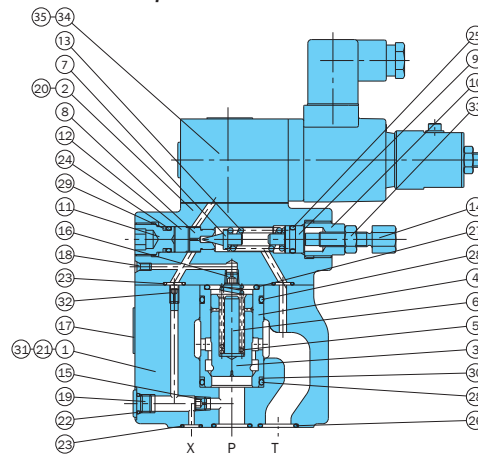
Seal Part List (Kit Model Number JPS-G01-1A)

Part No.	Part Name	Nominal Diameter/Part Number		Q'ty
		G03	G06	
22	O-ring	1B-P8	1B-P8	1
23	O-ring	1B-P9	1B-P9	3
24	O-ring	1B-P10A	1B-P10A	1
25	O-ring	1A-P11	1A-P11	1
26	O-ring	1B-P18	1B-P28	2
27	O-ring	1B-G25	1B-P28	1
28	O-ring	1B-G30	1B-P32	2
29	Backup ring	T2-P10A	T2-P10A	1
30	Backup ring	T2-G30	T2-P32	1

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.

2. For the ** part of the kit number, specify the valve size (G03, G06).

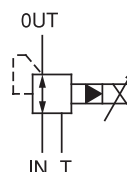
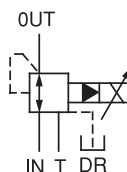
3. EPR-G01 pilot valve seal is available separately. See page G-3 for more information.



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	17	Plate	33	Nut
2	Cover	18	Plug	34	Pilot relief valve
3	Poppet	19	Plug	35	Screw
4	Sleeve	20	Screw		
5	Spring	21	Pin		
6	Spacer	22	O-ring		
7	Poppet	23	O-ring		
8	Seat	24	O-ring		
9	Plunger	25	O-ring		
10	Retainer	26	O-ring		
11	Plug	27	O-ring		
12	Collar	28	O-ring		
13	Spring	29	Backup ring		
14	Handle	30	Backup ring		
15	Orifice	31	Screw		
16	Orifice	32	Choke		

Electro-Hydraulic Proportional Reducing and Relief Valve

13.2 to 26.4 gpm
43.5 to 3625 psi



Features

This valve combines a compact, high-performance electro-hydraulic pilot relief valve, and a reducing and relief valve for low-pressure control of pressure within a hydraulic system in proportion to **input**

current.

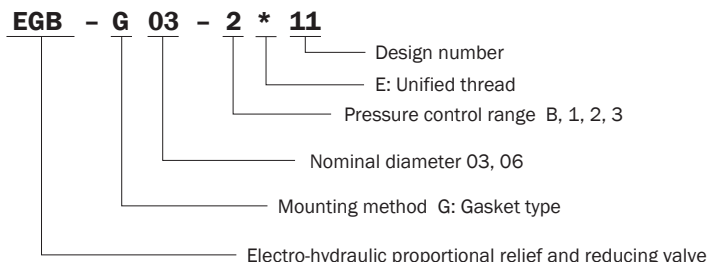
Since this valve includes a relief function, OUT side pressure can be maintained at a virtually fixed level, even when the valve's OUT side is used as reaction force. This valve also provides outstanding response as pressure drops.

Specifications

Item	Model No.	EGB-G03-*-11	EGB-G06-*-11
Maximum Operating Pressure psi		3625	
Maximum Flow Rate gpm		13.2	26.4
Pressure Control Range psi		B: 43 to 357 1: 100 to 1000 2: 129 to 2000 3: 214 to 3000	
Rated Current mA		800	
Coil Resistance Ω		20 (68° F)	
Hysteresis %		3 max. (Note 2)	
Weight lbs		12	17

Note: 1. G03 type only Rated flow rate: 5.2 gpm
2. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Understanding Model Numbers



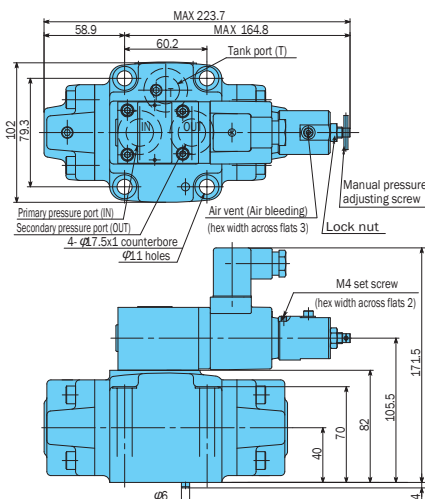
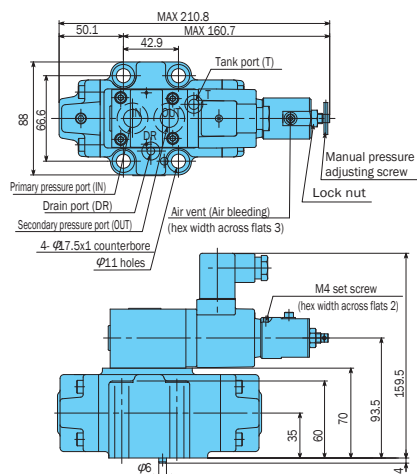
Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
EGB-G03	3/8-16 x 3"	4	33 to 40
EGB-G06	3/8-16 x 3 3/8"	4	33 to 40

6 Use an operating fluid that conforms to the both of the following.
Oil temperature: 4 to 140 °F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

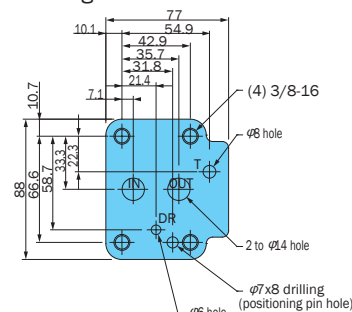
Installation Dimension Drawings

EGB-G03-*-11

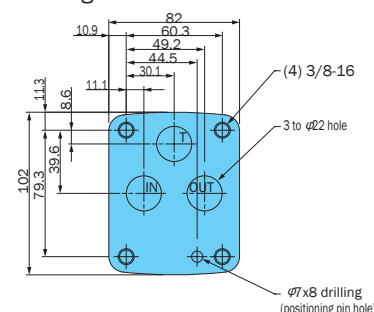
EGB-G06-*-11



Mounting Gasket Dimensions EGB-G03-*-11



Mounting Gasket Dimensions EGB-G06-*-11

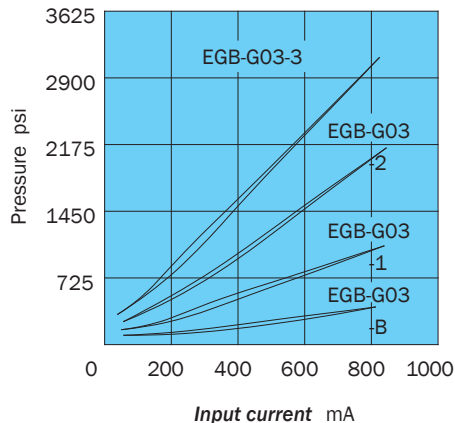


Performance Curves

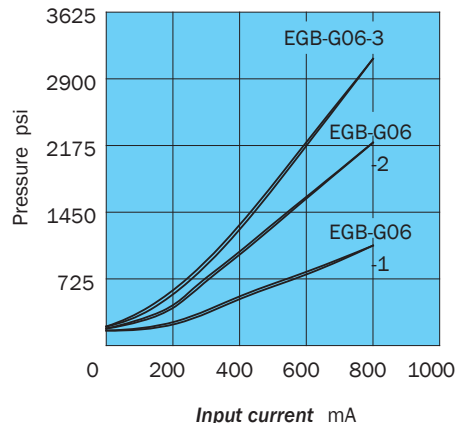
Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Pressure Characteristics

EGB-G03

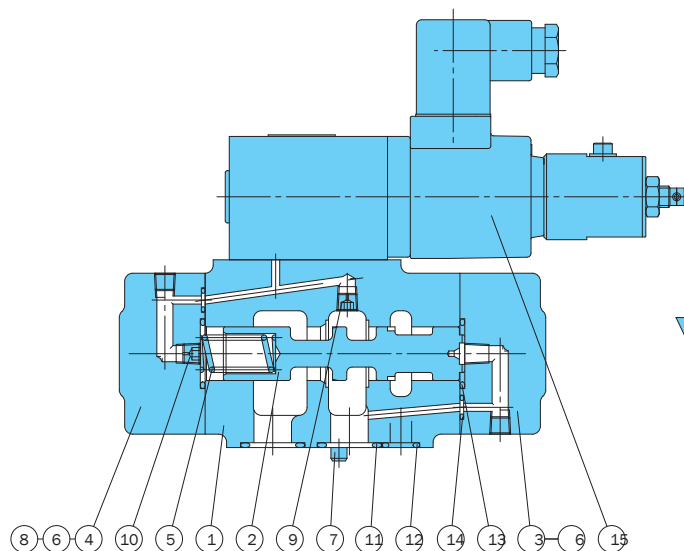


EGB-G06



Cross-sectional Drawing

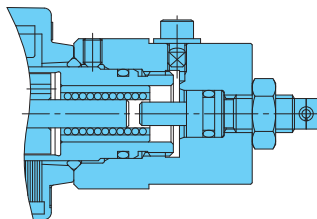
EGB-G**-*-11



EGB Valve Built-in Pilot Relief Valve List

Model No.	Built-in Pilot Relief Valve
EGB-G03-B-11	EPR-G01-B-0000-12
EGB-G03-1-11	1-0013-12
EGB-G03-2-11	2-0012-12
EGB-G03-3-11	3-0011-12
EGB-G06-1-11	EPR-G01-1-0013-12
EGB-G06-2-11	2-0012-12
EGB-G06-3-11	3-0012-12

Manual adjustment section



Seal Part List (Kit Model Number JGS-***)

Part No.	Part Name	EGB-G03-*-11		EGB-G06-*-11	
		Part Number	Q'ty	Part Number	Q'ty
11	O-ring	1B-P20	2	1B-P26	3
12	O-ring	1B-P10A	2	-	-
13	O-ring	1B-P22	2	1B-G30	2
14	O-ring	1B-P6	2	1B-P6	2

Note: 1.O-ring 1B-** refers to JIS B2401-1B-**.

2.For the ** part of the kit number, specify the valve size (G03, G06).

3.EPR-G01 pilot valve seal is available separately. See page G-3 for more information.

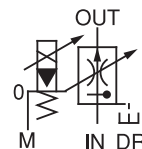
Part No.	Part Name
1	Body
2	Piston
3	Cover
4	Cover
5	Spring
6	Screw
7	Pin
8	Pin
9	Choke
10	Choke
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Pilot relief valve

Note:

Coil model number JD64-D2

Electro-Hydraulic Proportional Flow Control Valve

.5 to 132 gpm
3045 psi



Features

This valve controls actuator speed in response to the size of **input current**. Pressure and control fluid temperature fluctuation has little effect on setting

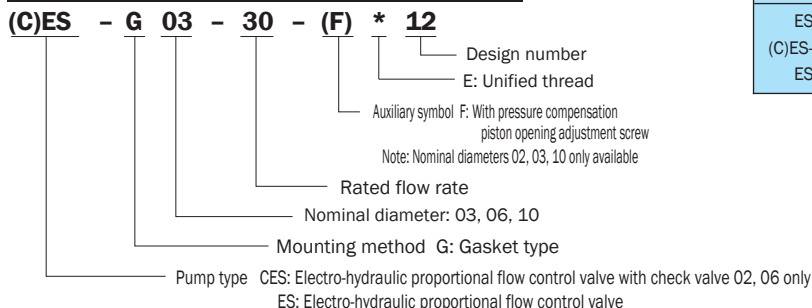
pressure which enables high-precision speed control. This valve is the perfect choice for actuator acceleration and deceleration control, and remote control.

Specifications

Item	Model No.	ES-G03-60 (F)-12 125	(C)ES-G06-250-11	ES-G10-500 (F)-11
Maximum Operating Pressure psi		3045	3045	3045
Flow Rate Control Range gpm		.5 to 15.8	1.3 to 66	3.9 to 132
Minimum Allowable Valve Pressure Differential psi		145 (Note1)	217 (Note1)	(Note1)
Reverse Flow Rate gpm (With check valve only)		33 (Note3)	52	-
Hysteresis %		3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
Rated Current mA		800	800	800
Coil Resistance Ω		20 (68°F)	20 (68°F)	20 (68°F)
Weight lbs		28.6	55	121

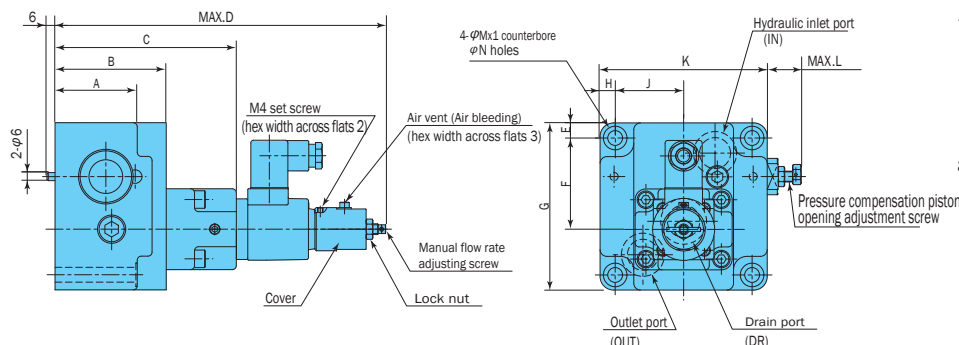
Note: 1. Control valve inlet and outlet pressure differential required to obtain favorable pressure compensation.
2. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).
3. ES-G03 does not have a built-in check valve, but a sub plate with check valve (Model No. MCF-03-D-22) is available for it.

Understanding Model Numbers



Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ES-G03	3/8-16 x 3"	4	33 to 40
(C)ES-G06	5/8-11 x 5 1/2"	4	140 to 170
ES-G10	3/4-10 x 6 1/4"	4	270 to 339

Installation Dimension Drawings



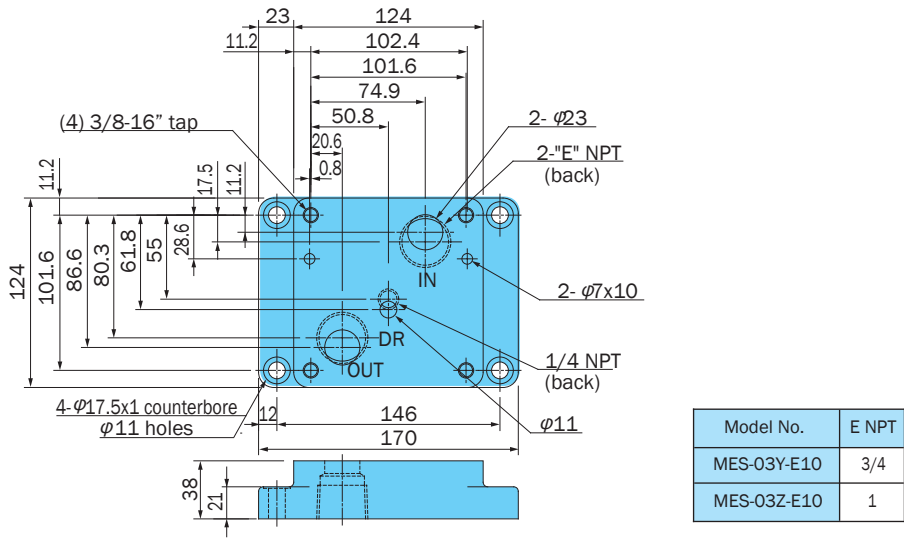
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N
ES-G03	61	82.5	134.5	245.3	11.2	67.8	124	11.2	50.8	124	26	17.5	11
(C)ES-G06	115	130	182	292.8	16.8	104.8	167	17	73	180	-	26	18
ES-G10	137	160	215	326.3	25	148	228	23.5	98.5	244	18	32	22

- Handling
- 1 Air Bleeding
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the M4 screw and rotating the cover.
- 2 Manual Flow Rate Adjusting Screw
For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, the flow rate can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.
- 3 Drain Port
Make sure that back pressure is no greater than 29 psi, and that his port is connected directly to the fluid tank at a point that is below the oil surface.
- 4 Bundled Accessories (Valve Mounting Bolts)

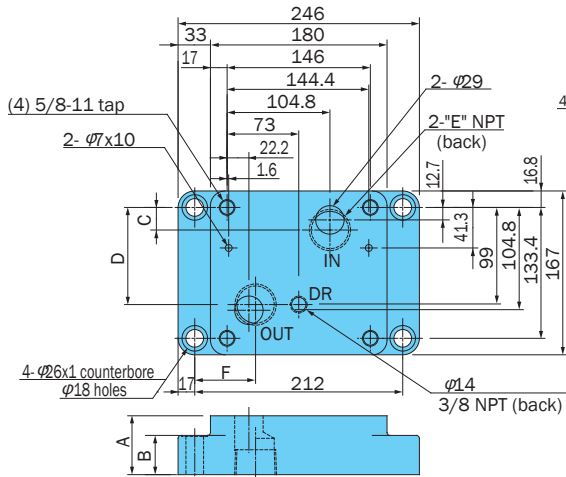
- 5 The loss coefficient and control valve can cause resonance when there is a great distance between the flow control valve and actuator (when the pipe internal volume is large). Be sure to keep the distance between the flow control valve and actuator as small as possible, and to avoid the use of flexible hose as much as possible.
- 6 Sub Plate
See the next page for more information about sub plates.
- 7 Use an operating fluid that conforms to the both of the following.
Oil temperature: 4 to 140 °F
Viscosity: -12 to 400 centistokes.
The recommended viscosity range is 15 to 60 centistokes.
- 8 Since this valve has a built-in pressure compensation valve, changing of the inertial load (using a high inertial oil motor, etc.) can create the risk of hunching under certain conditions. Contact your sales agent before changing the inertial load.
Note: Use a hex wrench that has a width across flats of 8 to adjust the aperture adjustment screw of nominal diameter 10.

• The gasket surface dimensions comply with the ISO standard shown below.
(C) ES-G03 ...ISO 6263-07-09-97
(C) ES-G06 ...ISO 6263-08-13-97

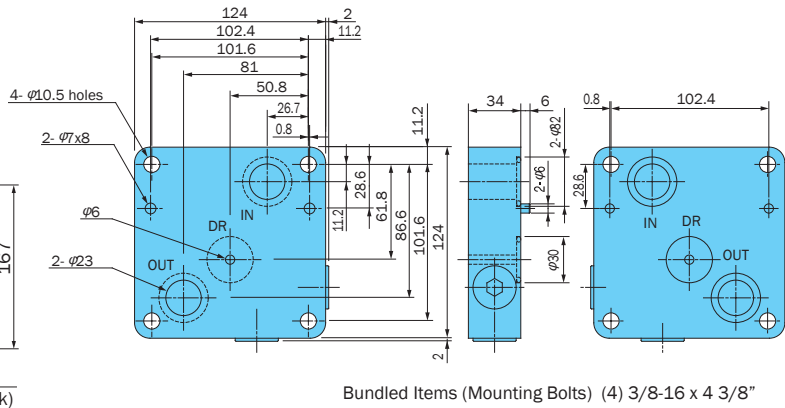
Sub Plate
MES-03*-E10



MES-06*-E10

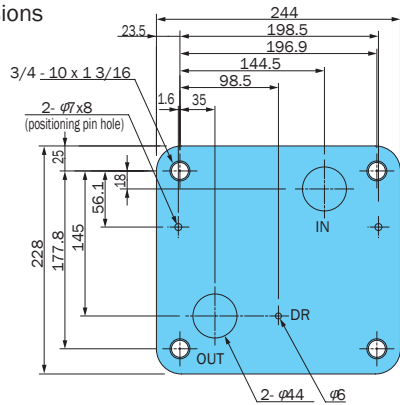


Auxiliary Plate with Check Valve
MCF-03-D-22



Model No.	A	B	C	D	E	F
MES-06X-E10	45	25	16	104.8	1	55.2
MES-06Y-E10	60	40	23	99	1 1/4	62

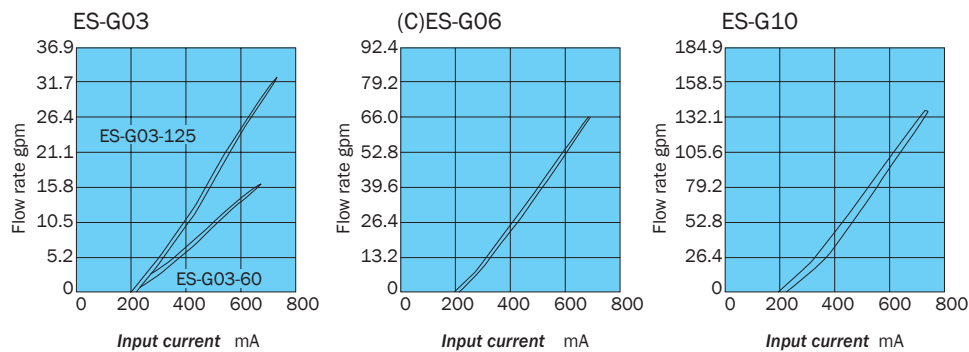
ES-G10*-E10 Mounting Gasket Surface Dimensions



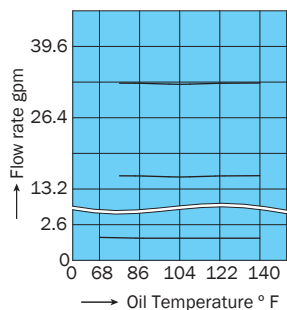
Performance Curves

Hydraulic Operating Fluid Viscosity Centistokes

Input Current – Flow Rate Characteristics

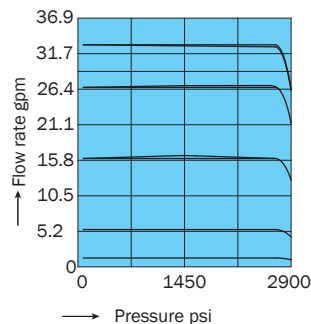


Fluid Temperature – Control Flow Rate Characteristics



Supply Pressure 2000 psi
Load Pressure 1450 psi
Operating Fluid VG32
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

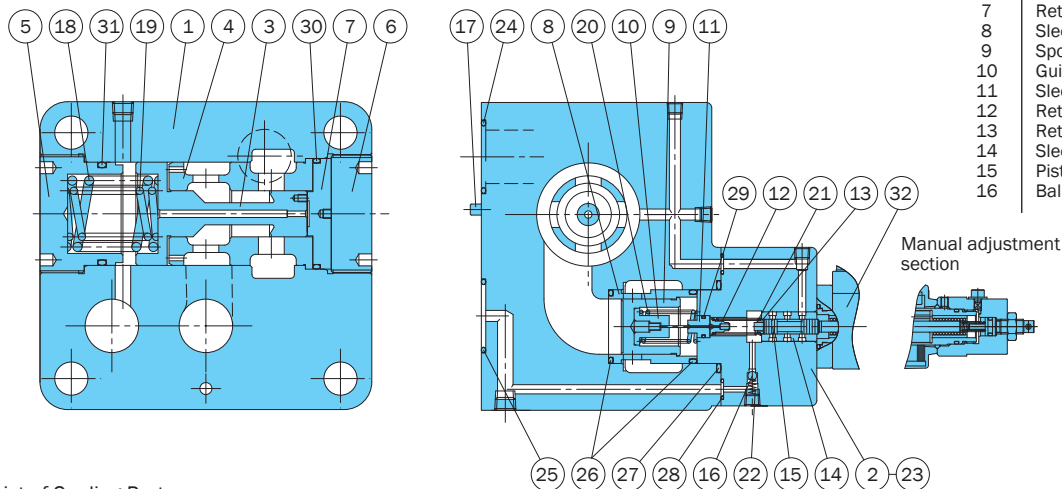
Pressure – Control Flow Rate Characteristics



Supply Pressure 3000 psi
Operating Fluid VG32
Fluid Temperature 104° F
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Cross-sectional Drawing

ES-G**-11(12)



Part No.	Part Name	Part No.	Part Name
1	Body	17	Pin
2	Cover	18	Spring
3	Piston	19	Spring
4	Sleeve	20	Spring
5	Plug	21	Spring
6	Plug	22	Spring
7	Retainer	23	Spring
8	Sleeve	24	O-ring
9	Spool	25	O-ring
10	Guide	26	O-ring
11	Sleeve	27	O-ring
12	Retainer	28	O-ring
13	Retainer	29	O-ring
14	Sleeve	30	O-ring
15	Piston	31	O-ring
16	Ball	32	Proportional solenoid

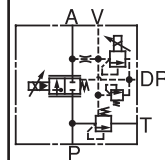
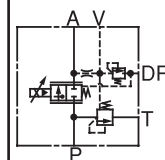
List of Sealing Parts

Part No.	Part Name	ES-G03		(C)ES-G06		ES-G10	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
24	O-ring	1B-P26	2	1B-G35	2	1B-P48	2
25	O-ring	1B-P28	1	1B-G35	1	1B-P48	1
26	O-ring	-	-	1B-G35	2	1B-G50	2
27	O-ring	1B-P29	1	1B-G45	1	1B-G60	1
28	O-ring	1B-P5	4	1B-P8	3	1B-P9	3
29	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
30	O-ring	1B-P20	1	1B-G55	1	1B-G75	2
31	O-ring	1B-P38	1	1B-P50	1	1B-G75	1
Seal Kit Number		JFS-G03		JFS-G06		JFS-G10	

Note: O-ring 1B-** refers to JIS B2401-1B-**.

Load Response Electro-Hydraulic Proportional Relief and Flow Control Valve

.26 to 132 gpm
3625 psi



Features

The load sensing function of this meter in flow control valve makes it possible to control pump discharge pressure automatically in accordance with the size of the load

pressure. Using this valve suppresses wasteful pump pressure rises and makes it possible to configure an energy-efficient circuit.

Specifications

Item	Model No.	ESR-G03-125 (R*)-12	ESR-G06-250 (R*)-12	ESR-G10-500 R*-11
Maximum Operating Pressure psi		3625	3625	3625
Rated Flow Rate l/min (gpm)		125 (33)	250 (66)	500 (132)
Flow Rate Control System	Flow Rate Control Range gpm	.5 to 33	1.3 to 66	3.9 to 132
	Valve Differential Pressure psi	72 (Note1)	101 (Note1)	130 (Note1)
	Hysteresis %	3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
	Repeatability %	1	1	1
	Rated Current mA	800	800	800
	Coil Resistance Ω	20 (68°F)	20 (68°F)	20 (68°F)
Pressure Control System (Note 3)	Pressure Control Range psi	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625
	Hysteresis %	3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
	Repeatability %	1	1	1
	Rated Current mA	800	800	800
	Coil Resistance Ω	20 (68°F)	20 (68°F)	20 (68°F)
	Weight lbs	30.8	61.7	132

Note: 1.Indicates the pressure differential between the valve P port and A port.
2.Value when a Nachi-Fujikoshi special amplifier is used (with dithering).
3.These specifications apply to valves that include an electro-hydraulic proportional pilot relief valve (i.e. ESR-G06-250R2-11).
4.The maximum adjustment pressure is 3625 psi for a valve that does not include an electro-hydraulic proportional pilot relief valve.
Factory default is minimum output (507 psi max.) Set this value in accordance with the pressure of the hydraulic circuit being used.

Understanding Model Numbers

ESR - G 06 - 250 (**) * 12

Design number
12: For 03, 06 size
11: For 10 size
E: Unified Thread
Pressure control function
None: Without electro-hydraulic proportional pilot relief valve (available with G03, G06)
R ※: With electro-hydraulic proportional pilot relief valve
Rated flow rate
Nominal diameter 03, 06, 10
Mounting method G: Gasket type
Pump type ESR: Load sensitive electro-hydraulic proportional relief and flow control valve

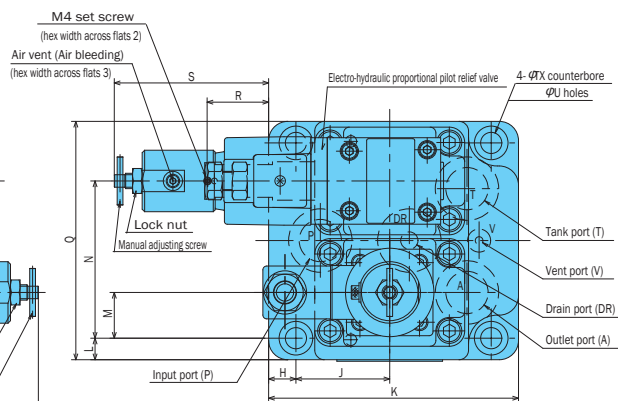
Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESR-G03	3/8-16 x 3 1/2	4	33 to 40
ESR-G06	5/8-11 x 5 1/4	4	140 to 173
ESR-G10	3/4-10 x 5	4	272 to 339

8 Sub Plate
See the next page for more information about sub plates.
9 Use an operating fluid that conforms to the both of the following. Oil temperature: -4 to 158°F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

- Handling
 - 1 In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation.
 - 2 Manual Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, pressure or flow rate can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.
 - 3 Drain Port
Minimum control pressure is increased by drain port back pressure, so be sure to connect the drain port directly to the fluid tank at a point that is below the oil surface.
 - 4 Safety Valve Setting Pressure
For a safety valve without an electro-hydraulic proportional pilot relief valve, safety valve pressure is set to minimum pressure (507 psi). In the case of a safety valve with an electrohydraulic proportional pilot relief valve, the safety valve setting pressure is set to the minimum adjustment pressure plus 217 psi. When actually using the valve, adjust in accordance with hydraulic circuit pressure.
 - 5 Minimum Relief Flow Rate During Pressure Control
Setting pressure can become unstable when the relief flow rate to the valve's T port is small. Because of this, use a relief flow rate of at least 2.6 gpm with a nominal diameter of .1", and a relief flow rate of at least 2.6 gpm with a nominal diameter of .39".
 - 6 Valve Mounting Orientation
When an electro-hydraulic proportional pilot relief valve main valve is mounted on a vertical surface with the pilot relief valve part facing downwards make it difficult to bleed air from the pilot relief valve. Because of this, you should not use this type of mounting orientation.
 - 7 Bundled Accessories (Valve Mounting Bolts)

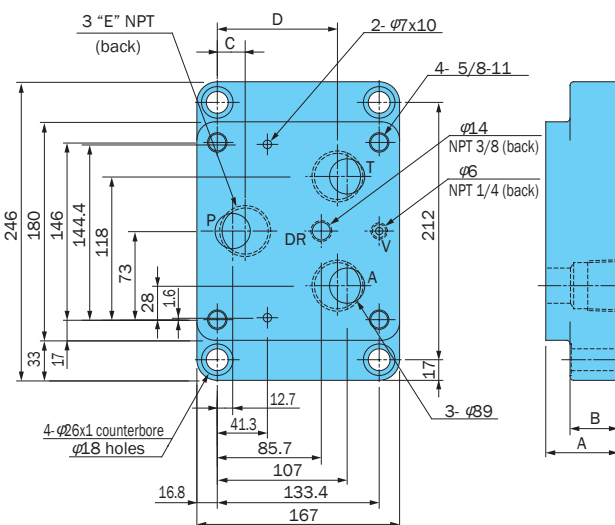
10 Since this valve has a built-in pressure compensation valve, changing of the inertial load (using a high inertial oil motor, etc.) can create the risk of hunching under certain conditions. Contact your sales agent before changing the inertial load.

Proportional Valves



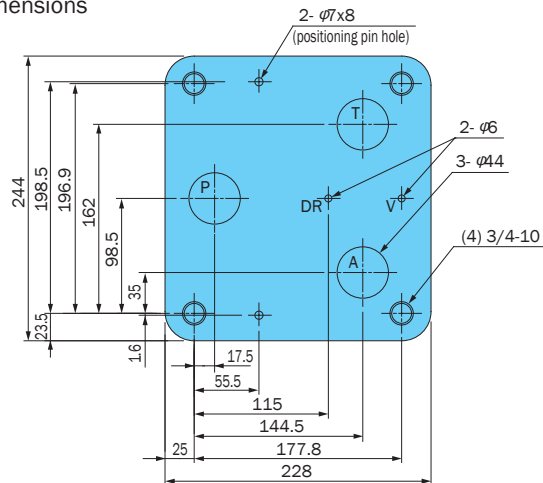
Sub Plate
MSR-03*-E10

MSR-06*-E10



Model No.	A	B	C	D	E
MSR-06X-E10	95	25	16	107	1 NPT
MSR-06Y-E10	60	40	23	99	1 1/4 NPT

ESR-G10 Mounting Gasket Surface
Dimensions

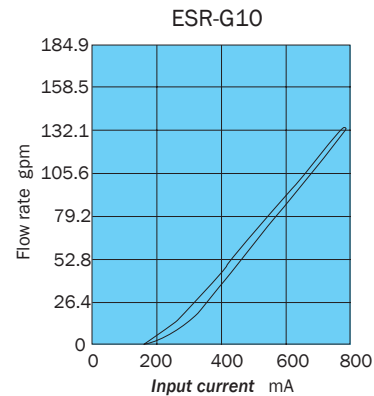
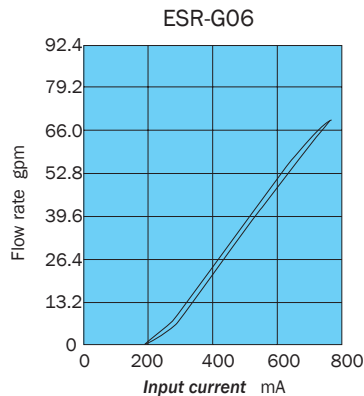
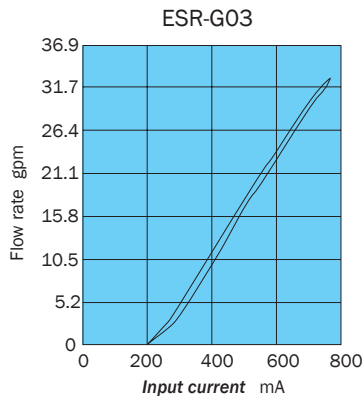


The gasket surface dimensions comply with the ISO standards shown below.
ESR-G03-ISO 6263-07-11-97
ESR-G06-ISO 6263-08-15-97

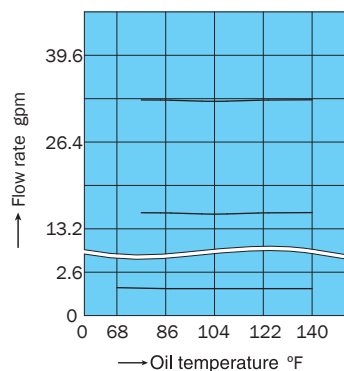
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Flow Rate Characteristics

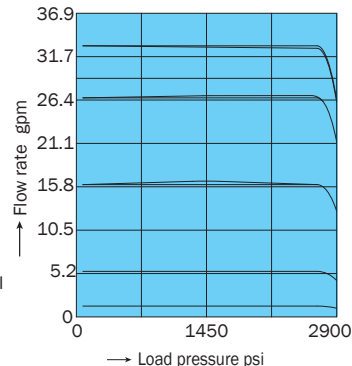


Fluid Temperature – Control Flow Rate Characteristics



Load Pressure: 1450 psi
Operating Fluid: VG32
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

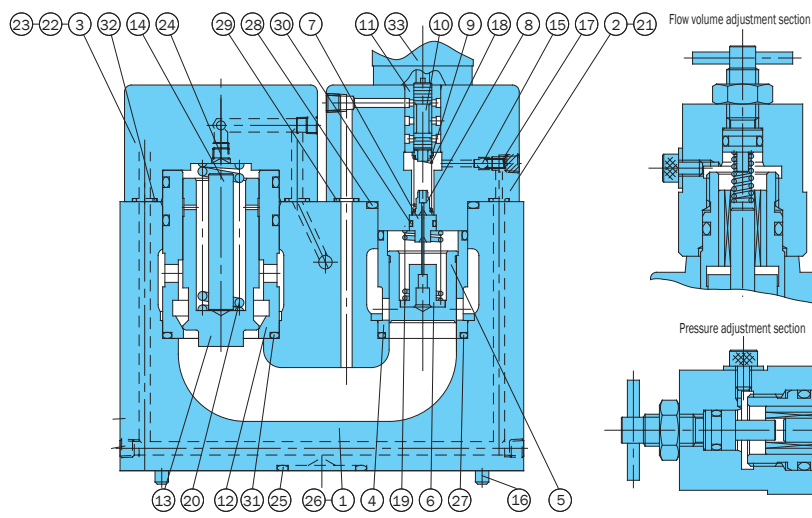
Pressure – Control Flow Rate Characteristics



Electro-hydraulic Proportional Pilot
Relief Valve Setting Pressure 3045 psi
Operating Fluid: VG32
Fluid Temperature: 104° F
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Cross-sectional Drawing

ESR-G***-11, 12



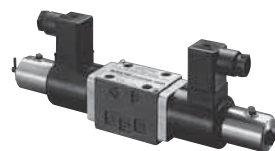
Part No.	Part Name	Part No.	Part Name
1	Body	18	Spring
2	Cover (A)	19	Spring
3	Cover (B)	20	Spring
4	Sleeve	21	Screw
5	Spool	22	Screw
6	Guide	23	Safety valve
7	Sleeve	24	Choke
8	Retainer	25	O-ring
9	Retainer	26	O-ring
10	Piston	27	O-ring
11	Sleeve	28	O-ring
12	Sleeve	29	O-ring
13	Poppet	30	O-ring
14	Guide	31	O-ring
15	Ball	32	O-ring
16	Pin	33	Proportional solenoid
17	Spring		

Note: Coil model number JD64-D2

List of Sealing Parts

Part No.	Part Name	ESR-G03		ESR-G06		ESR-G10	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
25	O-ring	1B-P26	4	1B-G35	4	1B-P48	4
26	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
27	O-ring	1B-G25	2	1B-G35	2	1B-G50	2
28	O-ring	1B-G35	1	1B-G45	1	1B-G60	1
29	O-ring	1B-P6	3	1B-P8	3	1B-P9	3
30	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
31	O-ring	1B-G35	3	1B-P46	3	1B-G65	3
32	O-ring	1B-P6	2	1B-P8	2	1B-P9	2
Seal Kit Number		JLS-G03R		JLS-G06R		JLS-G10R	

Note: 1.O-ring 1B-** refers to JIS B2401-1B-**. 2.EPR-G01 seal is available separately. See page G-3 for more information.



Electro-Hydraulic Proportional Flow and Directional Control Valve

2.6 to 132 gpm
3625 psi

Features

This valve uses a DC solenoid in a traditional 4-way solenoid valve to create a solenoid valve capable of both direction switching and high-speed control. The lineup consists of the direct system 01 size and the pilot system 03, 04, and 06 sizes.

Direction control is performed by supplying **input current** to one of the two proportional solenoid valves, and the size of the flow rate is controlled in accordance with the size of the **input current**. This type of valve can be used for remote control and shockless acceleration and deceleration control, and for simple configuration of hydraulic circuits.

Specifications

Model No. Item	ESD-G01-10 20 -12	ESD-G03-40 -12 80	ESD-G04-140 -12	ESD-G06-250 -13
Maximum Operating Pressure psi	3625			
Rated Flow Rate l/min (gpm)	10/20 (2.6/5.2) (Note 1)	40/80 (10.5/21) (Note 1)	139 (36.9) (Note 1)	125/250 (66) (Note 1)
Maximum Flow Rate gpm	6.6 (Note 2)	26.4 (Note 2)	36.9 (Note 2)	66 (Note 2)
Pilot Pressure psi	-	At least 145 (Note 3)		
Pilot Flow Rate gpm	-	At least .5 (Note 4)	At least .79 (Note 4)	At least 1.3 (Note 4)
T Port Allowable Back Pressure psi	2.5 (25.5)	Internal Drain: 362		
		External Drain: 3045		
Rated Current mA	850			
Coil Resistance Ω	20 (68 °F)			
Hysteresis %	5 max. (Note 5)			
Response Time s	0.04 (Note 6)	0.05 (Note 6)	0.08 (Note 6)	0.1 (Note 6)
Weight lbs	4.8	15.4	20.2	33

Note: 1. Value when pressure drop volume to P → A and P → B is $\Delta P = 145$ psi
2. Indicates maximum throughput volume value between each port.
3. Indicates differential between the pilot port and tank port, or drain port.
4. Value when 0.1 second is assumed for the response time from zero to the rated flow volume.
5. Value when a Nachi-Fujikoshi special amplifier is used.
6. Response time is typical value for a supply pressure of 2030 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

Understanding Model Numbers

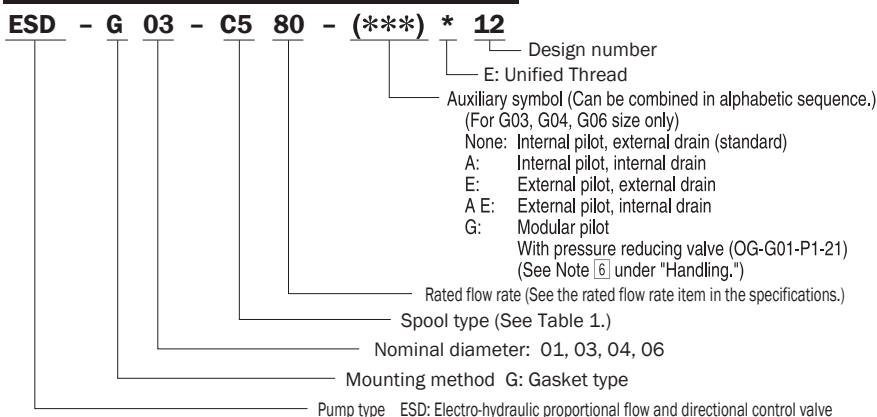


Table 1

Spool Type	Hydraulic Circuit		
	ESD-G01	ESD-G03, G04	ESD-G06
C5			
C6S			

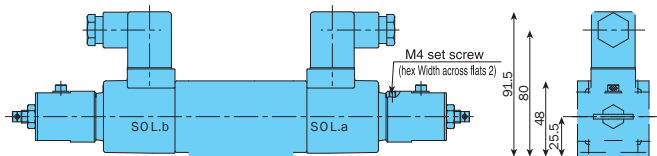
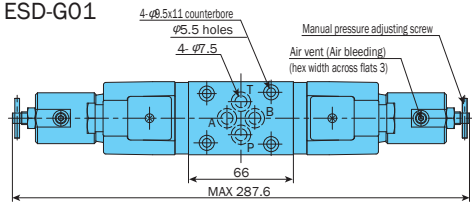
• Handling

- Air Bleeding**
In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation. For details, see the user's guide.
- T Port Piping**
When configuring piping, ensure that the T port (pilot valve T port for the G03, G04, and G06 sizes) is filled with operating fluid.
- Manual Adjusting Screw**
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, the valve can be operated and valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise).
- Valve Mounting Orientation**
Install the valve so the spool axis line is horizontal.
- Combining with a Pressure Compensation Valve**
Use of the optional pressure compensation kit is recommended when higher precision flow rate control is required or in high-pressure applications. For details, see page G-20.
- If pilot pressure (ESD-G03, G04, G06) exceeds 1300 psi use a modular type P port reduction valve (OG-G01-P1-21) at a setting of 290 psi.**
- On a system that requires large brake pressure during deceleration or a system that uses a vertical cylinder, equip a counter balance valve.**
Use a single rod, if the rod exit is not slowed sufficiently, use a counter balance valve on the rod.
- Maintain hydraulic operating fluid contamination so it is at least Class 9.**
Use of a G01 modular filter (Absolute: 8μ m) is also helpful.

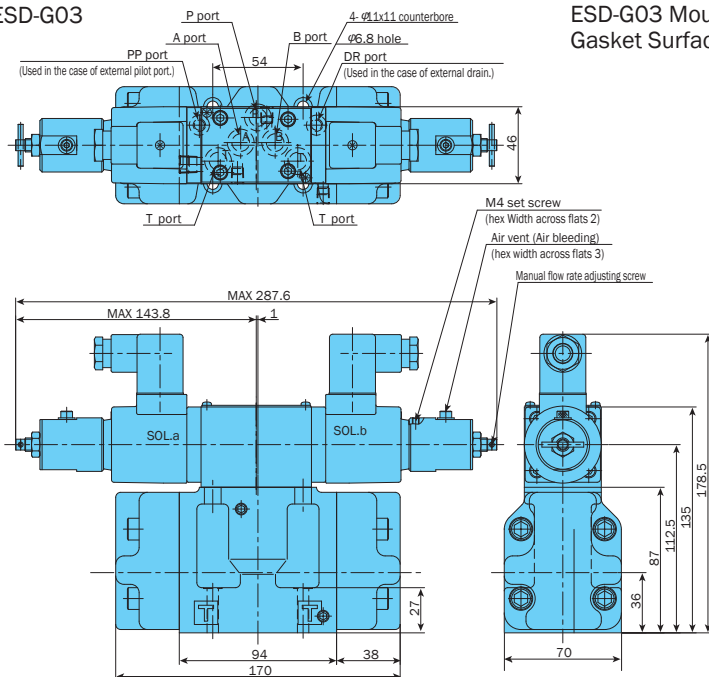
(Continued on next page)

Installation Dimension Drawings

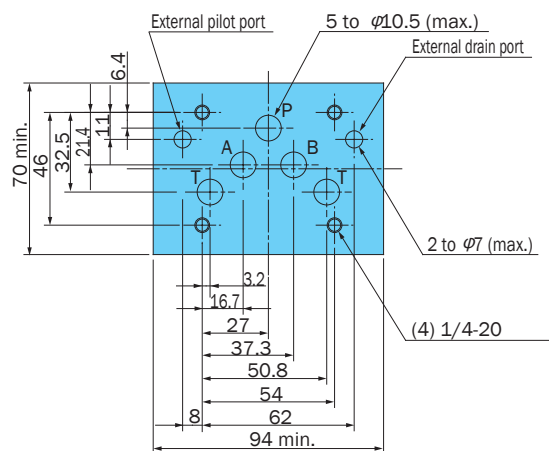
ESD-G01



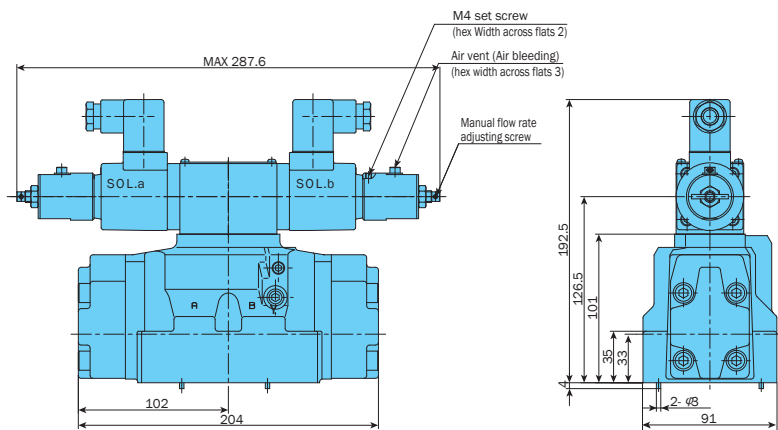
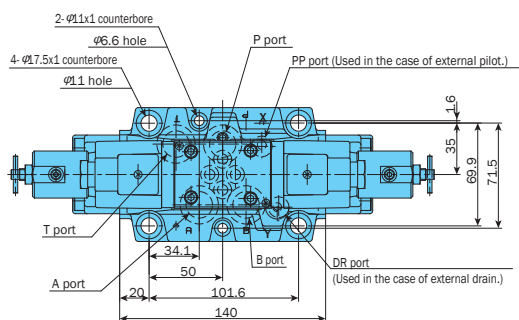
ESD-G03



ESD-G03 Mounting Gasket Surface Dimensions
Gasket Surface Mounting Dimensions (ISO4401-05-0-94)



ESD-G04



Bundled Accessories (Valve Mounting Bolts)

Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESD-G01	10-24 x 1 3/4	4	3.6 to 5 ft lbs
ESD-G03	1/4-20 x 1 3/8	4	7 to 9.5 ft lbs
ESD-G04	1/4-20 x 1 3/4	2	7 to 9.5 ft lbs
	3/8-16 x 2	4	33 to 40 ft lbs
ESD-G06	1/2-13 x 2 3/8	6	44 to 51 ft lbs

For information about sub plates, see MSA-01Y-E10 on page G-3.

Gasket Surface Dimensions (ISO 4401-03-02-0-94)

Use an operating fluid that conforms to both of the following.

Oil temperature: -4 to 158° F Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

- Auxiliary symbol G: Equipping a modular type pilot reduction valve increases the height by 1.57".
- The gasket surface dimensions comply with the ISO standards shown below.

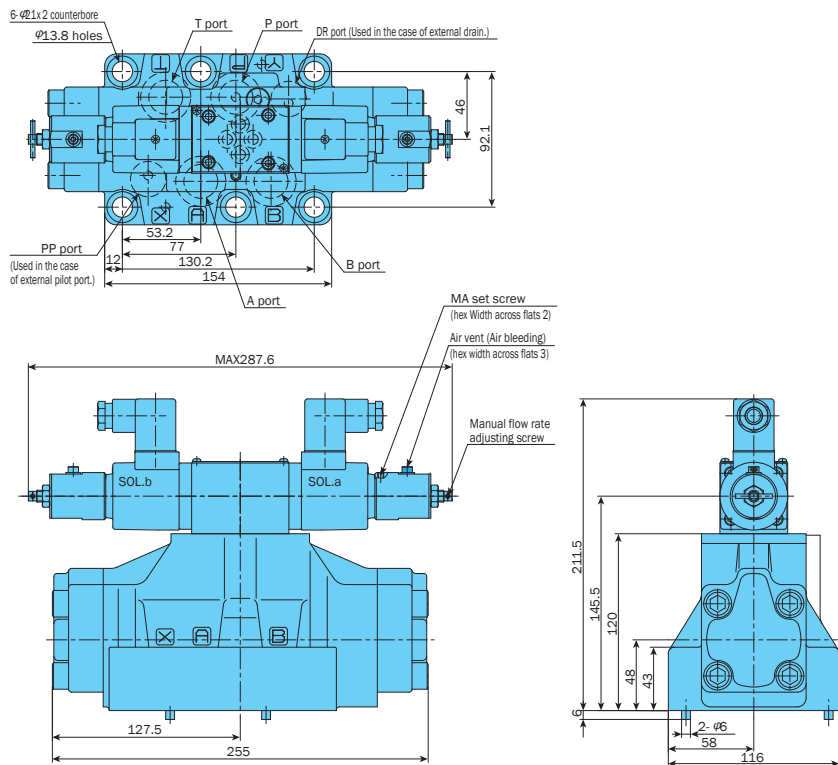
ESD-G04 - ISO 4401-07-06-0-94

ESD-G06 - ISO 4401-08-07-0-94

ESD-G10 - ISO 4401-10-08-0-94

Note: The coil cover has an M4 set screw. To change the air vent orientation, loosen the M4 screw and then rotate the cover. After bleeding air, tighten the cover and then secure it with the M4 screw.

ESD-G06



Performance Curves

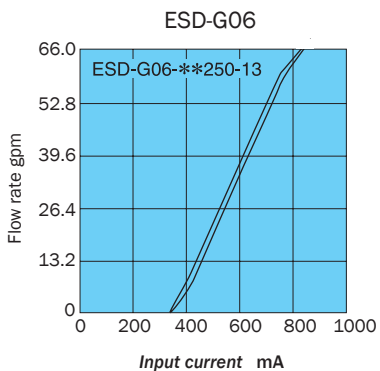
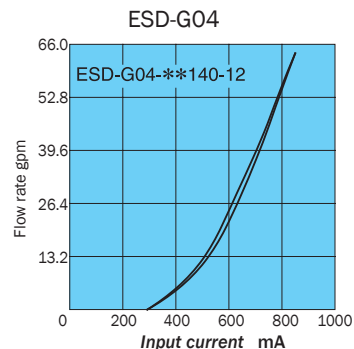
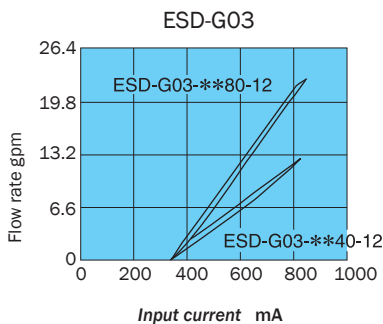
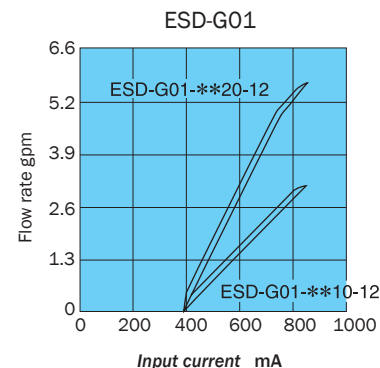
Input Current – Flow Rate Characteristics are characteristic when the P $\rightarrow$ A or P $\rightarrow$ B pressure drop is $\Delta P = 145$ psi.

Hydraulic Operating Fluid Viscosity 32 centistokes

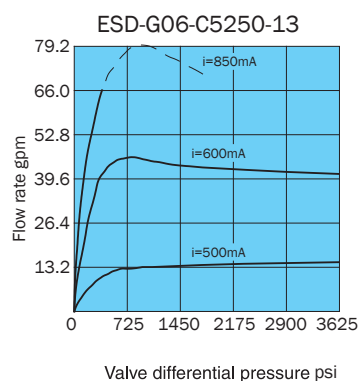
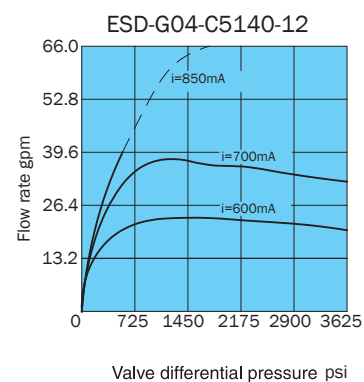
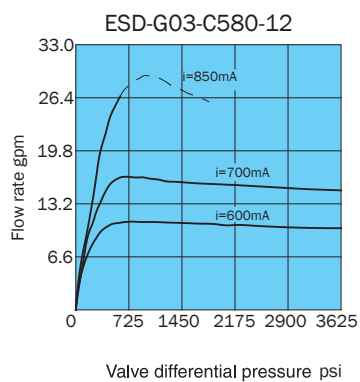
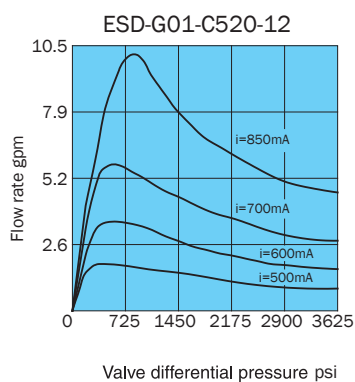
For Pressure – Flow Rate Characteristics, the horizontal shaft valve differential pressure indicates the pressure drop volume of the entire control valve

(between P, A, B, T), and flow rate is measured at the oil motor.

Input Current – Flow Rate Characteristics

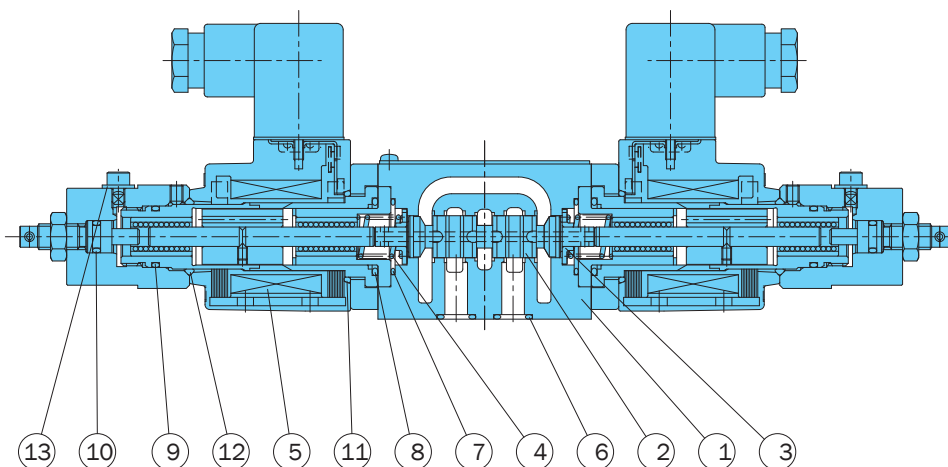


Pressure – Flow Rate Characteristics



Cross-sectional Drawing

ESD-G01-***-12



Part No.	Part Name
1	Body
2	Spool
3	Retainer
4	Spring
5	Coil
6	O-ring
7	O-ring
8	O-ring
9	O-ring
10	O-ring
11	O-ring
12	O-ring
13	Seal

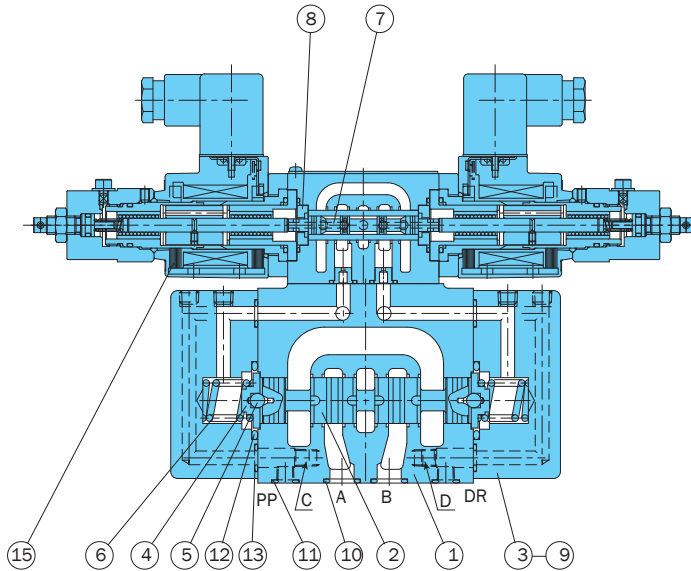
Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JDS-G01-1A)

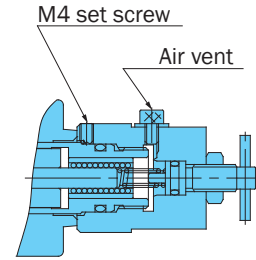
Part No.	Part Name	Part Number	Q'ty
6	O-ring	AS 568-012(Hs90)	4
7	O-ring	AS 568-019(Hs90)	2
8	O-ring	1B-P22	2
9	O-ring	AS 568-016(Hs90)	2
10	O-ring	1B-P7	2
11	O-ring	S-25	1
12	O-ring	1A-P20	1
13	Seal	CW1000FO	2

Note: O-ring 1A/B-** refers to JIS B2401-1A/B-**.

ESD-G03-***-(**)-12



Manual adjustment section
(ESD-G03, G04, G06, G10)

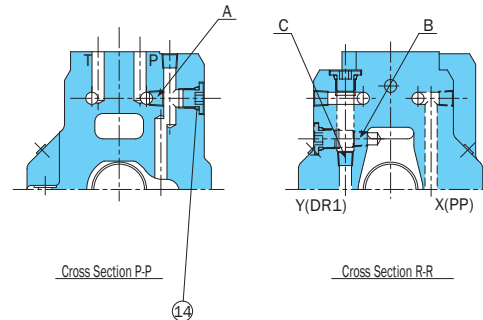
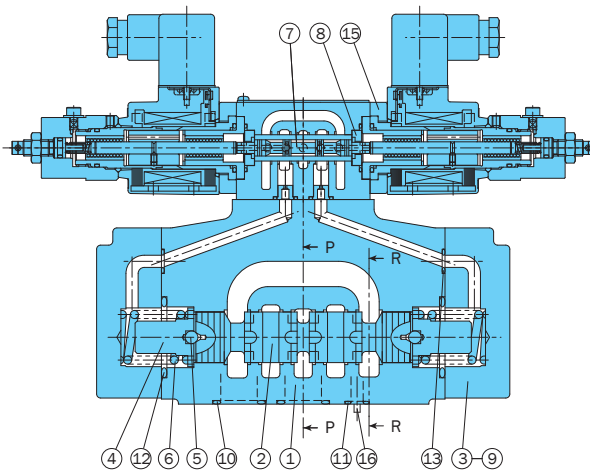


Note: The coil cover has an M4 set screw.
When changing the orientation of the air vent, loosen the M4 screw and rotate the cover. Retighten after bleeding the air.

Methods for Changing the Pilot/Drain System

After Change		Hexagon Socket Head Plug
Pilot	Internal	Change to PP port from C.
	External	Change from PP port to C.
Drain	Internal	Change from D to DR port.
	External	Change from DR port to D.

ESD-G04-***-(**)-12



Methods for Changing the Pilot/Drain System

After Change		Hexagon Socket Head Plug
Pilot	Internal	Remove from A
	External	Insert from A
Drain	Internal	Change from B to C
	External	Change from C to B

Note: A single hex head plug (NPTF 1/16) is required when changing to external pilot.
Hex Head Plug: TPUA-1/16

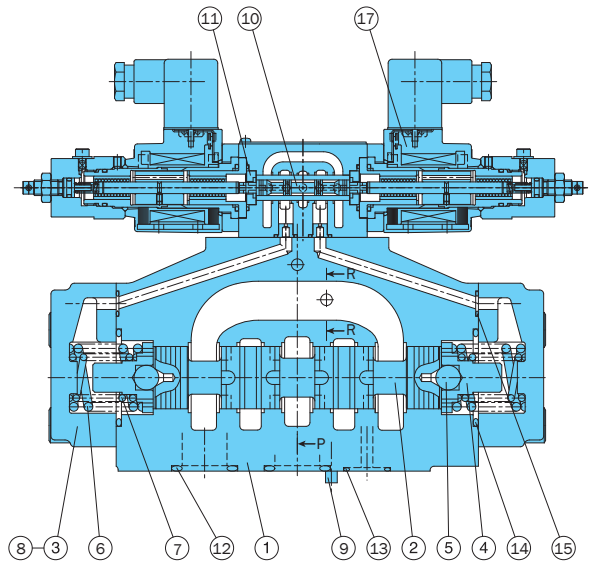
Part No.	Part Name
1	Body
2	Spool
3	Cover
4	Retainer
5	Ball
6	Spring
7	Pilot spool
8	Stopper
9	Screw
10	O-ring
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Proportional solenoid

Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JHS-***)

Part No.	Part Name	ESD-G03		ESD-G04	
		Part Number	Q'ty	Part Number	Q'ty
10	O-ring	1B-P12	5	1B-P22	4
11	O-ring	1B-P9	2	1B-P10A	2
12	O-ring	1B-P28	2	1B-P34	2
13	O-ring	1B-P9	6	1B-P9	2
14	O-ring	---	-	1B-P8	3
Kit Model No.		JHSG03		JHSG04	

Note: O-ring 1B-** refers to JIS B 2401-1B-**.

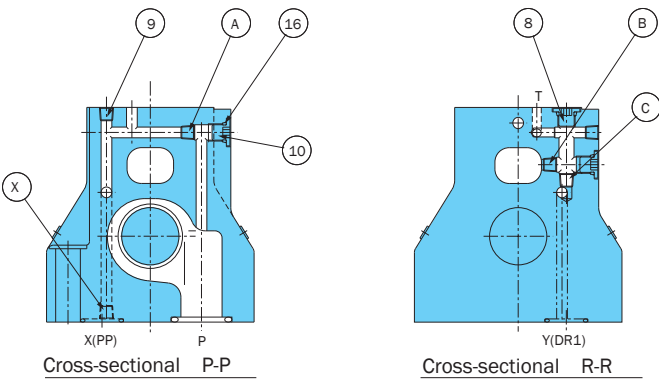


Seal Part List (Kit Model Number JHS-G06)

Part No.	Part Name	Part Number	Q'ty
12	O-ring	1B-P28	4
13	O-ring	1B-P20	2
14	O-ring	1B-G45	2
15	O-ring	1B-P10	2
16	O-ring	1B-P8	3

Note: O-ring 1B-** refers to JIS B 2401-1B-**.

Pilot, Drain System Change



Changing the Pilot and Drain Connections

After Change		Hexagon Socket Head Plug
Pilot	Internal	Switch from A to x .
	External	Switch from x to A .
Drain	Internal	Switch from B to C .
	External	Switch from C to B .

Part No.	Part Name
1	Body
2	Spool
3	Cover
4	Retainer
5	Ball
6	Spring
7	Spring
8	Screw
9	Pin
10	Pilot spool
11	Stopper
12	O-ring
13	O-ring
14	O-ring
15	O-ring
16	O-ring
17	Proportional solenoid

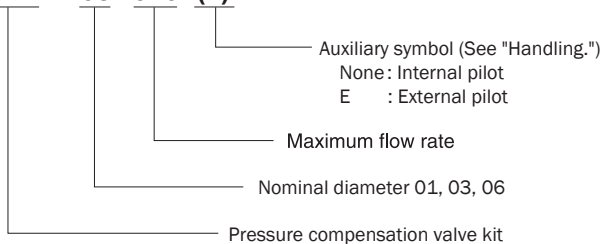
Pressure Compensation Valve Kit

Specifications

Item \ Model No.	JHF-01027	JHF-03040(E)	JHF-03080(E)	JHF-06170(E)
Maximum Operating Pressure psi	3045	3625	3625	3045
Pressure Compensation Differential Pressure psi	145	87	203	116
Maximum Flow Rate ℓ /min (gpm)	27 (7.1)	40 (10.5)	80 (21.1)	170 (44.9)
Weight lbs	3.3	10.3	11.0	26.4

Understanding Model Numbers

JHF - 03 040 (E)



• Handling

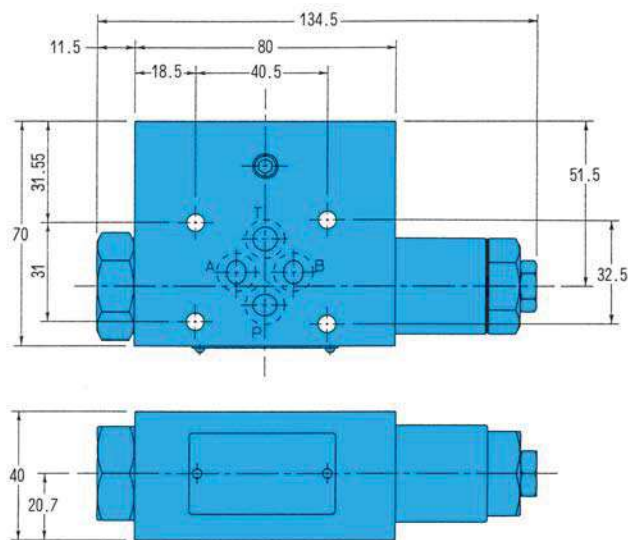
When using the pressure compensation kit, use an external pilot type for the ESD valve (G03, 06).

An internal pilot type pressure compensation valve kit is used when the pilot flow rate is supplied from the P port, without an external pilot port (Pp port) on the manifold. An

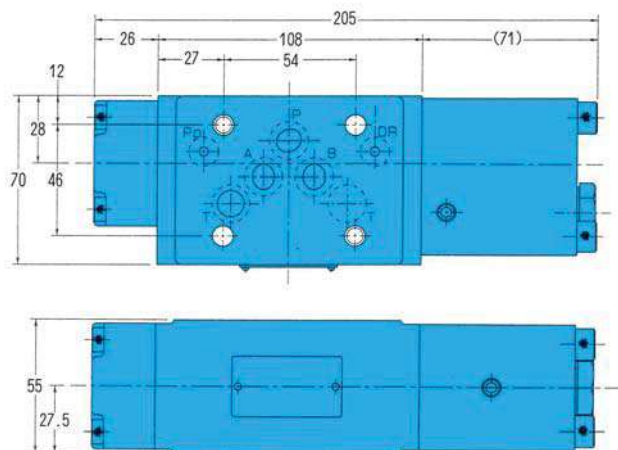
external pilot type pressure compensation valve kit is used when there is an external pilot port (Pp port) on the manifold.

Installation Dimension Drawings

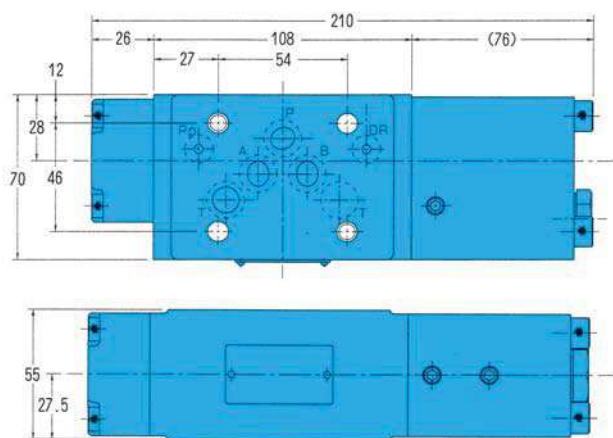
Pressure compensation valve kit
JHF-01027



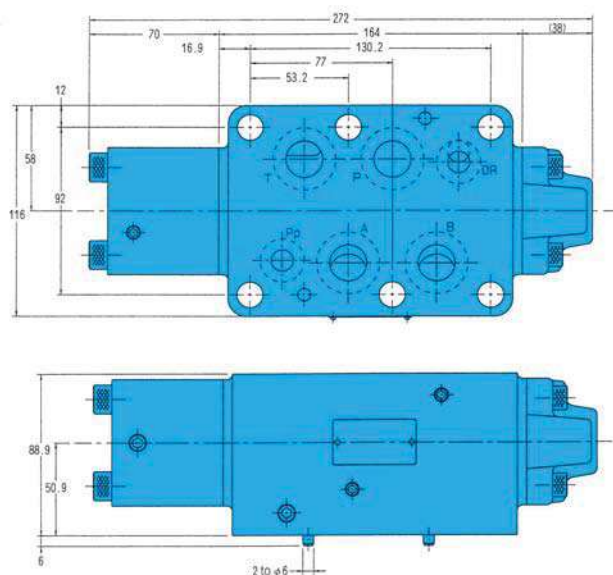
JHF-03040(E)



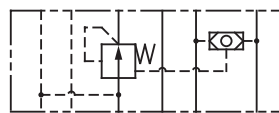
JHF-03080(E)



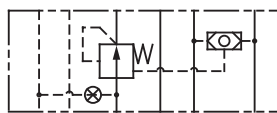
JHF-06170(E)



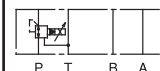
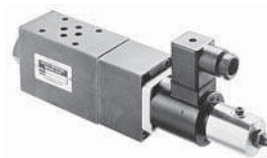
Note: Mounting bolts are not included with the pressure compensation kit. Use the valve mounting bolt lists on pages F-87 through F-89 to select mounting bolts.



Internal pilot



External pilot



Modular Type Electro-Hydraulic Proportional Reducing Valve

7.9 gpm
43.5 to 2030 psi

Features

This valve incorporates the ease-of-use principles of the modular valve into an electro-hydraulic proportional reducing valve to provide reduction

control of hydraulic system pressure in proportion to **input current**. This valve is perfect for a small-scale hydraulic system, such as those used

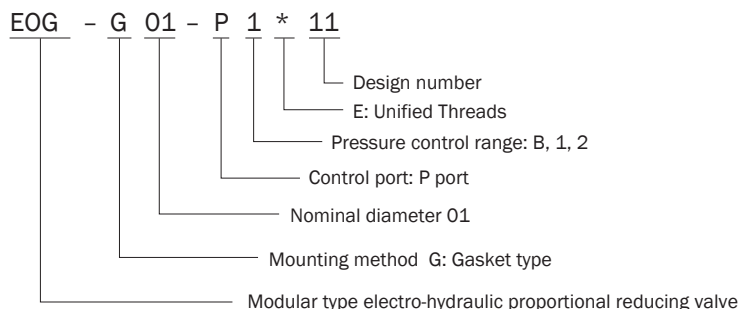
for continuous proportional control of lathe chuck pressure. A relief function ensures outstanding pressure response characteristics.

Specifications

Item	Model No.	EOG-G01-P*-11
Maximum Operating Pressure psi		3625
Maximum Flow Rate gpm		7.9
Pressure Control Range psi		B: 43.5 to 362 1: 58 to 1000 2: 87 to 2000
T Port Allowable Back Pressure psi		362
Rated Current mA		850
Coil Resistance Ω		20 (68° F)
Hysteresis %		3 max. (Note 1)
Weight lbs		7.9

Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Understanding Model Numbers

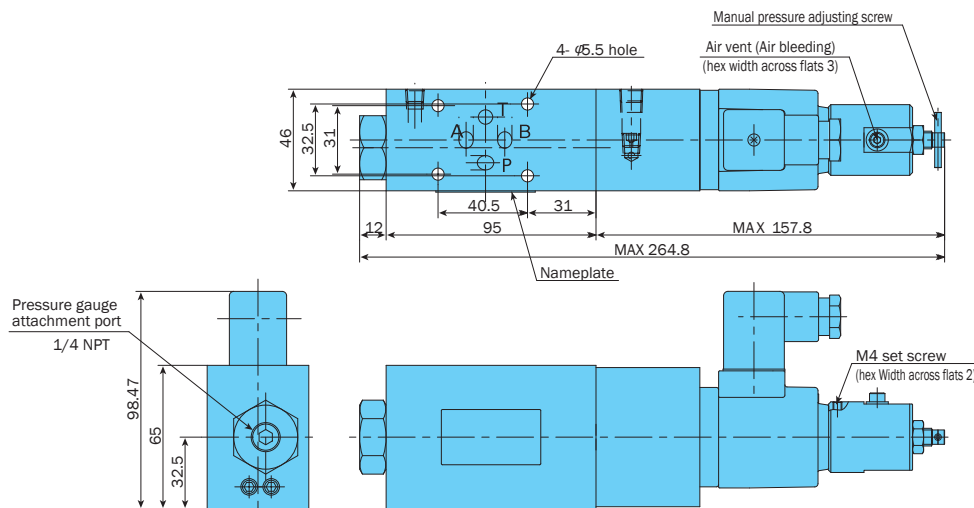


• Handling

- 1 Air Bleeding**
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid.
- 2 Manual Pressure Adjusting Screw**
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counter-clockwise) and secured with the lock nut.
- 3 Minimum Control Pressure**
Since this valve has an internal drain system, T port back pressure has an effect on minimum control pressure.
- 4 Load Capacity**
Make load capacity (valve OUT side capacity) at least .13 gpm.
- 5 Use an operating fluid that conforms to the both of the following.**
Oil temperature: -4 to 158°F
Viscosity: 12 to 400 centistokes
The recommended viscosity range is 15 to 60 centistokes.

Installation Dimension Drawings

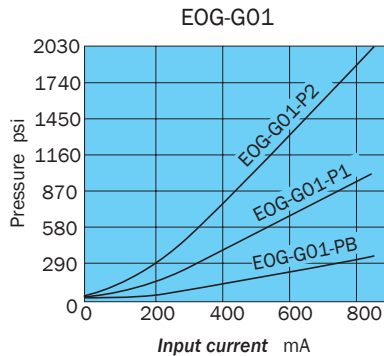
EOG-G01-P*-E11



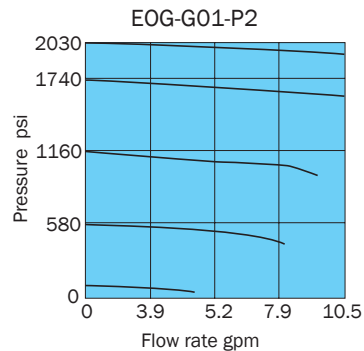
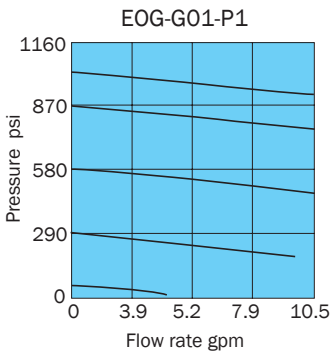
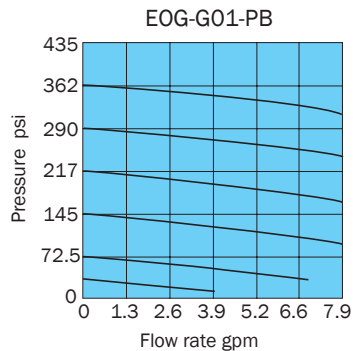
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

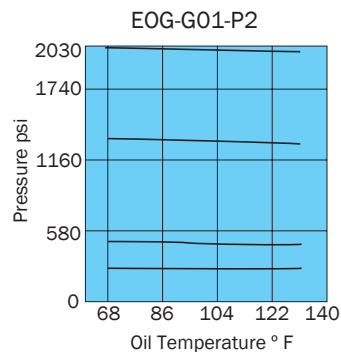
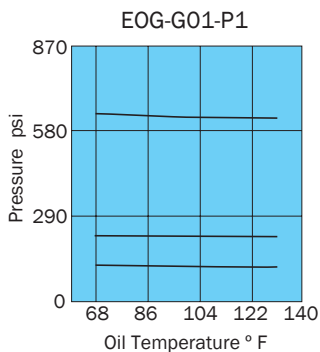
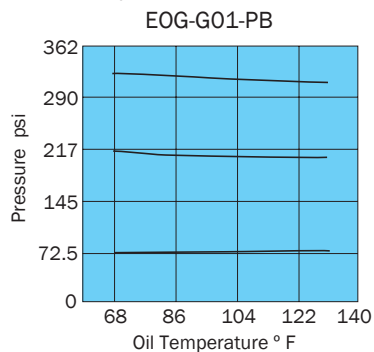
Input Current - Pressure Characteristics



Flow Rate - Pressure Characteristics

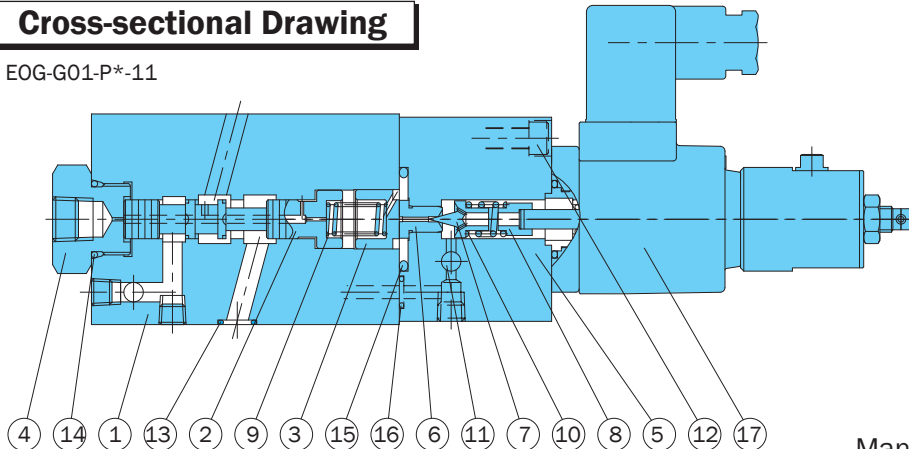


Fluid Temperature Characteristics



Cross-sectional Drawing

EOG-G01-P*-11



Seal Part List (Kit Model Number JBS-G01)

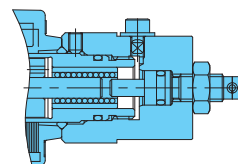
Part No.	Part Name	Part Number	Q'ty
13	O-ring	1B-P9	4
14	O-ring	1B-P20	1
15	O-ring	1B-P26	1
16	O-ring	1B-P7	1

Note: O-ring 1B-** refers to JIS B2401 1B-**.

Part No.	Part Name	Part No.	Part Name
1	Body	10	Spring
2	Spool	11	Choke
3	Retainer	12	Screw
4	Plug	13	O-ring
5	Cover	14	O-ring
6	Seat	15	O-ring
7	Poppet	16	O-ring
8	Retainer	17	Proportional solenoid
9	Spring		

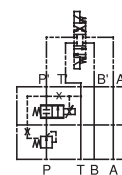
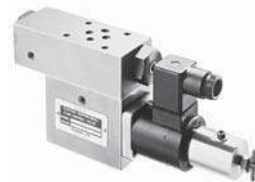
Note: Coil model number JD64-D2

Manual adjustment section



Modular Type Electro-Hydraulic Proportional Flow Control Valve

.07 to 6.6 gpm
3045 psi



Features

An electro-hydraulic proportional restrictor valve and pressure compensation valve are combined into a modular configuration, available as one of two types: the meter in control EOF-G01-P and meter out control EOF-G01-T.

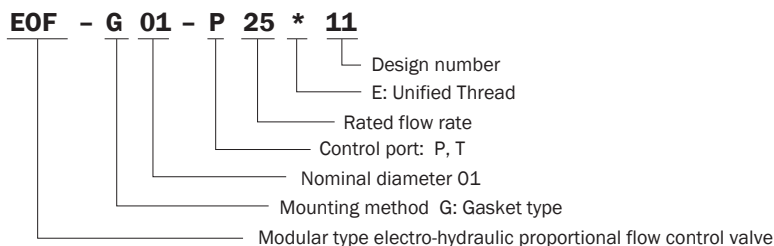
The pressure fluctuations have little influence on the setting flow rate making this valve perfect for electro-hydraulic proportional control of small hydraulic systems used for machine tool APC and ATC high-speed shockless control, remote control, etc.

Specifications

Item	Model No.	EOF-G01- P T 25-11
Maximum Operating Pressure psi		3045
Flow Rate Control Range ℓ/min (gpm)		0.3 to 25 (.07 to 6.6)
Flow Rate Control Port		EOF-G01-P : P port EOF-G01-T : T Port
T Port Allowable Back Pressure psi		362 max.
Hysteresis %		3 max. (Note 1)
Response Speed S		0.05
Rated Current mA		800
Coil Resistance Ω		20 (68° F)
Weight lbs		8.1

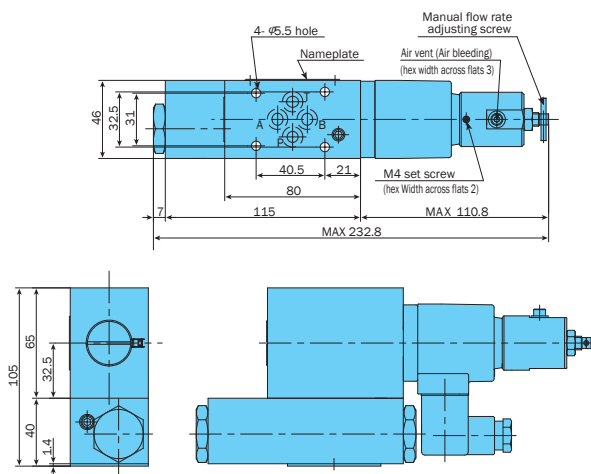
Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Understanding Model Numbers

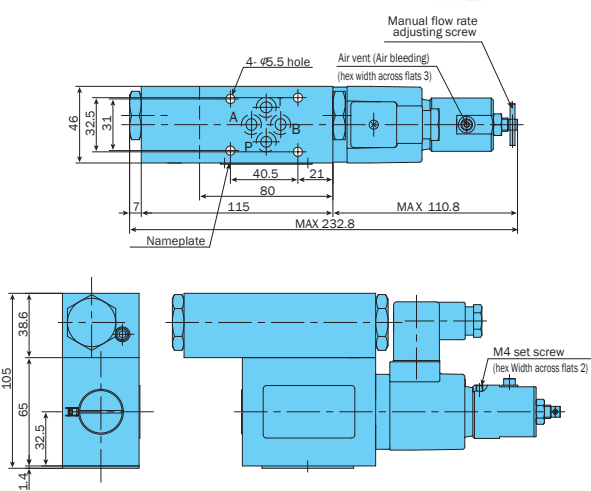


Installation Dimension Drawings

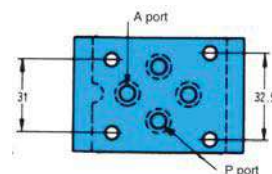
EOF-G01-P25-11



EOF-G01-T25-11



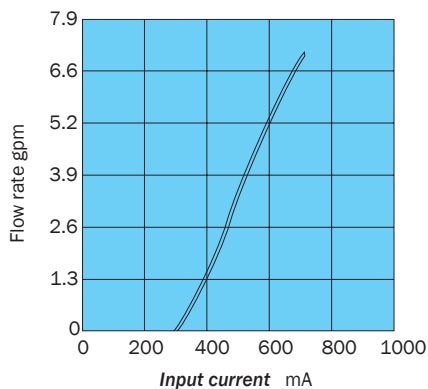
- Handling
- 1 Air Bleeding
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the lock screw and rotating the cover.
- 2 Manual flow rate adjusting screw
For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, the flow rate can be adjusted by rotating the manual adjustment screw. Rotate clockwise (rightward) to increase flow rate.
Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.
- 3 T Port Back Pressure
Since this valve has an internal drain system, make sure that valve T port back pressure is no greater than 362 psi.
- 4 Use an operating fluid that conforms to the both of the following.
Oil temperature: -4 to 158°F
Viscosity: 12 to 400 centistokes
The recommended viscosity range is 15 to 60 centistokes.
- 5 O-ring Plate Orientation
 - The port nearest the nameplate surface is the P port.
 - The port with a mounting pitch width of 31 (narrow pitch width) is the A port.
 - The cutout on the O-ring plate is on the A port side.



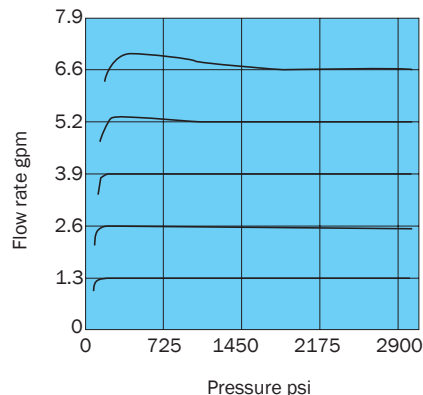
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

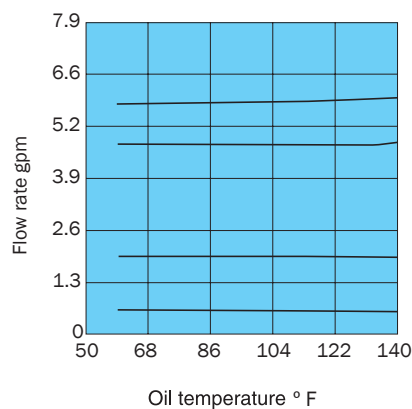
Input Current -
Flow Rate
Characteristics



Pressure -
Flow Rate
Characteristics

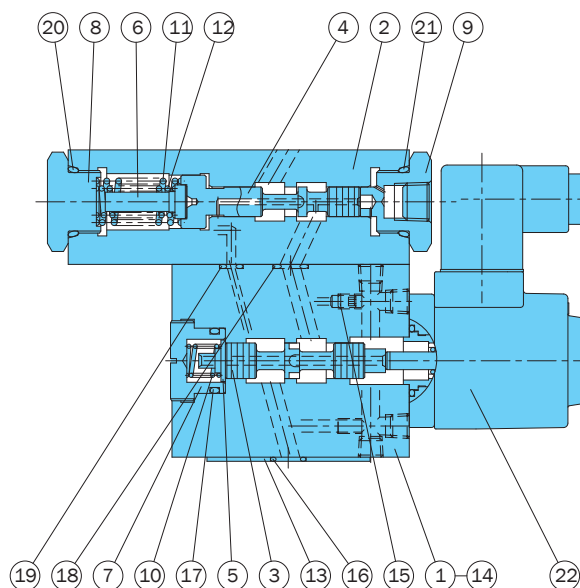


Fluid Temperature
Characteristics



Cross-sectional Drawing

EOF-G01-T25



Part No. Part Name

1	Body
2	Body
3	Spool
4	Piston
5	Retainer
6	Retainer
7	Plug
8	Plug
9	Plug
10	Spring
11	Spring
12	Spring
13	Plate
14	Screw
15	Screw
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	O-ring
21	O-ring
22	Proportional solenoid

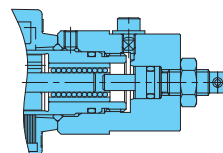
Note: Coil model number
JD64-D2

Seal Part List (Kit Model Number JMS-G01)

Part No.	Part Name	Part Number	Q'ty
16	O-ring	1B-P9	4
17	O-ring	1B-P18	1
18	O-ring	1B-P9	4
19	O-ring	1B-P5	1
20	O-ring	1B-P20	1
21	O-ring	1B-P20	1

Note: 1B-** refers to JIS
B2401-1B-**.

Manual adjustment section





Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

Overview

This special amplifier is for driving electrohydraulic proportional pressure control valves, electrohydraulic proportional flow control valves, and electrohydraulic proportional direction control valves. It comes in a choice of two different types: an amp type and a controller type.

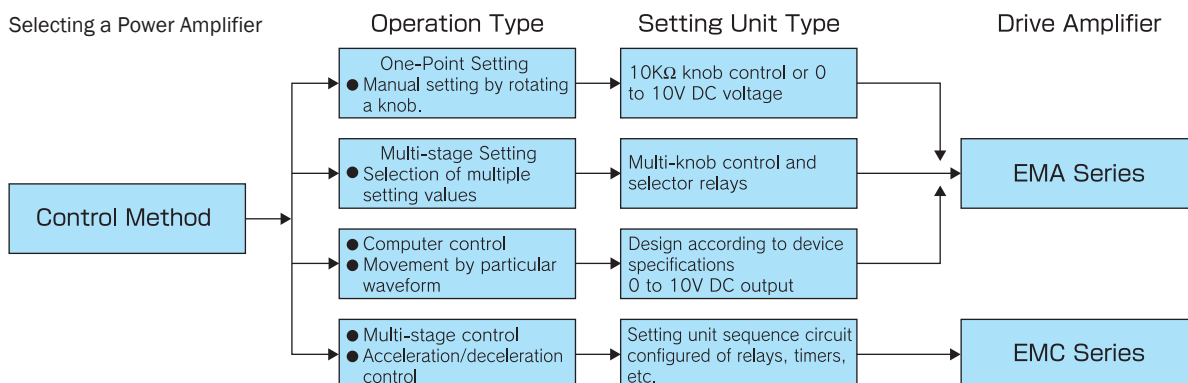
Basically, the amp type converts 0 to 10V DC range command voltage to a **DC current** in the range of 0 to 900mA, which is then supplied to the control valve.

The control type performs multi-stage control of **output current** in accordance with the ON-OFF signal of external contacts.

Power Amplifier Types and Functions

Type	Model No.	Drive Control Valve	Functions
Amp Type	EMA-PD5-N-20	Pressure Control Valves Flow Control Valves Direction Control Valves	Three functions: open loop control, feedback control, and acceleration/deceleration control.
Controller Type	EMC-PC6-A-20	Same as above.	Built-in command voltage setting units (potentiometers) Setting unit selection is performed by relay contacts, limit switches, timer contacts, etc.

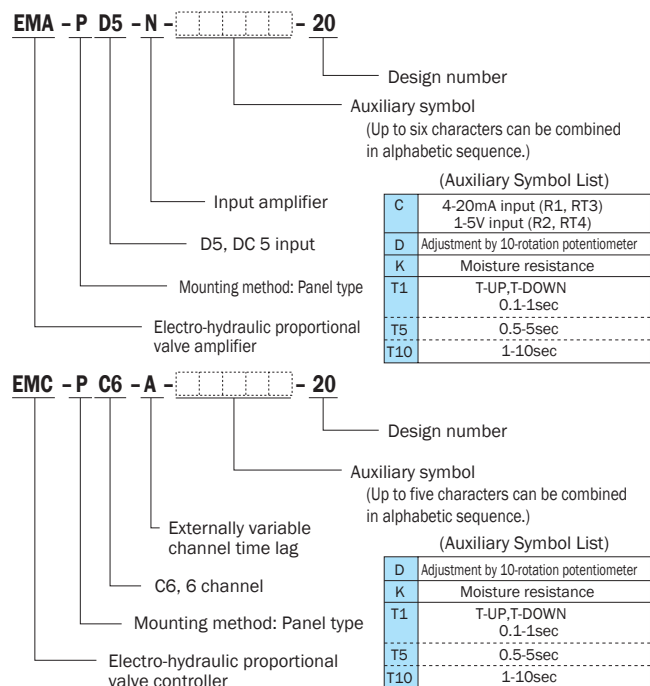
Selecting a Power Amplifier



Specifications

Item	Model No.	EMA-PD5-N-20	EMC-PC6-A-20
Function		Amp Type (Closed Loop)	Controller Type
Number of Inputs		5 DC inputs	-
Number of Channels		-	6
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		0 to +10V DC	-
Feedback Voltage		0 to +10V DC	-
Input Impedance		At least 50kΩ	-
Externally Set Variable Resistance		10kΩ	-
Zero Adjust(NULL)		0 to 900mA	0 to 900mA
Time Lag (T-UP, DOWN)		0.3 to 3sec	-
Gain Adjustment (GAIN)		$\frac{900\text{mA}}{10\text{V}_{\text{oc}}}$ to $\frac{900\text{mA}}{1.5\text{V}}$	0 to $\frac{900\text{mA}}{80\% \text{ channel setting}}$
External power supply		+10V _{oc} (10mA)	-
External Contact Resistance		-	10Ω max. when closed
Dither (Internal, semi-fixed)		Level: 0 to 500mAp-p Frequency: 50 to 220Hz	Level: 0 to 500mAp-p Frequency: 50 to 220Hz
Channel Time Lag (TIME)		-	0.3 to 3 seconds Externally variable
Power Supply Voltage		AC100, 110, 200, 220V (±10%)50/60Hz	AC100, 110, 200, 220V (±10%)50/60Hz
Power Consumption		50VA	50VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°C max.	0.2mA/°C max.
Weight lbs		7.7	7.7

Understanding Model Numbers



Note: T-UP, DOWN, and TIMER all become 0.3-3 sec when there is no signal for T1, T5, and T10.

• Handling

- Power supply voltage can be either 110V or 230V.
- When selecting a location, avoid areas subject to high temperatures and high

humidity, and select an area where there is little vibration and dust.

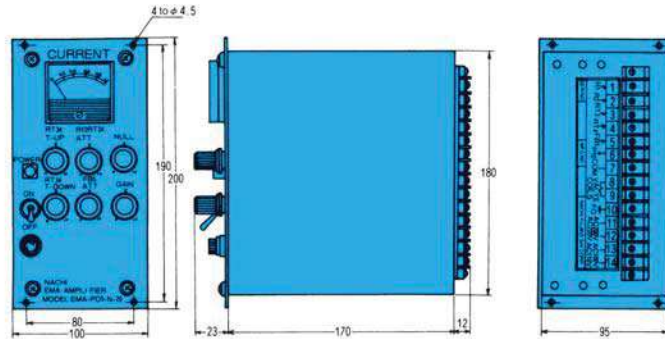
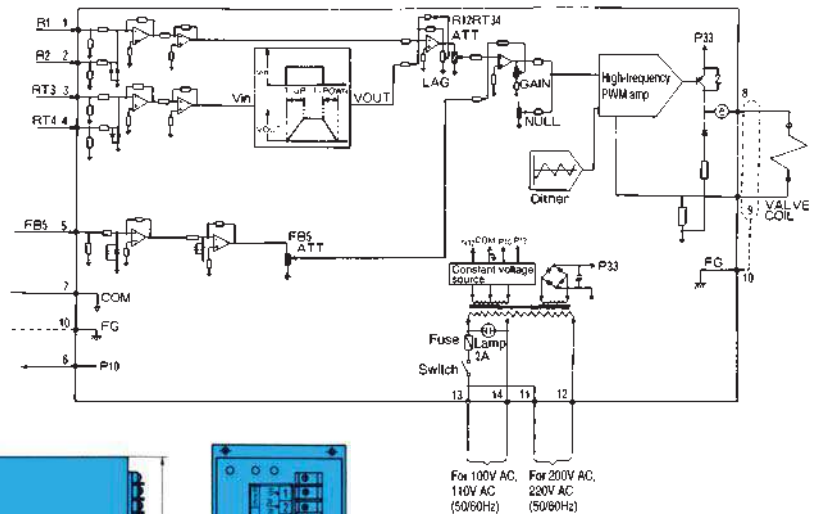
- Use shielded wire for the analog signal and valve output signal wires.

- When performing valve output signal line ON-OFF switching with a relay, connect a surge absorber or varistor parallel with the relay.

Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

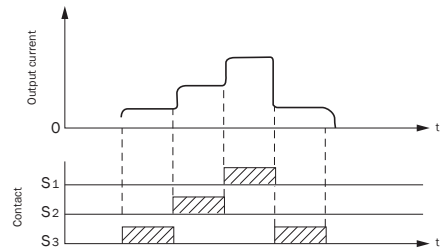
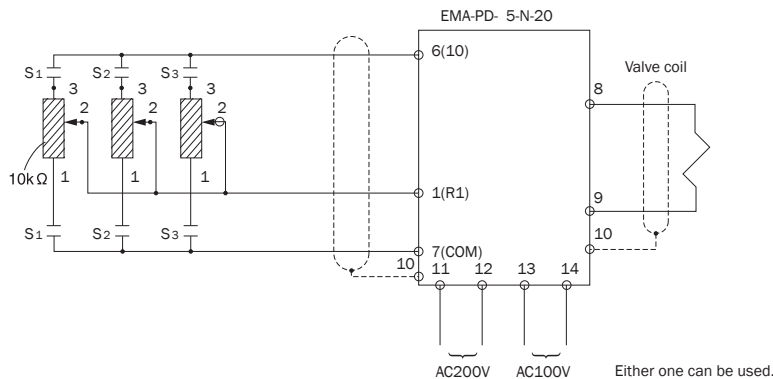
EMA-PD5-N-20

No.	Name		No.	Name
1	R1	Input	8	Output terminal to
2	R2	Input	9	VALVE COIL valve
3	RT3, delay input		10	FG, case ground
4	RT4, delay input		11	AC200, 220V
5	FB5, feedback input		12	
6	P10, external power supply		13	AC100, 110V
7	COM, signal land		14	



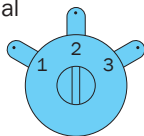
Application Examples

1. Multi-stage Setting Using Multiple Potentiometers

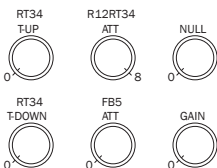


(1) Wiring the amp and external potentiometer

A potentiometer has three terminals numbered 1, 2, and 3.



(2) Setting the adjusting knobs
Terminals 2 (R2), 3 (RT3), and 4 (RT4) can also be used in place of terminal 1. An RT34T-UP and RT34T-DOWN acceleration/deceleration timer can also be used in the case of terminal 3 (RT3) and terminal 4 (RT4). In this case, the settings of the knobs on the front panel of the amp are normally as shown in the illustration below. The manual setting unit provides **output current** control in the range of 0 to 900mA as it is rotated from full counterclockwise to full clockwise.



Wiring

Amp terminal 7 (0V)

Potentiometer terminal 1

Amp terminal 6 (10V)

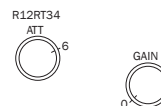
Potentiometer terminal 3

Amp terminal 1 (R1)

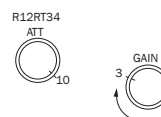
Potentiometer terminal 2

With this wiring, rotating the potentiometer clockwise causes the **output current** to increase.

- If an output in the range of 0 to 600mA is desired even while the manual setting unit is rotated fully clockwise, restrict the setting of R12RT34ATT to 6.



- When the level deceleration ratio and other factors limit the effective use of the manual setting unit to only 150° of the 300°, use GAIN to adjust the **output current** to 900mA.



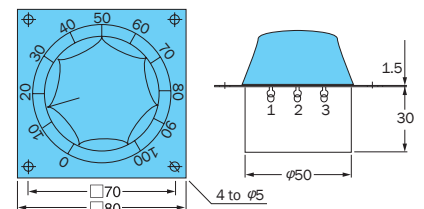
Note: 1. A range of 5KΩ to 10KΩ is recommended for external knobs and potentiometers.

2. In order to prevent **current** loss across terminals 6 and 7, insert relays between terminal 6 and the potentiometers and terminal 7 and the potentiometers.

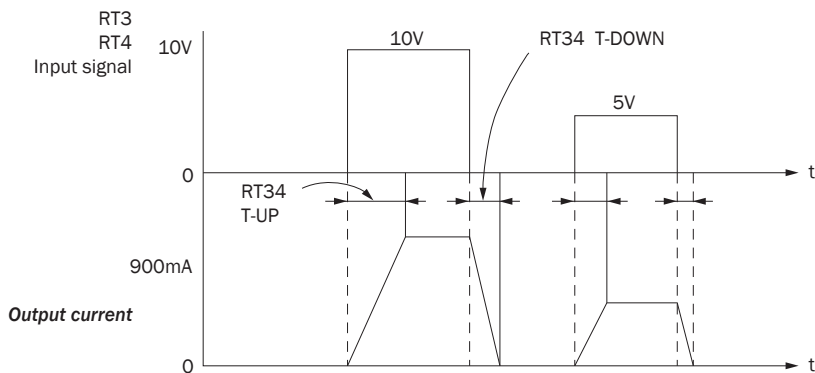
3. Do not enable more than one potentiometer at the same time.

(3) The following is available for the external setting knob.

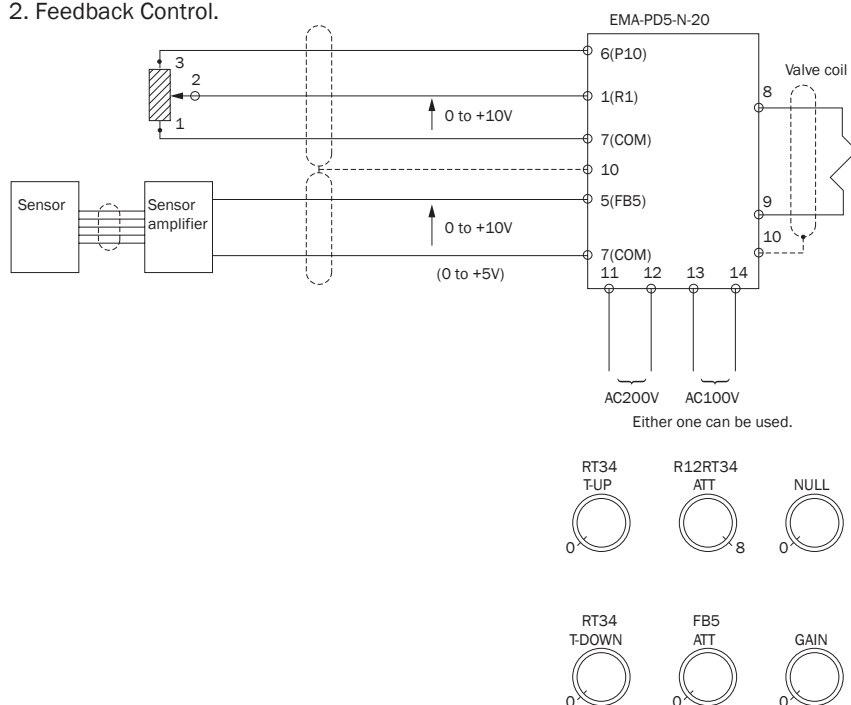
Model No. F ZS-6350-101



(4) Acceleration time adjustment (RT34T-UP) and deceleration time adjustment (RT34T-DOWN)

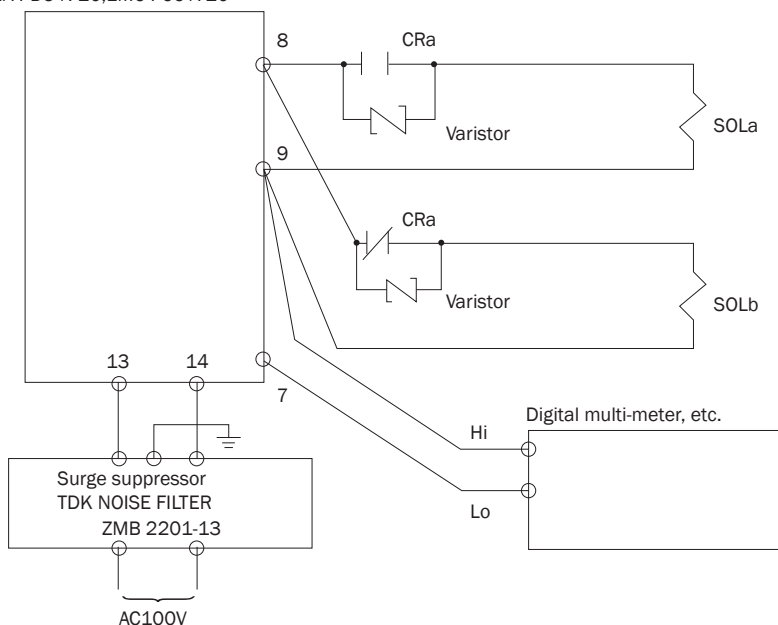


2. Feedback Control.



3. Direction Control Valve (ESD) Drive

EMA-PD5-N-20, EMC-PC6-A-20



This circuit creates a fixed acceleration time lag in accordance with the voltage that added the input signal to terminals 3 and 4 (RT3, RT4).

The time lag is adjustable in the range of 0.3 to 3 seconds, as standard.

As shown in the diagram to the left, even when RT34T-UP is set to 3 seconds, the change to 5V during stepped input from 0 to 10V and stepped input from 0 to 5V takes 1.5 seconds, which is half the set time.

With the wiring shown to the left, **output current** is increased or decreased in accordance with the feedback signal of the sensor, which regulates pressure or the flow rate.

Note:

Using terminal 3 (RT3) and terminal 4 (RT4) in place of terminal 1 (R1) enables T-UP and T-DOWN, which allows feedback control without overshooting or undershooting, even when input signal voltage is stepped.

Adjustment Method

- Initially, set FB5ATT to 0 as shown in the illustration to the left, and check to see if open loop control is possible.
- Next, set FB2ATT to 2 and GAIN to 2, and input a feedback signal.

Gradually rotate FB5ATT clockwise and increase gain.

Set the feedback gain to the level that is immediately before the point where vibration is generated in the control system.

(FB5ATT, GAIN)

Note:

- To measure **current**, measure the voltage at terminal 9, using terminal 7 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.
- Switch the terminal 8 line using a relay. Make sure that both relays are not on at the same time.
- To absorb surge voltage, include 82V varistors in parallel with the relay contacts.

Recommended Varistor

Tama Electric Co., Ltd. NV082D10
Matsushita ERZV10D820

- For relays, use OMRON LY type power relays or the equivalent.

- Too much noise in the 110V AC or 230V AC power supply line can result in unstable **output current**. If this happens, equip a surge absorber on the power supply.

Recommended Model

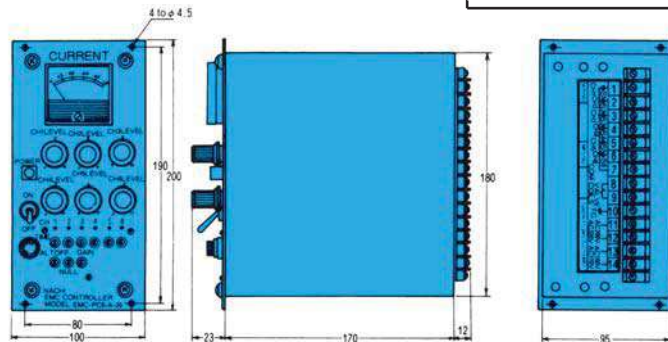
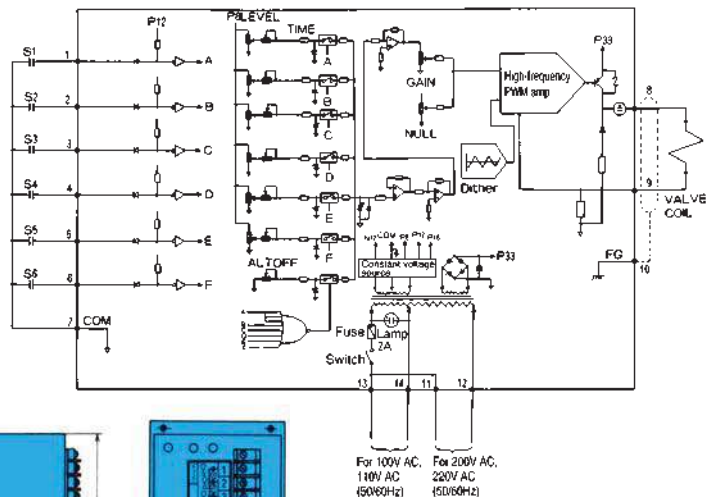
TDK NOISE FILTER

ZMB2201-13

Power Amplifier Series for Electro-hydraulic Proportional Valve Drive

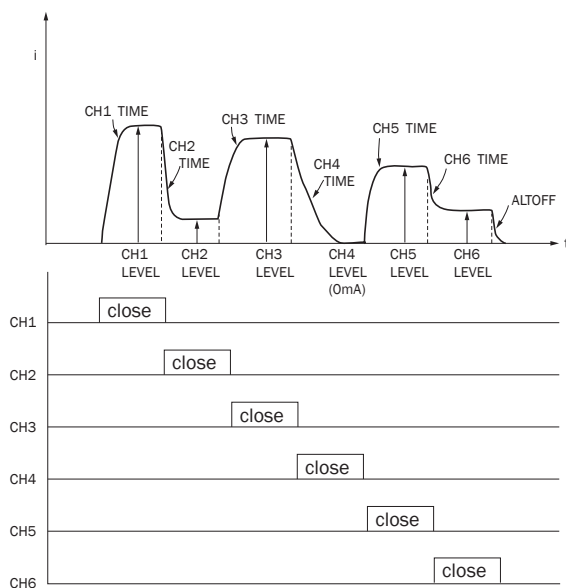
EMC-PC6-A-20

No.	Name	No.	Name
1	CH1 Input command contact	8	Output terminal to valve
2	CH2 "	9	VALVE COIL
3	CH3 "	10	FG, case ground
4	CH4 "	11	AC200 220V
5	CH5 "	12	AC100 110V
6	CH6 "		
7	Common COM input contact	14	



Note: When external contacts S1 through S6 are closed, use a non-voltage contact no greater than 10 Ω .

Application



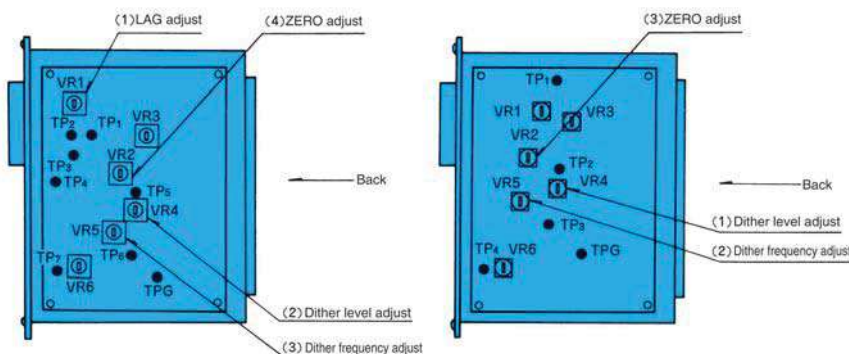
- LEDs are provided to indicate channel selection.
- The TIME knob of each channel adjusts the time until the selected channel's level is reached, as shown to the left. Make sure that the lap time (or time when channel is not selected) when changing the channel selection is 30msec maximum.
- Use independent external contacts. Even when external contacts are superimposed, output is not the sum of each channel, so use of superimposed external contacts is not supported.

Note: When replacing a Design Number 10 controller with a Design Number 20 controller, you must also change the sequence from superimposed external contacts to independent.

Dither Adjustment Method (Dither is set to load 400mA_{p-pm} 100Hz.)

(1) EMA-PD-N-20

(2) EMC-PC6-A-20



Removing the left side panel when viewed from the front reveals the configuration shown in the illustrations to the left.

1. If piping or other items vibrate in response to the dither, raise the dither frequency by rotating the trimmer clockwise.
2. When repeat stability is poor and the hysteresis is large, increase the dither level by rotating clockwise. If this does not resolve the problem, lower the dither frequency by rotating the trimmer counterclockwise.
3. When repeatability is poor with the ES valve or ESD valve due to insufficient air bleeding within the guide, raise the dither frequency by rotating the tripper clockwise, as described in 1.



Small Type Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

Features

This power amplifier provides high efficiency and reliability in a compact configuration.

Lightweight, compact design — The configuration of this amplifier is 1/3 the weight and 1/2 the volume of existing models.

High efficiency — A PWM control system enables a highly efficient design with little heat generation.

High reliability — All functions are integrated onto a single circuit board for a highly reliable design with no internal wiring.

Specifications

Item	Model No.	EBA-PD1-N-C1-10	EBA-PD1-NW-C1-10	EBA-PD1-N(Z)-D2-10	EBA-PD1-NW(Z)-D2-10
Function		Amp Type (Open Loop)	Amp Type (Open Loop)	Amp Type (Open Loop)	Amp Type (Open Loop)
Number of Inputs		1 DC inputs	1 DC inputs	1 DC inputs	1 DC inputs
Drive Solenoid		SOL a	SOL a, SOL b	SOL a	SOL a, SOL b
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)	900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		0 to +10V DC	-10 to +10V DC	0 to +10V DC	-10 to +10V DC
Input Impedance		50kΩ	50kΩ	50kΩ	50kΩ
Externally Set Variable Resistance		10kΩ	10kΩ	10kΩ	10kΩ
Zero Adjust (NULL)		0 to 900mA	0 to 900mA	0 to 900mA	0 to 900mA
Gain Adjustment (GAIN)		0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$
External power supply		+5V DC (5mA)	+5V DC (5mA) -5V DC (5mA)	+5V DC (5mA)	+5V DC (5mA) -5V DC (5mA)
Dither Frequency (DITHER)		Variable: 80 to 220Hz	Variable: 80 to 220Hz	Variable: 80 to 220Hz	Variable: 80 to 220Hz
Time Lag (LAG)		Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds
Power Supply Voltage		AC100 · 110V ±10% (50/60Hz)	AC100 · 110V ±10% (50/60Hz)	DC24V (DC24 to 30V)	DC24V (DC24 to 30V)
Power Consumption		30VA	30VA	30VA	30VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F	32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°F max.	0.2mA/°F max.	0.2mA/°F max.	0.2mA/°F max.
Weight lbs		4.8	4.8	.3 (1.3 with Z)	3.0 (1.3 with Z)
Driven Valve		Pressure Control Valves Flow Control Valves	Direction Control Valve	Pressure Control Valves Flow Control Valves	Direction Control Valve

• Handling

- When selecting a location, avoid areas subject to high temperatures and high humidity, and select an area where there is little vibration and dust.
- Use shielded wire for the analog signal and valve output signal wires.
- The brightness of the LED changes in accordance with the size of the output current.

Understanding Model Numbers

EBA - PD1 - NWZ - D2 - 10

Design number

Voltage symbol
C1 : AC100,110V ±10%(50/60Hz)
D2 : DC24V

Auxiliary symbol
N : Open loop with one output (SOL a)
NW : Open loop with two outputs (SOL a, SOL b)
Z : With case (Can be used with voltage symbol D2 only.)

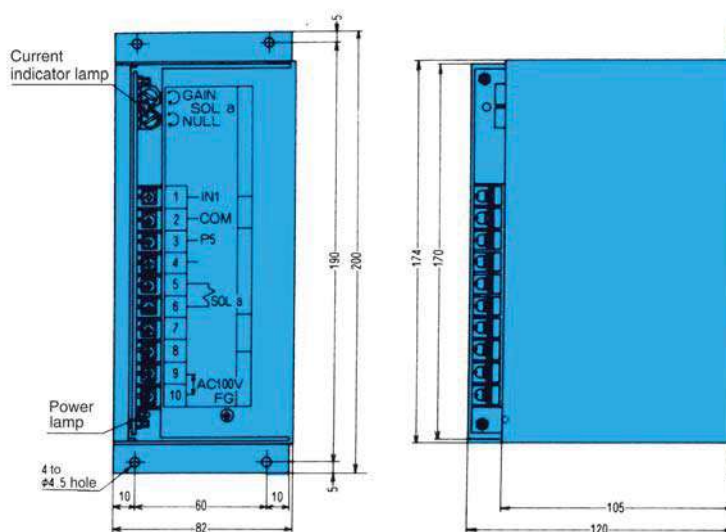
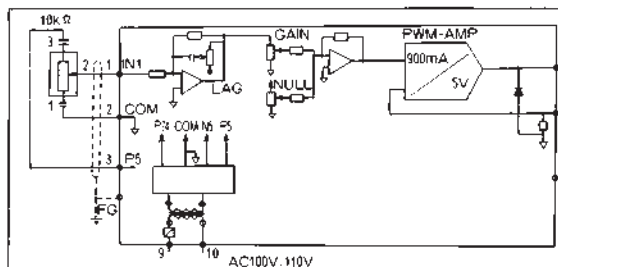
Type Classification
D1, DC 1 input

Small type power amplifier

Installation Dimension Drawings

EBA-PD1-N-C1-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to
2	Input signal terminal COM	6	valve SOL a
3	External power supply P5	7	
		8	
		9	
		10	AC100 · 110V

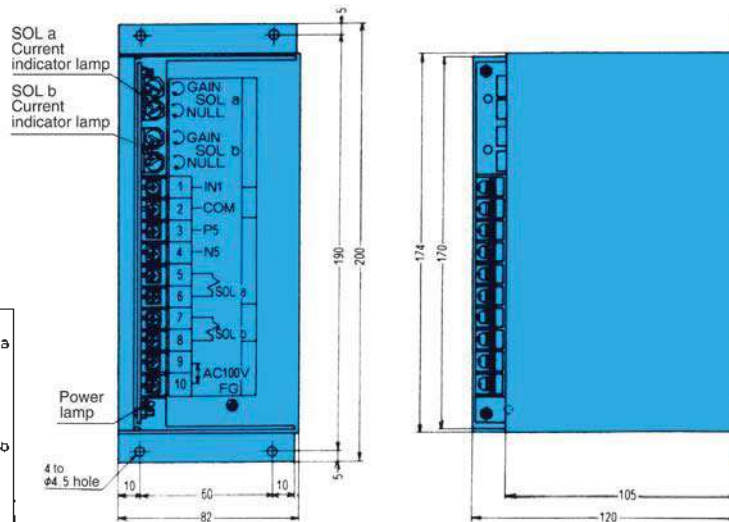
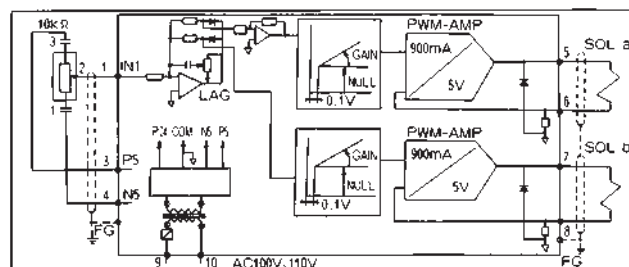


- With EBA-PD1-N (Z), **current** is supplied to the control valve in proportion to input signal voltage in the range of 0 to +10V.
- To measure **current**, measure the voltage at terminal 6, using terminal 2 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Input impedance of the measurement device should be at least 1MΩ.

- With EBA-PD1-NW (Z), the polarity of the input voltage is determined, and current is supplied to SOLa when it's positive and to SOLb when it is negative.
- NULL and GAIN for SOL a and SOL b are enabled when each of their input signal voltage is ±0.1V or more.

EBA-PD1-NW-C1-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to
2	Input signal terminal COM	6	valve SOL a
3	External power supply P5	7	Output terminal to
4	External power supply N5	8	valve SOL b
		9	
		10	AC100 · 110V

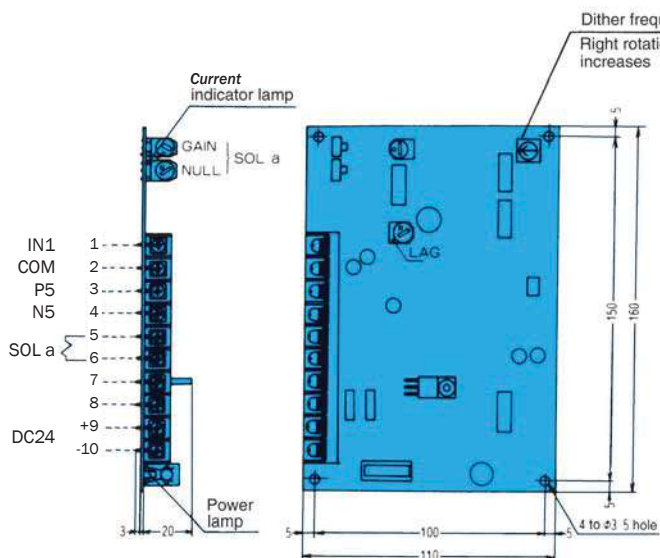
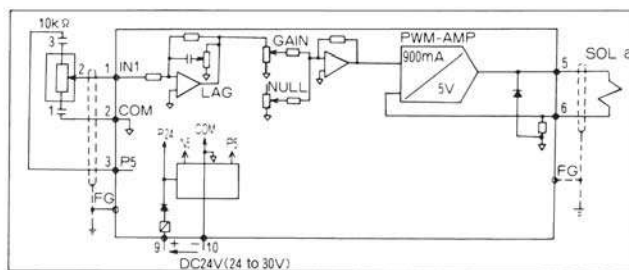


- To measure **current**, measure the voltage at SOLa terminal 6 and SOLb terminal 6, using terminal 2 as reference. The voltage across

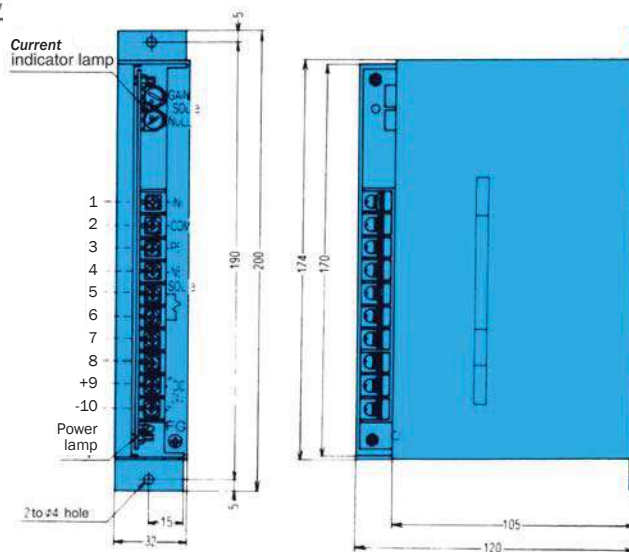
- the 0.5Ω **current** detection resistor at 1A is 0.5V. Input impedance of the measurement device should be at least 1MΩ.

EBA-PD1-N(Z)-D2-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to valve SOL a
2	Input signal terminal COM	6	
3	External power supply P5	7	
		8	
		9	+ DC24V
		10	- DC24V



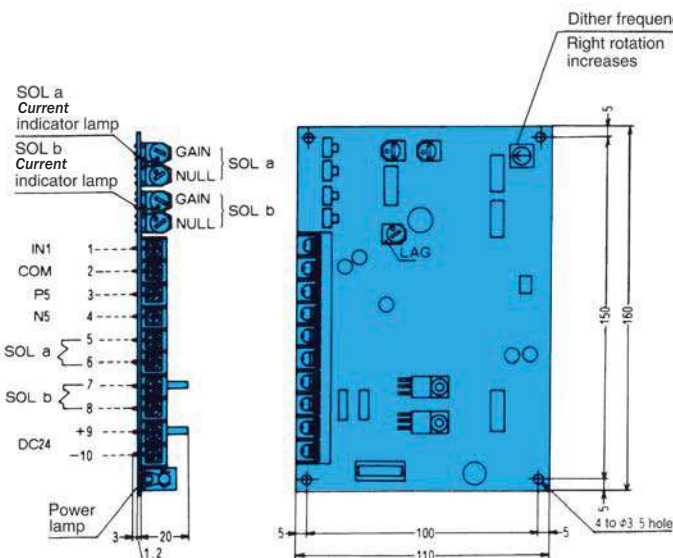
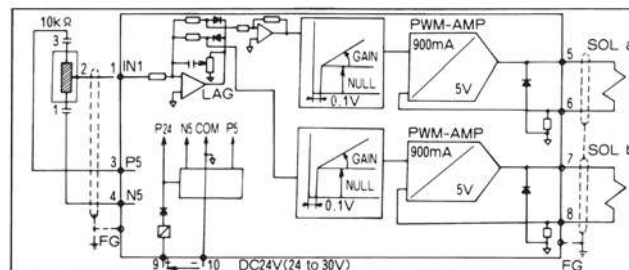
EBA-PD1-N-D2-10



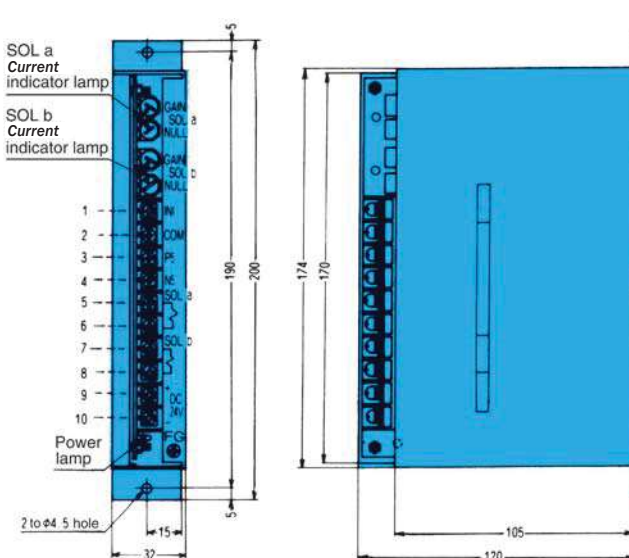
EBA-PD1-NZ-D2-10

EBA-PD1-NW(Z)-D2-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to valve SOL a
2	Input signal terminal COM	6	
3	External power supply P5	7	Output terminal to valve SOL b
4	External power supply N5	8	
		9	+ DC24V
		10	- DC24V



EBA-PD1-NW-D2-10



EBA-PD1-NWZ-D2-10

Note: Use a 24V switching regulator with a capacitance of at least 1A.

Example

Manufacturer	Model No.	Capacity
COSEL	R25A-24	24V 1.1A
TDK	EAK24-1R3G	24V 1.3A
DENSEI-LAMBDA	EWS25-24	24V 1.2A

• General Precautions

1 Measuring **current** flow in the solenoid coil

As shown in the illustration below, disconnect the line supplying **current** to the solenoid coil, and then insert a 1A DC rated **current** meter or measure voltage across terminals 5 and 6. Solenoid coil resistance is 20Ω, so the relationship between voltage and **current** is as shown below. Note, however, that these values are not exact, because coil resistance changes with temperature.

Voltage (V)	Current (mA)
0	0
4	200
8	400
12	600
16	800

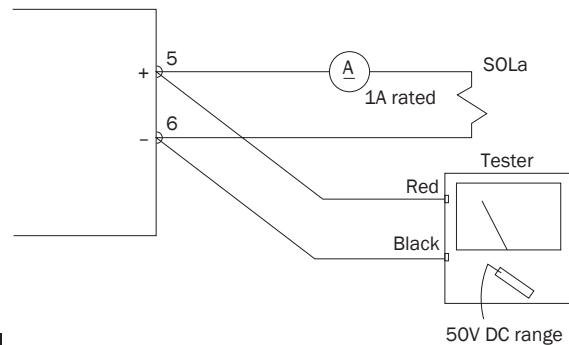
Measurements across terminals 7 and 8 can be performed the same as shown in the illustration below.

2 Never energize only the solenoid coil. The amp will not operate correctly if the iron coil is not inserted.

3 For connection between the amp/controller and solenoid coil, use a 2-conductor shielded wire with a conductor nominal cross-section area of 2.0mm². Type VCTF (Rated Voltage: 300V vinyl cab tire cord).

Wiring between the command voltage generator and amplifier should be VCTF 0.75m² 3-conductor wire.

Use a shield that conforms to JIS Class 3 grounding. If the ground line is unstable, do not connect the shield to anything.



Power Amplifier Operation and Terminology

• Zero Adjust (NULL)

This knob sets the lower limit of the operating pressure and flow rate. Rotating it clockwise increases the **output current**. This knob is also used for manual control while checking valve operation.

• Gain Adjust (GAIN)

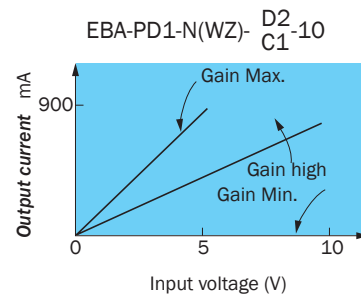
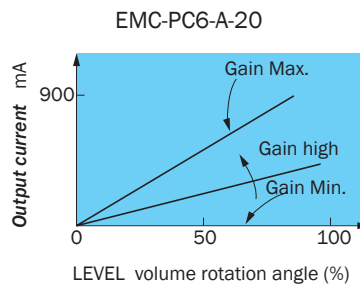
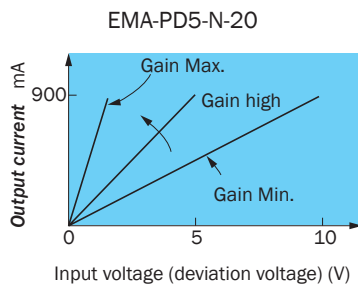
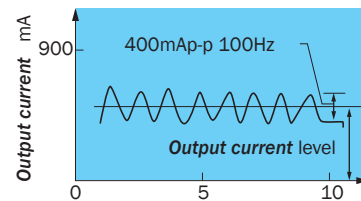
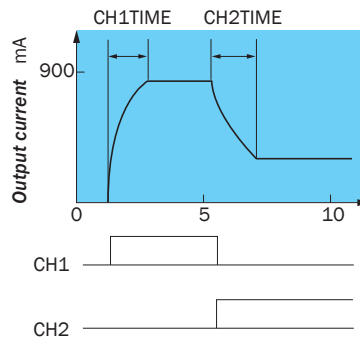
This knob adjusts **output current** in proportion to input signal voltage or the channel level knob rotation angle. Rotating it clockwise increases gain.

• Channel Time Lag (TIME)

This knob adjusts the time it takes for a channel selected by external contact to reach its channel level. Rotating it clockwise increases the time lag.

• Dither

Dither plays a role in improving control valve hysteresis, response, stability, etc.





Small Type Multi-Function Power Amplifier

Features

This compact, multi-function power amplifier uses advanced hybrid integrated circuits (HIC).

Compact design — Less than half the size of previous models.

High reliability — Circuit board configuration eliminates the need for wiring.

Multi-Function —

- Simultaneous driving of two valves
- Controller with built-in amplifier (EDC-PC6-AWZ-D2-20)
- Dither frequency selection function (From Designs 11, 20)

Specifications

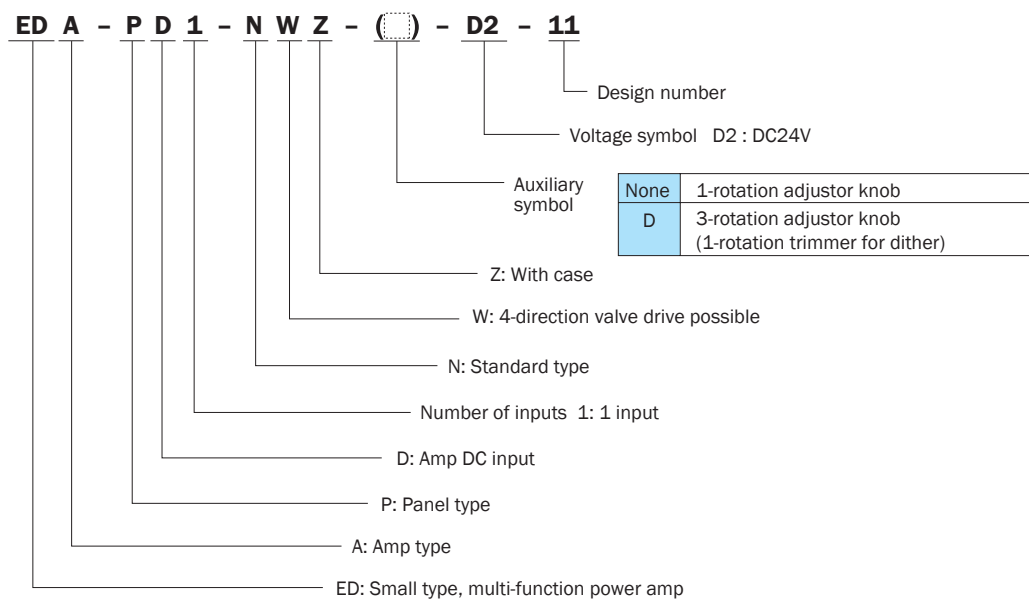
Item	Model No.	EDA-PD1-NWZ-D2-11	EDC-PC6-AWZ-D2-20
Function		Amp Type	Amp/Controller Type
Input type		1 DC inputs	Contacts, 6 inputs, DC 2 inputs
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		-10 to +10VDC	0 to +10VDC
Input Impedance		50kΩ	50kΩ
Externally Set Variable Resistance		10kΩ	10kΩ
Drive Solenoid		SOL a, SOL b	SOL 1, SOL 2
Zero Adjust (NULL)		0 to 900mA	0 to 900mA
Gain Adjust (GAIN)		0 to $\frac{900mA}{2.5V}$	0 to $\frac{900mA}{2.5V}$
External power supply		+5VDC(5mA) -5VDC(5mA)	+5VDC(10mA)
Time Lag (LAG)		0 to 2sec	0 to 2sec
Dither Frequency (DITHER)		80 to 250Hz	80 to 250Hz
Power Supply Voltage		DC24V (DC24 to 30V)	DC24V (DC24 to 30V)
Power Consumption		30VA	60VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°F max.	0.2mA/°F max.
Weight lbs		.6 lbs	.8 lbs
Driven Valve		Pressure, flow, direction control valves	Pressure, flow, direction control valves

• Handling

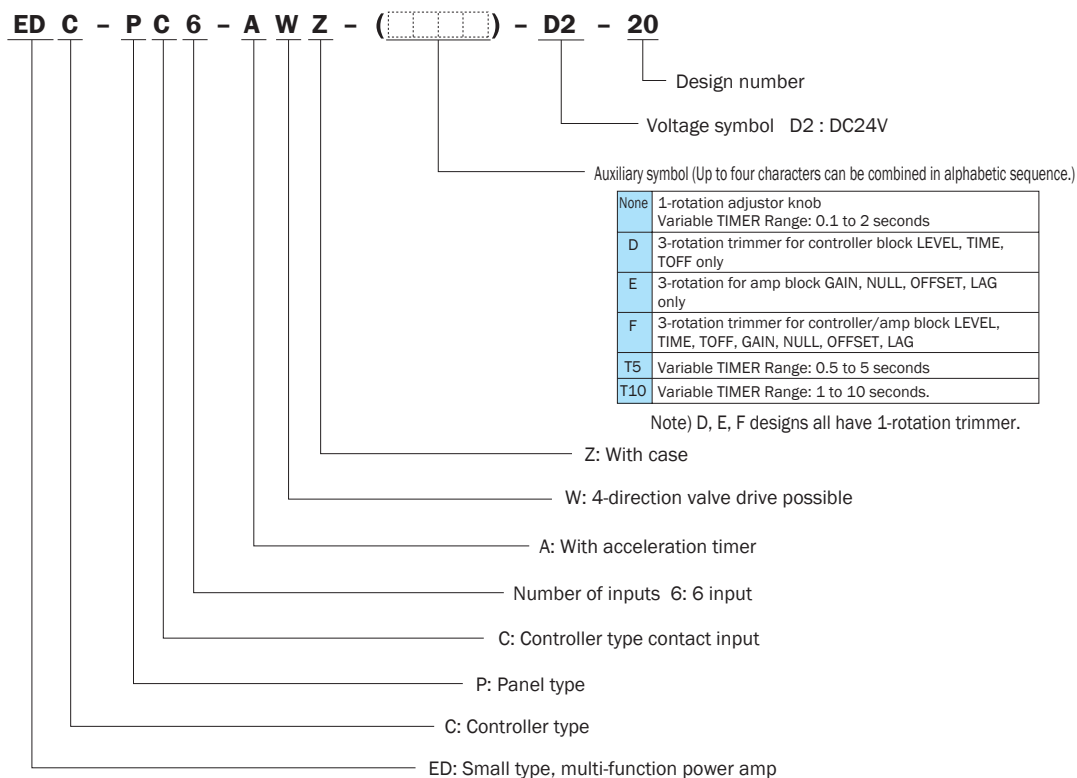
- 1 When selecting a location, avoid areas subject to high temperatures and high humidity, and select an area where there is little vibration and dust.
- 2 Use shielded wire for the analog signal and valve output signal wires. See page G-33 for general precautions.
- 3 The brightness of the LED changes in accordance with the size of the **output current**.

Power Amplifier Operation and Terminology

(1) Amp Type



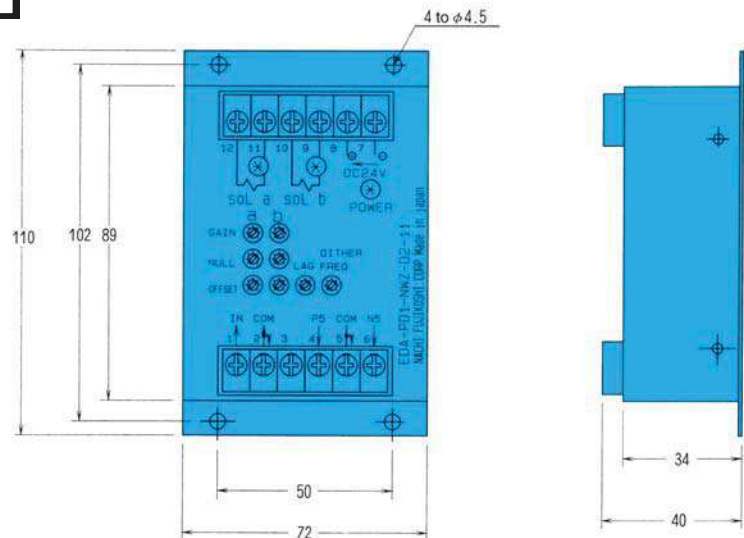
(2) Amp/Controller Type



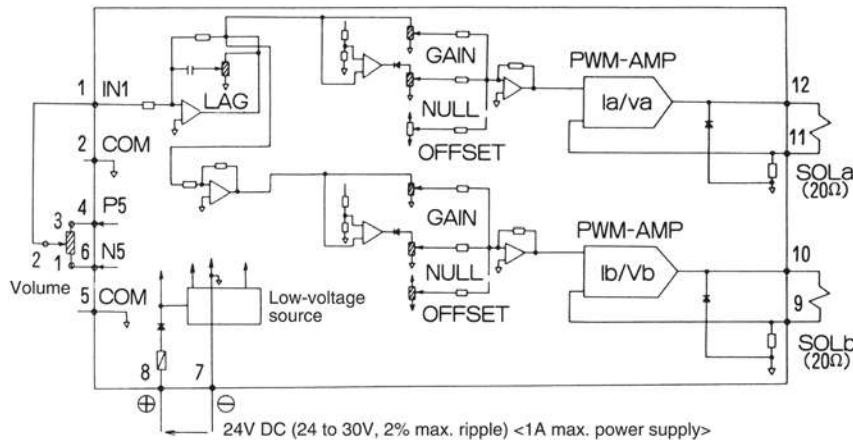
Power Amplifier Operation and Terminology

EDA-PD1-NWZ-D2-11

No.	Name	No.	Name
1	Input signal terminal IN1	7	- DC24V
2	Input signal terminal COM	8	+ DC24V
3		9	Output terminal to valve
4	External power supply P5	10	SOL b
5	Input signal terminal COM	11	Output terminal to valve
6	External power supply N5	12	SOL a



Block Diagram

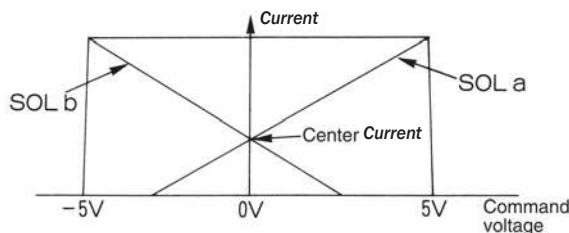


- **Current** is supplied to SOL a when input signal voltage polarity is positive, and to SOL b when negative. Either SOL a or SOL b can be driven at any one time.
- Push-pull drive is also supported.
- To measure **current**, measure the voltage at SOL a terminal 11 and SOL b terminal 9, using terminal 5 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.
- To use SOL a only, connect terminal 1 of the knob to amp terminal 2, use an input voltage range of 0 to 5V. (ER, ES only)

Application Examples

Adjusting Push-pull Drive for a Special Proportional Valve (Special Specification Direction Control Valve)

- Overlap Type Proportional Valve ESD-G01-C5 $\frac{10}{20}$ -6333D:300mA (Center **Current**)
- Zero-Lap Type Proportional Valve ESD-G01-C5 $\frac{10}{20}$ -6586C:200mA (Center **Current**)



As shown in the figure to the left, push-pull control aims at increasing response at the zero point by simultaneously energizing both solenoids.

Adjustment Procedure

- 1 NULL, GAIN, OFFSET
Rotate all seven knobs counterclockwise as far as they will go.
- 2 Without any connection between terminals 1 and 2, use the OFFSET knob to simultaneously energize SOL a and SOL b as follows.
SOL a 300mA(200mA)
SOL b 300mA(200mA)
- 3 Next, apply +5V to terminal 1 (connecting 1 and 4), and set the SOL a GAIN knob to

the following:

SOL a 850mA
SOL b 300mA

For the SOL b **current** here, SOL b GAIN should be fully rotated counterclockwise, 4 and its setting should not be changed.

Apply -5V to terminal 1 (connecting 1 and 6), and set the SOL b GAIN knob for the following:
SOL a 0mA
SOL b 850mA

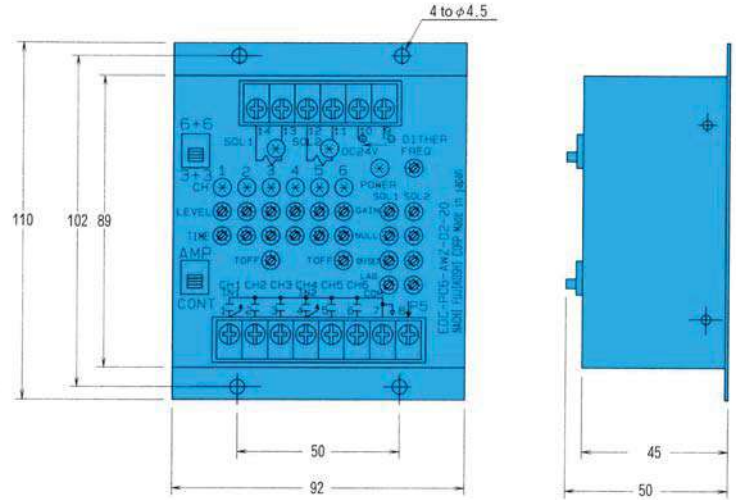
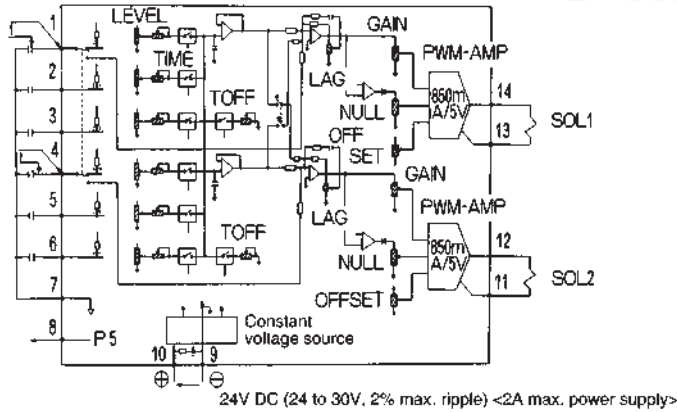
This completes the setting procedure.

- The three LAG and NULL knobs should be left rotated fully counterclockwise. There is no need to change their settings.
- EDA-PD1-NWZ-D2-11 is configured with a feedback system, so it does not have a feedback gain adjustment function. In this case, use EDA-PD1-NWZ-D2-11 in combination with the EA-PD4-D10-*10 NACHI servo amp.

EDC-PC6-AWZ-D2-20

No.	Name	No.	Name
1	CH1 select terminal	7	COM
2	CH2 select terminal	8	External power supply P5
3	CH3 select terminal	9	- DC24V
4	CH4 select terminal	10	+ DC24V
5	CH5 select terminal	11	Output terminal to valve SOL 2
6	CH6 select terminal	12	Output terminal to valve SOL 1

Block Diagram

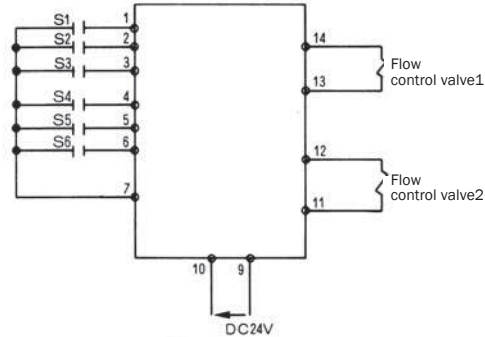


- Dual simultaneous output to SOL 1 and SOL 2 is supported.
- To measure **current**, measure the voltage at SOL a terminal 13 and SOL b terminal 1, using terminal 7 as reference. The voltage across the 0.5Ω current detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.

Application Examples

1) Switch Position

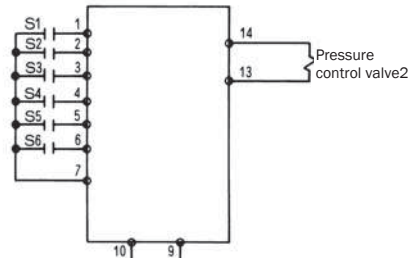
- CONT
- 3+3



- Simultaneous control using two flow control valves (3-speed)
- As shown in the diagram to the left, flow control 1 speed is controlled with CH1 LEVEL when CH1 and CH2 are turned on at the same time. Next, flow control valve 2 speed is controlled by CH4 LEVEL, and simultaneous control is possible by adjusting flow control valve 1 speed in the same way. 3-speed synchronous control is possible by grouping CH1 through CH3 and CH4 through CH6.

2) Switch Position

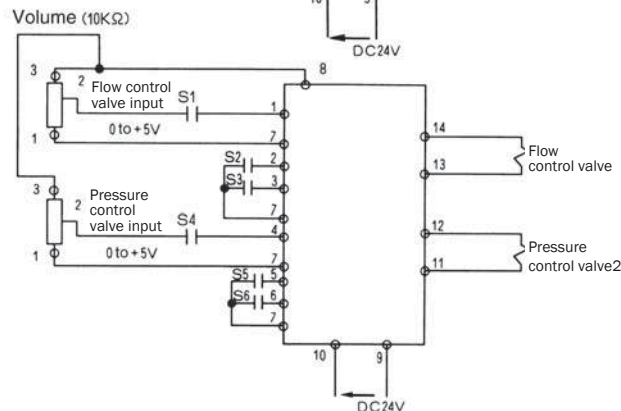
- CONT
- 6+6



- Pressure control valve 6-pressure control
- As shown in the diagram to the left, this amplifier can be use as a 6-channel controller for a single pressure control valve. Minimum pressure at this time is in accordance with the setting of the OFFSET knob. The NULL knob cannot be used to configure settings unless a channel is selected.

3) Switch Position

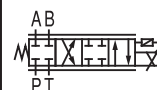
- AMP
- 3+3



- 2-output amplifier for simultaneous control of load-sensitive system pressure and flow rate
- As shown in the diagram to the left, 0 to +5V input and channel CH2 or CH3 input are added together and output to the flow control valve. Likewise, 0 to +5V and CH5 or CH6 input is added together and output to the pressure control valve.

High-Response Proportional Flow Control Valve ESH-G01

2.6 to 13.2 gpm
4640 psi



Features

Frequency response equivalent to an electro-hydraulic servo valve. Direct spool by a high-output proportional solenoid. Differential transformer for accurate spool positioning with minor feedback.

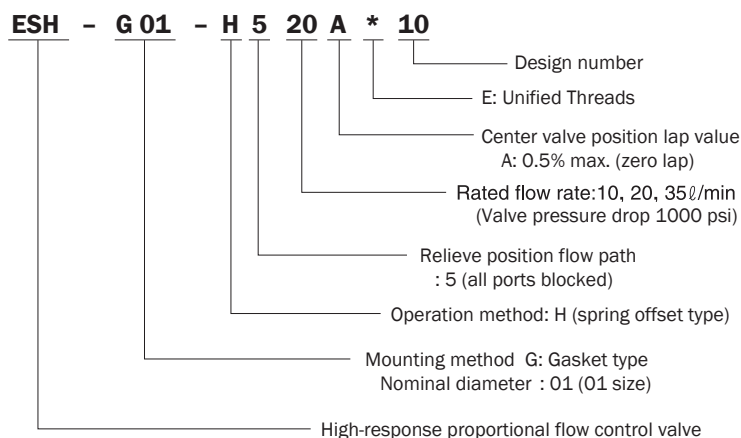
Recovery of all port block positions following amp power off or wiring disconnection (Failsafe Function). Steel spool and spring for long life.

Specifications

Model No.		ESH-G01-H510A-10	ESH-G01-H520A-10	ESH-G01-H540A-10
Item				
Maximum Operating Pressure P, A, B psi		4640		
T Port Allowable Back Pressure psi		362 max.		
Rated Flow Rate l/min (gpm) (Valve pressure drop 1000 psi)		10 (2.6)	20 (5.2)	40 (9.2)
Maximum Flow Rate gpm		5.8	9.2	13
Limit Valve Pressure Drop psi		4640	3045	2030
Hysteresis %		0.5 max.		
Step Response ms (0→100% Displacement)		16 max. (Note 1)		
Frequency Response Hz (90° Phase Delay ±10% Displacement)		At least 80 (Note 1)		
Center Drift	Supply Pressure	0.5% max/FS (Δp=3625 psi)		
	Fluid Temperature	1.5% max/FS (Δt=104°F)		
Filtration		Class NAS9 max.		
Operating Fluid Temperature Range ° F (Recommended Fluid Temperature Range ° F)		32 to 140° F (86 to 140° F)		
Water and Dust Resistance		IP53		
Weight lbs		5		

Note: 1. Step response is typical value for a supply pressure of 1000 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

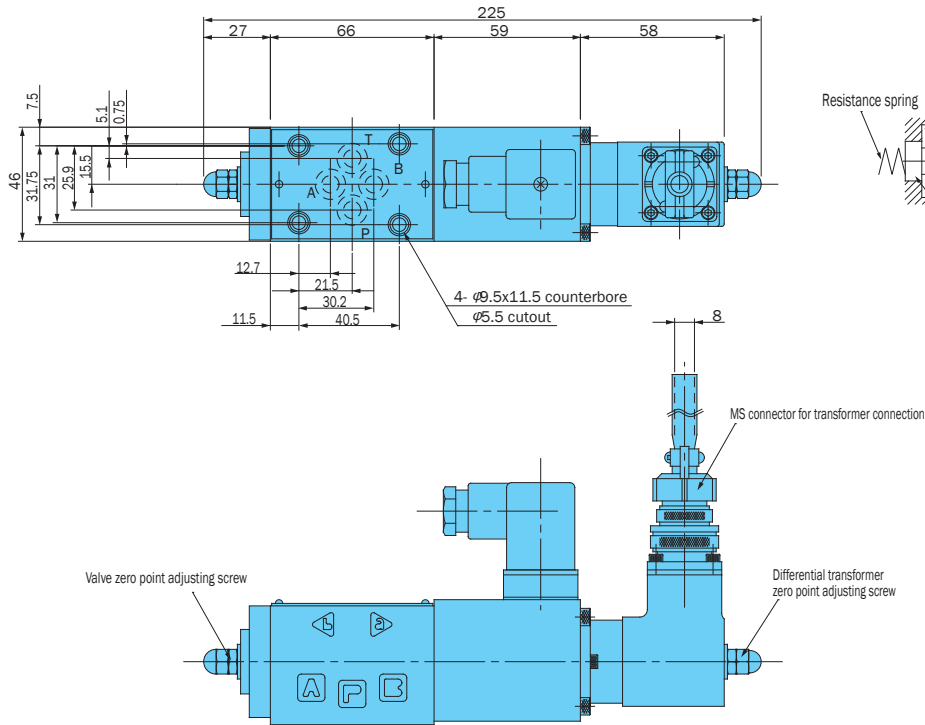
Understanding Model Numbers



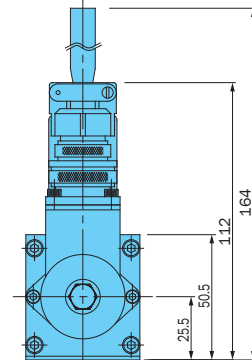
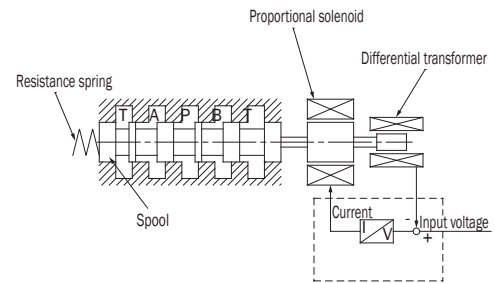
• Handling

- The amp and valve are adjusted to match at the factory, so be sure to use items that have the same MFG No.
- The differential transformer zero adjust screw and valve zero adjust screw are adjusted and fixed at the factory. Because of this, you should not touch the screws (sealed cap nuts).
- Install the valve so the spool axis line is horizontal.
- In the case of 3-port applications and for the direction that throughflow is most common, use of the following flow is recommended P→A→B→T. P→A limit differential pressure is greater than that of P→B.
- Be sure to perform sufficient flushing before a test run.
- Use steel piping for this valve and the main actuator, and keep piping as short as possible.
- There is no air bleeding.
- Mineral oil hydraulic operating fluid is standard. Use an R&O type and wear resistant type of ISO VG32, 46, or 68 or equivalent.
- Use an operating fluid that conforms to the both of the following.
Kinematic viscosity: 20 to 140 centistokes
Oil temperature: 86 to 140° F
- Filtration
Maintain hydraulic operating fluid contamination so it is at least NAS Class 9.
- Electrical wiring between the amp and valve should be no longer than 30 meters. For the solenoid valve use VCTF 2 mm², 2-conductor shielded wire, and for the differential transformer use VCTF 0.5 mm², 4-conductor shielded wire.
- After disassembling the valve, be sure to fill the inside of the guide with operating fluid before reassembling.
- Bundled Accessories (Valve Mounting Bolts)
(4) 10-24 x 1 3/4"
Tightening Torque: 3.5 to 5 ft lbs

Installation Dimension Drawings

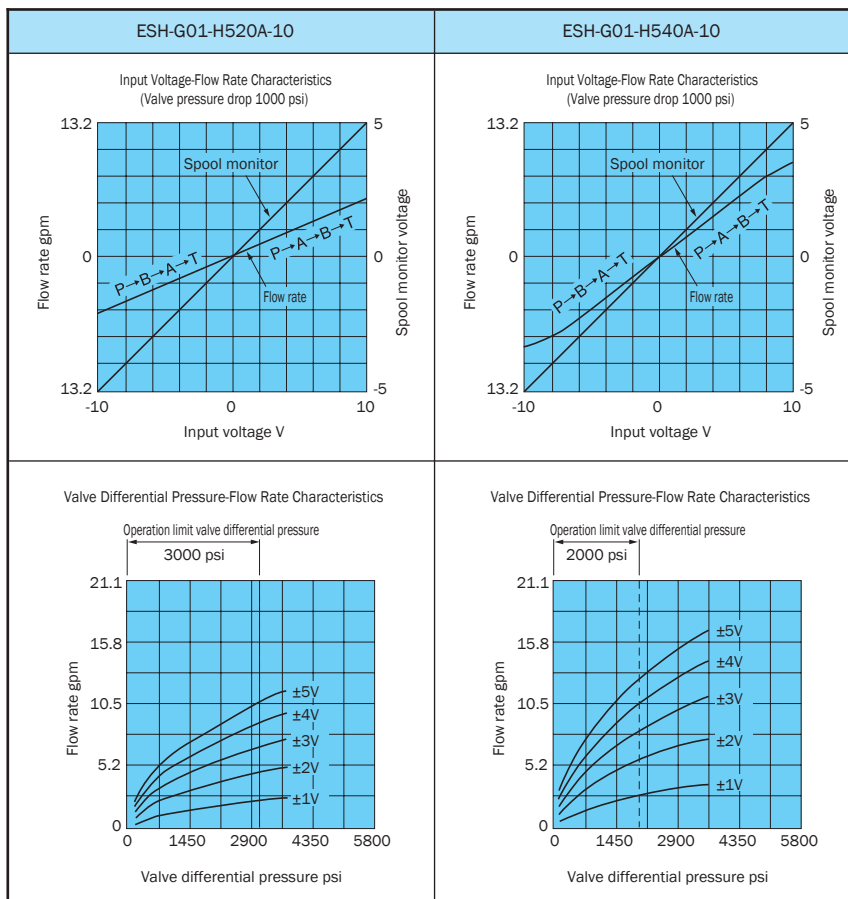


Operation Principle



The gasket mounting method conforms to ISO4401-AB-03-4-A.

Performance Curves



Note: $\pm 10V$ input amp factory default data.
Rotating the GAIN trimmer clockwise (rightward) increases the flow rate by up to 10%.

- Valve Pressure Drop and Rated Flow Rate

Valve Pressure Drop (ΔP_x)

$$= P_S - P_L - P_T$$

P_S : Valve supply pressure

P_L : Load pressure

P_T : T Port back pressure

The rated flow rate is the value when the above valve pressure drop is 1000 psi.

- Valve Pressure Drop and Control Flow Rate

The following is the maximum control flow rate when the size of the obtained valve pressure drop is ΔP_x ,

$$Q_x = Q_{\text{rate}} \times \sqrt{\frac{\Delta P_x}{7}}$$

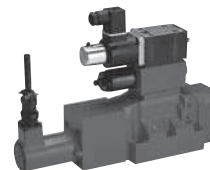
Qrate : Rated flow rate

$$\Delta P_x = P_S - P_L - P_T$$

- Calculation example
- When ESH-G01-H520A-10 is used under the following conditions:
 $P_S = 102 \text{ kgf/cm}^2$ (1450 psi)
 $P_L = 61 \text{ kgf/cm}^2$ (870 psi)
 $P_T = 10 \text{ kgf/cm}^2$ (145 psi)
 Maximum control flow rate Q_x is as shown below:

$$Q_x = Q_{\text{rate}} \times \sqrt{\frac{P_S - P_L - P_T}{7}}$$

$$= 20 \times \sqrt{\frac{10 - 6 - 1}{7}} = 13 \text{ l/min}$$



High-Response Proportional Flow Control Valve ESH-G03, 04, 06

21 to 158 gpm
4060 to 4640 psi

Features

- Main spool minor feedback for greatly increased hysteresis and repeatability.
- Response characteristics suitable to 20Hz and high precision acceleration control.
- Recovery of center position following amp power off or wiring disconnection (Failsafe Function).
- Single rod cylinder spool available for easy use.
- Built-in pilot pressure reducing valve for stable operation.

Specifications

Model No.			ESH-G03- D*****-(*)-11	ESH-G04- D*****-(*)-11	ESH-G06- D*****-(*)-11
Item					
Maximum Operating Pressure psi	P,A,B Ports	External Pilot	4060	4640	4640
		Internal Pilo	3625	3625	3625
	T Port		3045	3045	3045
	Pp Port		3625	3625	3625
Minimum Pilot Pressure psi			217	217	217
Rated Flow Rate ℓ/min (gpm) Rated stroke, P→A pressure drop, 145 psi			80 (21)	180 (47.5)	350 (92.5)
Maximum Flow Rate gpm			37	79.2	158
Pilot Pressure Reducing Valve Set Pressure psi			290	290	580
Hysteresis %			0.5 max.	0.5 max.	0.5 max.
Step Response ms (0 →100% displacement)			50(Note1)	50(Note1)	50(Note1)
Frequency Response Hz (±10% input, 90 ° phase delay)			20(Note1)	20(Note1)	20(Note1)
Pilot Flow Rate gpm			1	2.1	3.1
Y (DR1), L (DR2) allowable back pressure psi			29	29	29
Weight lbs			17.6	26.4	39.7

Note: 1. Step response is typical value for a supply pressure of 1000 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

Understanding Model Numbers

ESH - G 04 - D 5 180 S1 - (*) - 11

Design number

Auxiliary symbol

None: External pilot, external drain

E: External pilot, external drain

Contraction ratio

S1 (Normal)	P→A : B→T=1 : 1 P→B : A→T=1 : 1
S2 (Single rod/cylinder)	P→A : B→T=1 : 0.5 P→B : A→T=0.5 : 1

Rated flow rate (See the rated flow rate item in the specifications.)

Indicated through flow rate at rated stroke when pressure drop to P→A is ΔP= 145 psi

Through flow rate for P→A, A→T, B→T pressure drop at 145 psi is determined by contraction ratio.

Center valve position flow path

5		20% Center Position
6S		20% Center Position

Operation method D: Pressure center

Nominal diameter 03, 04, 06

Mounting method G: Gasket type

ESH: High response proportional flow valve

• Handling

1 Air Bleeding

In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation.

2 Y (DR1), L (DR2) Ports

Connect ports Y (DR1) and L (DR2) directly to the fluid tank so they are always supplied with operating fluid, in order to keep back pressure no greater than 29 psi.

3 L (DR2) Port

Since this valve is a pressure center type, G04 and G06 have an L (DR2) port. Be sure to connect this port directly to the fluid tank.

G03 has a Y (DR1) port only, and this is connected internally to L.

4 Valve Mounting Orientation

Install the valve so the spool axis line is horizontal.

5 Filtration

Maintain hydraulic operating fluid contamination so it is at least NAS Class 9.

6 The amp and valve are adjusted to match at the factory, so be sure to use items that have the same MFG No.

7 Oil-based operating fluid is standard. Use an R&O type and wear-resistant type of ISO VG32, 46, or 68 or equivalent.

8 Use an operating fluid that conforms to the both of the following.

Kinematic viscosity: 20 to 140 centistokes

Oil temperature: 86 to 140° F

9 Electrical wiring between the amp and valve should be no longer than 30 meters. For the solenoid valve use VCTF 2 mm2 2-conductor shielded wire, and for the differential transformer use VCTF 0.5 mm2 4-conductor shielded wire.

10 Bundled Accessories (Valve Mounting Bolts)

Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESH-G03	1/4-20 x 1 3/8"	4	7 to 9.5
ESH-G04	3/8-16 x 2"	4	33 to 40
	1/4-20 x 1 3/4"	2	7 to 9.5
ESH-G06	1/2-13 x 2 3/8"	6	44 to 51

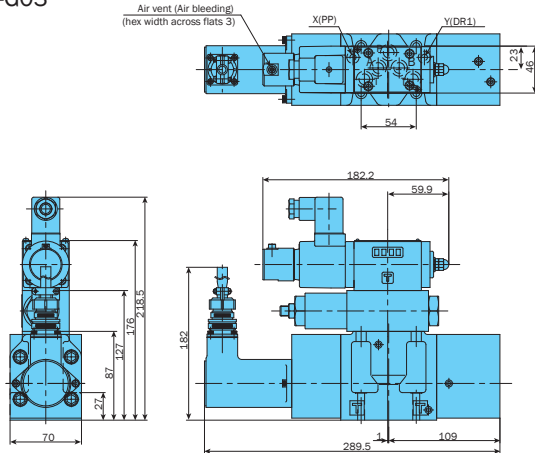
11 With G03 and G04, providing command in the range of 0 to +10V to the amp's RF input produces a flow of P→A→B→T. With G06, flow is P→B→A→T.

12 For G03 and G04, connect the ports and actuator to achieve a working of P→A→B→T. For G06, connect for a working of P→B→A→T.

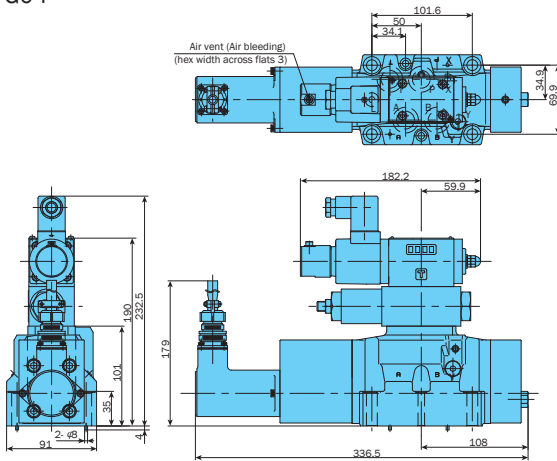
13 Contact your agent for a contraction ratio S2 with the G06 size.

Installation Dimension Drawings

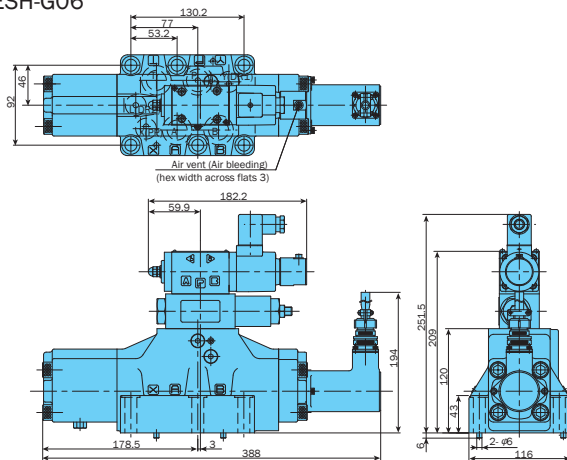
ESH-G03



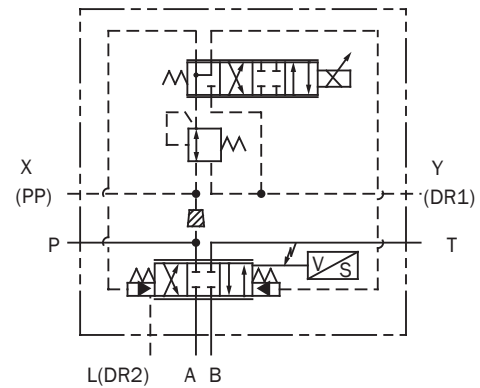
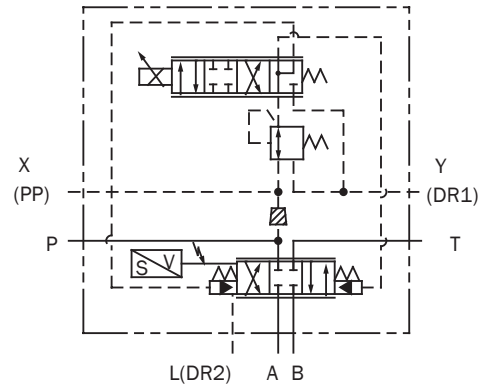
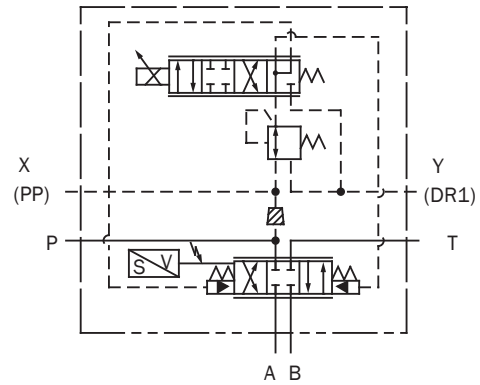
ESH-G04



ESH-G06



JIS Symbol



Note:
A stopper plug is needed for the  area if the pilot is external.

Gasket Surface Dimensions

For G03, see ESD-G03 gasket surface dimensions, and for G04 and G06, see DSS-G04, 06-**-20 gasket surface dimensions. Y (DR1) and L (DR2) are required. Gasket surface dimensions conform to the following.

G03: ISO 4401-03-02-0-94 (D05)

G04: ISO 4401-07-06-0-94 (D07)

G06: ISO 4401-08-07-0-94 (D08)



High-Speed Response Proportional Control Valve Amplifier EHA Series

Features

Coil current feedback and spool position feedback amplification for stable, high-speed spool positioning. Built in check connector ICS simplifies maintenance.

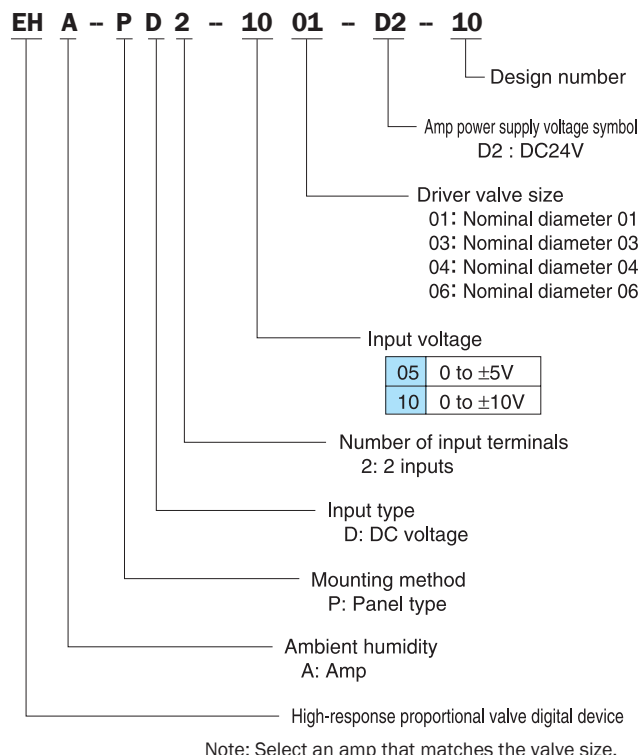
A single printed circuit board allows separation of connectors and the terminal box. Built-in differential transformer disconnect detection circuit drops **coil current** to 0mA

when disconnection occurs. Servo ready and servo ON interfaces. Power supply and **current** control switching system for improved efficiency.

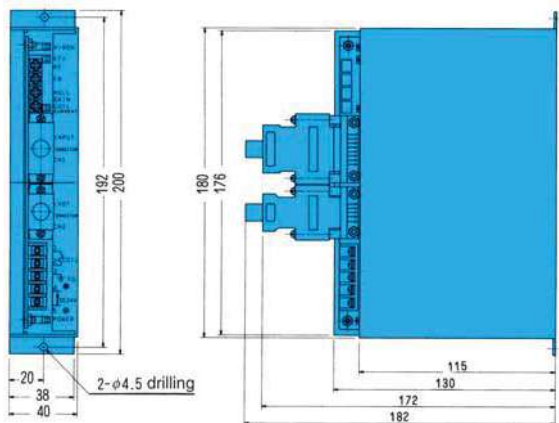
Specifications

Power Supply Voltage	24V DC (22V DC to 28V DC) Lip Noise: 150mVp-p max.
Power Supply Capacity	At least 2.1A (COSEL R50A-24 equivalent switching regulator)
Ambient Temperature	32 to 122° F
Ambient Temperature	35 to 85% RH (non-condensation)
Input Signal Voltage	0 to ±5V DC or 0 to ±10V DC
Input Impedance	50kΩ
Power Consumption	2.1A maximum consumption current at 24V
Weight lbs	2
External Supply Voltage	+5V : (10mA maximum supply possible) -5V : (10mA maximum supply possible)
Drive Coil	2.5Ω; max. 2.7A or 5 Ω; max. 2.4A
Spool Displacement Measurement	Differential transformer (LVDT)
Servo ON	Application of 24V DC during valve operation
Ready	During normal valve operation: ON
Spool displacement monitor	0 to ±5V

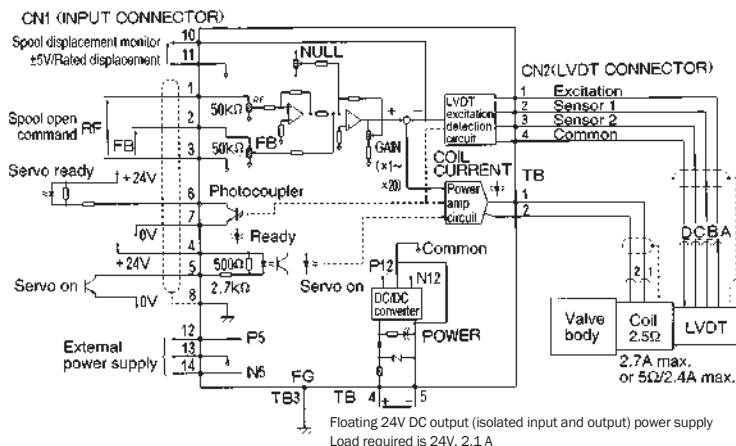
Understanding Model Numbers



Installation Dimension Drawings



Block Diagram



Note:
Since G03, G04, and G05 are pilot operation types, there is an LVDT on the main spool, but connection is identical.

G

Proportional Valves



G

Proportional Valves



Electro-Hydraulic Servo Valve Driver Amplifier

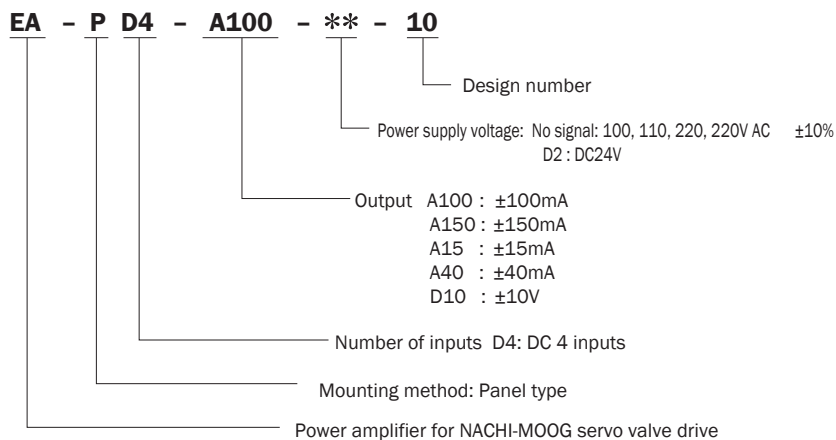
Features

- Compact design.
- Capable of driving virtually all NACHI-MOOG servo valve series.
- Power supply support for 24V DC in addition to 100V AC and 200V AC.

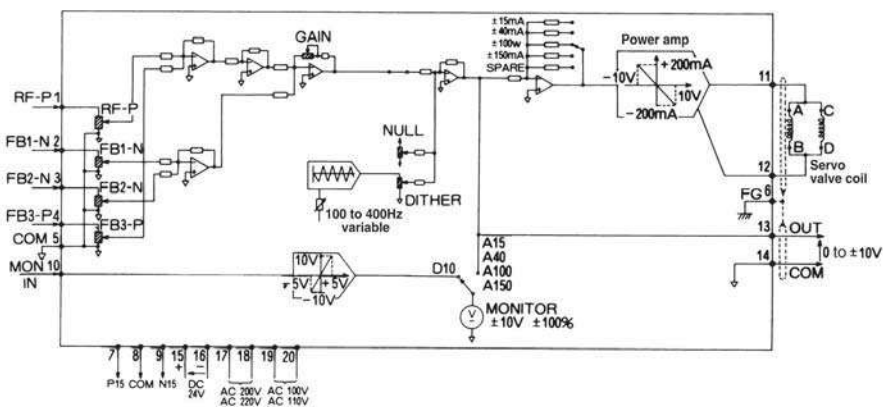
Specifications

Item	Description
Number of Inputs	4 (RF-P, FB1-N, FB2-N, FB3-P)
Input Voltage Range	$\pm 10\text{VDC}$ (Command Signal/ Feedback Signal)
Input Impedance	$50\text{k}\Omega$
Gain Adjust (GAIN)	1 to 20 X/5 to 100 X switchable
Zero Adjust (NULL)	0 to $\pm 20\%$
Frequency Characteristics	-3dB attenuation at 700Hz
Dither (DITHER)	100 to 400Hz variable (Factory default; 200Hz)
Power Supply Voltage	AC100, 110, 200, 220V ($\pm 10\%$) 50/60Hz
Power Consumption	20VA
External power supply	+15V (200mA) -15V (200mA)
Allowable Ambient Temperature	32 to 122° F
Temperature Drift	$50\mu\text{V}/^\circ\text{C}$ max.
Weight lbs	6.6
Servo Valve Coil Drive Current	$\pm 15\text{mA}$ (100 Ω) $\pm 40\text{mA}$ (40 Ω) $\pm 100\text{mA}$ (14 Ω) $\pm 150\text{mA}$ (14 Ω) It is possible to switch the output voltage $\pm 10\text{V}$ for the four types noted above. Resistance values in parentheses indicate resistance in the case of parallel wiring of the servo valve coil.

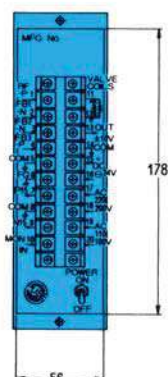
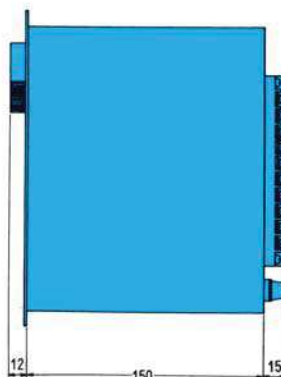
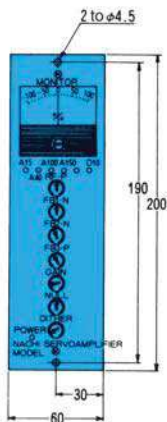
Understanding Model Numbers



Note: 24V DC only can be used in the case of power supply voltage signal D2. 100V, 200V AC cannot be used.



No.	Name	No.	Name
1	RF-P input	11	Control current
2	FB1-N feedback input	12	Output terminal
3	FB2-N feedback input	13	Control voltage
4	FB3-P feedback input	14	Output terminal
5	COM signal land	15	+
6	FG case ground	16	- DC24V
7	P15 external power supply	17	AC200, 220V
8	COM signal land	18	
9	N15 external power supply	19	
10	MON/IN monitor in	20	AC100, 110V

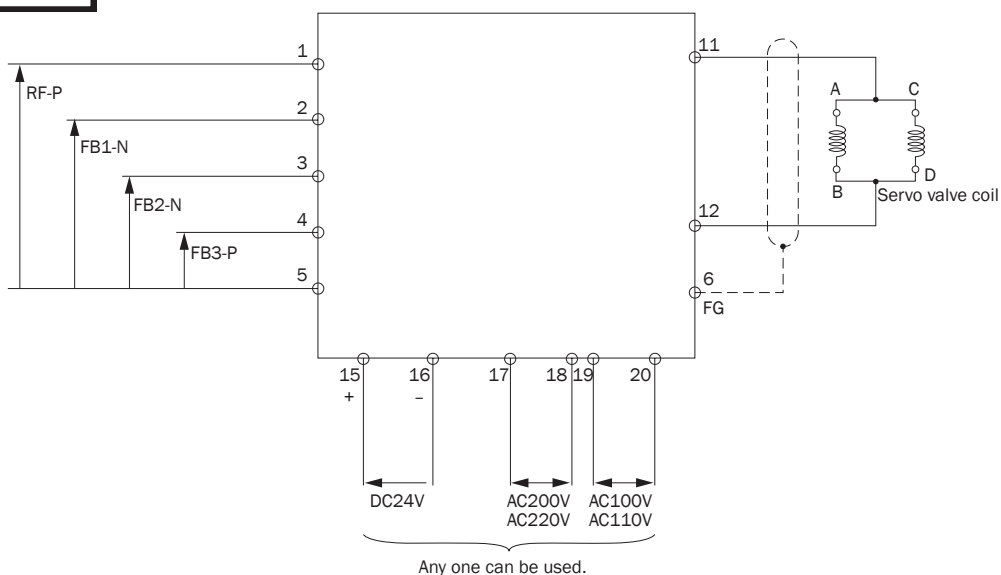


Installation Dimension Drawings

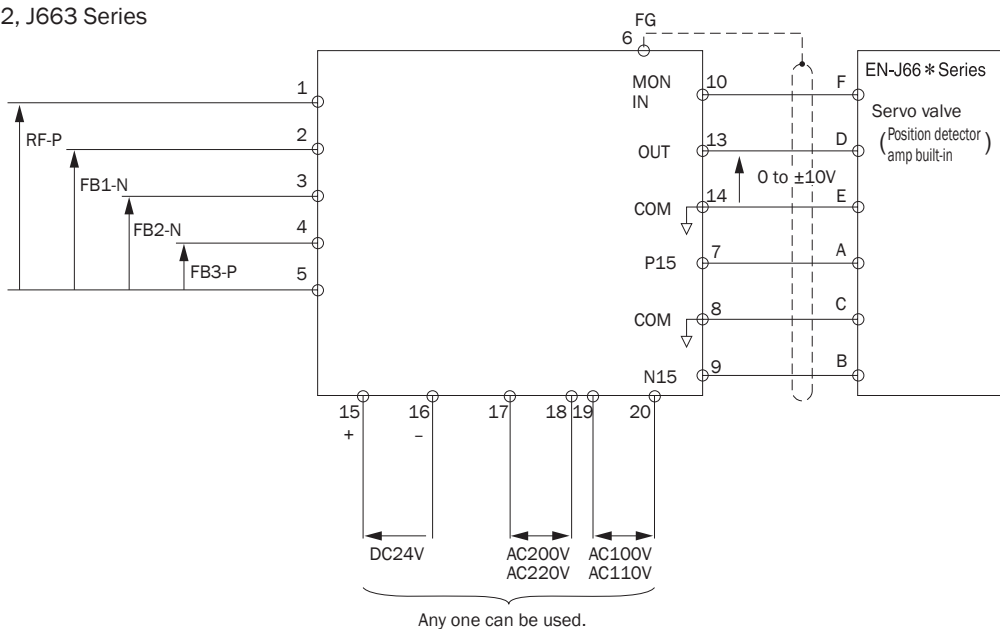
Servo Model Number	Rated Output	Applicable Servo Amplifier Model Number
EN-J631 Series	$\pm 100\text{mA}$ (parallel wiring)	EA-PD4-A100
EN-31 Series Center Flow 19.8 gpm Rated Models	$\pm 150\text{mA}$ (parallel wiring)	EA-PD4-A150
EN-J072-401, EN-J072-402, EN-J073-401, EN-J073-402, EN-J073-403, EN-J073-404, EN-J073-405, EN-J076-401, EN-J076-402, EN-J076-403, EN-J076-404, EN-J076-405	$\pm 15\text{mA}$ (parallel wiring)	EA-PD4-A15
EN-J072-403, EN-J770, EN-J073-406, EN-J076-406	$\pm 40\text{mA}$ (parallel wiring)	EA-PD4-A40
EN-J661 EN-J662 (Main Valve Position Detector or AmP Built In) EN-J663	$\pm 10\text{V}$	EA-PD4-D10

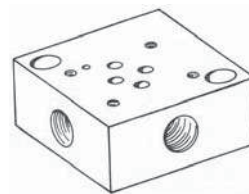
Wiring Diagram

EN-J631, J072, J073,
J076, J770 Series



EN-J661, J662, J663 Series

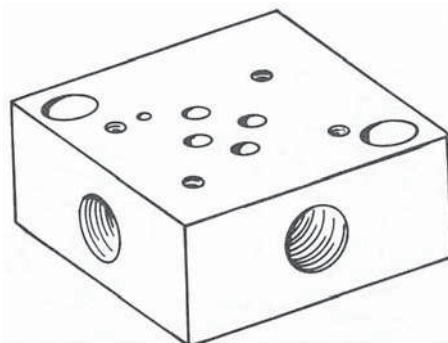




MSA-01/03-S10 & MDS-06-S10 Series Aluminum Subplates

Features

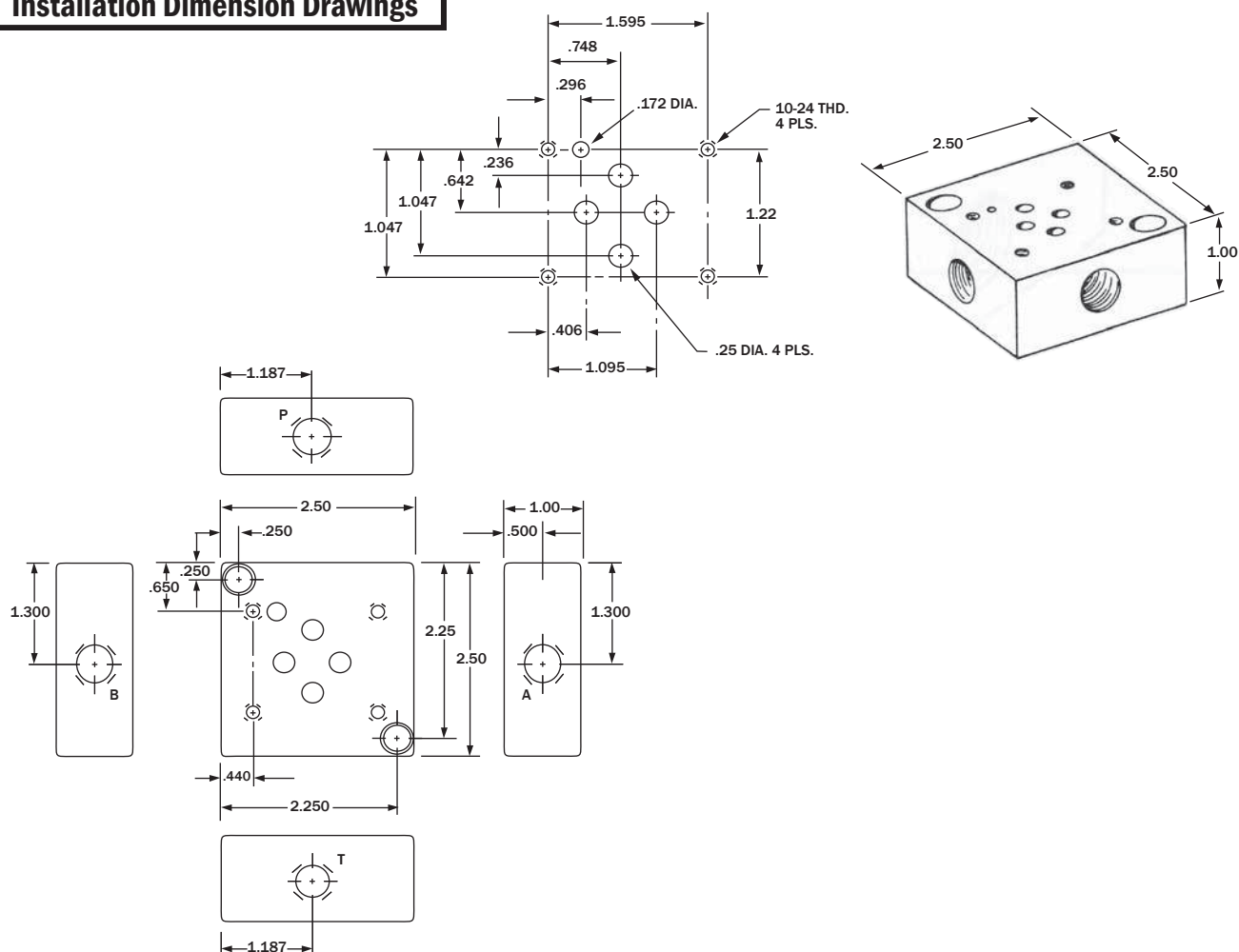
Aluminum construction with "SAE" Ports. Workports are located on sides for easy piping.



Specifications

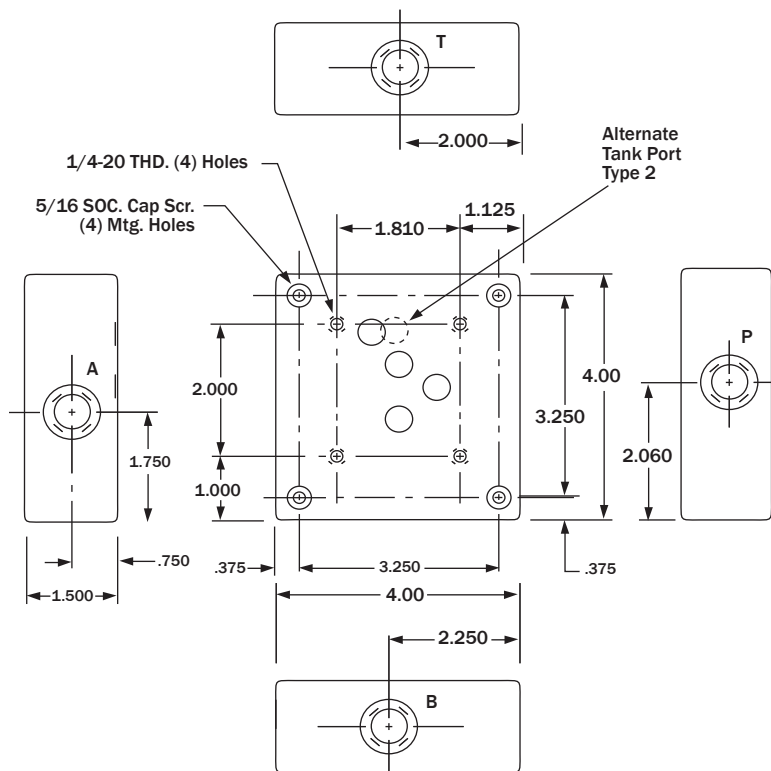
Model	NFPA Mfg. Standard	Material	Max Pressure Rating
MSA-01Y-T-S10 Side Ported 9/16-18 SAE	D03 P • B • • A • T	Aluminum 6061-T6	3000 psi

Installation Dimension Drawings



Subplates

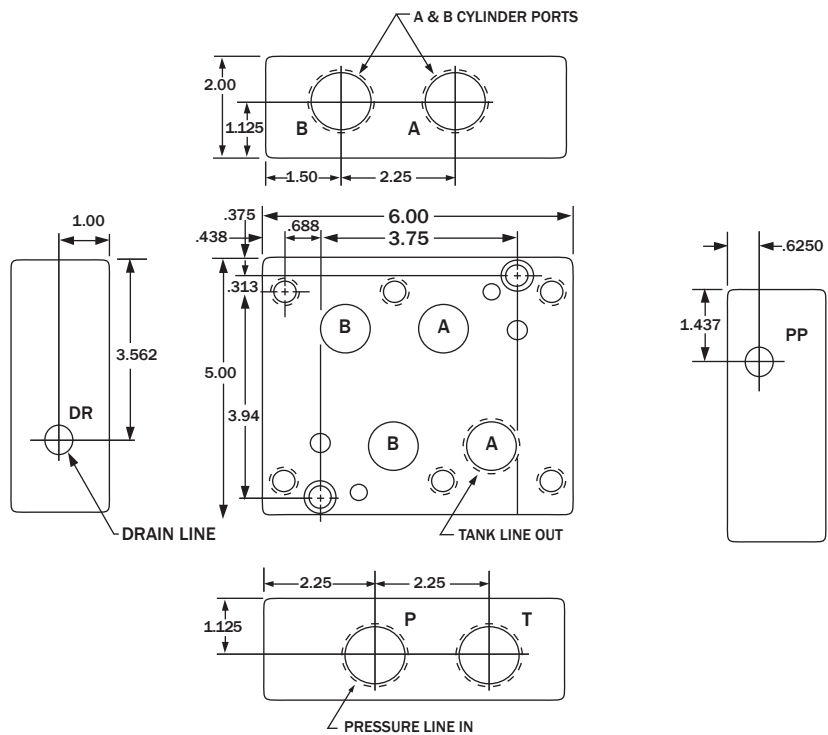
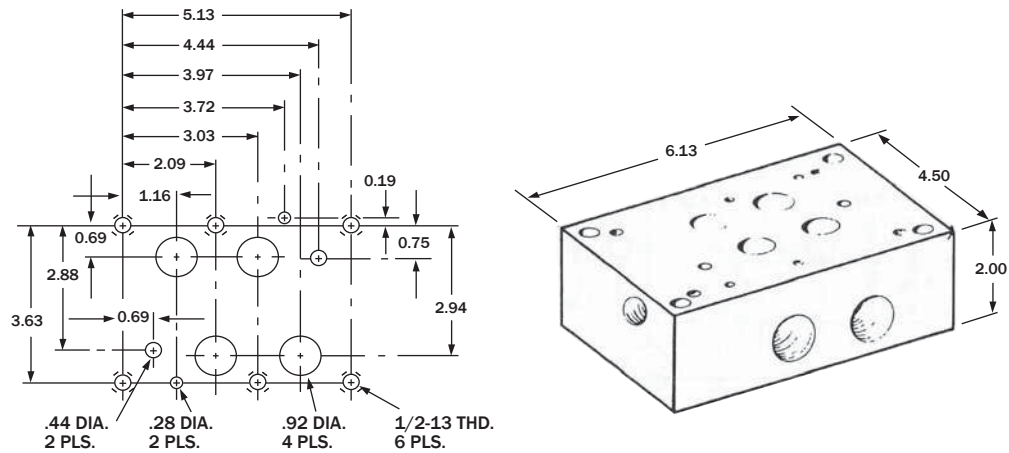
Installation Dimension Drawings



Specifications

Model	NFPA Mfg. Standard	Material	Max Pressure Rating
MSA-06Y-T-S10 Side Ported 1 5/16-12 SAE	D08 P B • • A T	Aluminum 6061-T6	3000 psi

Installation Dimension Drawings



Solenoid Valve/Modular Valve Subplate

Features

This plate is for when only a single solenoid valve and modular is used.

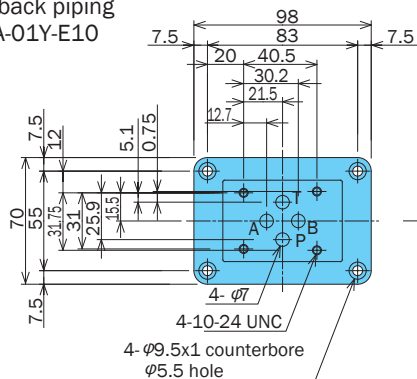
The 01 and 03 sizes include one-side piping types. E includes NPT piping.

Installation Dimension Drawings

Use the following table for specification when a sub plate is required.

01 (nominal diameter)

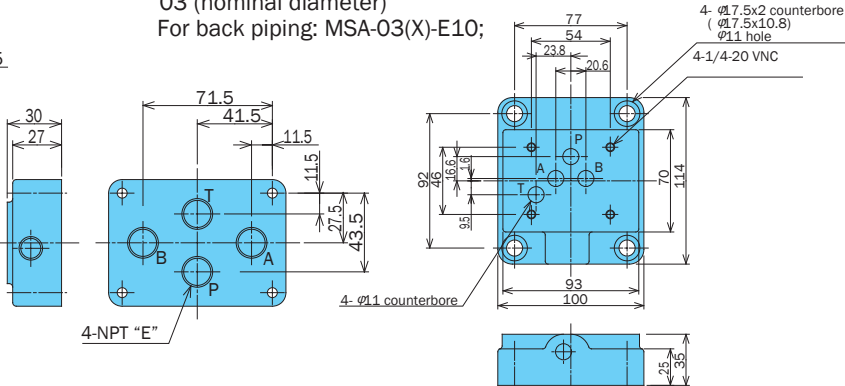
For back piping
MSA-01Y-E10



Model No.	Pipe Outlet Size E	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs
MSA-01X-E10	1/4	3625	5.2	2.6
MSA-01Y-E10	3/8		10.5	2.6

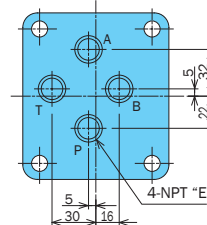
03 (nominal diameter)

For back piping: MSA-03(X)-E10;



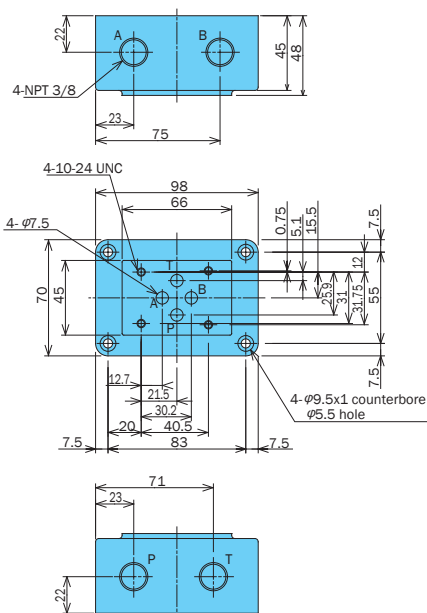
Sub Plate Number

Mounting bolt	Model No.	Maximum Working Pressure psi	Recommended Flow Rate gpm	E NPT
1/4-20	MSA-03-E10	3625	11.8	3/8
	MSA-03X-E10		21.1	1/2



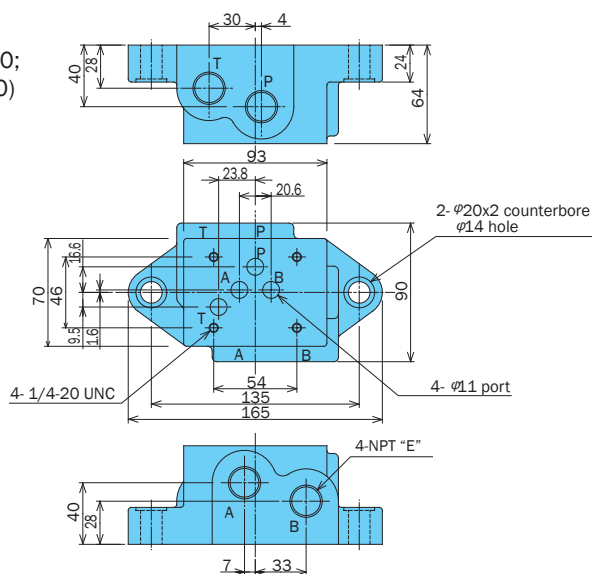
Note: Dimensions in parentheses indicate MS-03 (X) -30.

For side piping MSA-01Y-T-E10



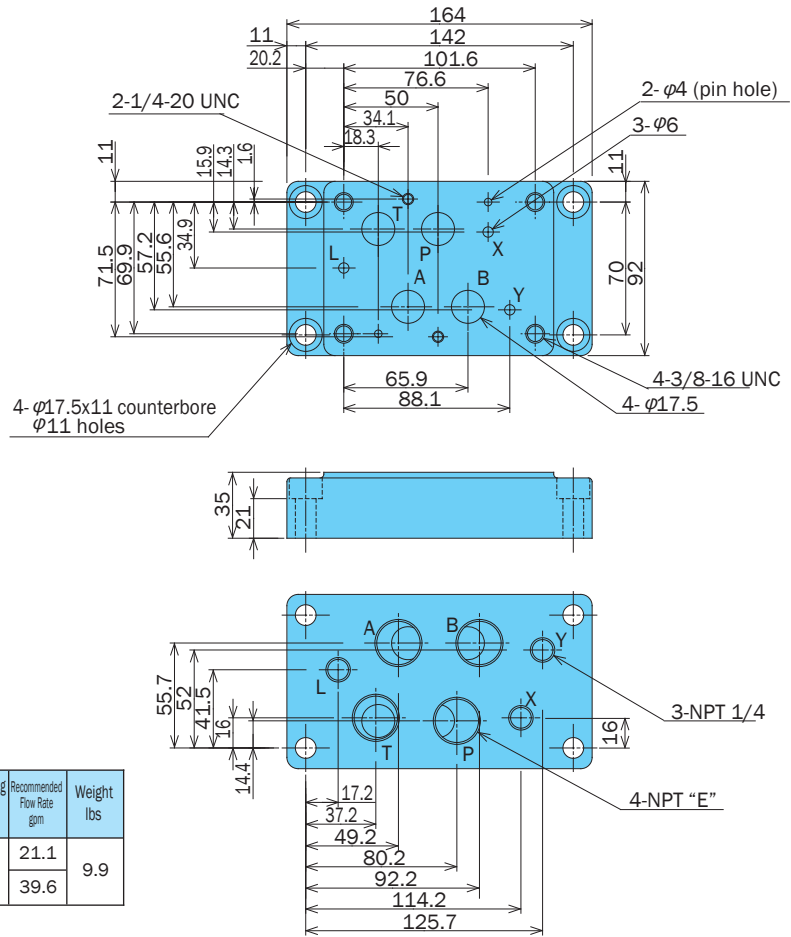
Model No.	Pipe Outlet Size E	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs
MSA-01Y-T-E10	3/8	3625	10.5	4.1

For side piping
MSA-03(X)-T-E10;
(MS-03(X)-T-E10)



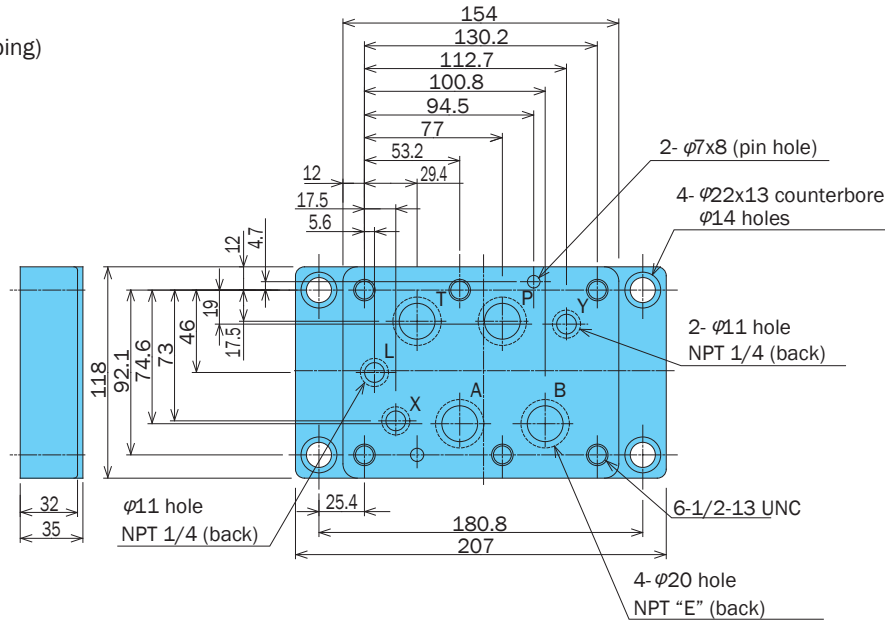
Mounting bolt	Model No.	Maximum Working Pressure psi	Recommended Flow Rate gpm	Pipe Outlet Size E	Weight lbs
1/4-20	MSA-03-T-E10	3625	11.1	3/8	8.3
	MSA-03X-T-E10		21.1	1/2	

O4 (nominal diameter)
MDS-O4(X)-E10



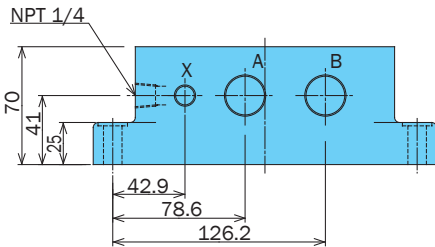
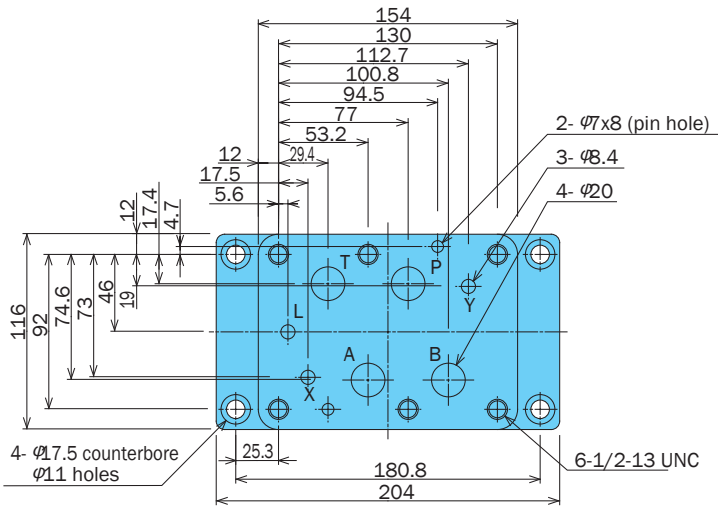
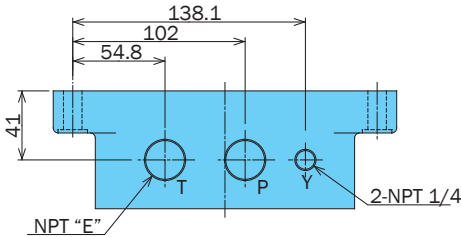
Model No.	Pipe Outlet Size E	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs
MDS-O4-E10	1/2	3625	21.1	9.9
MDS-O4X-E10	3/4		39.6	

O6 (nominal diameter)
MDS-O6(X)-E30(for back piping)

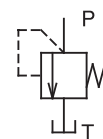


Model No.	Pipe Outlet Size E	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs
MDS-O6-E30	3/4	3625	39.6	11.4
MDS-O6X-E30	1		79.2	

MDS-06(X)-T-10(for side piping)



Model No.	Pipe Outlet Size E	Maximum Working Pressure psi	Recommended Flow Rate gpm	Weight lbs
MDS-06-T-E10	3/4	3625	39.6	19.8
MDS-06X-T-E10	1		79.2	



Relief Valve

5.2 to 100 gpm
3045 psi

Features

Balanced piston relief valve.
Optimum pressure control for hydraulic circuit allows operation as a safety valve.

A vent port enables remote control of pressure and use of an unloading circuit.

Specifications

Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs	
Screw Mounting	Gasket Mounting					T Type	G Type
R-T03- A-12 B-12	R-G03- A-E12 B-E12	3/8	3045 P, X (Vent Ports)	5.2	0 to 145 0 to 362	6.6	9.5
R-T03- 1-12 3-12	R-G03- 1-E20 3-E20	3/8		21	0 to 1000 500 to 3000	6.6	9.5
R-T06- 1-E20 3-E20	R-G06- 1-E20 3-E20	3/4		45	0 to 1000 500 to 3000	8.5	11.6
R-T10- 1-E20 3-E20	R-G10- 1-E20 3-E20	1 1/4		100	0 to 1000 500 to 3000	17	17

Note: See the Flow Rate - Low Pressure characteristics for information about items marked with an asterisk (*).

Handling

- To adjust pressure, loosen the lock nut and then rotate the handle clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- Make sure that tank port back pressure is no greater than 29 psi. For tank piping of the A and B type pressure adjusting ranges, return directly to the tank without connecting any other piping and eliminate back pressure.
- The pressure adjustment range for the high vent type is 188 psi. Note that R-T/G03 is not a high vent type.
- When using a relief valve as a safety valve, use a pressure override that is higher than the required circuit pressure.
- When using a remote control valve, connect piping to the relief valve port. Pipe capacity can be a source of vibration. Use of thick iron pipe with an inside diameter of no more than .15 in. and a connection length of no more than three meters is recommended.
- Pressure becomes unstable when at slow control flow rates. Use a flow rate of no less than 2.1 gpm for the 03, 06 sizes, and 2.6 gpm for the 10 size. Use

a drain type relief valve in the case of a flow rate that is less than the minimum flow rate.

- Use the following table for specification when a sub plate is required.

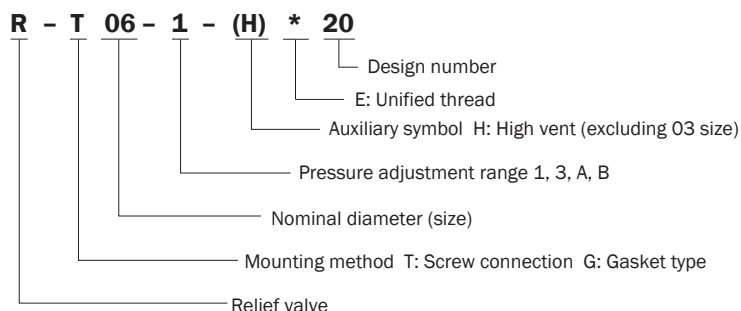
Model No.	Pipe Diameter	Weight lbs	Applicable Valve Model
MR-03-E10	3/8	3.5	R-G03-*-12
MR-06-E20	3/4	7.7	R-G06-*-E20
MR-06X-E20	1		
MR-10-E20	1 1/4	18.7	R-G10-*-E20
MR-10X-E20	1 1/2		

- The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
R-G03-*-12	3/8-16 x 3"	4	33 to 40
R-G06-*-E20	5/8-11 x 3 1/8"	4	140 to 173
R-G10-*-E20	7/8-9 x 4 1/8"	4	272 to 339

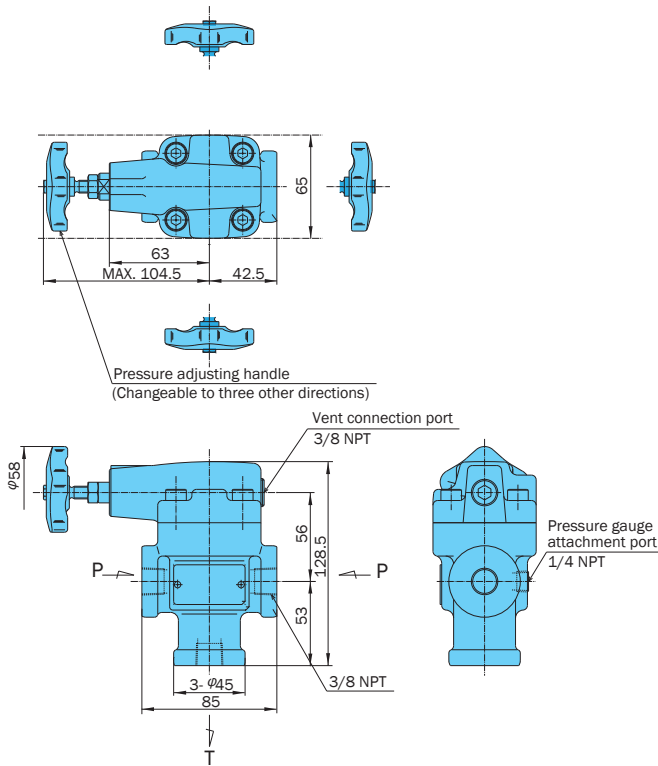
Note: For mounting bolts, use grade 8 or equivalent.

Understanding Model Numbers

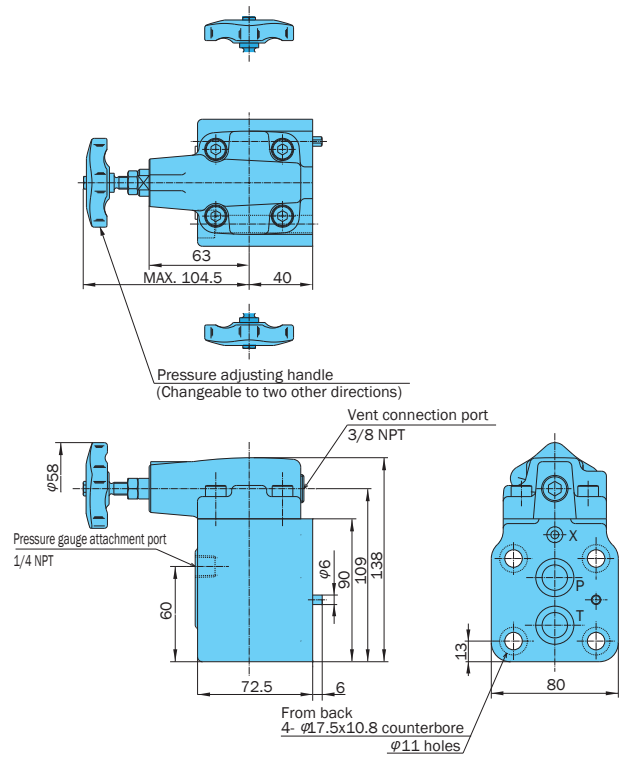


Installation Dimension Drawings

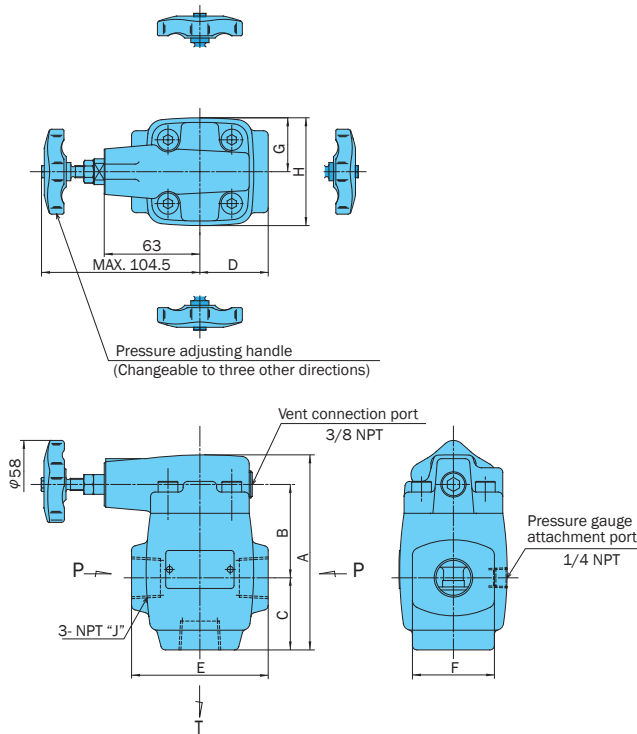
R-T03-*- E12 (Screw Mounting)



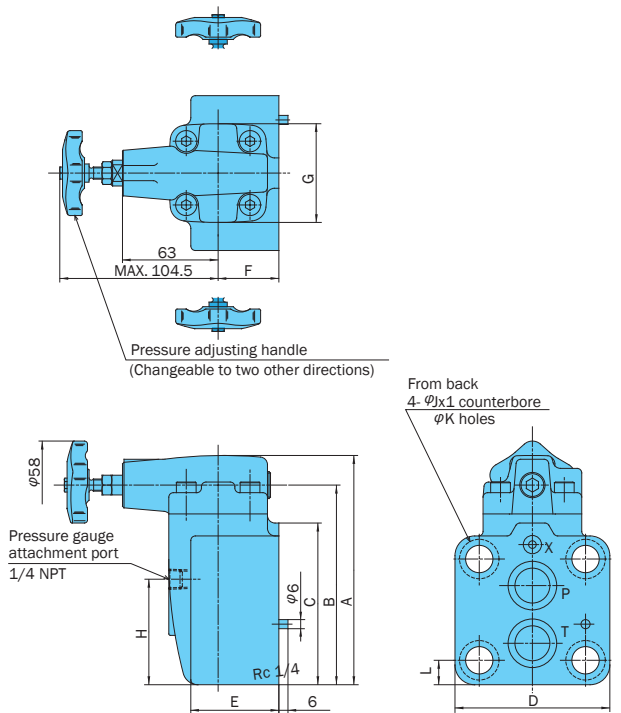
R-G03-*-12 (Gasket Mounting)



R-T**-*- E20 (Screw Mounting)



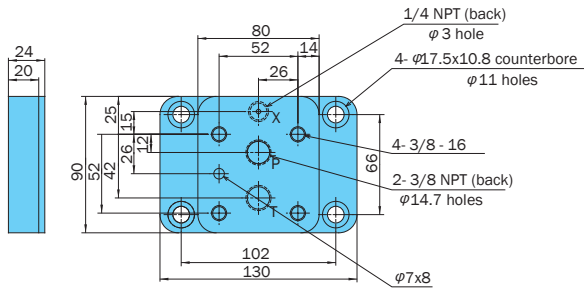
R-G**-*-20 (Gasket Mounting)



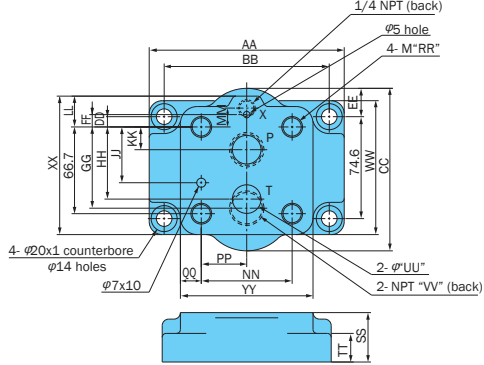
Model No.	A	B	C	D	E	F	G	H	J
R-T06-*-20	128.5	61.5	47.5	45	90	54	35.5	71	3/4
R-T10-*-20	153.5	72	62	62.5	125	69	47	94	1 1/4

Model No.	A	B	C	D	E	F	G	H	J	K	L
R-G06-*-20	151	131.5	106.5	102	58	40	65	69.5	26	18	16.1
R-G10-*-20	162.5	143	110	127	80	50	86	70.5	32	22	17.7

Sub Plate MR-03- E10



MR-**- E20



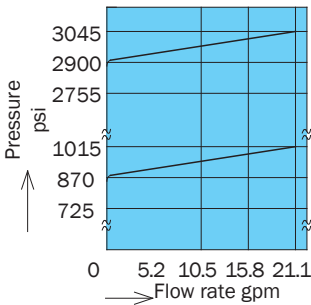
Model No.	Dimensions (mm)																			
	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	QQ	RR	SS	TT	UU	VV
MR-06-E20	150	127	125	7.9	21.8	9.5	62.5	55.5	42.9	17.5	23.7	14.5	69.9	34.9	16.1	5/8-11	38	22	22	3/4
MR-06X-E20																				1
MR-10-E20	175	152.4	150	6.4	39.2	15.9	71.3	58.7	50.8	14.3	25.6	25.9	92.1	46.1	17.5	7/8-9	55	22	28.5	1 1/4
MR-10X-E20																				1 1/2

Performance Curves

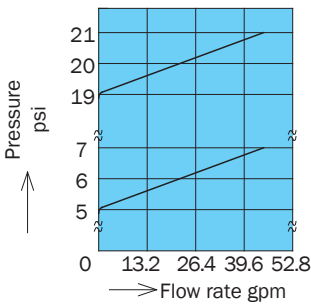
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure - Flow Rate Characteristics

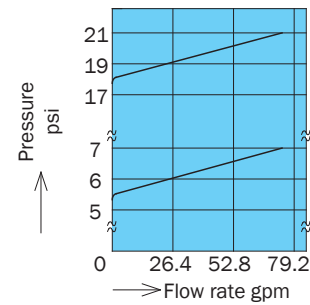
R-03-**-E12



R-06-**-E20

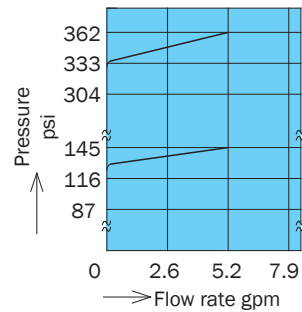


R-10-**-E20

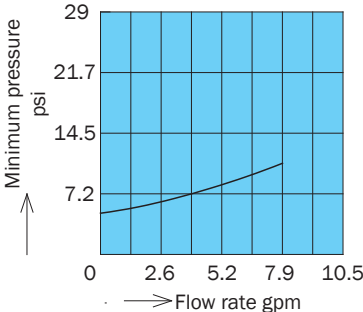


Flow Rate - Minimum Pressure Characteristics

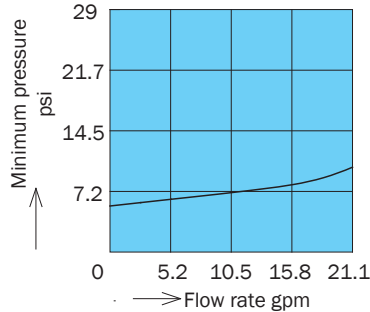
R-03-^A/_B-E12



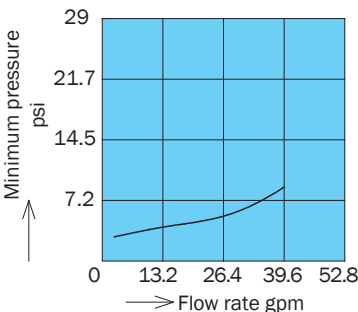
R-03-^A/_B-E12



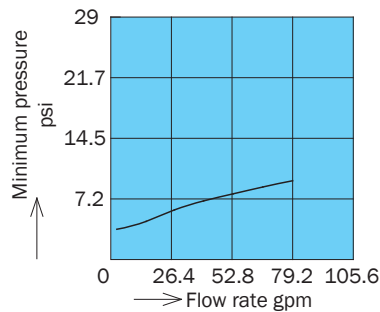
R-03-1-E12



R-06-1-E20



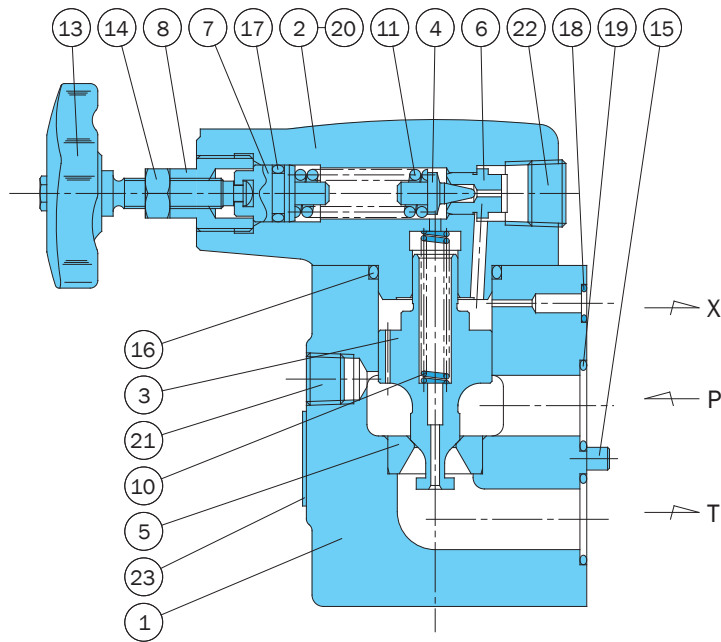
R-10-1-E20



Note: The performance curves do not include T port back pressure.

Installation Dimension Drawings

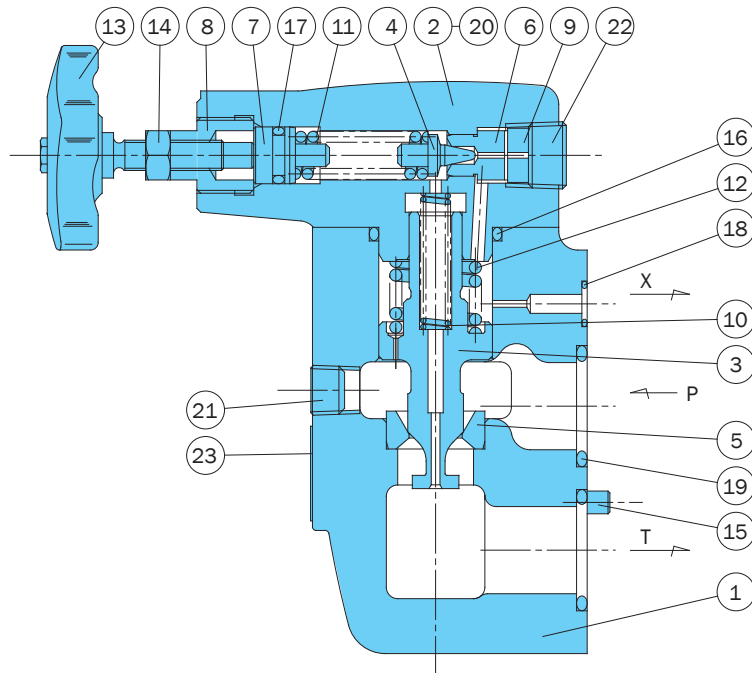
R-G03- $\frac{A}{B}$ -12



Part No.	Part Name
1	Body
2	Cover
3	Spool
4	Poppet
5	Seat
6	Seat
7	Plunger
8	Retainer
9	Collar
10	Spring
11	Spring
12	Spring
13	Handle
14	Nut
15	Spring pin
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	Screw
21	Plug
22	Plug
23	Nameplate

Note:
The No. 12 spring is not included when auxiliary symbol H is selected (except with the 03 size).

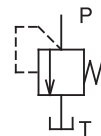
R-G03- $\frac{1}{3}$ -12 R-G $\frac{06}{10}$ - $\frac{1}{3}$ -20



Seal Part List (Kit Model Number RRS-*** (03 size)
RRBS-*** (06, 10 size))

Part No.	Part Name	Type/Part Number						Q'ty
		R-G03-*-12	R-T03-*-12	R-G06-*-20	R-T06-*-20	R-G10-*-20	R-T10-*-20	
16	O-ring	IB-G30	IB-G30	IB-G30	IB-G30	IB-G40	IB-G40	1
17	O-ring	IA-P11	IA-P11	IA-P11	IA-P11	IA-P11	IA-P11	1
18	O-ring	IB-P7	-	IB-P9	-	IB-P9	-	1
19	O-ring	IB-P20	-	IB-P26	-	IB-G35	-	2

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.
*** in the kit number is used for specification of the valve size (G03, T06, etc.)



RI Series Relief Valve (ISO Mounting, Balanced Piston Type)

10.5 to 84.5 gpm
5075 psi

Features

Balanced piston relief valve.
Optimum pressure control for hydraulic circuit allows operation as a safety valve.

A vent port enables remote control of pressure and use of an unloading circuit.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs	Gasket Surface Dimensions
Gasket Mounting						
RI-G03-C-20	3/8	5075 P, X Ports	10.5	21 to 507	9.9	ISO 6264-AR-06-2-A
RI-G03-1-20 3 5	3/8		39.6	116 to 1000 507 to 3625 507 to 5075	9.9	
RI-G06-1-20 3 5	3/4		84.5	116 to 1000 507 to 3625 507 to 5075	12.3	ISO 6264-AS-08-2-A

Handling

- To adjust pressure, loosen the lock nut and then rotate the handle clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- Make sure that tank port back pressure is no greater than 29 psi.
- For use as a safety valve, use a pressure override that is higher than the required circuit pressure.
- When using a remote control valve, connect piping to the relief valve port. Pipe capacity can cause vibration. Use of thick iron pipe with an inside diameter of no

more than .15" and a connection length of no more than three meters is recommended.

- The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
RI-G03-*20	3/8 - 16	4	55 to 70
RI-G06-*20	5/8 - 11	4	140 to 173

Note: For mounting bolts, use grade 8 or equivalent.

- A small control flow rate can cause pressure instability. Use a control flow rate that is at least 2.1 gpm.

Use a drain type relief valve in the case of a flow rate that is less than the minimum flow rate.

- Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Weight lbs	Applicable Valve Model
MRI-03-E10	3/8	5.7	RI-G03
MRI-03X-E10	1/2		
MRI-06-E10	3/4	7.7	RI-G06
MRI-06X-E10	1		

Understanding Model Numbers

RI - G 06 - 1 - 20

Design number

Pressure adjustment range C, 1, 3, 5

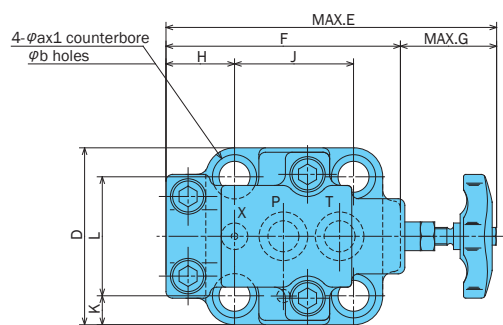
Nominal diameter (size)

Mounting method G: Gasket type

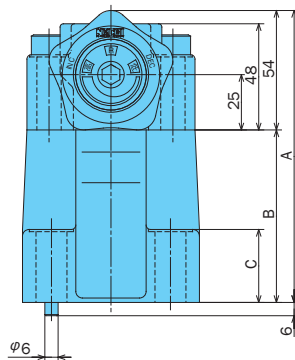
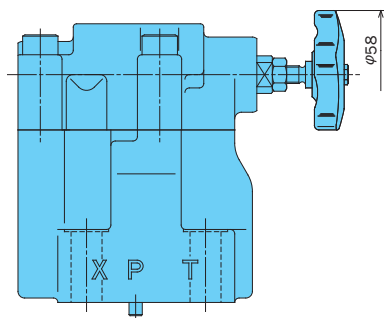
RI series relief valve

Installation Dimension Drawings

RI-G**-*-20

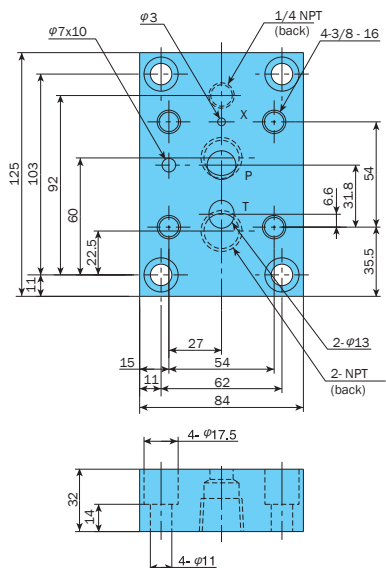


Model No.	A	B	C	D	E	F	G	H	J	K	L	a	b
RI-G03*-20	132	78	32	80	149.5	106	43.5	31	53.8	13.1	53.8	20	14
RI-G06*-20	137	83	36	100	158.5	119	39.5	37	66.7	15	70	26	17.5



Sub Plate MRI-03*-E10

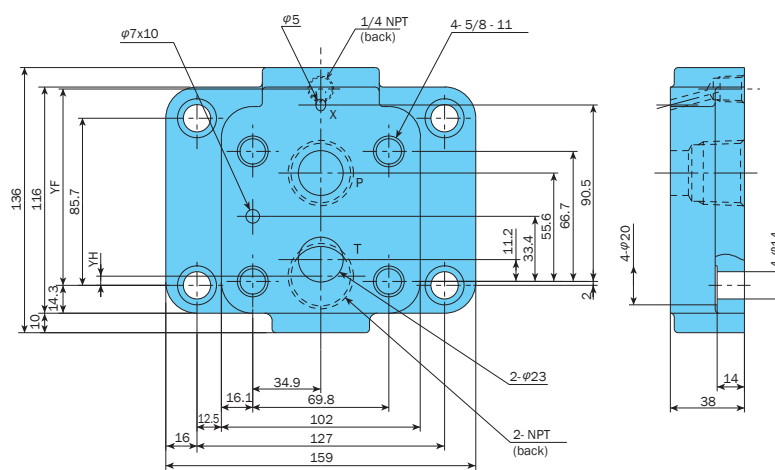
(Maximum Operating Pressure: 3625 psi)



Model No.	A
MRI-03-E10	3/8
MRI-03X-E10	1/2
MRI-06-E10	3/4
MRI-06X-E10	1

Sub Plate MRI-06*-E10

(Maximum Operating Pressure: 3625 psi)



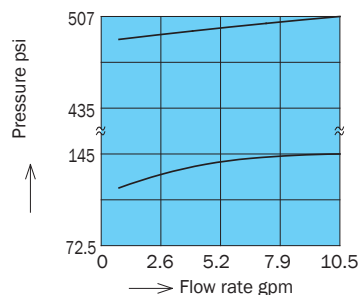
Attach a plug when the vent (X) port is not used.

Model No.	YF	YH
MRI-06-E10	92.5	13.2
MRI-06X-E10	100.7	4.7

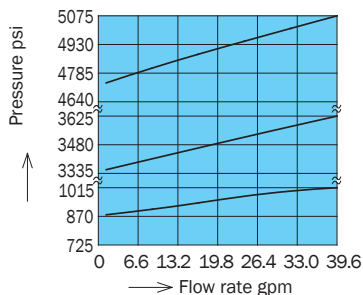
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

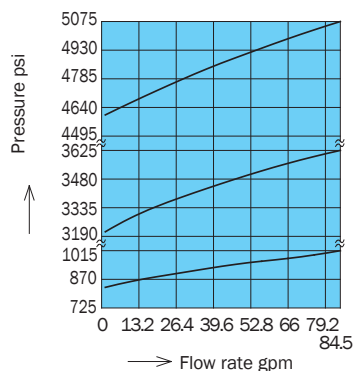
Pressure - Flow Rate Characteristics
RI-G03-C-20



RI-G03-*-20



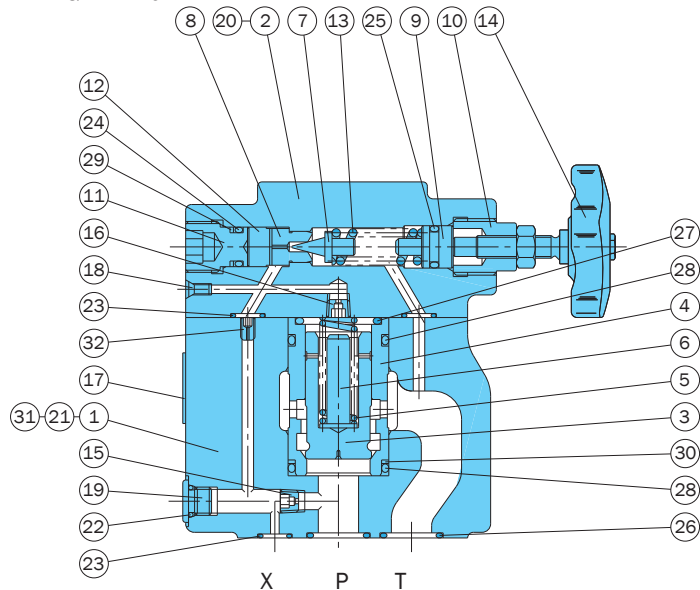
RI-G06-*-20



Note: The performance curves do not include T port back pressure.

Cross-sectional Drawing

RI-G**-*-20



Part No.	Part Name	Part No.	Part Name
1	Body	17	Plate
2	Cover	18	Plug
3	Poppet	19	Plug
4	Sleeve	20	Screw
5	Spring	21	Pin
6	Spacer	22	O-ring
7	Poppet	23	O-ring
8	Seat	24	O-ring
9	Plunger	25	O-ring
10	Retainer	26	O-ring
11	Plug	27	O-ring
12	Collar	28	O-ring
13	Spring	29	Backup ring
14	Handle assy	30	Backup ring
15	Orifice	31	Screw
16	Orifice	32	Choke

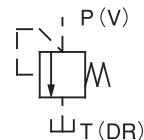
Seal Part List (Kit Model Number REBS-***)

Part No.	Part Name	Nominal Diameter/Part Number		Q'ty
		G03	G06	
22	O-ring	1B-P8	1B-P8	1
23	O-ring	1B-P9	1B-P9	3
24	O-ring	1B-P10A	1B-P10A	1
25	O-ring	1A-P11	1A-P11	1
26	O-ring	1B-P18	1B-P28	2
27	O-ring	1B-G25	1B-P28	1
28	O-ring	1B-G30	1B-P32	2
29	Backup ring	T2-P10A	T2-P10A	1
30	Backup ring	T2-G30	T2-P32	1

Note: O-ring 1A/B-** refers to JIS B 2401-1A/1B-**. For the *** part of the kit number, specify the valve size (G03, G06).

Remote Control Relief Valve

.52 to 3.9 gpm
3045 psi



Features

Connecting a relief valve or reducing valve to the vent port of a balanced piston type pressure control valve provides

simple remote control of pressure. RCD type can also be used as a direct type relief valve.

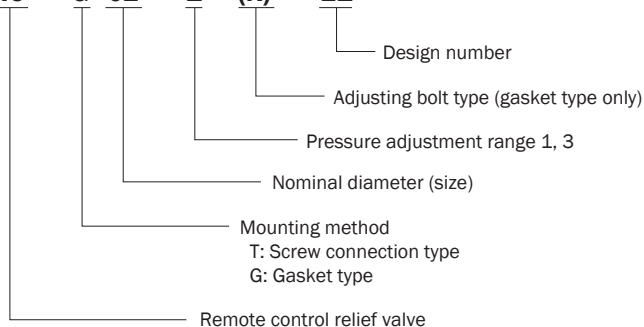
Specifications

Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs
Screw Mounting	Gasket mounting					
RCD-T02-1-11 3-11	-	1/4	3045 P, V ports	3.9	116 to 1015 507 to 3045	4.6
RC-T02-1-12 3-12	RC-G02-1-21 3-21			.52	116 to 1015 507 to 3045	3.0

Note: The pressure adjustment range indicates cracking pressure.

Understanding Model Numbers

RC - G 02 - 1 - (K) - 21

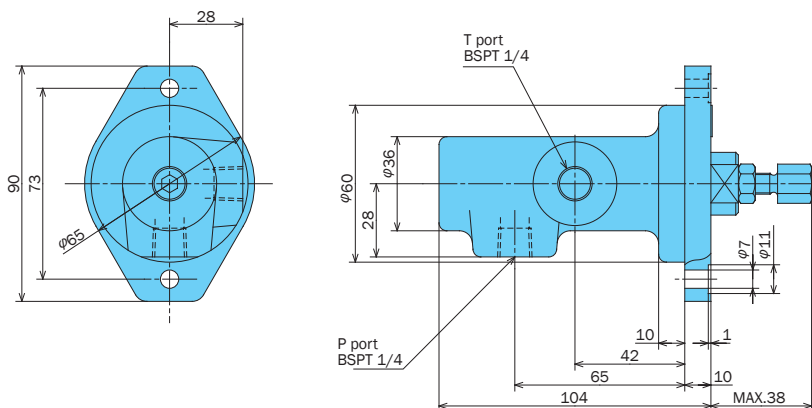


• Handling

- 1 To adjust pressure, loosen the lock nut and then rotate the handle clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- 2 Make sure that drain port back pressure is no greater than 29 psi.
- 3 When configuring pipes for the pressure control valve and remote control valve, use of thick iron pipe with an inside diameter of no more than .15" and a connection length of no more than three meters is recommended. Pipe capacity can be a source of vibration.
- 4 When an adjustment bolt type is required for the pressure adjustment block, insert K for the type specification. See the dimension drawings, RC-G02 only.
- 5 Use the following to specify a sub plate.

Installation Dimension Drawings

RCD-T02-*-11 (Screw Mounting)



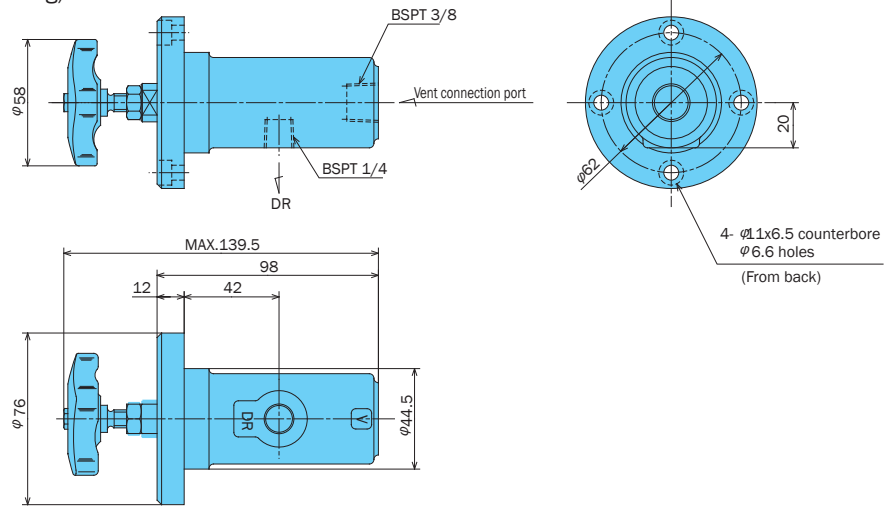
Model No.	Weight lbs
MRC-02-20	2.2

- 6 The following are the bundled mounting bolts.

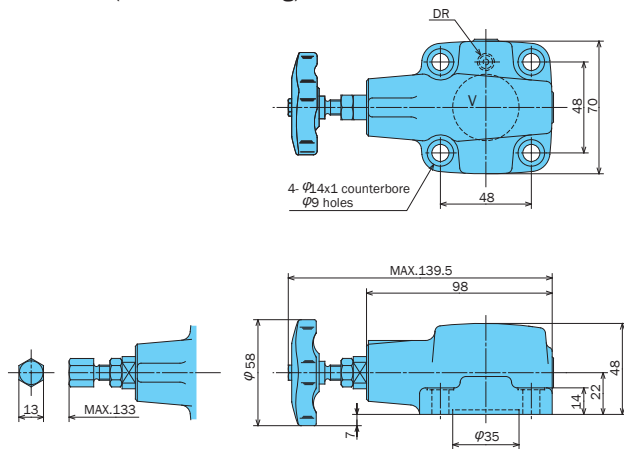
Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
RC-G02-*-21	M8 x 25r	4	14 to 18.5

Note: For mounting bolts, use 12T or equivalent.

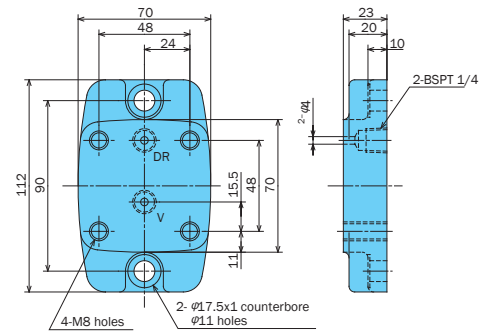
RC-T02-*-12 (Screw Mounting)



RC-G02-*-21 (Gasket Mounting)

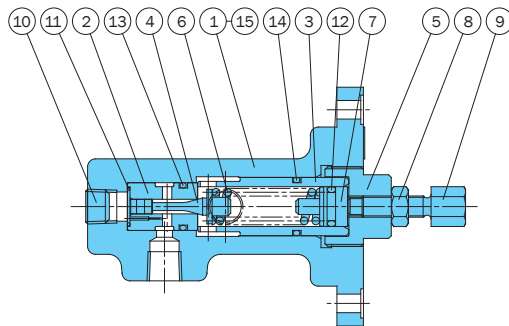


Sub Plate MRC-02-20

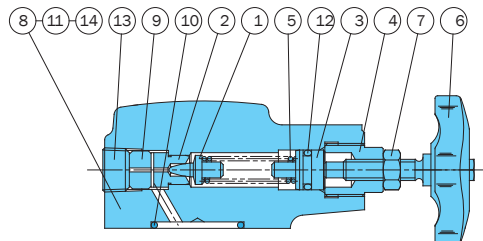


Cross-sectional Drawing

RCD-T02-*-11



RC-G02-*- (K)-21



Part No.	Part Name	Part No.	Part Name
1	Body	12	O-ring
2	Sleeve	13	O-ring
3	Sleeve	14	O-ring
4	Poppet	15	Nameplate
5	Retainer		
6	Spring		
7	Guide		
8	Nut		
9	Screw		
10	Plug		
11	O-ring		

Seal Part List (Kit Model Number RCS-T02CD)

Part No.	Part Name	Part Number	Q'ty
11	O-ring	S12.5(NOK)	1
12	O-ring	1A-P11	1
13	O-ring	1B-P14	1
14	O-ring	1B-P18	1

Note: O-ring 1A/B-** refers to JIS B2401 1A/B.

Part No.	Part Name	Part No.	Part Name
1	Poppet	8	Cover
2	Seat	9	Collar
3	Plunger	10	O-ring
4	Retainer	11	O-ring
5	Spring	12	O-ring
6	Handle	13	Plug
7	Nut	14	Plate

Seal Part List (Kit Model Number RCBS-G02)

Part No.	Part Name	Part Number	Q'ty
10	O-ring	1B-G30	1
11	O-ring	1B-P6	1
12	O-ring	1A-P11	1

Note: O-ring 1A/B-** refers to JIS B2401 1A/B.



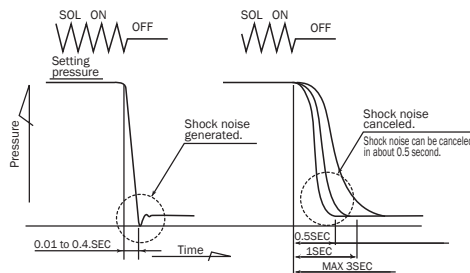
Solenoid Controlled Relief Valve 7.9 to 100 gpm 3045 psi

Features

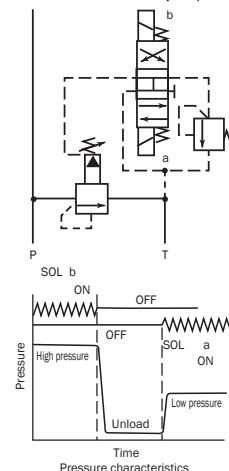
This valve adds a wet type solenoid valve to a balanced type piston type relief valve to form a hydraulic device unload circuit. The shockless type has an internal structure that prevents shock generated during unloading. This valve can also be used in a pressure relief circuit, and has a maximum adjustment time of three seconds. See the pressure relief circuit example.

A two-pressure control circuit can be configured by adding a relief modular valve. Contact your agent for more information.

(Pressure Relief Circuit Example)



(Two-pressure Control Circuit Example)



Specifications

Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs		JIS Symbol	Used Solenoid Valve Model Number
Screw Mounting	Gasket Mounting					T Type	G Type		
RSS (RSA) -T03-AQ 1/3**-.15	RSS (RSA) -G03-AQ 1/3**-.15	3/8	3045 P, X Ports	21	Type 1 0.8 to 7 116 to 1015	7	9.9		SS (SA) -G01-A3X-**-31
RSS (RSA) -T06-AQ 1/3**-.E23	RSS (RSA) -G06-AQ 1/3**-.E23	3/4		45		8.8	14		
RSS (RSA) -T10-AQ 1/3**-.E23	RSS (RSA) -G10-AQ 1/3**-.E23	1 1/4		100		19.4	22		
RSS (RSA) -T03-AR 1/3**-.15	RSS (RSA) -G03-AR 1/3**-.15	3/8		21	Type 3 3.5 to 21 507 to 3045	7	9.9		SS (SA) -G01-AR-**-31
RSS (RSA) -T06-AR 1/3**-.E23	RSS (RSA) -G06-AR 1/3**-.E23	3/4		45		8.8	14		
RSS (RSA) -T10-AR 1/3**-.E23	RSS (RSA) -G10-AR 1/3**-.E23	1 1/4		100		19.4	22		

Shockless Type

RSS (RSA) -T03-1/3-F**-15	RSS (RSA) -G03-1/3-F**-15	3/8	3045 P, X Ports	21	Type 1 1 to 7 145 to 1015 Type 3 3.5 to 21 507 to 3045	9.2	12		SS (SA) -G01-A8X0-**-31
RSS (RSA) -T06-1/3-F**-E23	RSS (RSA) -G06-1/3-F**-E23	3/4		45		11	16.3		
RSS (RSA) -T10-1/3-F**-E23	RSS (RSA) -G10-1/3-F**-E23	1 1/4		100		21.6	26.4		

Note: For information about electrical specifications, see the SS type and SA type solenoid valve items on pages D-4 and D-16.

• Handling

- To adjust pressure, loosen the lock nut and then rotate the adjusting bolt clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- To adjust the time from onload to unload, loosen the lock nut and rotate the restrictor adjusting bolt clockwise (rightward) to make the time longer, or counterclockwise (leftward) to make it shorter.
- Make sure that tank port back pressure is no greater than 29 psi.
- The ** before the design number in the model number of the solenoid valve used shows voltage. See the voltage symbols in the model number explanation.

- Pressure becomes unstable when at slow control flow rates. Use a flow rate of no less than 2.1 gpm for the 03, 06 sizes, and 2.6 gpm for the 10 size.
- Use 90 to 110% of rated voltage.
- The pressure adjustment range for the high vent type is 188 psi. Note that RSS (RSA) -T/G03 is not a high vent type.
- Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Weight lbs	Applicable Valve Type
MR-03-E10	3/8	3.5	RSS (RSA) -G03-****-.15
MR-06-E20	3/4	7.7	RSS (RSA) -G06-****-.23
MR-06X-E20	1		
MR-10-E20	1 1/4	18.7	RSS (RSA) -G10-****-.23
MR-10X-E20	1 1/2		

Note: See page relief valve page item on I-3 for dimensions.

- The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Qty	Tightening Torque ft. lbs
RSS (RSA) -G03-****-.15	3/8 - 16	4	33 to 40.5
RSS (RSA) -G06-****-.23	5/8 - 11	4	140 to 173
RSS (RSA) -G10-****-.23	7/8 - 9	4	272 to 339

Note: For mounting bolts, use 12T or equivalent.

- The coil surface temperature increases if this pump is kept continuously energized. Install the valve so there is not chance of it being touched directly by hand.

Understanding Model Numbers

RSS (RSA) - G 06 - A Q 1 - (H) - C1 * 23

Design number

E: Unified thread

Voltage symbol

C1: AC100V 50/60Hz

C2: AC200V 50/60Hz

D1: DC12V

D2: DC24V

E1: AC100V 50/60Hz

E2: AC200V 50/60Hz

Auxiliary symbol

H: High vent (excluding O3 size)

F: With shock canceller

(See shockless type item.)

Pressure adjustment range 1, 3

Stop position flow path

Q: Open

R: Blocked

Operation method A: Spring offset

Nominal diameter (size)

Mounting method T: Screw connection type

G: Gasket type

Solenoid controlled relieve valve
(with SA type solenoid valve)

Solenoid controlled relieve valve
(with SS type solenoid valve)

Other auxiliary symbols can be used
(enter them in alphabetic order if there are 2 or more).

With SS type solenoid valve G, N, Q (R is omitted).

With SA type solenoid valve GR, J, N, Q, R

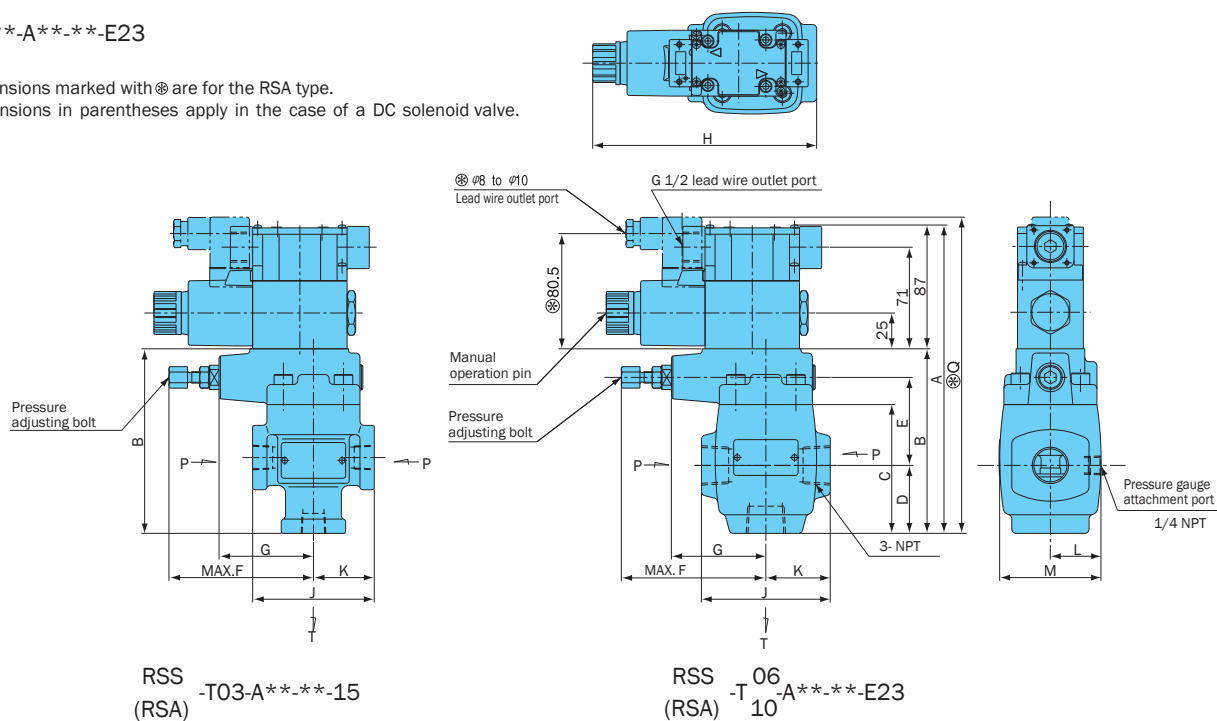
Not required with
the shockless type.

Installation Dimension Drawings

RSS
(RSA) -T**-A**-**-E23

Note: Dimensions marked with ⌀ are for the RSA type.

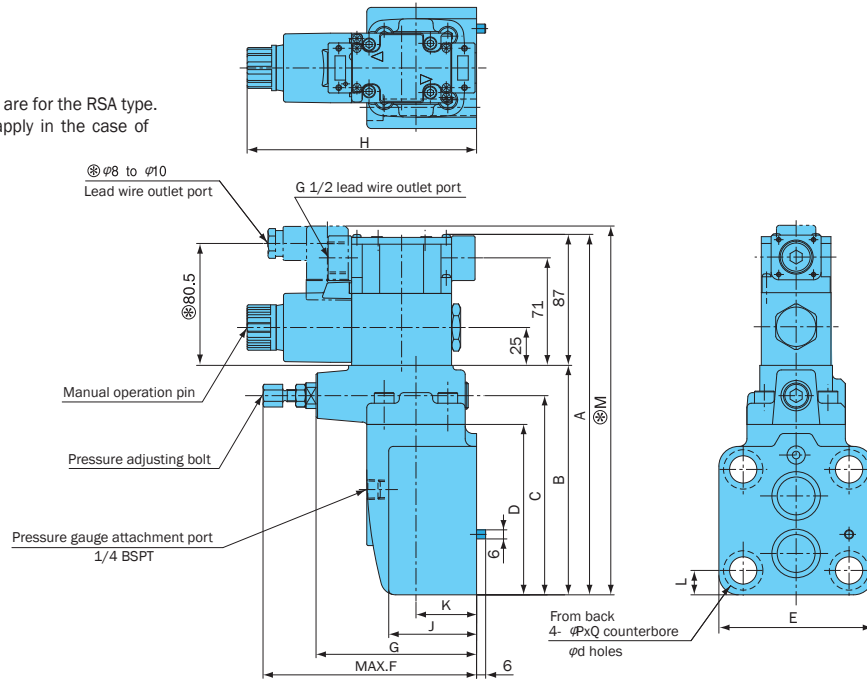
Note: Dimensions in parentheses apply in the case of a DC solenoid valve.



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	Q
RSS (RSA) -T03-A**-**-15	214.5	129	90	53	56	101	66	154 (161)	85	42.5	32.5	65	3/8	221.5
RSS (RSA) -T06-A**-**-E23	214.5	129	90	47.5	61.5	101	66	156.5 (163.5)	90	45	35.5	71	3/4	221.5
RSS (RSA) -T10-A**-**-E23	239	153.5	111.5	62	72	98	63	164.5 (171.5)	125	62.5	47	94	1 1/4	246

RSS
(RSA) -G**-A**-**E23

Note: Dimensions marked with ♂ & are for the RSA type.
Note: Dimensions in parentheses apply in the case of a DC solenoid valve.

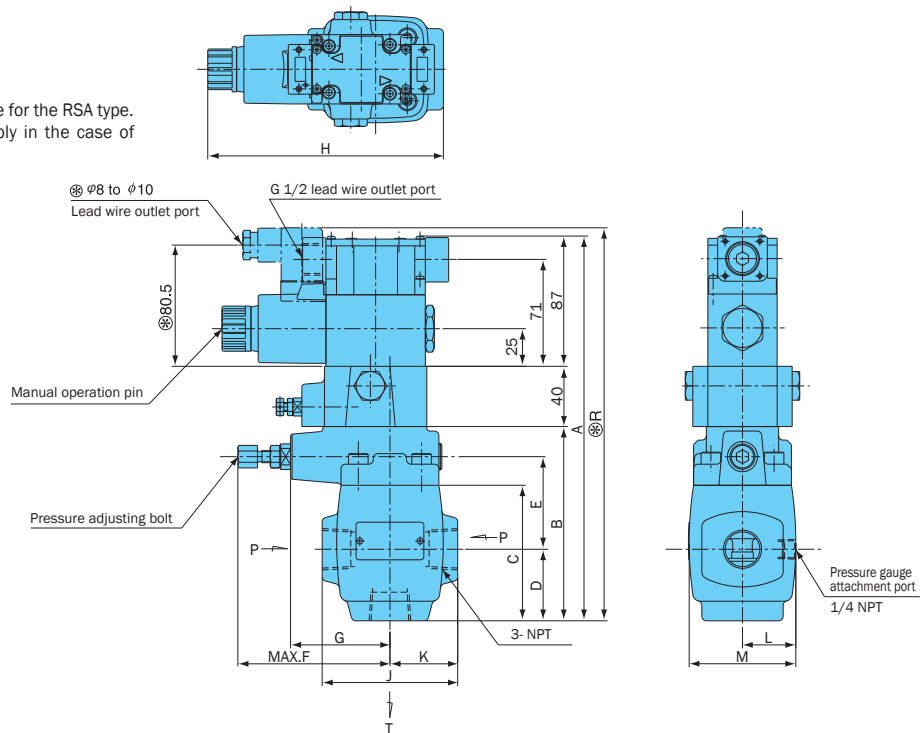


Model No.	A	B	C	D	E	F	G	H	J	K	L	P	Q	d	M
RSS (RSA) -G03-A**-**E23	214.5	129	109	90	80	141	106	150.5 (157.5)	72.5	40	13	17.5	10.8	11	221.5
RSS (RSA) -G06-A**-**E23	237	151.5	131.5	112.5	102	141	106	151.5 (158.5)	58	40	16.1	26	1	18	244
RSS (RSA) -G10-A**-**E23	248	162.5	143	120.5	127	148	113	152 (159)	80	50	17.7	32	1	22	255

Note: For gasket surface dimensions, see R-G**-** 12/20.

RSS
(RSA) -T**-F**-**E23

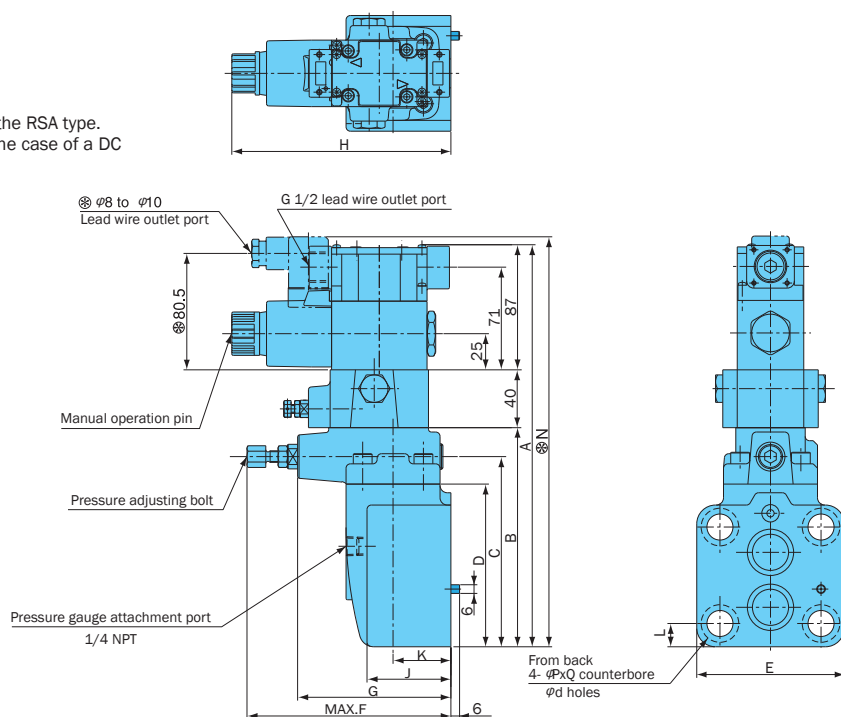
Note: Dimensions marked with ♂ & are for the RSA type.
Note: Dimensions in parentheses apply in the case of a DC solenoid valve.



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	Q	R
RSS (RSA) -T03-F**-**E23	254.5	129	90	53	56	101	66	154 (161)	85	42.5	32.5	65	32	3/8	261.5
RSS (RSA) -T06-F**-**E23	254.5	129	90	47.5	61.5	101	66	156.5 (163.5)	90	45	35.5	71	33	3/4	261.5
RSS (RSA) -T10-F**-**E23	279	153.5	111.5	62	72	98	63	164.5 (171.5)	125	62.5	47	94	32.5	1 1/4	286

RSS
(RSA) -G**-*-F**-23

Note: Dimensions marked with ⊗ & are for the RSA type.
Note: Dimensions in parentheses apply in the case of a DC solenoid valve.

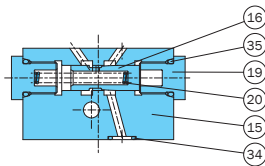
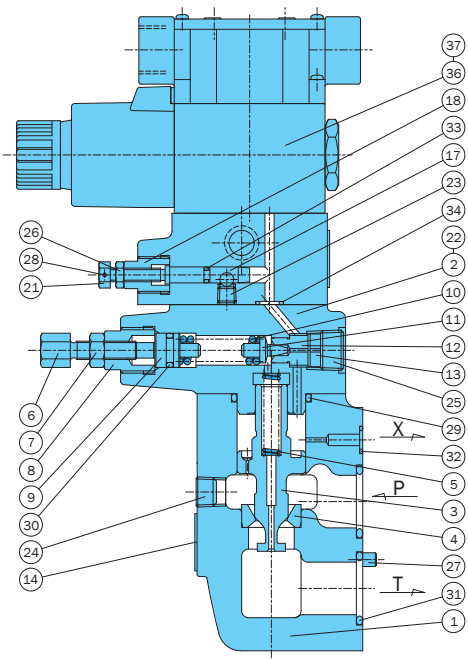


Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	d
RSS (RSA) -G03-*F-**-15	254.5	129	109	90	80	141	106	150.5 (157.5)	72.5	40	13	32	261.5	17.5	10.8	11
RSS (RSA) -G06-*F-**-23	277	151.5	131.5	112.5	102	141	106	151.5 (158.5)	58	40	16.1	33	284	26	1	18
RSS (RSA) -G10-*F-**-23	288	162.5	143	120.5	127	148	113	152 (159)	80	50	17.7	32.5	295	32	1	22

Note: For gasket surface dimensions, see R-G**-* 12/20.

Cross-sectional Drawing

RSS-G**-*-F**-23



Part No.	Part Name	Part No.	Part Name
1	Body	20	Spring
2	Cover	21	Nut
3	Spool	22	Screw
4	Seat	23	Plug
5	Spring	24	Plug
6	Screw	25	Plug
7	Nut	26	Nut
8	Retainer	27	Spring pin
9	Plunger	28	Spring pin
10	Spring	29	O-ring
11	Poppet	30	O-ring
12	Seat	31	O-ring
13	Collar	32	O-ring
14	Nameplate	33	O-ring
15	Body	34	O-ring
16	Spool	35	O-ring
17	Throttle	36	Solenoid Valves
18	Retainer	37	Screw
19	Spring guide		

Seal Parts List (Kit Model Number RSBS-***F)

Part No.	Part Name	Type/Part Number			Q'ty
		RSS-G03-*F-**-15	RSS-G06-*F-**-23	RSS-G10-*F-**-23	
29	O-ring	1B-G30	1B-G30	1B-G40	1
30	O-ring	1A-P11	1A-P11	1A-P11	1
31	O-ring	1B-P20	1B-P26	1B-G35	2
32	O-ring	1B-P7	1B-P9	1B-P9	1
33	O-ring	1B-P4	1B-P4	1B-P4	1
34	O-ring	1B-P9	1B-P9	1B-P9	2
35	O-ring	1B-P12.5	1B-P12.5	1B-P12.5	2

Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. For the *** part of the kit number, specify the valve size (G03, G06, G10).
3. SS (SA)-G01 pilot valve seal is available separately. For details, see pages D-14 (D-26).



RI Series Solenoid Controlled Relief Valve

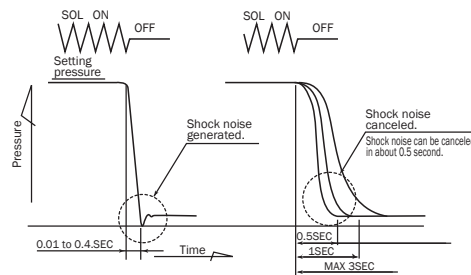
39.6 to 84.5 gpm
5075 psi

Features

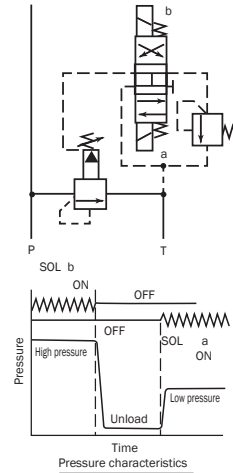
This valve adds a wet type solenoid valve to a balanced type piston type relief valve to form a hydraulic device unload circuit. The shockless type has an internal structure that prevents shock generated during unloading. This valve can also be used in a pressure relief circuit, and has a maximum adjustment time of three seconds. See the pressure relief circuit example.

A two-pressure control circuit can be configured by adding a relief modular valve.
Contact your agent for more information.

(Pressure Relief Circuit Example)



(Two-pressure Control Circuit Example)



Specifications

Model No. Gasket Mounting	Nominal Diameter (Size)	Maximum Flow Rate gpm	Maximum Working Pressure psi	Pressure adjustment range psi	Weight lbs	Gasket Surface Dimensions	JIS Symbol	Used Solenoid Valve Type
RIS-G03-AQ 1 3-**-21 5	3/8	39.6	5075 P, X Ports	Type 1: 116 to 1015	13.2	ISO 6264-AR-06-2-A		SS-G01-A3X-**-31
RIS-G06-AQ 1 3-**-21 5	3/4	84.5		Type 3: 507 to 3625	15.6	ISO 6264-AS-08-2-A		
RIS-G03-AR 1 3-**-21 5	3/8	39.6		Type 5: 507 to 5075	13.2	ISO 6264-AR-06-2-A		SS-G01-AR-**-31
RIS-G06-AR 1 3-**-21 5	3/4	84.5			15.6	ISO 6264-AS-08-2-A		

Shockless Type

RIS-G03- 1 3-F-**-21 5	3/8	39.6	5075 P, X Ports	Type 1: 145 to 1015	15.4	ISO 6264-AR-06-2-A		SS-G01-A3X-**-31
RIS-G06- 1 3-F-**-21 5	3/4	84.5		Type 3: 507 to 3625 Type 5: 507 to 5075	17.8	ISO 6264-AS-08-2-A		

Note: For electrical specifications, see the SS type solenoid valve item on page D-4.

Handling

- To adjust pressure, loosen the lock nut and then rotate the handle clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- To adjust the time from onload to unload, loosen the lock nut and rotate the restrictor adjusting bolt clockwise (rightward) to make the time longer, or counterclockwise (leftward) to make it shorter.
- Make sure that tank port back pressure is no greater than 29 psi.
- The ** before the design number in the model number of the solenoid valve used shows voltage. See the voltage symbols in

- the model number explanation.
- A small control flow rate can cause pressure instability. Use a control flow rate that is at least 2.1 gpm. Use a drain type relief valve in the case of a flow rate that is less than the minimum flow rate.
- Use 90 to 110% of rated voltage. Use the following table for specification when a sub plate is required. Maximum operating pressure is 3625 psi.

Model No.	Pipe Diameter	Weight lbs	Applicable Valve Model
MRI-03-E10	3/8	5.7	RIS-G03
MRI-03X-E10	1/2		
MRI-06-E10	3/4	7.7	RIS-G06
MRI-06X-E10	1		

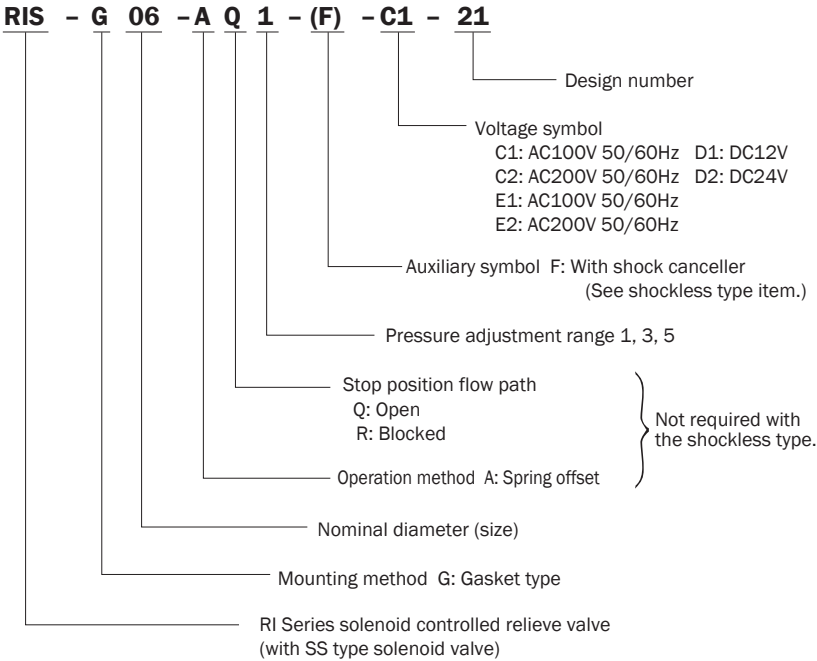
- The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Qty	Tightening Torque ft lbs
RIS-G03-**-**-21	3/8 - 16	4	55 to 70
RIS-G06-**-**-21	5/8 - 11	4	140 to 173

Note: For mounting bolts, use Grade 8 or equivalent.

- The coil surface temperature increases if this pump is kept continuously energized. Install the valve so there is not chance of it being touched directly by hand.

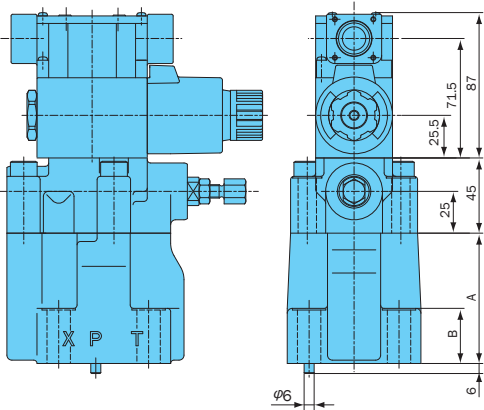
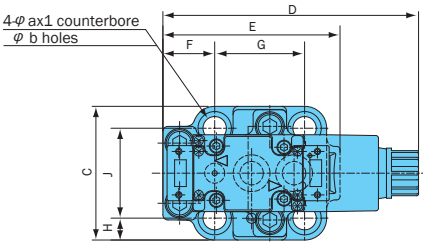
Understanding Model Numbers



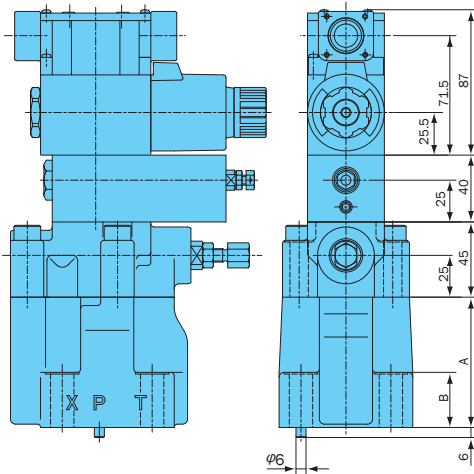
Other auxiliary symbols G, N, and Q (R is omitted) can be used (enter them in alphabetic order if there are 2 or more).

Installation Dimension Drawings

RIS-G**-A**-**-21



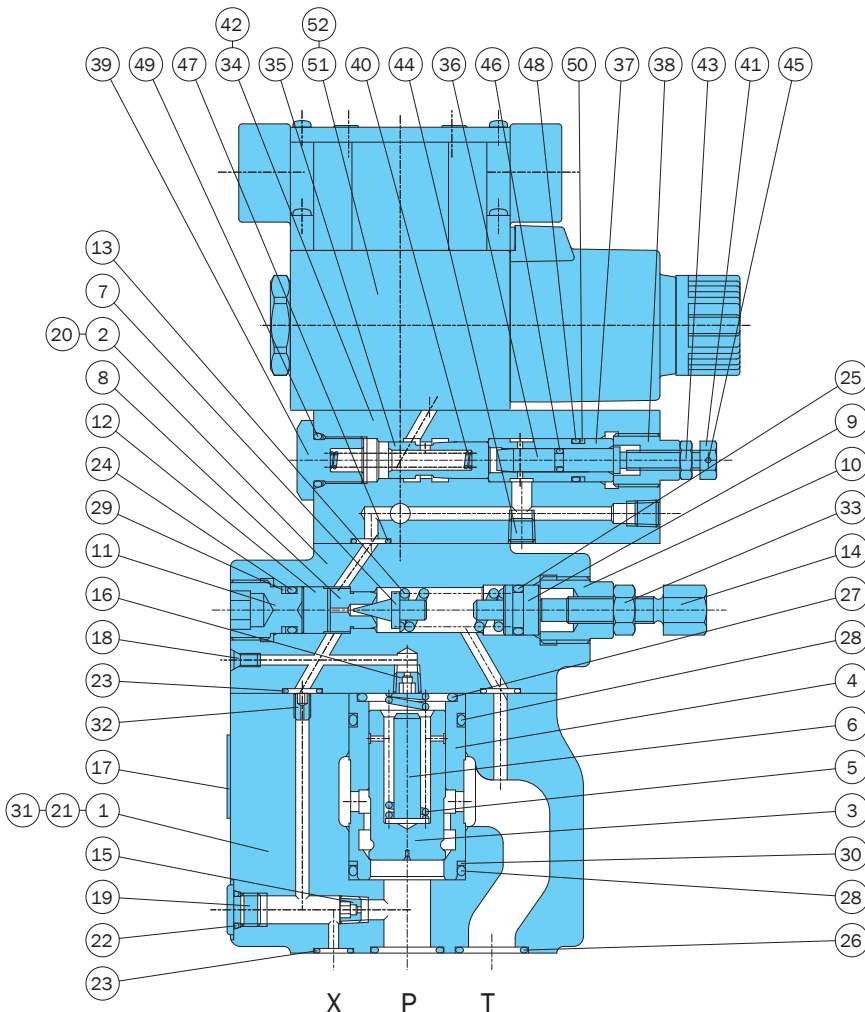
RIS-G**-*-F**-21



Model No.	A	B	C	D	E	F	G	H	J	a	b
RIS-G03-**-**-21	78	32	80	153 (160)	106	31	53.8	13.1	53.8	20	14
RIS-G06-**-**-21	83	36	100	162 (169)	119	37	66.7	15	70	26	17.5

Note: 1. For gasket surface dimensions, see RI-G**-* on page I-5.
2. Figures in (parenthesis) are for the DC solenoid valve.

Cross-sectional Drawing



Part No.	Part Name
1	Body
2	Cover
3	Poppet
4	Sleeve
5	Spring
6	Spacer
7	Poppet
8	Seat
9	Plunger
10	Retainer
11	Plug
12	Collar
13	Spring
14	Handle assy
15	Orifice
16	Orifice
17	Plate

Part No.	Part Name
18	Plug
19	Plug
20	Screw
21	Pin
22	O-ring
23	O-ring
24	O-ring
25	O-ring
26	O-ring
27	O-ring
28	O-ring
29	Backup ring
30	Backup ring
31	Screw
32	Choke
33	Nut
34	Body

Part No.	Part Name
35	Spool
36	Throttle
37	Sleeve
38	Retainer
39	Guide
40	Spring
41	Nut
42	Plate
43	Nut
44	Plug
45	Pin
46	O-ring
47	O-ring
48	O-ring
49	O-ring
50	Backup ring
51	Solenoid Valves
52	Screw

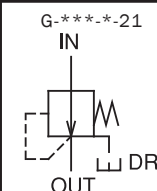
Seal Part List (Kit Model Numbers: Main REBS-***, Restrictor Valve DFS-01H)

Component Parts	Part No.	Part Name	Nominal Diameter/Part Number		Q'ty
			G03	G06	
Main	22	O-ring	1B-P8	1B-P8	1
	23	O-ring	1B-P9	1B-P9	3
	24	O-ring	1B-P10A	1B-P10A	1
	25	O-ring	1A-P11	1A-P11	1
	26	O-ring	1B-P18	1B-P28	2
	27	O-ring	1B-G25	1B-P28	1
	28	O-ring	1B-G30	1B-P32	2
	29	Backup ring	T2-P10A	T2-P10A	1
	30	Backup ring	T2-G30	T2-P32	1
	46	O-ring	1B-P4		1
Restrictor Valve	47	O-ring	1B-P9		2
	48	O-ring	1B-P10		1
	49	O-ring	1B-P12.5		1
	50	Backup ring	T2-P10		1

Note: 1. O-ring 1A/1B-** refers to JIS B 2401-1A/1B-**.
 2. For the *** part of the kit number, specify the valve size (G03, G06).
 3. The restrictor valve kit is required only when a shockless valve is included.
 4. SS (SA)-G01 pilot valve seal is available separately. For details, see pages D-14 (D-26).

Pressure Reducing (and Check) Valve

5.2 to 73.9 gpm
3045 psi



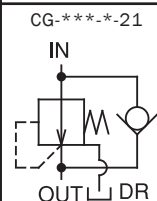
Features

This valve is used when part of the circuit uses pressure that is lower than the main circuit.

Even when pressure changes in the primary main circuit, the reduced secondary pressure is adjusted automati-

cally and maintained at a constant level. Connecting a remote control valve to the vent port allows remote control of adjustment pressure.

The mounting surface of the gasket conforms to the ISO standards shown in the table below.

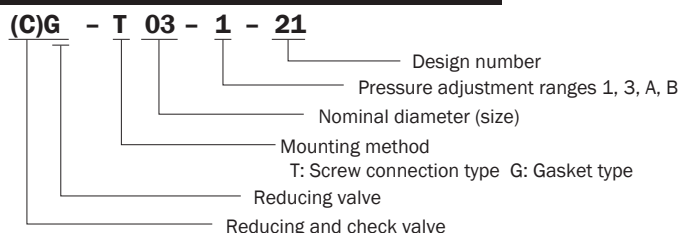


Specifications

Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs		Gasket Surface Dimensions
Screw Mounting	Gasket Mounting					T Type	G Type	
(C)G-T03- A-21 B-21	(C)G-G03- A-21 B-21	3/8	3045 IN, OUT, Vent Port	5.2	36 to 145 43 to 362	7.2 7.9	8.5 9.2	ISO 5781-AG-06-2-A
(C)G-T03-1-21 3-21	(C)G-G03-1-21 3-21	3/8		13.2	116 to 1015 507 to 3045	7.2 7.9	8.5 9.2	
(C)G-T06-1-21 3-21	(C)G-G06-1-21 3-21	3/4		31.7	116 to 1015 507 to 3045	12.5 13.4	13.6 14.5	ISO 5781-AH-08-2-A
(C)G-T10-1-21 3-21	(C)G-G10-1-21 3-21	1 1/4		73.9	116 to 1015 507 to 3045	22 25	26 29	ISO 5781-AJ-10-2-A

Weight values in parentheses are for when a check valve is included.
The cracking pressure of the check valve is 14.5 psi.

Understanding Model Numbers

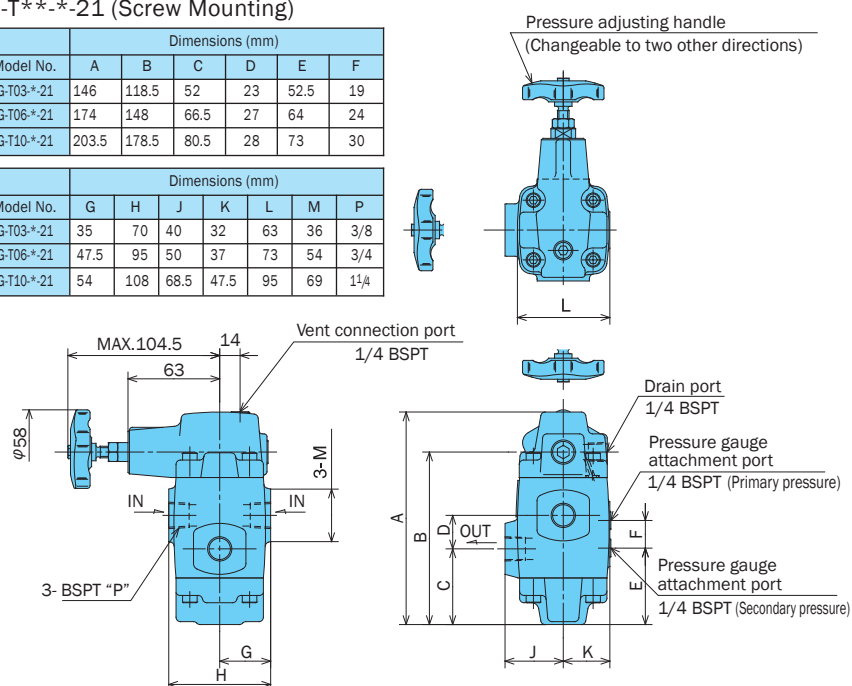


Installation Dimension Drawings

G-T***-21 (Screw Mounting)

Dimensions (mm)						
Model No.	A	B	C	D	E	F
G-T03*-21	146	118.5	52	23	52.5	19
G-T06*-21	174	148	66.5	27	64	24
G-T10*-21	203.5	178.5	80.5	28	73	30

Dimensions (mm)							
Model No.	G	H	J	K	L	M	P
G-T03*-21	35	70	40	32	63	36	3/8
G-T06*-21	47.5	95	50	37	73	54	3/4
G-T10*-21	54	108	68.5	47.5	95	69	1 1/4



- Handling
- 1 Provide an independent drain pipe directly to the tank.
- 2 When using a remote control valve, connect piping to the reducing valve vent port. Pipe capacity can be a source of vibration. Use of thick iron pipe with an inside diameter of no more than .15" and a connection length of no more than three meters is recommended.
- 3 Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Weight lbs	Applicable Valve Model
MG-03-20	3/8	3.5	(C)G-G03*-21
MG-03X-20	1/2		
MG-06-20	3/4	8.6	(C)G-G06*-21
MG-06X-20	1		
MG-10-20	1 1/4	14.7	(C)G-G10*-21
MG-10X-20	1 1/2		

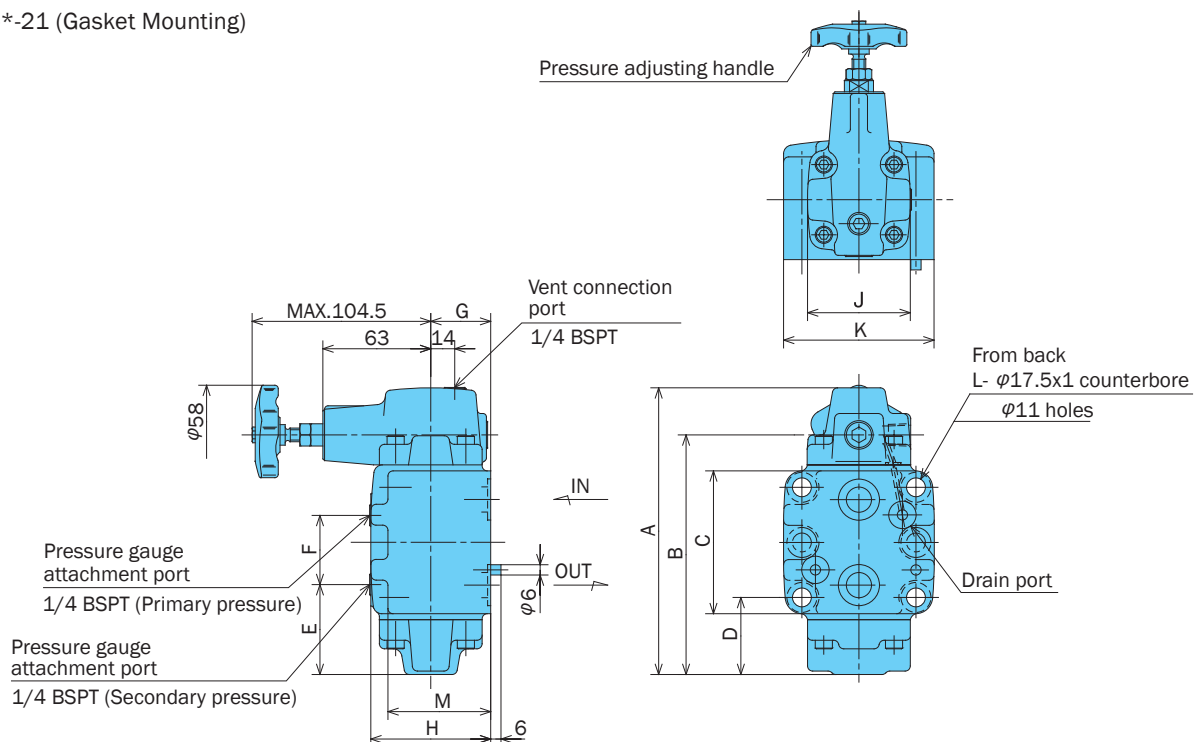
These sub plates can also be used for pressure control valves.

- 4 The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
(C)G-G03*-21	M10 × 75 l	4	33 to 40.5
(C)G-G06*-21	M10 × 85 l	4	
(C)G-G10*-21	M10 × 105 l	6	

Note: For mounting bolts, use 12T or equivalent.

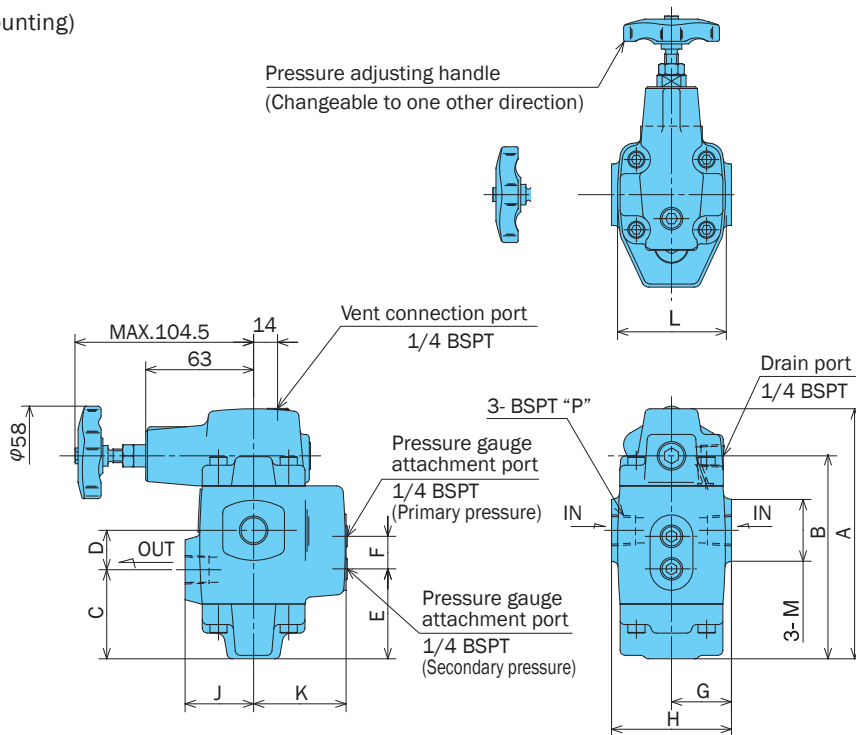
G-G**-*-21 (Gasket Mounting)



Model No.	A	B	C	D	E	F	G	H	J	K	L	M
G-G03*-21	146	118.5	62	45.1	52.5	19	35	70	60	88	4	60
G-G06*-21	174	148	82	51.4	64	24	40	80	70	102	4	70
G-G10*-21	203.5	178.5	102	54	73	30	51	102	92	122	6	92

Note: The orientation of the pressure adjusting handle cannot be change.

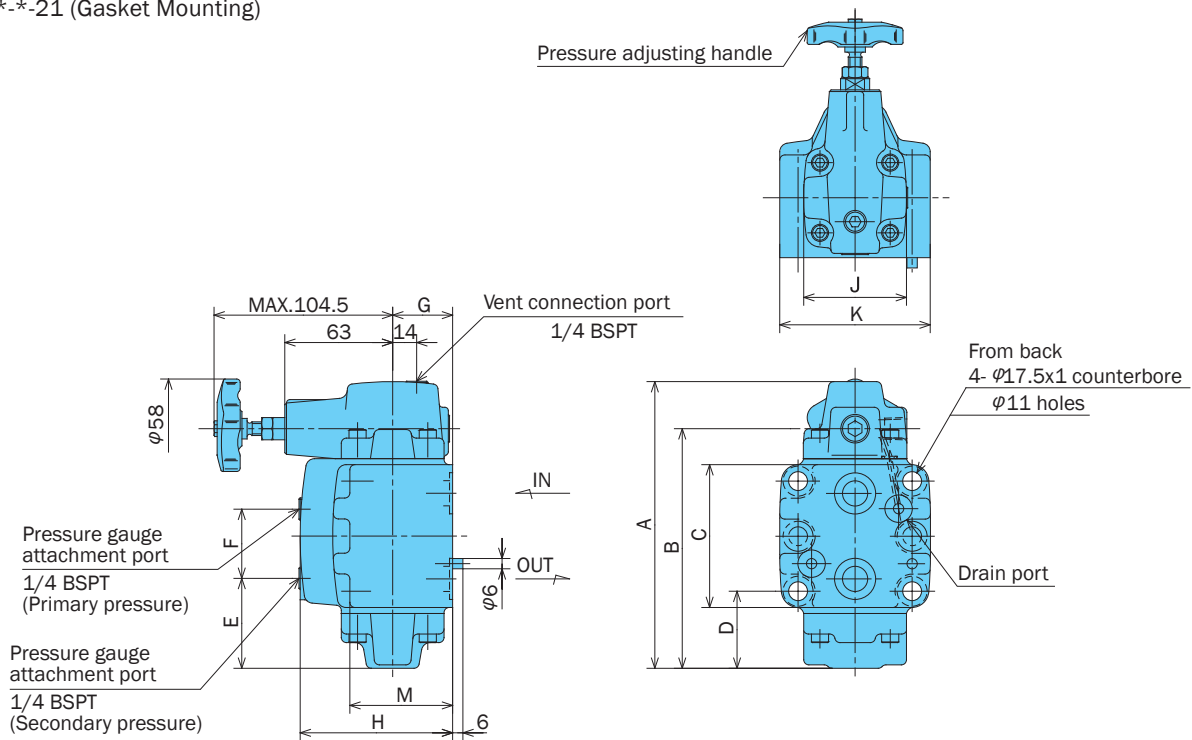
CG-T**-*-21 (Screw Mounting)



Model No.	A	B	C	D	E	F	G	H	J	K	L	M	P
CG-T03*-21	146	118.5	52	23	52.5	19	35	70	40	54	63	36	3/8
CG-T06*-21	174	148	66.5	27	64	24	47.5	95	50	60	73	54	3/4
CG-T10*-21	203.5	178.5	80.5	28	73	30	54	108	68.5	80	95	69	1 1/4

Note: After the orientation of the pressure adjusting handle has been changed, also modify the cover alignment surface ring (1B-P6).

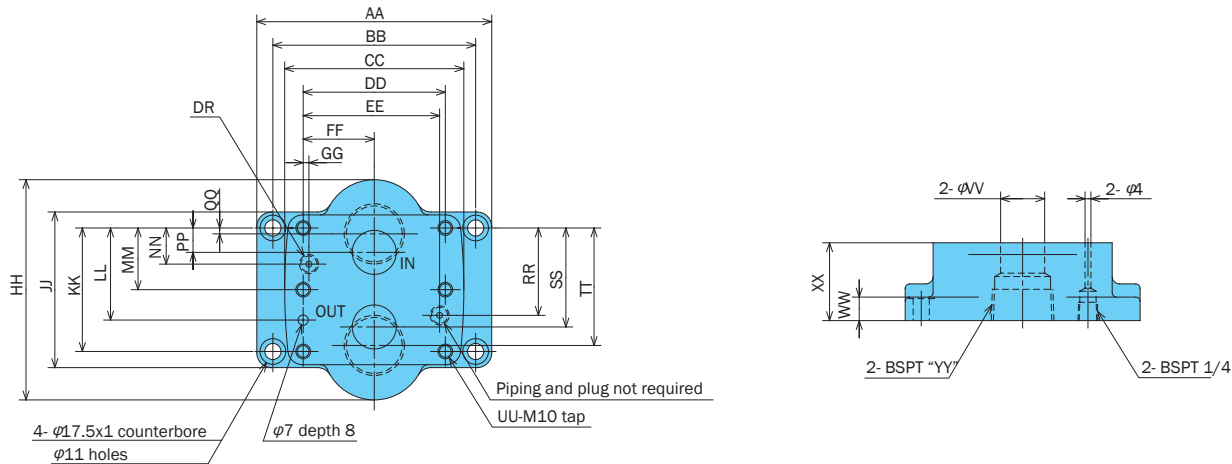
CG-G**-*-21 (Gasket Mounting)



Model No.	Dimensions mm											
	A	B	C	D	E	F	G	H	J	K	L	M
CG-G03*-21	146	118.5	62	45.1	52.5	19	35	89	60	88	4	60
CG-G06*-21	174	148	82	51.4	64	24	40	100	70	102	4	70
CG-G10*-21	203.5	178.5	102	54	73	30	51	131	92	122	6	92

Note: The orientation of the pressure adjusting handle cannot be change.

Sub Plate MG-***-20



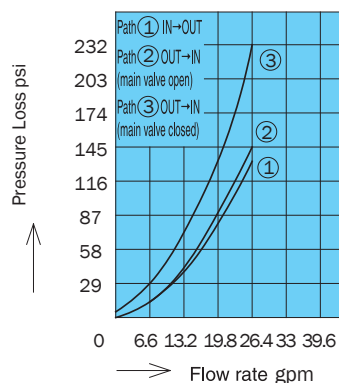
Model No.	Dimensions mm																			
	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	QQ	RR	SS	TT	UU	VV
MG-03-20	128	106.4	88	66.6	58.7	33.3	7.9	76	62	42.9	31.8	-	21.4	7.2	3.5	21.5	35.7	39.5	4	14
MG-03X-20																				
MG-06-20	146	123.8	102	79.3	72.9	39.7	6.4	110	82	60.3	44.5	-	20.6	11.1	3.7	39.7	49.2	56.7	4	22
MG-06X-20																				
MG-10-20	160	138.1	122	96.8	92.9	48.4	3.9	150	102	84.1	62.7	42.1	24.6	16.7	4.1	59.5	67.5	80.1	6	30
MG-10X-20																				

Performance Curves

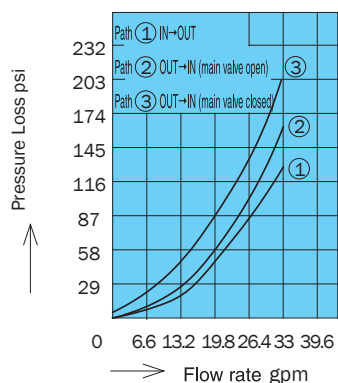
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

(C)G-G03-*-21

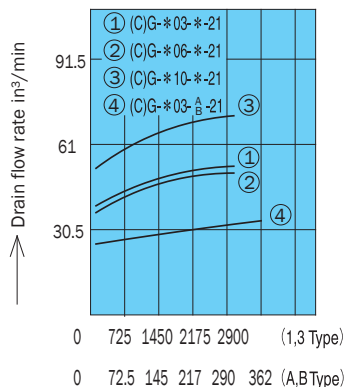


(C)G-T03-*-21



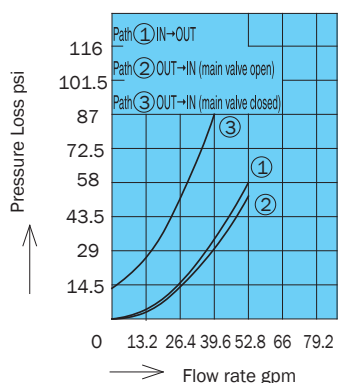
Pressure - Drain Flow Rate Characteristics

(C)G-***-*-21

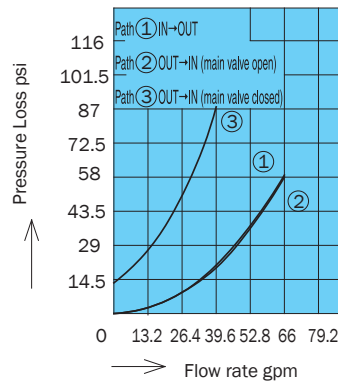


Secondary Pressure - Flow Rate Characteristics

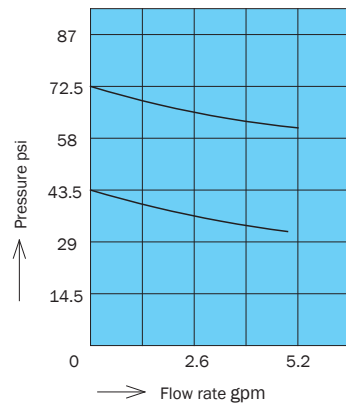
(C)G-G06-*-21



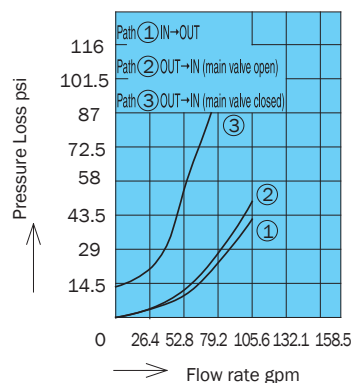
(C)G-T06-*-21



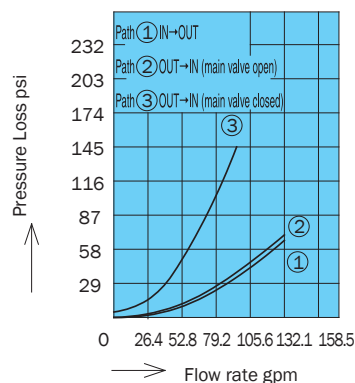
(C)G-*03-A-B-21



(C)G-G10-*-21

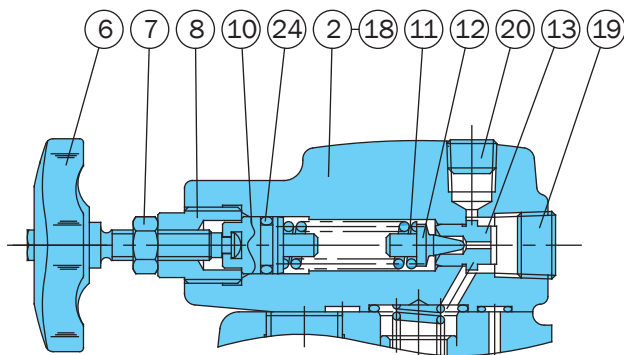


(C)G-T10-*-21

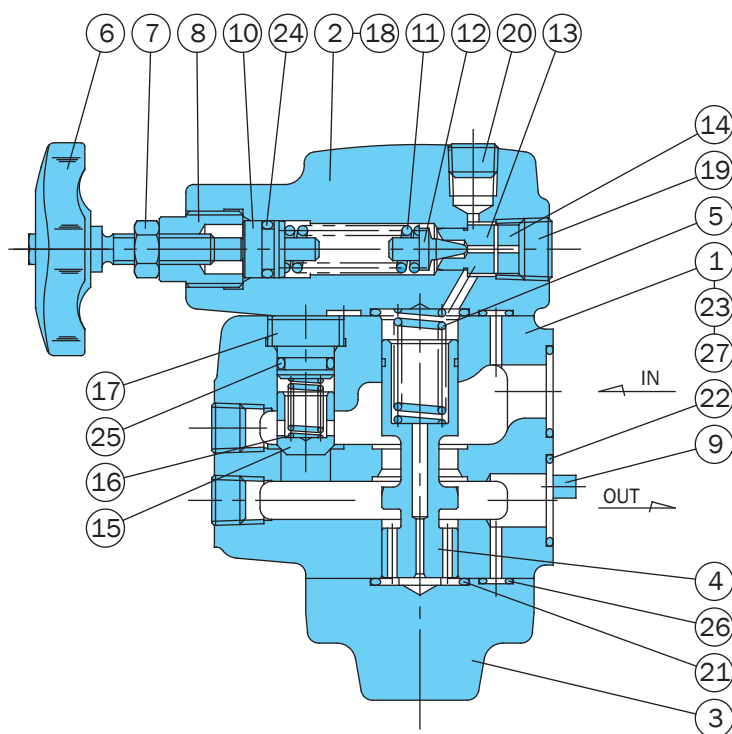


Cross-sectional Drawing

(C)G-G**-^A_B-21



CG-G**-*-21



Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Piston
5	Spring
6	Handle
7	Nut
8	Retainer
9	Spring pin
10	Push rod
11	Spring
12	Poppet
13	Seat
14	Collar
15	Poppet
16	Spring
17	Spring guide
18	Screw
19	Plug
20	Plug
21	O-ring
22	O-ring
23	O-ring
24	O-ring
25	O-ring
26	O-ring
27	Nameplate

Note: Part numbers 15, 16, 17, and 25 are not required when there is no check valve.

Seal Part List (Kit Model Number RGBS-***)

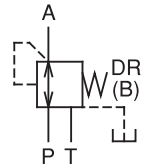
Part No.	Part Name	Part Number						Q'ty
		CG-G03-*-21	CG-T03-*-21	CG-G06-*-21	CG-T06-*-21	CG-G10-*-21	CG-T10-*-21	
21	O-ring	1B-P22	1B-P22	1B-G30	1B-G30	1B-G40	1B-G40	2
22	O-ring	1B-P20	-	1B-P26	-	1B-G35	-	2
23	O-ring	1B-P12	-	1B-P12	-	1B-P12	-	2
24	O-ring	1A-P11	1A-P11	1A-P11	1A-P11	1A-P11	1A-P11	1
25	O-ring	1B-P11	1B-P11	1B-P14	1B-P14	1B-P22	1B-P22	1
26	O-ring	1B-P6	1B-P6	1B-P6	1B-P6	1B-P6	1B-P6	4

Note: O-ring 1A/B-** refers to JIS B2401 1A/B-**.

*** in the kit number is used for specification of the valve size (G03, T06, etc.) To specify inclusion of a check valve, add C to the end.

Balancing Valve (Pressure Reducing and Relief Valve)

7.9 to 13.2 gpm
2030 psi



Features

2-in-1 operation allows a simpler circuit configuration. Combination valve that provides both pressure reducing and counter balance functions.

Pressure adjustment using a single screw (bolt). Compact and lightweight valve that can be mounted using the same methods as a 01, 03 size solenoid valve.

Specifications

Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs	Gasket Surface Dimensions
GR-G01-A1-20 A2	1/8	3045 P port	30	116 to 1015 507 to 2030	3.3	ISO 4401-03-02-0-94
GR-G03-A1-(B)-20 A2	3/8		50	145 to 1015 507 to 2030	7.7	ISO 4401-05-04-0-94

Understanding Model Numbers

GR - G 03 - A 1 - BK - 20

Design number
Note: For 03 size, relationship between mounting bolts and design number is indicated as J20: M6, 20: M8.

Auxiliary symbol
B: External drain (03 size only)
K: With handle

Pressure adjustment range 1, 2

Control port: A port

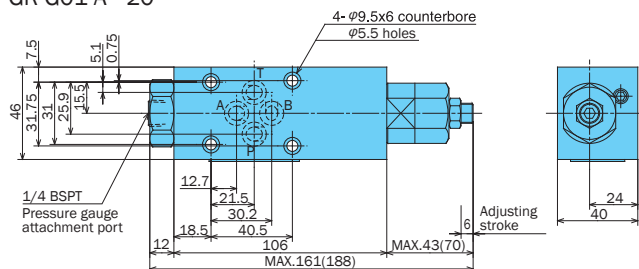
Nominal diameter (size)

Mounting method G: Gasket type

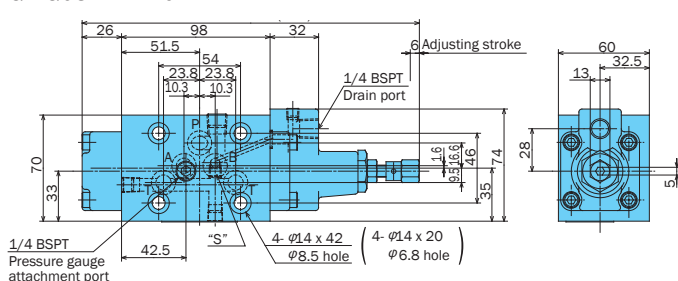
Balancing valve

Installation Dimension Drawings

GR-G01-A*-20



GR-G03-A*-B-20



Note: 1. For size 03, an escape valve with piping from the drain discharge port is standard for the drain (GR-G03-A*-B-20). To change from internal drain to external drain, install a plug (NPTF 1/16) in part S, and remove the drain discharge port plug (1/4 BSPT). To change from external drain to internal drain, install a plug (1/4 BSPT) into the drain discharge port, and remove the S part plug (NPTF 1/16). In this case, however, the B port cannot be used as the tank port.
2. Dimensions in parentheses show dimensions with handle (K type).

- Handling
 - 1 To adjust pressure, loosen the lock nut and then rotate the adjusting screw (bolt) clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
 - 2 For the 01 size, draining is from the gasket side B port.
 - 3 For the drain of a 03 size valve when auxiliary symbol B is specified, run a pipe from the drain discharge port directly to the tank. The drain discharge port can also be plugged for direct draining from the gasket side B port. In the case of modification, be sure to change the valve type marking on the nameplate. When using drain piping, use a tightening torque of 16-18.4 ft lbs for pipe joints.
 - 4 The drain of 03 size valve that does not have a B auxiliary symbol can be directly from the T port.
 - 5 Make sure that drain back pressure is no greater than 29 psi.
 - 6 When an adjustment handle is required for pressure adjustment block, insert K for the type specification.
 - 7 Set the difference between the pressure at the primary circuit (port P) and the secondary circuit (port A) at least 72 psi.
 - 8 Use the following table for specification when a sub plate is required.

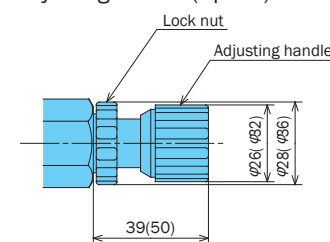
Model No.	Pipe Outlet Size	Weight lbs
MSA-01Y-E10	3/8	2.6
MSA-03-E10	3/8	8.3
MSA-03X-E10	1/2	

The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
GR-G01-A*-20	1024 x 13/4"	4	3.6 to 5
GR-G03-A*-20	1/4-20 x 1 1/8"	4	14.7 to 18.4

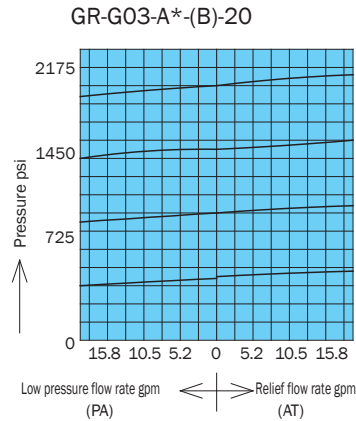
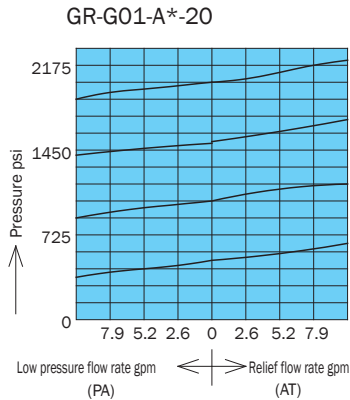
Note: For mounting bolts, use grade 8 or equivalent.

Adjusting Handle (Option)

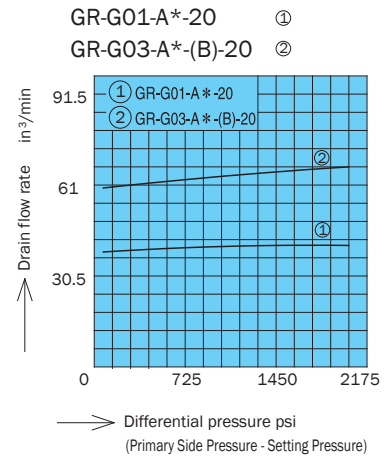


Performance Curves

Pressure – Flow Rate Characteristics



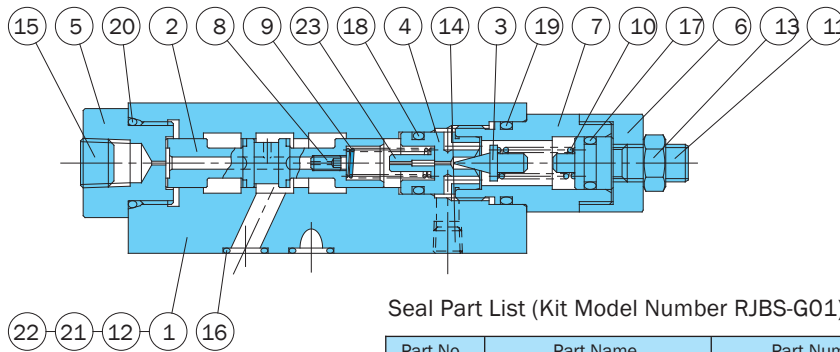
Setting Pressure – Drain Flow Rate Characteristics



Cross-sectional Drawing

Note: O-ring 1A/B-** refers to JIS B2401- 1A/B-**.

GR-G01-A*-20

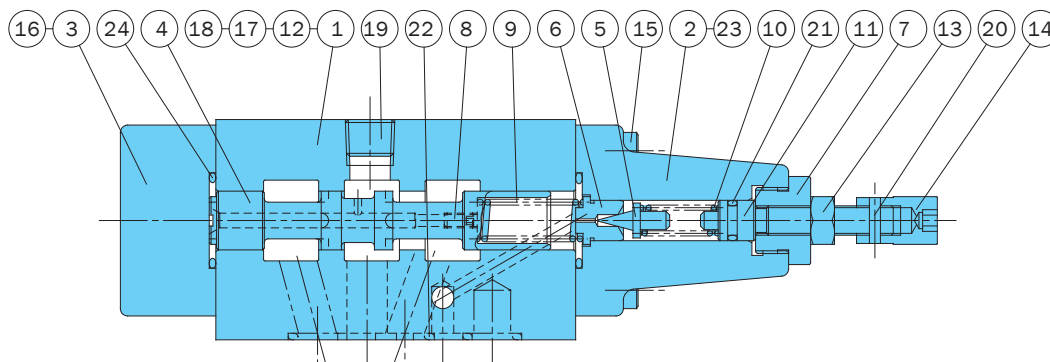


Seal Part List (Kit Model Number RJBS-G01)

Part No.	Part Name	Part Number	Q'ty
16	O-ring	1B-P9	4
17	O-ring	1A-P10A	1
18	O-ring	1B-P12.5	1
19	O-ring	1B-P18	1
20	O-ring	1B-P20	1

Part No.	Part Name	Part No.	Part Name
1	Body	7	Retainer
2	Spool	8	Choke
3	Poppet	9	Spring
4	Seat	10	Spring
5	Bushing	11	Screw
6	Bushing	12	Plate
		13	Nut
		14	Plug
		15	Plug
		16	O-ring
		17	O-ring
		18	O-ring
		19	O-ring
		20	O-ring
		21	Plug
		22	Spacer
		23	Choke

GR-G03-A*-B-20



Seal Part List (Kit Model Number RJBS-G03)

Part No.	Part Name	Part Number	Q'ty
21	O-ring	1A-P8	1
22	O-ring	1B-P12	5
23	O-ring	1B-P9	1
24	O-ring	1B-P22	2

Part No.	Part Name
1	Body
2	Cover (A)
3	Cover (B)
4	Spool
5	Poppet
6	Seat
7	Retainer
8	Choke
9	Spring
10	Spring
11	Screw
12	Plate
13	Nut
14	Nut
15	Screw
16	Screw
17	Plug
18	Plug
19	Plug
20	Pin
21	O-ring
22	O-ring
23	O-ring
24	O-ring

Pressure Control (and Check) Valve

13.2 to 73.9 gpm
2030 psi

Features

This circuit control valve works as a sequence valve, unloading valve, and counter balance valve.

Maximum operating pressure is 3045 psi. Though a direct type valve, there is little pressure override.

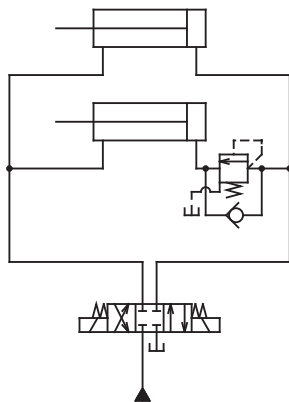
The mounting surface of the gasket conforms to the ISO standards shown in the table below.

Specifications

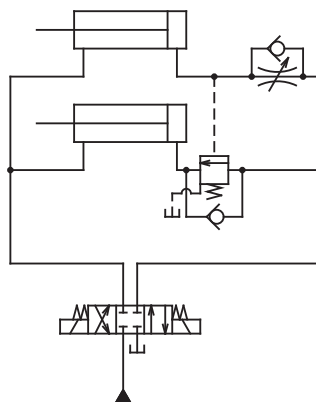
Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Pressure adjustment range psi	Weight lbs		Gasket Surface Dimensions
Screw Mounting	Gasket Mounting					T Type	G Type	
(C)Q-T03-*A-21 B C D E	(C)Q-G03-*A-21 B C D E	3/8	3045 IN, OUT, PP Ports	13.2	Type A 36 to 123 Type B 72 to 253	6.3	7.7	ISO 5781-AG-06-2-A
(C)Q-T06-*A-21 B C D E	(C)Q-G06-*A-21 B C D E	3/4		31.7	Type C 123 to 507 Type D 253 to 1015	11	13.2	ISO 5781-AH-08-2-A
(C)Q-T10-*A-21 B C D E	(C)Q-G10-*A-21 B C D E	1 1/4		73.9	Type E 507 to 2030	21.6	25.3	ISO 5781-AJ-10-2-A

Weight values in parentheses are for when a check valve is included. The cracking pressure of the check valve is 14.5 psi.

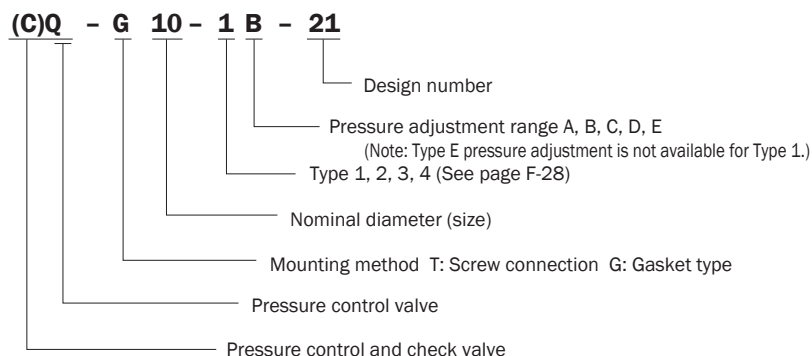
Example circuit 1
When using type 2.



Example circuit 2
When using type 3.



Understanding Model Numbers



- Handling
- 1 To adjust pressure, loosen the lock nut and then rotate the adjusting bolt clockwise (rightward) to increase pressure or counterclockwise (leftward) to decrease it.
- 2 The pressure adjustment range is expressed in terms of cracking pressure.
- 3 Run the out port of Q-T/G** type 1 and 4 directly to the tank.
- 4 The following describes the method for using Types 2 and 3. Application of back pressure to the valve output side such as in the example circuit shown below, use Type 2 or Type 3 and run the drain port directly to the tank.
- 5 When two or more of these valves are ganged in sequence, make sure the setting pressure (cracking pressure) differential between them is at least 145 psi.
- 6 Vibration (chattering) may occur with the (C) Q-***-1E-21 depending on operating conditions when using type 1 and pressure adjustment range E. Use external drain type 2E if it happens.
- 7 Type 2 is standard. When Type 1, 3, or 4 is required, make modifications in accordance with the figures on the next page. Modifications change the valve type, so be sure to change the markings on the nameplate.
- 8 Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Weight lbs	Applicable Valve Model
MG-03-20	3/8	3.5	(C)Q-G03-**-21
MG-03X-20	1/2		
MG-06-20	3/4	8.5	(C)Q-G06-**-21
MG-06X-20	1		
MG-10-20	1 1/4	14.7	(C)Q-G10-**-21
MG-10X-20	1 1/2		

Note: These sub plates can also be used for reducing valves.

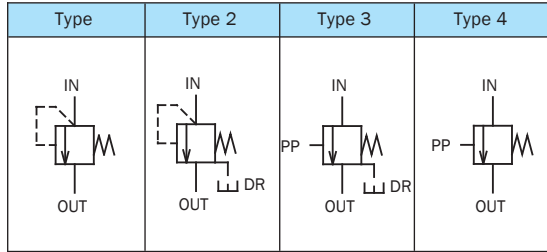
The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Qty	Tightening Torque ft. lbs
(C)Q-G03-**-21	M10 × 75	4	33 to 40
(C)Q-G06-**-21	M10 × 85	4	
(C)Q-G10-**-21	M10 × 105	6	

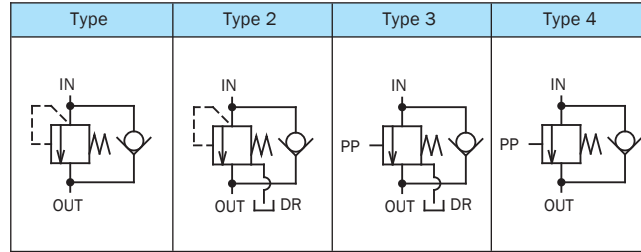
Note: For mounting bolts, use 12T or equivalent.

Performance Curves

Q-***-**-21



CQ-***-**-21

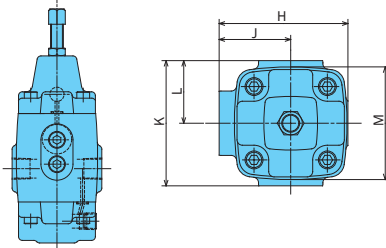


Type 2 is standard.

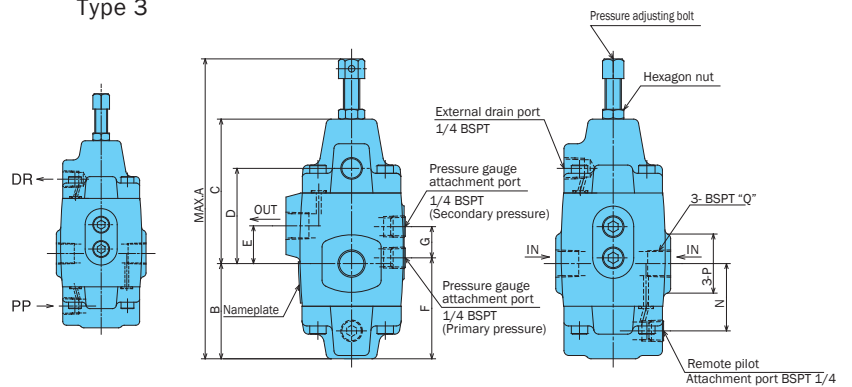
Installation Dimension Drawing

Q-T**-2*-21 (Screw Mounting)

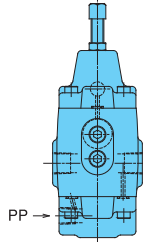
Type 1



Type 3



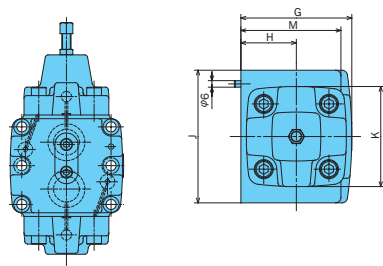
Type 4



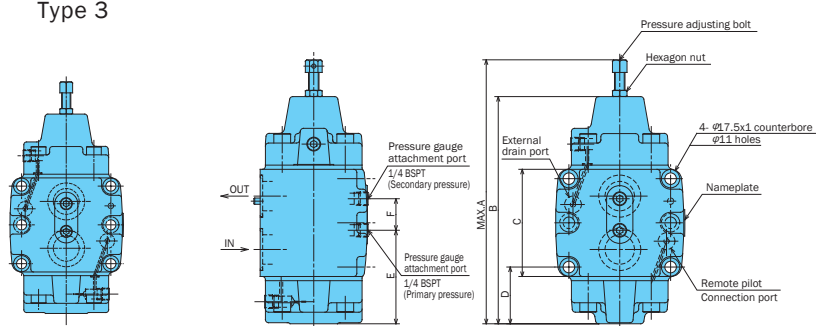
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
(C)Q-T03-**-21	179.5	58	88	58	23	61.5	19	72	40	70	35	63	41	36	3/8
(C)Q-T06-**-21	204.5	69.5	101.5	71.5	27	85	24	87	50	95	47.5	73	52.5	54	3/4
(C)Q-T10-**-21	251	83.5	132.5	87.5	28	89	30	116	68.5	108	54	95	62.5	69	1 1/4

Q-G**-2*-21 (Gasket Mounting)

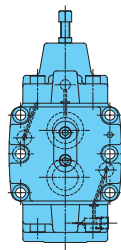
Type 1



Type 3



Type 4

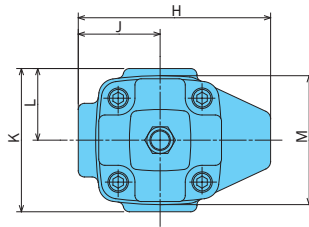
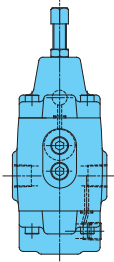


Model No.	A	B	C	D	E	F	G	H	J	K	L	M
Q-G03-**-21	179.5	146	62	45.1	61.5	19	72	35	88	60	4	60
Q-G06-**-21	204.5	171	82	51.4	75	24	80	40	102	70	4	70
Q-G10-**-21	251	216	102	54	89	30	102	51	122	92	6	92

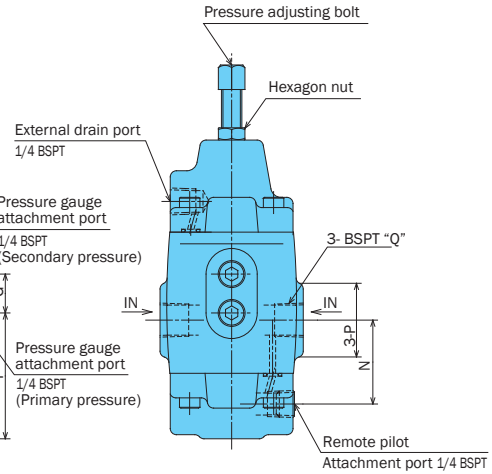
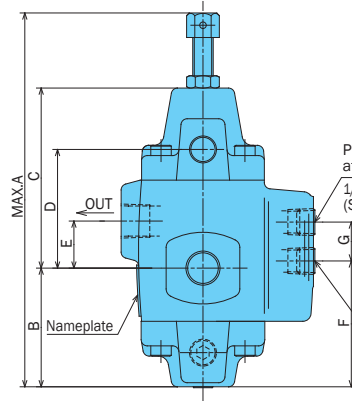
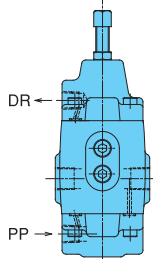
Installation Dimension Drawing

CQ-T**-2*-21 (Screw Mounting)

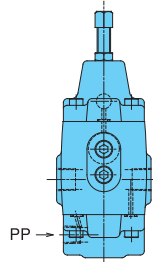
Type 1



Type 3



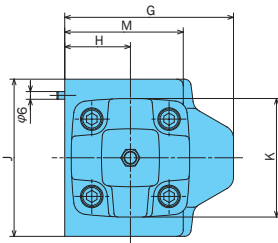
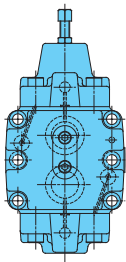
Type 4



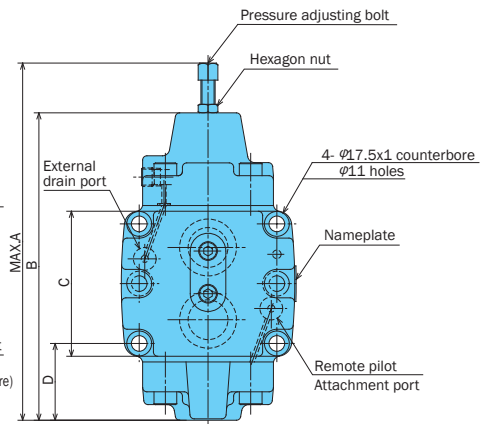
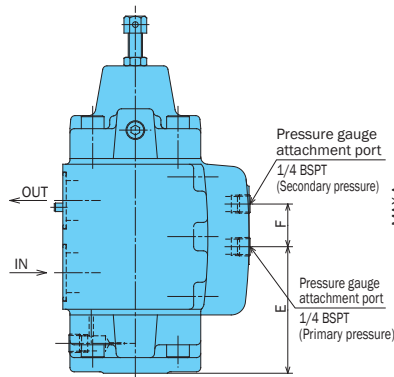
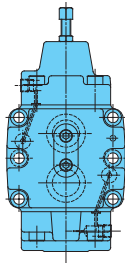
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
CQ-T03**-21	179.5	58	88	58	23	61.5	19	94	40	70	35	63	41	36	3/8
CQ-T06**-21	204.5	69.5	101.5	81.5	27	75	24	110	50	95	47.5	73	52.5	54	3/4
CQ-T10**-21	251	83.5	132.5	87.5	28	89	30	148.5	68.5	108	54	95	62.5	69	1 1/4

CQ-G**-2*-21 (Gasket Mounting)

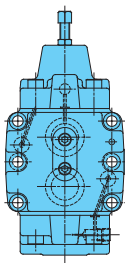
Type 1



Type 3

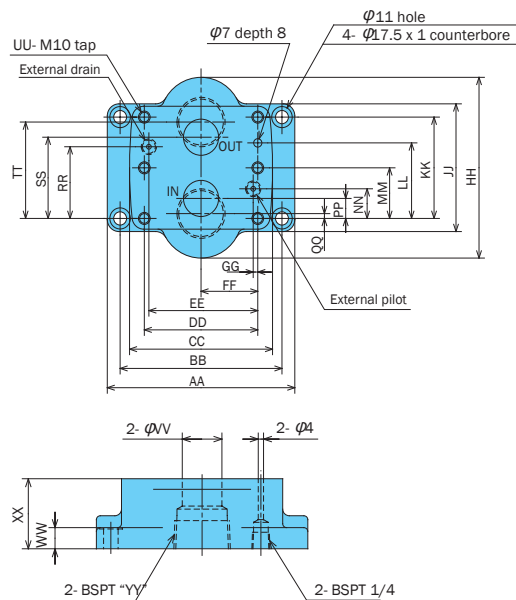


Type 4



Model No.	A	B	C	D	E	F	G	H	J	K	L	M
CQ-G03**-21	179.5	146	62	45.1	61.5	19	89	35	88	60	4	60
CQ-G06**-21	204.5	171	82	51.4	75	24	100	40	102	70	4	70
CQ-G10**-21	251	216	102	54	89	30	131	51	122	92	6	92

Sub Plate MG-***-20



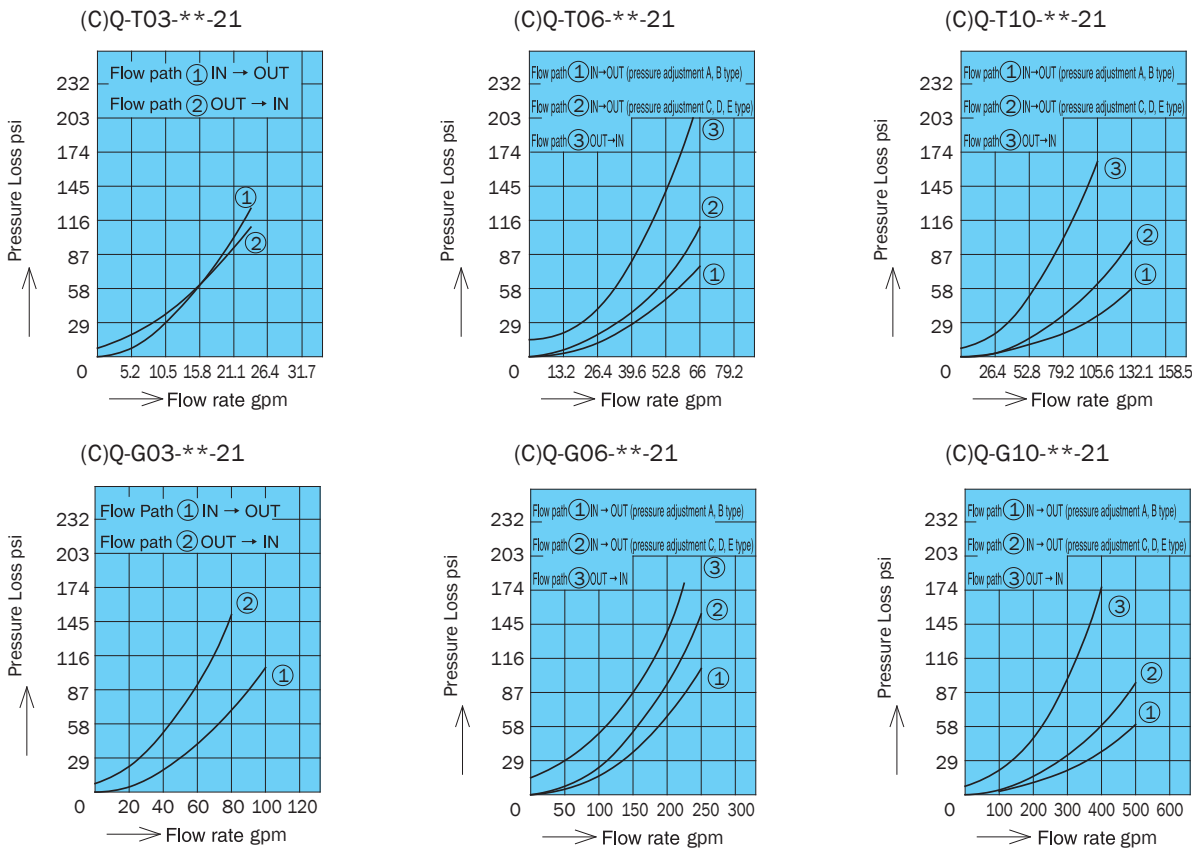
Note 1: The figure shows size 10(X), with four M10 tap holes for size 03(X) and 06(X) valve mounting bolts.
Note 2: When a valve cover external drain and external pilot port are used, remove the plugs from the sub plate external drain and external pilot port.

Model No.	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	QQ	RR	SS	TT	UU	VV	WW	XX	YY
MG-03-20	128	106.4	88	66.6	58.7	33.3	7.9	76	62	42.9	31.8	-	21.4	7.2	3.5	21.4	35.7	39.5	4	14	11	30	3/8
MG-03X-20																							1/2
MG-06-20	160	123.8	102	79.3	72.9	39.7	6.4	110	82	60.3	44.5	-	20.6	11.1	3.7	39.7	49.2	56.7	4	22	16	40	3/4
MG-06X-20																							1
MG-10-20	160	138.1	122	96.8	92.9	48.4	3.9	150	102	84.1	62.7	42.1	24.6	16.7	4.1	59.5	67.5	80.1	6	30	16	53	1 1/4
MG-10X-20																							1 1/2

Performance Curves

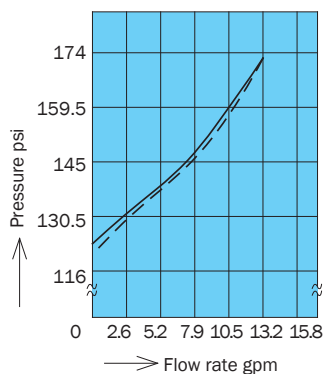
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

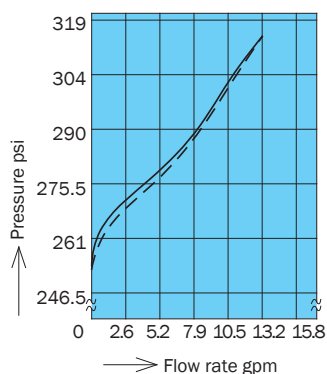


Pressure - Flow Rate Characteristics (— : Press rise
 - - - : Pressure drop)

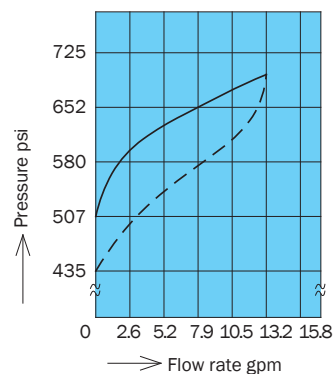
(C)Q-*03-2A-21



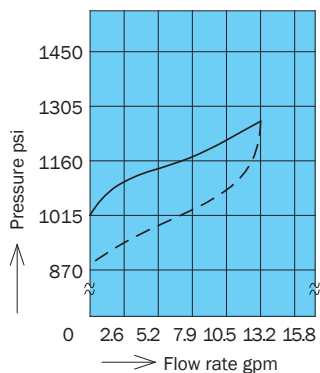
(C)Q-*03-2B-21



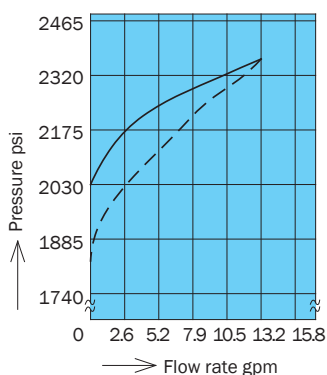
(C)Q-*03-2C-21



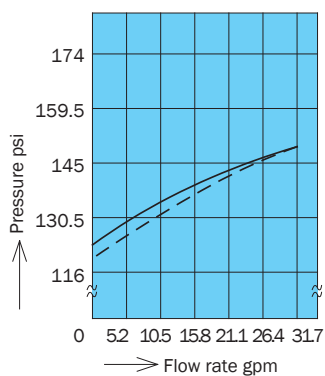
(C)Q-*03-2D-21



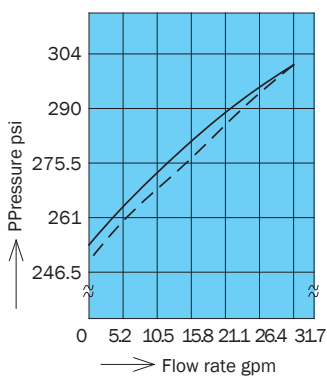
(C)Q-*03-2E-21



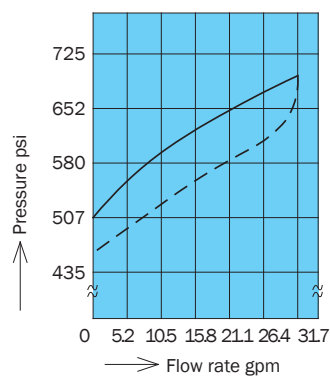
(C)Q-*06-2A-21



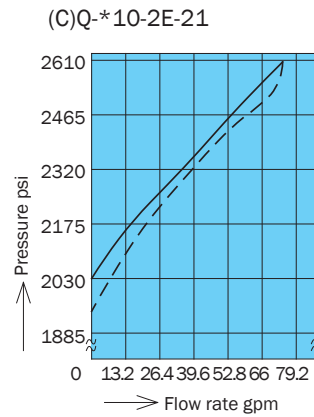
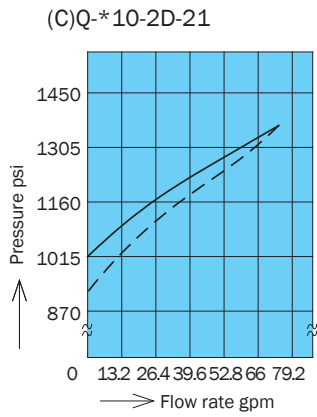
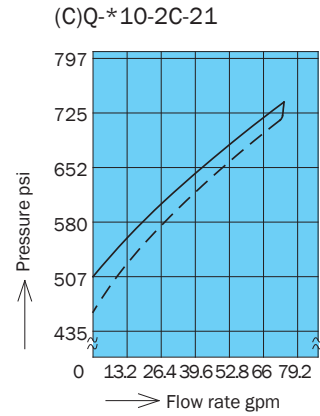
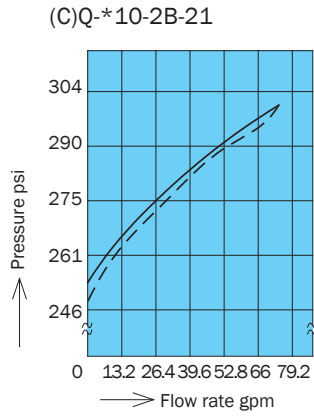
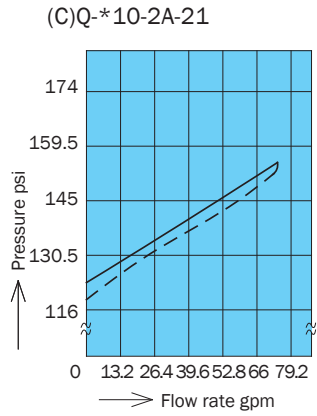
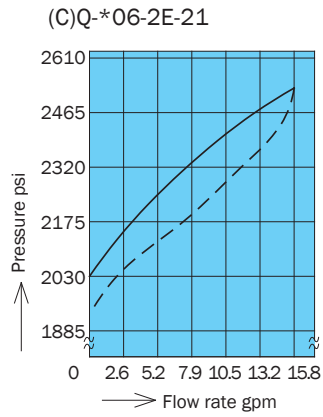
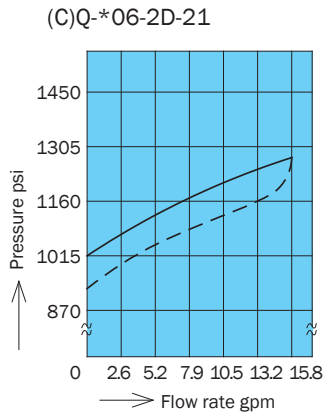
(C)Q-*06-2B-21

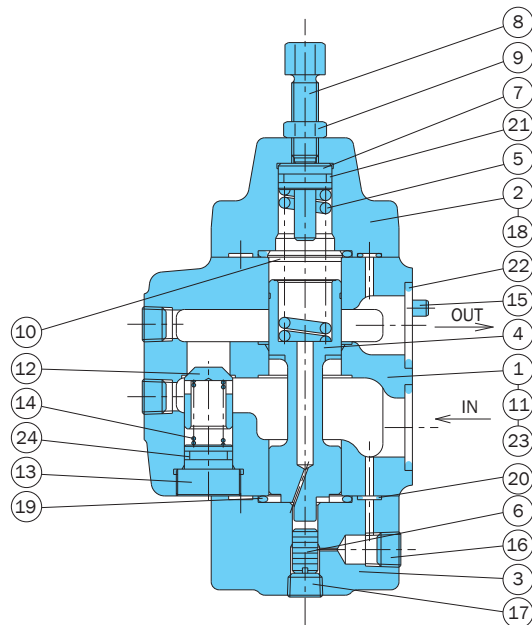


(C)Q-*06-2C-21



Pressure - Flow Rate Characteristics (— : Press rise
----- : Pressure drop)





Part No.	Part Name
1	Body
2	Cover
3	Cover
4	Piston
5	Spring
6	Plunger
7	Push rod
8	Screw
9	Nut
10	Spacer
11	Nameplate
12	Poppet
13	Spring guide
14	Spring
15	Pin
16	Plug
17	Plug
18	Screw
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	O-ring
24	O-ring

Note: The illustration shows the configuration for pressure adjustment ranges Type C, Type D, and Type E. For Type A and Type B, the #6 piston is eliminated, and the #4 spool and #5 spring are different.

Note: Part numbers 12, 13, 14, and 24 are not required when there is no check valve.

Seal Part List (Kit Model Number RQBS-*** (C))

Part No.	Part Name	Type/Part Number						Q'ty
		CQ-G03-**-21	CQ-T03-**-21	CQ-G06-**-21	CQ-T06-**-21	CQ-G10-**-21	CQ-T10-**-21	
19	O-ring	1B-P22	1B-P22	1B-G30	1B-G30	1B-P40	1B-G40	2
20	O-ring	1B-P6	1B-P6	1B-P6	1B-P6	1B-P6	1B-P6	4
21	O-ring	1B-P11	1B-P11	1B-P16	1B-P16	1B-P22A	1B-P22A	1
22	O-ring	1B-P20	-	1B-P26	-	1B-G35	-	2
23	O-ring	1B-P12	-	1B-P12	-	1B-P12	-	2
24	O-ring	1B-P11	1B-P11	1B-P14	1B-P14	1B-P22	1B-P22	1

Note: O-ring 1B-** refers to JIS B2401-1B-**. For the *** part of the kit number, specify the valve size (G03, T06). To specify inclusion of a check valve, add C to the end.

Throttle (and Check) Valve

50 gpm
3045 psi

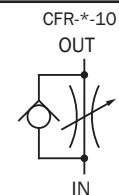


Features

Compact and lightweight, requires very little space for installation. Special needle valve configuration provides smooth flow rate control.

Pressure is internally balanced for light handle operation, even at high pressure.

Specifications



Model No.		Nominal Diameter (Size)	Maximum Flow Rate gpm	Cracking pressure psi	Maximum Working Pressure psi	Weight lbs	
Screw Mounting	Gasket Mounting					T Type	G Type
(C)FR-T03-10	(C)FR-G03-10	3/8	7.9	21.7	3045	2.8	3.7
(C)FR-T06-10	(C)FR-G06-10	3/4	19.8	14.5		6.6	8.1
(C)FR-T10-10	(C)FR-G10-10	1¼	50			12.3	12.7

• Handling

- 1 The control flow rate is increased by counter clockwise (leftward) rotation of the flow rate control handle.
- 2 The control flow rate does not become zero even if the handle is fully turned.
- 3 There is no pressure or temperature compensation mechanism.
- 4 Bi-directional restriction is possible when there is no check valve.
- 5 Use the table to the right for specification when a sub plate is required.
- 6 See the table to the right for installation hex socket bolts. However, bolts are not included for a screw mounting type.

Applicable Pump Model	Bolt Size	Q'ty	Tightening Torque ft lbs
(C)FR-G03-10	M8 × 65 ℓ	4	14.7 to 18.4
(C)FR-G06-10	M12 × 75 ℓ	4	55 to 70
(C)FR-G10-10	M14 × 90 ℓ	4	88 to 110

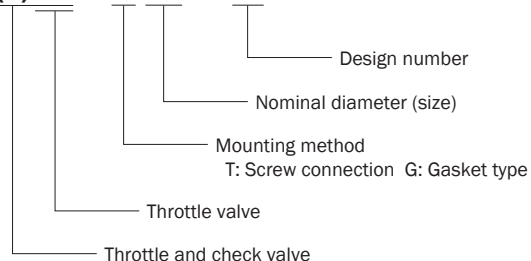
Note: For mounting bolts, use 12T or equivalent.

• Sub Plate

Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MFR-03-10	3/8	7.9	2.2	(C)FR-G03-10
MFR-06-10	3/4	19.8	4.8	(C)FR-G06-10
MFR-10-10	1 1/4	50	9	(C)FR-G10-10

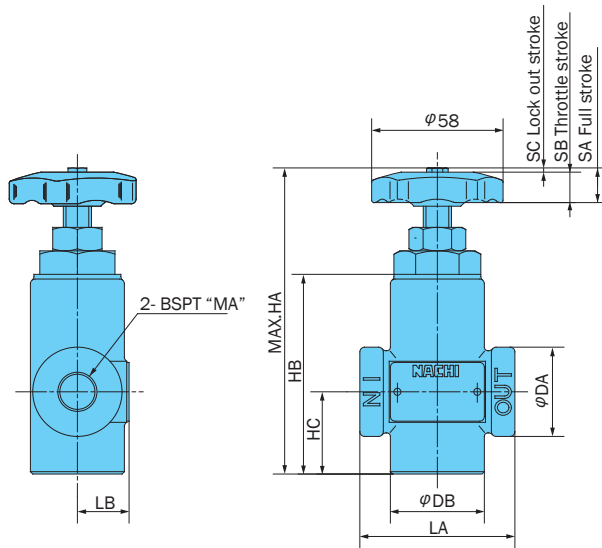
Understanding Model Numbers

(C)FR - G 03 - 10



Installation Dimension Drawings

(C)FR-T**-10 (Screw Mounting)

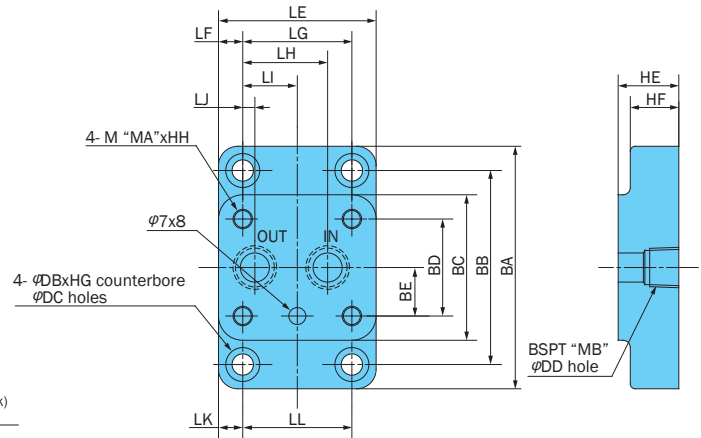
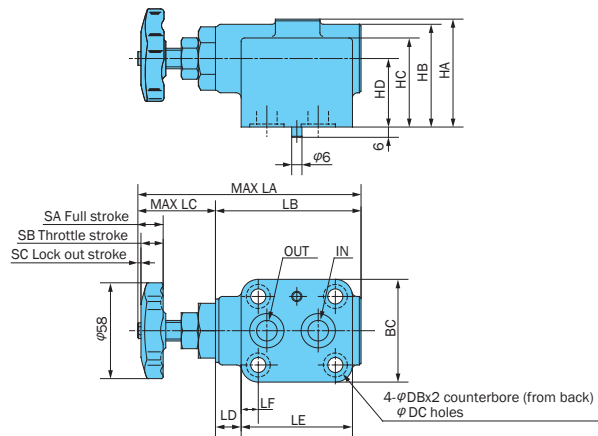


Model No.	LA	LB	DA	DB
(C)FR-T03-10	66	21.5	38	40
(C)FR-T06-10	95	30.5	55	55
(C)FR-T10-10	130	38.5	74	70

HA	HB	HC	SA	SB	SC	MA
130.5	85	35	7	6	1	3/8
175.5	123	55	10	9	1	3/4
206.5	150	70	14	12	2	1 1/4

(C)FR-G**-10 (Gasket Mounting)

Sub Plate MFR**-10



DB	DC	DD	MA	MB	SA	SB	SC
14	8.8	12	8	3/8	7	6	1
20	13	20	12	3/4	10	9	1
23	15	30	14	1 1/4	14	12	2

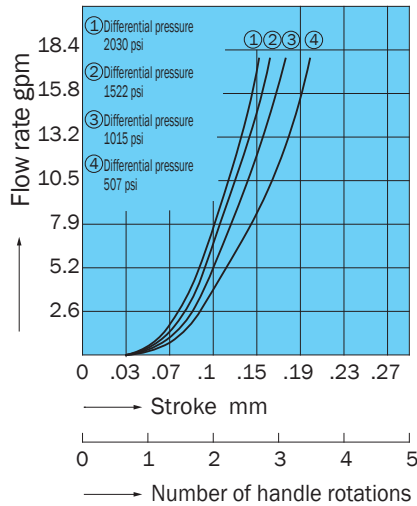
Model Number	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	BA	BB	BC	BD	BE	HA	HB	HC	HD	HE	HF	HG	HH
(C)FR-G03-10	130.5	85	45	15	65	10	45	35	22.5	5	10	45	100	80	60	40	20	63	60	52	40	25	20	8.6	18
(C)FR-G06-10	175.5	123	52	14	96	13	70	55	35	15	14	68	132	106	80	54	27	71	68	57	40	30	25	13	20
(C)FR-G10-10	206.5	150	56	14	120	15	90	72.5	45	17.5	16	88	154	122	90	60	30	83	80	68	45	40	35	15.2	25

Performance Curves

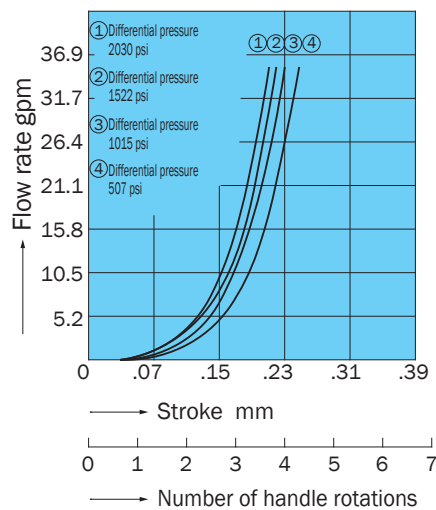
Hydraulic Operating Fluid Viscosity 32 centistokes

Stroke – Flow Rate Characteristics

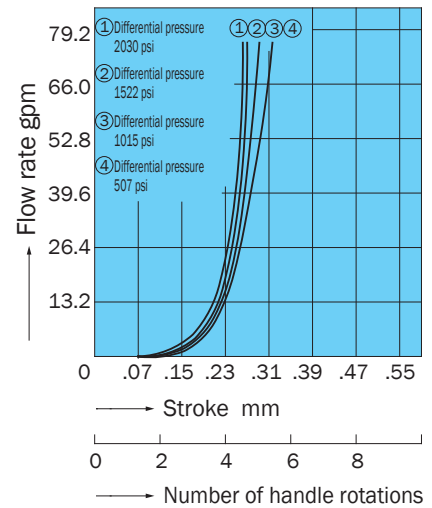
(C)FR-*03-10



(C)FR-*06-10



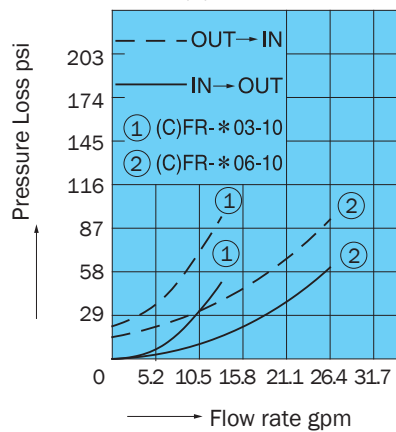
(C)FR-*10-10



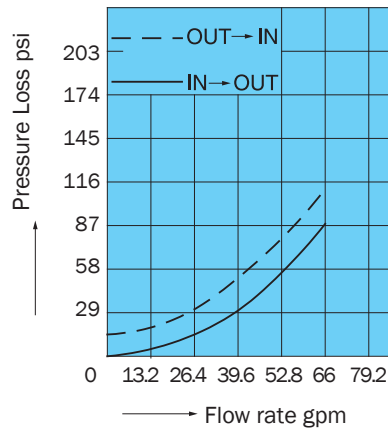
Pressure Loss Characteristics

(C)FR-*03-10

(C)FR-*06-10

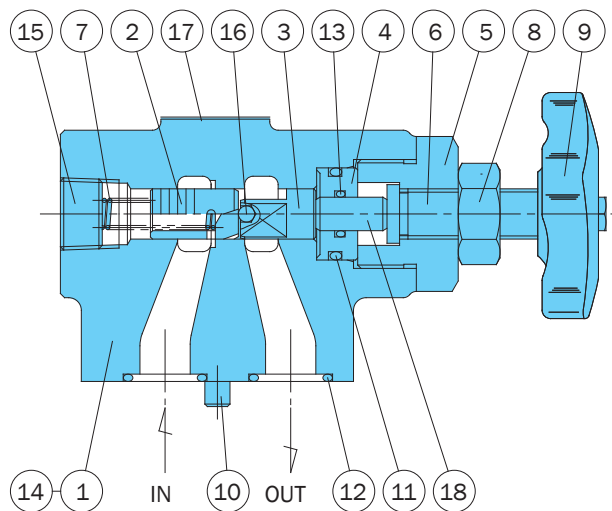


(C)FR-*10-10



Cross-sectional Drawing

CFR-G**-10



Part No. Part Name

- 1 Body
- 2 Poppet
- 3 Piston
- 4 Bracket
- 5 Stopper
- 6 Screw
- 7 Spring
- 8 Nut
- 9 Handle
- 10 Pin
- 11 O-ring
- 12 O-ring
- 13 O-ring
- 14 Plug
- 15 Plug
- 16 Ball
- 17 Plate
- 18 Rod

Seal Part List (Kit Model Number FSS-***)

Part No.	Part Name	CFR-G03-10		CFR-G06-10		CFR-G10-10	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
11	O-ring	IB-P18	1	IB-G25	1	IB-G25	1
12	O-ring	IB-P16	2	IB-G25	2	IB-G35	2
13	O-ring	IB-P8	1	IB-P8	1	IB-P8	1

Note: O-ring 1B-** refers to JIS B2401:1B-**.

*** in the kit number is used for specification of the valve size (G03, T06, etc.)



FT-G0*-**-22



FT Type Flow Control (and Check) Valve (with Pressure and Temperature Compensation)

.01 to 28 gpm
3045 psi

Features

Pressure compensation and temperature compensation mechanisms provide a stable control flow rate, even when fluid

temperature fluctuates.
A wider control flow rate range as well as easier minute flow rate adjustability than previous products.

Specifications

Model No.	Nominal Diameter (Size)	Volume control flow rate gpm	Maximum Working Pressure psi	Reverse Flow Rate gpm	Cracking pressure psi	Weight lbs	Gasket Surface Dimensions
(C)FT-G02-8-22 30-22	1/4	.01 to 2.1 .02 to 7.9	3045	13.2	14.5	8.1	ISO 6263-AK-06-2-A
FT-G03-42-22 106-22	3/8	.02 to 11.0 .05 to 28.0		31.7		17.4	ISO 6263-AM-07-2-A

Asterisk (*) indicates values for auxiliary plate with check valve.

• Handling

- In the temperature range of 68°F to 140°F, flow rate fluctuation is within ±5% of the standard flow rate at 104°F.
- In the pressure range of 145 to 3045 psi, flow rate fluctuation is within ±5% of the setting flow rate.
- Note that flow rate fluctuation exceeds the rated fluctuation amount slightly in the vicinity of the minimum control flow rate, due to changes in operating temperature and hydraulic fluid viscosity.
- When controlling flow rates that are less than .05 gpm, use with a filter that does not exceed 10µm.
- For flow rate control, make sure that the pressure differential between the input port and output port is at least 145 psi.
- The control flow rate is increased by clockwise (rightward) rotation of the control handle.

7 See the table below for installation hex socket bolts.

8 Use the following table for specification when a sub plate is required.

• Sub Plate and Auxiliary Plate Application Table

Name	Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type	Use With Sub Plate
Sub Plate	MF-02X-10	3/8	7.9	4.8	(C)FT-G02-*-22	-
	MF-02Y-20	1/2	13.2			
Sub Plate	MF-03-10	3/8	11	7.2	FT-G03-*-22	-
	MF-03Y-20	3/4	19.8			
	MF-03Z-20	1	31.7			
Sub Plate with Check Valve	MF-03Y-C-22	3/4	19.8	12.5		
	MF-03Z-C-22	1	31.7	12.3		
Auxiliary Plate A with Check Valve	MCF-03-A-22	φ23	31.7	7.0		MF-03-*-*

9 Though FT-G03 does not have a built-in check valve, a sub plate with check valve and auxiliary plate with check valve is

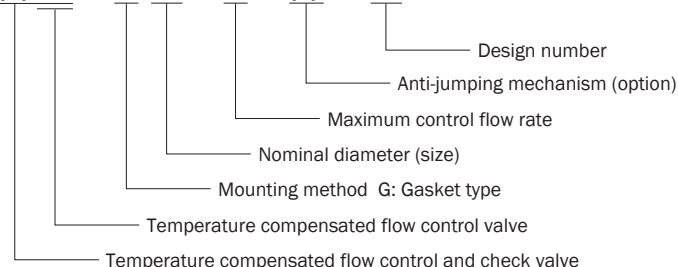
used in addition to the normal sub-plate. (Use the auxiliary plate in combination with the sub plate.)

Applicable Model	Bolt Size	Q'ty	Tightening Torque ft lbs
(G)FT-G02-*-22	M8 × 55 ℓ	4	14.7 to 18.4
FT-G03-*-22	M10 × 75 ℓ	4	55 to 70
With FT-G03 Auxiliary Plate	M10 × 110 ℓ	4	55 to 70

Note: For mounting bolts, use grade 8 or equivalent.

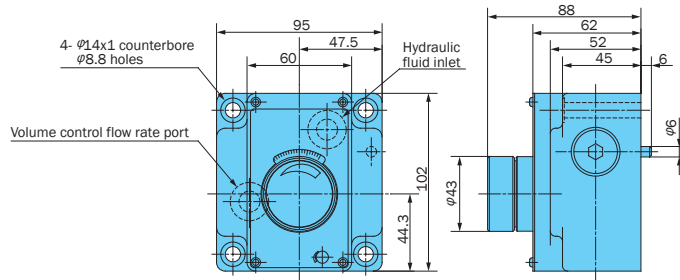
Understanding Model Numbers

(C) FT - G 02 - 8 - (F) - 22

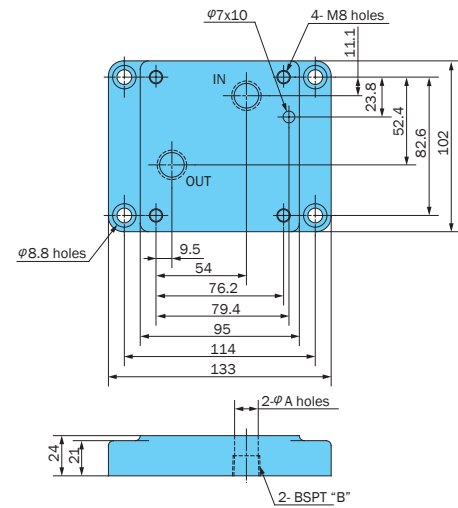


Installation Dimension Drawings

(C)FT-G02-**-22

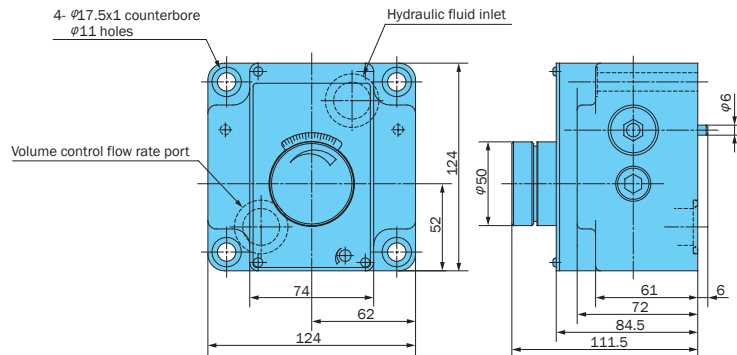


Sub Plate MF-02*-*



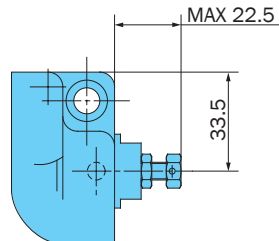
Sub Plate	A	B
MF-02X-10	14.7	3/8
MF-02Y-20	17	1/2

FT-G03-***-22

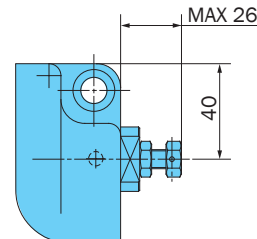


Anti-jumping mechanism

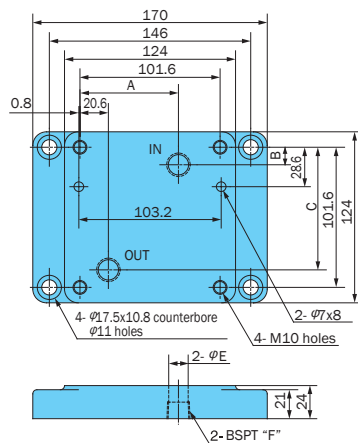
(C)FT-G02-*-F-22



(C)FT-G03-*-F-22

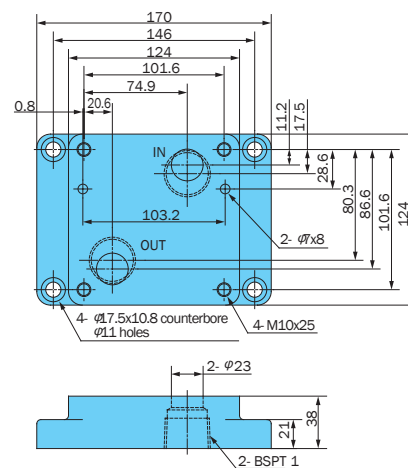


Sub Plate MF-03-10
MF-03Y-20

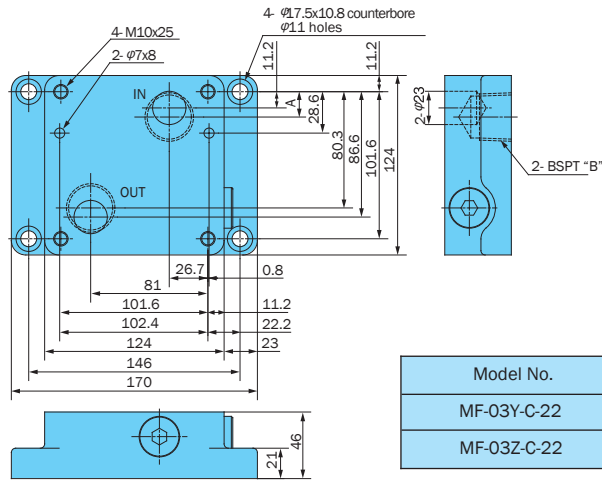


Sub Plate	A	B	C	E	F
MF-03-10	71.4	12.7	88.9	14.7	3/8
MF-03Y-20	74.9	11.2	86.6	23.0	3/4

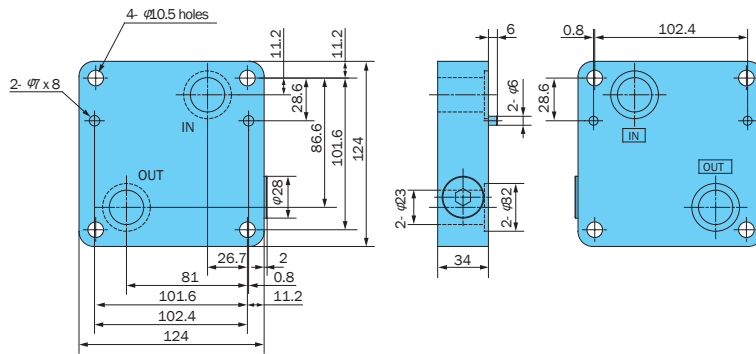
MF-03Z-20



Sub Plate with Check Valve MF-03*-C-22



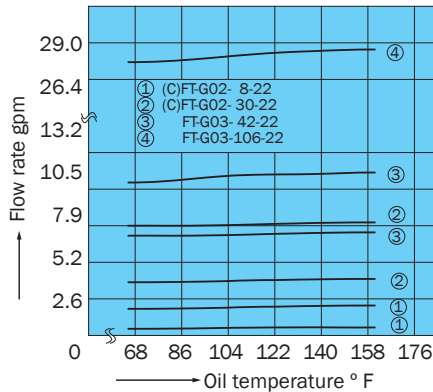
Auxiliary Plate with Check Valve MCF-03-A-22



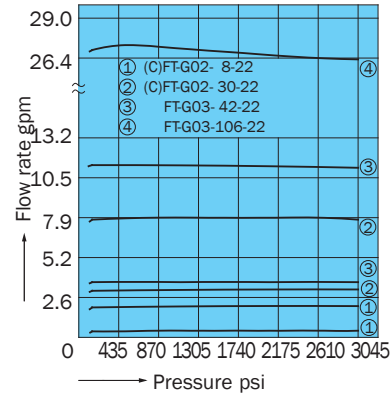
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

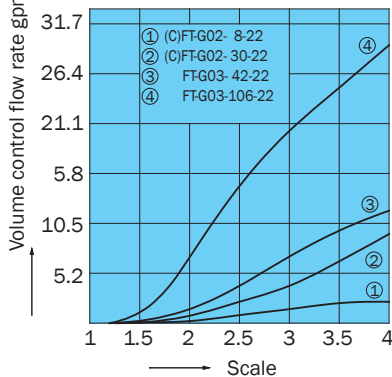
Fluid Temperature - Control Flow Rate Characteristics



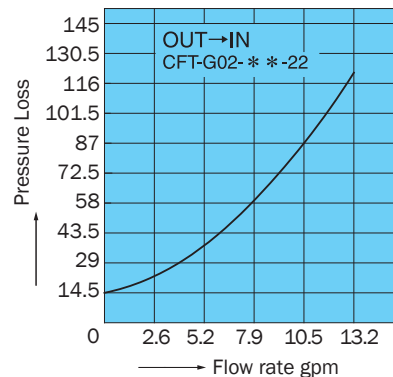
Pressure - Control Flow Rate Characteristics



Scale - Control Flow Rate Characteristics



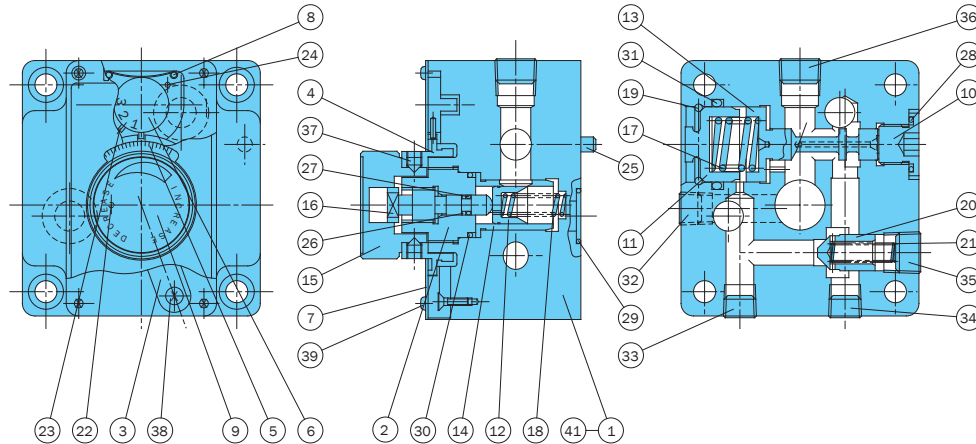
Pressure Loss Characteristics



Cross-sectional Drawing

CFT-G02-*-22

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	15	Knob	29	O-ring
2	Retainer	16	Screw	30	O-ring
3	Stopper	17	Spring	31	O-ring
4	Dial	18	Spring	32	Plug
5	Plate	19	Snap ring	33	Plug
6	Plate	20	Poppet	34	Plug
7	Plate	21	Spring	35	Plug
8	Spring	22	Pin	36	Plug
9	Plate	23	Pin	37	Screw
10	Plug	24	Pin	38	Screw
11	Plug	25	Pin	39	Screw
12	Throttle	26	Backup ring	40	Washer
13	Piston	27	O-ring	41	O-ring
14	Sleeve	28	O-ring		

Seal Part List (Kit Model Number FBBS-***)

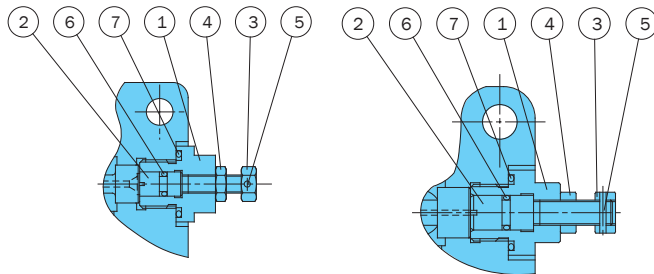
Part No.	Part Name	(C)FT-G02-*-22		FT-G03-*-22	
		Part Number	Q'ty	Part Number	Q'ty
26	Backup ring	T2-P5	1	T2-P5	1
27	O-ring	IB-P5	1	IB-P5	1
28	O-ring	IB-P18	1	IB-P20	1
29	O-ring	IB-P18	2	IB-P26	2
30	O-ring	IB-P22	1	IB-P26	1
31	O-ring	IB-P30	1	IB-P38	1
41	O-ring	-	-	IB-P20	1
Seal Kit Number		FBBS-G02-1A		FBBS-G03	

Note: 1.O-ring 1B-** refers to JIS B2401-1B-**. 2.Backup ring indicates JIS B2407-T2**.

Anti-jumping mechanism

(C)FT-G02-*-F-22

(C)FT-G03-*-22



Anti-jumping mechanism

Part No. Part Name

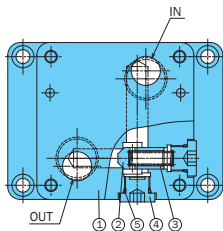
1	Retainer
2	Bolt
3	Nut
4	Nut
5	Spring pin
6	O-ring
7	O-ring

List of Sealing Parts

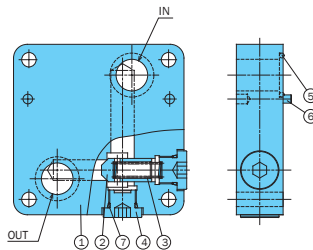
Part No.	Part Name	(C)FT-G02-*-22		FT-G03-*-22	
		Part Number	Q'ty	Part Number	Q'ty
6	O-ring	IB-P5	1	IB-P8	1
7	O-ring	IB-P18	1	IB-P20	1

Note: 1.O-ring 1B-** refers to JIS B2401-1B-**. 2.#7 O-ring and #29 O-ring are interchangeable.

Sub Plate MF-03*-C-22



MCF-03-A-22



Part No.	Part Name	Part No.	Part Name
1	Sub Plate	4	Plug
2	Poppet	5	O-ring
3	Spring		

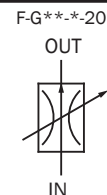
List of Sealing Parts

Part No.	Part Name	Part Number	Q'ty
5	O-ring	1B-P18	2

Part No.	Part Name	Part No.	Part Name
1	Sub Plate	5	O-ring
2	Poppet	6	Pin
3	Spring	7	O-ring
4	Plug	8	Screw

List of Sealing Parts

Part No.	Part Name	Part Number	Q'ty
5	O-ring	1B-P26	2
7	O-ring	1B-P18	2



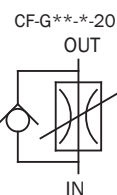
F Type Flow Control (and Check) Valve (with Pressure Compensation)

2.3 to 98.5 gpm
3045 psi

Features

Wide control flow rate range.
A pressure compensation mechanism ensures that the control flow rate does not change, even when there is pressure fluctuation.

Specifications



Model No.	Nominal Diameter (Size)	Volume control flow rate gpm	Maximum Working Pressure psi	Cracking pressure psi	Weight lbs	Gasket Surface Dimensions
(C)F-G06-170-20	3/4	2.3 to 44.9	3045	14.5	45.2	ISO 6263-AP-08-2-A
(C)F-G10-373-20	1 1/4	5.2 to 98.5			95	-

• Handling

- 1 In the pressure range of 145 to 3045 psi, flow rate fluctuation is within $\pm 5\%$ of the setting flow rate.
- 2 For flow rate control, make sure that the pressure differential between the input port and output port is at least 145 psi.
- 3 The control flow rate is increased by clockwise (rightward) rotation of the control handle.

4 See the table below for installation hex socket bolts.

5 Use the following table for specification when a sub plate is required.

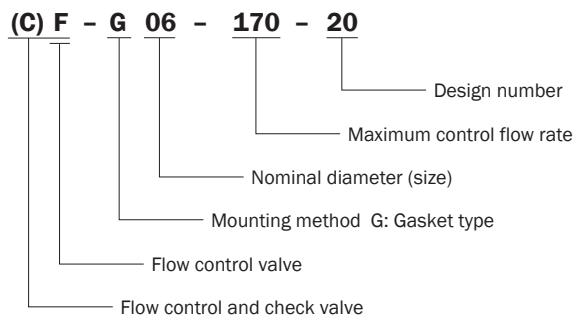
Sub Plate Application Table

Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MF-06-10	3/4	28	13.8	(C)F-G06-170-20
MF-06X-20	1	44.9	21.3	
MF-10-10	1 1/4	64.9	46.5	(C)F-G10-373-20

Applicable Model	Bolt Size	Q'ty	Tightening Torque ft lbs
(C)F-G06	M16 × 100 ℓ	4	140 to 173
(C)F-G10	M20 × 115 ℓ	4	272 to 339

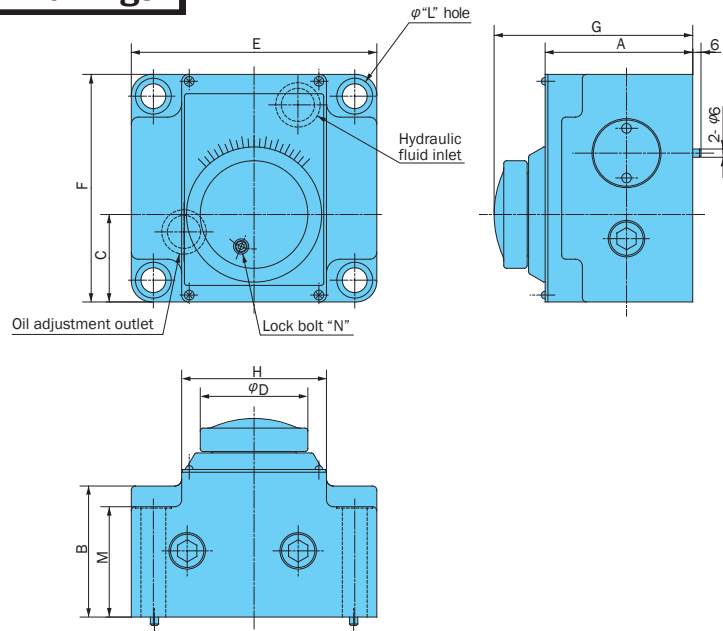
Note: For mounting bolts, use 12T or equivalent.

Understanding Model Numbers



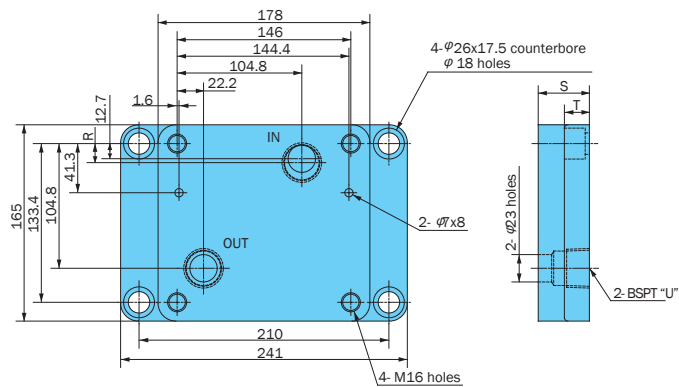
Installation Dimension Drawings

(C)F-G**-*-20



Model No.	Dimensions mm												
	A	B	C	D	E	F	G	H	J	K	L	M	N
(C)F-G06-*-20	107	95	63.4	80	178	165	144.5	105	26	1	18	80	M5
(C)F-G10-*-20	124	108	81.8	90	245	225	169.5	140	32	1	22	89	M6

Sub Plate MF-06*-20

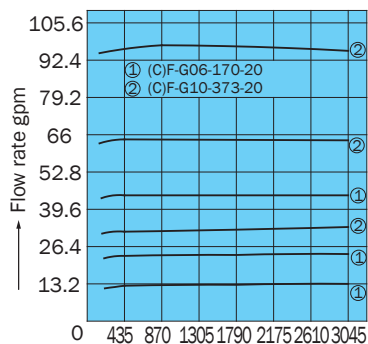


Sub Plate	Dimensions mm			
	R	S	T	U
MF-06-20	12.7	25	22	3/4
MF-06X-20	16	43	21	1

Performance Curves

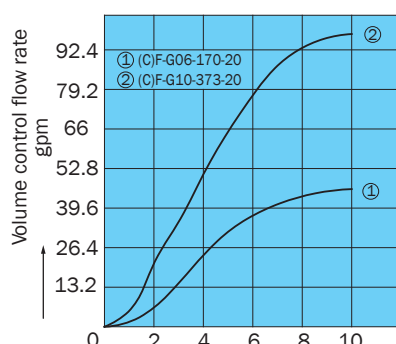
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure - Control Flow Rate Characteristics



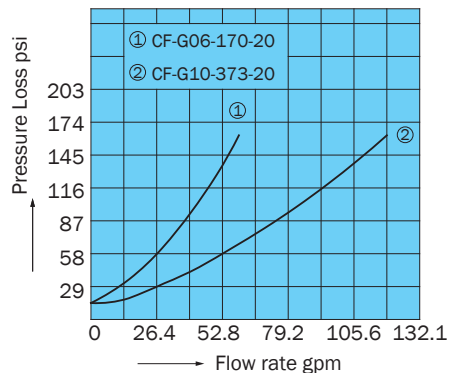
→ Pressure psi

Scale - Control Flow Rate Characteristics



→ Scale

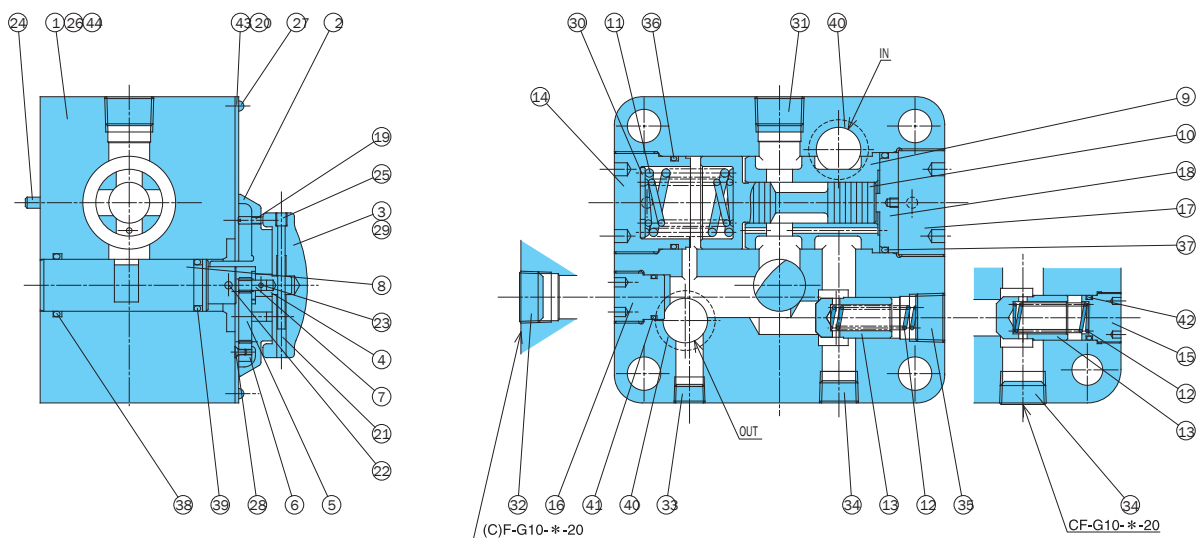
Pressure Loss Characteristics



→ Flow rate gpm

Cross-sectional Drawing

CF-G**-**-20



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	9	Sleeve	18	Retainer	27	Screw	36	O-ring
2	Cover	10	Piston	19	Stopper	28	Screw	37	O-ring
3	Knob	11	Spring	20	Pin	29	Screw	38	O-ring
4	Gear	12	Spring	30	Pin	30	Washer	39	O-ring
5	Gea	13	Poppet	22	Pin	31	Plug	40	O-ring
6	Gear	14	Plug	23	Pin	32	Plug	41	O-ring
7	Bushing	15	Plug	24	Pin	33	Plug	42	O-ring
8	Throttle	16	Plug	25	Screw	34	Plug	43	Plate
		17	Plug	26	Screw	35	Plug	44	Screw

Seal Part List (Kit Model Number FBBS-***)

Part No.	Part Name	CF-G06-170-20		CF-G10-373-20	
		Part Number	Q'ty	Part Number	Q'ty
36	O-ring	IB-G45	1	IB-G60	1
37	O-ring	IB-P48	1	IB-G65	1
38	O-ring	IB-P28	1	IB-P45	1
39	O-ring	IB-P22A	1	IB-P39	1
40	O-ring	IB-P29	2	IB-P32	2
41	O-ring	IB-P20	1	-	-
42	O-ring	-	-	IB-P26	1

Note: O-ring 1B-*** refers to JIS B2401-1B-***.
For the *** part of the kit number, specify the valve size (G06, G10).



TN-G02-2-11



TN Type Flow Control (and Check) Valve (Fine Adjustment Type with Pressure and Temperature Compensation)

.0079 to 2.1 gpm
1522 psi

Features

With a very compact, lightweight configuration, the intelligent design of this valve makes it a low-cost option.
Minute flow rate control from 1.8 in³.

Stable control of each setting flow rate, even as pressure and fluid temperature are fluctuating. Dial markings are proportional

to flow rate for simple and accurate control flow rate adjustment.

Specifications

Model No.	Nominal Diameter (Size)	Volume control flow rate gpm	Maximum Working Pressure psi	Reverse Flow Rate gpm	Cracking pressure psi	Weight lbs
(C)TN-G02-2-11 8-11	1/4	.007 to .52 .01 to 2.1	1522	9.2	14.5	4.8

• Handling

- 1 In the temperature range of 68° to 140° F, flow rate fluctuation is within ±5% of the standard flow rate at 104° F.
- 2 In the pressure range 145 to 1522 psi, flow rate fluctuation is within ±5% of the setting flow rate.
- 3 Note that flow rate fluctuation exceeds the rated flow rate fluctuation amount slightly in the vicinity of the minimum control flow rate, due to changes in operating temperature and hydraulic fluid viscosity.
- 4 When controlling flow rates that are less than .05 gpm, use with a filter that does not exceed 10µm.
- 5 Make sure that the pressure differential between the inlet port and outlet is at least 87 psi at 1 gpm or less, and at least 145 psi at 16 gpm or greater.
- 6 The control flow rate is increased by clockwise (rightward) rotation of the adjustment handle.

- 7 For connection to piping, normally connect to the sub plate. Valve mounting is gasket type, using an O-ring. When a screw in connection is required, seal the gasket surface, remove the side plug, and create a screw in connection directly to the valve unit. In this case, remove all seal material affixed to the plug.

- 8 Use the following table for specification when a sub plate is required.

Model No	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs
MTL-03-10	3/8	9.2	2.8

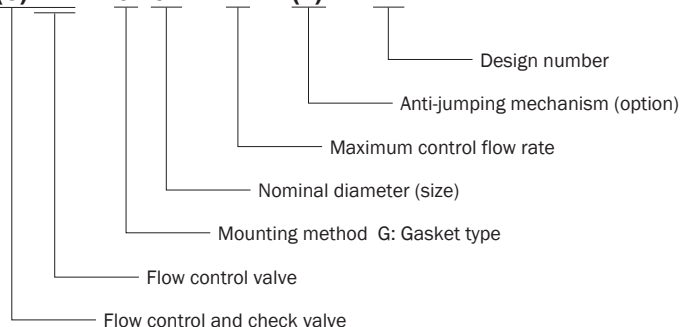
- 9 Bundled Accessories: Hex Socket Bolts M8 x 60 ℓ, (four)

Note: 1.For mounting bolts, use 12T or equivalent.

2.Tightening torque is 14.7 to 18.4 ft lbs.

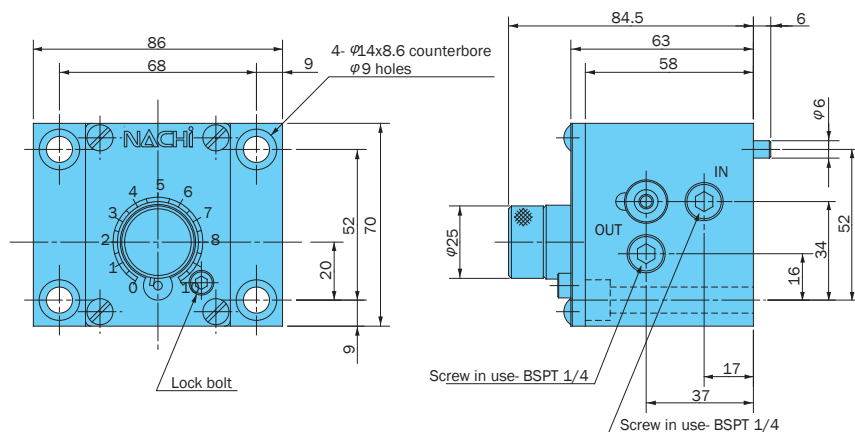
Understanding Model Numbers

(C) TN - G 02 - 2 - (F) - 11

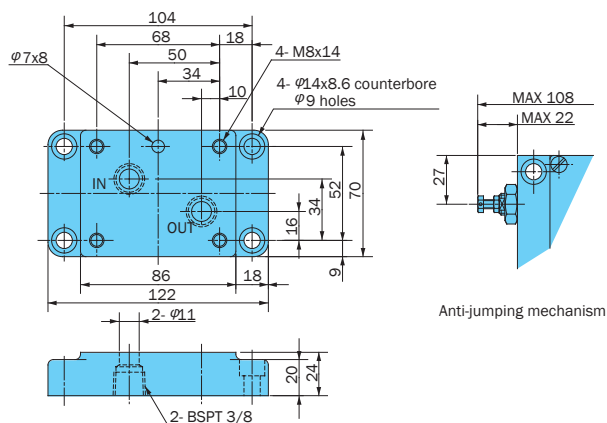


Installation Dimension Drawings

(C)TN-G02-**-11



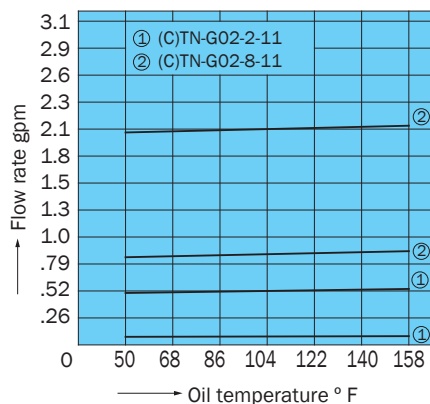
Sub Plate MTL-03-10



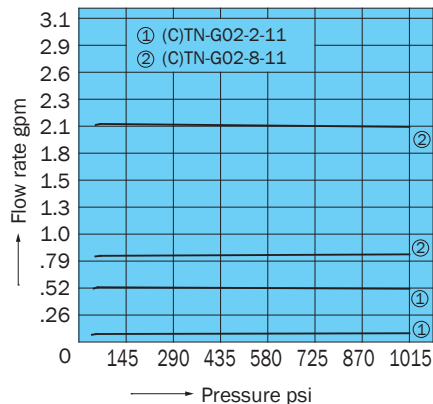
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

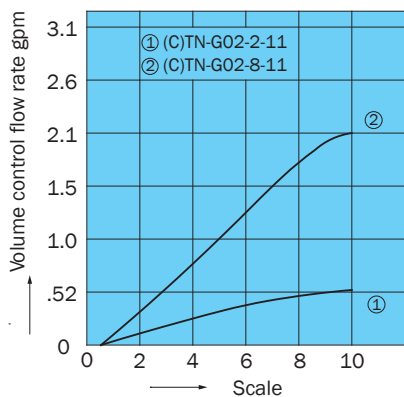
Fluid Temperature - Control Flow Rate Characteristics



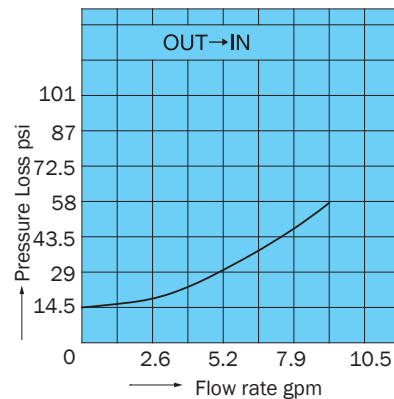
Pressure - Control Flow Rate Characteristics



Scale - Control Flow Rate Characteristics

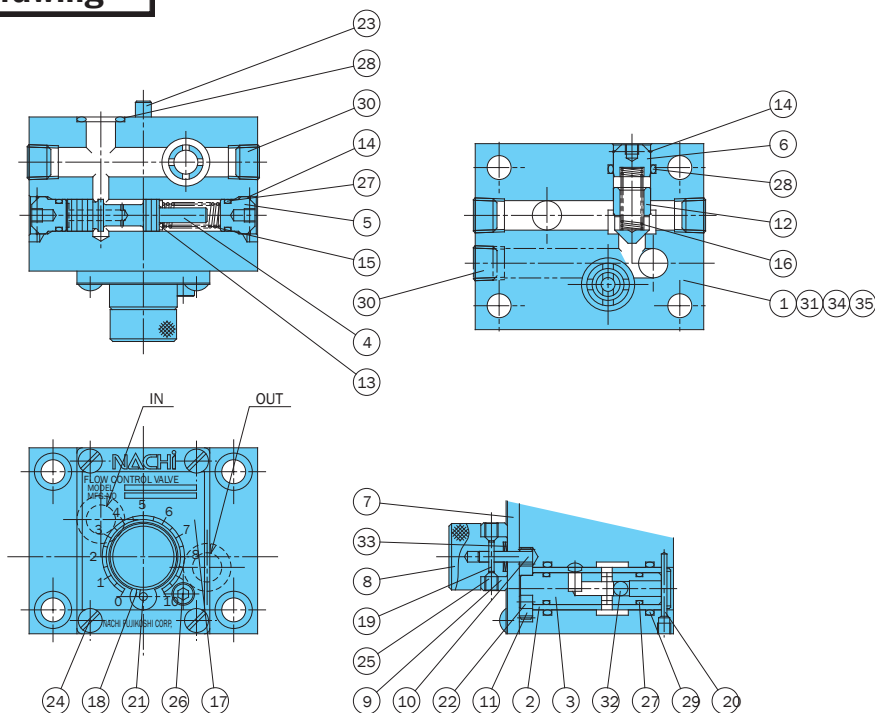


Pressure Loss Characteristics



Cross-sectional Drawing

CTN-G02-*-11



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	13	Spacer	25	Screw
2	Sleeve	14	Snap ring	26	Screw
3	Spool	15	Spring	27	O-ring
4	Piston	16	Spring	28	O-ring
5	Plug	17	Plate	29	O-ring
6	Plug	18	Pin	30	Plug
7	Plate	19	Pin	31	Ball
8	Knob	20	Pin	32	Ball
9	Ring	21	Pin	33	Washer
10	Gear	22	Pin	34	Screw
11	Gear	23	Pin	35	Plate
12	Poppet	24	Screw		

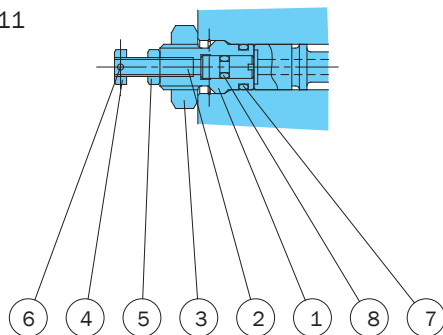
Seal Part List (Kit Model Number FNS-G02(C))

Part No.	Part Name	TN-G02-*-11		CTN-G02-*-11	
		Part Number	Q'ty	Part Number	Q'ty
27	O-ring	IA-P9	4	IA-P9	4
28	O-ring	IA-P14	2	IA-P14	3
29	O-ring	IA-P16	2	IA-P16	2

Note: Specify C at the end of the model number for the CTN kit.

Note: O-ring 1A-*** refers to JIS B2401-1A-***.

Anti-jumping mechanism
(C)TN-G02-*-F-11



Part No.	Part Name
1	Retainer
2	Bolt
3	Nut
4	Nut
5	Nut
6	Spring pin
7	O-ring
8	O-ring

Seal Part List

Part No.	Part Name	Part Number	Q'ty
7	O-ring	IA-P9	1
8	O-ring	IA-P3	1

Note: #7 O-ring and #27 O-ring are interchangeable.

TS Type Flow Control (and Check) Valve (Fine Adjustment Type with Pressure and Temperature Compensation)

.002 to .52 gpm
1522 psi



TS-G01-2-11



Features

Original compact, lightweight configuration.
High-precision control up to minute flow rates of .61 in³.
Design allows large 5.2 gpm reverse flow

rate relative to control flow rate, which means there is no need to include an extra valve in the quick return circuit.
Stable control of each setting flow rate,

even as pressure and fluid temperature are fluctuating.

Specifications

Model No.	Nominal Diameter (Size)	Volume control flow rate gpm	Maximum Working Pressure psi	Reverse Flow Rate gpm	Cracking pressure psi	Weight lbs
(C)TS-G01-2-11	1/8	.002 to .52	1522	5.2	11.6	1.9

• Handling

- 1 In the temperature range of 68° to 140° F, flow rate fluctuation is within ±5% of the standard flow rate at 104° F.
- 2 In the pressure range of 87 to 1522 psi, flow rate fluctuation is within ±5% of the setting flow rate.
- 3 Note that flow rate fluctuation exceeds the rated fluctuation amount slightly in the vicinity of the minimum control flow rate, due to changes in operating temperature and hydraulic fluid viscosity.

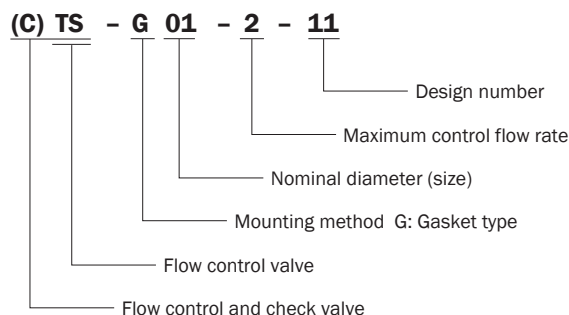
- 4 When controlling flow rates that are less than .05 gpm, use with a filter that does not exceed 10 μm.
- 5 For flow rate control, make sure that the pressure differential between the input port and output port is at least 87 psi.
- 6 The control flow rate is increased by clockwise (rightward) rotation of the control handle.
- 7 Use the table to the right for specification when a sub plate is required.

Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs
MTS-01Y-10	3/8	5.2	1.7

8 Bundled Accessories: Hex Socket Bolts: M4 x 35 ℓ (four)

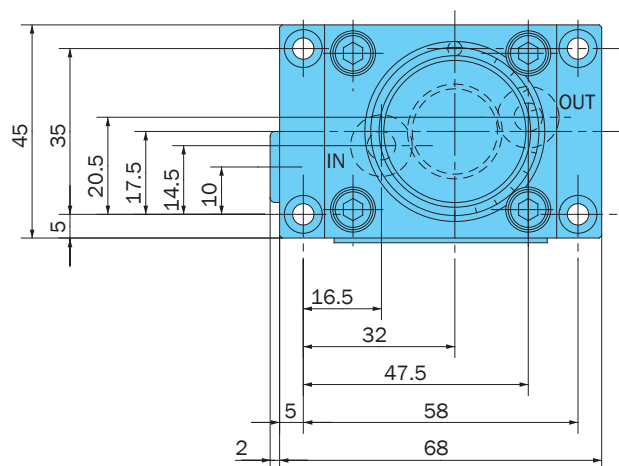
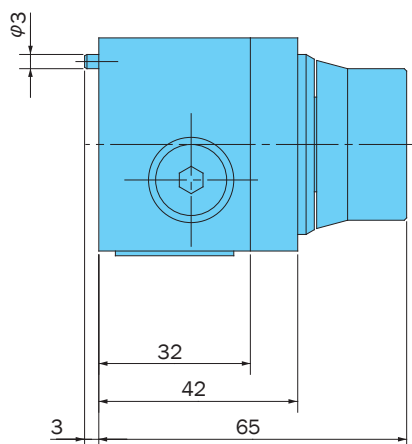
Note: 1. For mounting bolts, use 12T or equivalent.
2. Tightening torque is 1.9 to 2.4 ft lbs.

Understanding Model Numbers



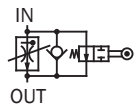
Installation Dimension Drawings

(C)TS-G01-2-11



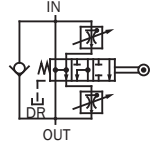


TL-G0*-*.11



Note: 04 has DR

TLT-G04*-*.11



TL (TLT) Type Feed Control Valve (Fine Control Type with Pressure Compensation)

.02 to 2.1 gpm
1000 psi

Features

Very compact, lightweight, and economically priced.

Applicable for control of machine tool table operations. For example, a single valve provides smooth control of: Fast Feed =>

Cutting Feed (2 stage) => Fast Return.
Stable control of each setting flow rate, even as pressure and fluid temperature are fluctuating.
Dial markings are proportional to flow rate for simple control flow rate adjustment

Sealing the gasket surface allows as-is screw-in connection.

Specifications

Model No	Nominal Diameter (Size)	Volume control flow rate gpm		Reverse Flow Rate gpm	Maximum Working Pressure psi	Cracking pressure psi	Weight lbs
		Feed 1	Feed 2				
TL-G03-2-11 8-11	3/8	.02 to .5 .02 to 2.1	-	9.2	1015	14.5	4.8
TL-G04-2-11 8-11	1/2	.02 to .5 .02 to 2.1	-	14.0			15.4
TLT-G04-2-1.5-11 8-2-11		.02 to .5 .02 to 2.1	.02 to .39 .02 to .5				

• Handling

- In the temperature range of 68° F to 140° F, flow rate fluctuation is within ±5% of the standard flow rate at 104° F.
- In the pressure range of 145 to 1000 psi, flow rate fluctuation is within ±5% of the setting flow rate.
- Note that flow rate fluctuation exceeds the rated fluctuation amount slightly in the vicinity of the minimum control flow rate, due to changes in operating temperature and hydraulic fluid viscosity.
- When controlling flow rates that are less than .05 gpm, use with a line filter no greater than 10µm.
- Make sure that the pressure differential between the inlet port and outlet is at least 87 psi at 1 gpm or less, and at least 145 psi at 1 gpm or greater.

- The control flow rate is increased by clockwise (rightward) rotation of the control handle.
- For connection to piping, normally connect to the sub plate. Valve mounting is gasket type, using an O-ring. When a screw in connection is required, seal the gasket surface, remove the side plug, and create a screw in connection directly to the valve unit. In this case, remove all seal material affixed to the plug.
- See the table below for installation hex socket bolts.
- Use the table to the right for specification when a sub plate is required.

Model No.	Pipe Diameter	Recommended Flow Rate gpm	Applicable Valve Type
MTL-03-10	3/8	9.2	TL-G03-*.11
MTL-04-10	1/2	14.0	TL(T)-G04-*.11

TL-G03-11 -

Cam Down Force
27 lbs minimum

TLT-G04-*.11

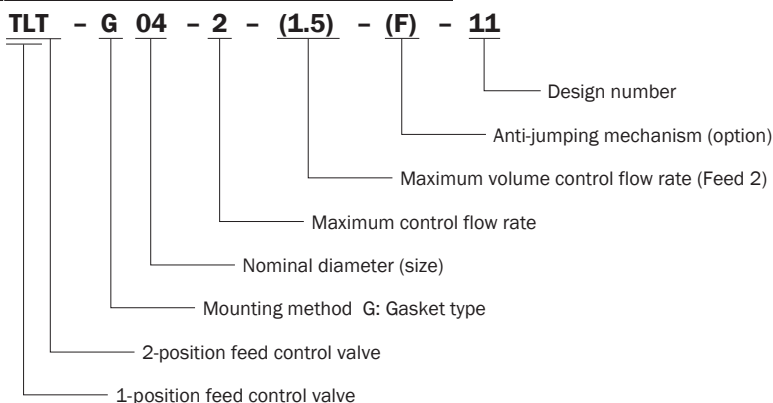
Feed 1 Cam Down Force
31 lbs minimum
Feed 2 Cam Down Force
45 lbs minimum

- Make the cam angle no greater than 30 degrees.

Applicable Model	Bolt Size	Q'ty	Tightening Torque ft lbs
TL-G03-*.11	M8 × 60r	4	14.7 to 18.4
TL(T)-G04-*.11	M10 × 75r	4	33 to 40.5

Note: For mounting bolts, use 12T or equivalent.

Understanding Model Numbers



Flow Control Valves

Technical drawing of the NACHI 4W-20-100 solenoid valve, showing front and side views with dimensions and labels.

Front View (Left):

- Overall width: 86 mm
- Distance from left edge to center of top port: 68 mm
- Distance from left edge to center of bottom port: 18 mm
- Port diameter: $\phi 16$
- Top port offset: 9 mm
- Bottom port offset: 6.4 mm
- Overall height: 87 mm
- Distance from bottom edge to center of bottom port: 52 mm
- Distance from bottom edge to center of top port: 70 mm
- Lock bolt location: 9 mm from bottom edge
- Port numbering: 1, 2, 3, 4, 5, 6, 7, 8
- Label: "NACHI"

Side View (Right):

- Overall width: 84.5 mm
- Distance from left edge to center of top port: 63 mm
- Distance from left edge to center of bottom port: 4 mm
- Port diameter: $\phi 6$
- Overall height: 52 mm
- Distance from bottom edge to center of bottom port: 34 mm
- Distance from bottom edge to center of top port: 16 mm
- Lock bolt location: 17 mm from bottom edge
- Port labels: "IN" and "OUT"
- Port numbering: 1, 2, 3, 4, 5, 6, 7, 8

Labels and Dimensions:

- Full stroke 8
- Throttle stroke 6
- Lockout stroke 2
- 4- $\phi 14 \times 8.6$ counterbore $\phi 9$ holes
- Lock bolt
- Screw in use - BSPT 3/8
- Screw in use - BSPT 3/8

Technical drawing of a rectangular plate with the following dimensions and features:

- Overall width: 104
- Overall height: 70
- Top edge dimensions (from left): 68, 18
- Bottom edge dimensions (from left): 86, 18
- Left edge dimensions (from top): 50, 34, 10
- Right edge dimensions (from top): 16, 34, 9
- Central hole: 2- $\phi 11$
- Top edge features: 4-M8x14, 4- $\phi 14 \times 8.6$ counterbore $\phi 9$ holes
- Left edge features: $\phi 7 \times 8$, IN
- Bottom edge features: OUT
- Bottom edge dimensions (from left): 16, 34, 9
- Bottom edge dimensions (from right): 20, 24
- Bottom edge features: 2-3/8 BSPT

[illegible]

Technical drawing of a 108mm x 180mm plate. The drawing includes the following dimensions and features:

- Overall dimensions: 108mm (height) x 180mm (width).
- Top edge dimensions: 140mm, 118mm, 84mm, 82mm, 74mm, 59mm, 49mm, 41mm.
- Left edge dimensions: 108mm, 78mm, 52mm, 22mm, 115mm.
- Bottom edge dimensions: 160mm, 180mm.
- Internal dimensions: 11mm, 41mm.
- Holes and features:
 - 4- M10x20 holes (top edge).
 - 4- $\phi 7.5 \times 11$ counterbore holes (bottom edge).
 - 4- $\phi 11$ holes (bottom edge).
 - IN (Inlet) and OUT (Outlet) ports.
 - DR (Drain) port.
 - 2- $\phi 14$ holes (bottom edge).
 - 2- 1/2 BSPT (Bottom Spigot Threaded Port) holes (bottom edge).
 - 1- 1/4 BSPT (Bottom Spigot Threaded Port) hole (bottom edge).
 - $\phi 6$ hole (bottom edge).

Technical drawing of a mechanical part showing dimensions: 11, MAX 108, MAX 22, and 27.

Technical drawing of a mechanical part with dimensions:

- MAX 162
- MAX 22
- 37

Hydraulic Operating Fluid Viscosity 32 centistokes

Figure 1 is a line graph showing the relationship between Flow rate (gpm) on the y-axis and Oil temperature (°F) on the x-axis. The y-axis ranges from 0 to 3.1 with major grid lines every 0.25 units. The x-axis ranges from 50 to 158 with major grid lines every 16 units. Three data series are plotted, representing different oil volumes:

- 2 l (top line):** Starts at approximately 2.0 gpm at 50°F and increases slightly to about 2.1 gpm at 158°F.
- 8 l (middle line):** Starts at approximately 0.75 gpm at 50°F and increases slightly to about 0.8 gpm at 158°F.
- 1.5 l (bottom line):** Starts at approximately 0.5 gpm at 50°F and increases slightly to about 0.55 gpm at 158°F.

The legend indicates the oil volumes: ① 2 l, ② 8 l, ③ 1.5 l. The x-axis is labeled "Oil temperature °F" and the y-axis is labeled "Flow rate gpm".

Flow rate gpm

Pressure psi

① 2" ② 8" ③ 1.5"

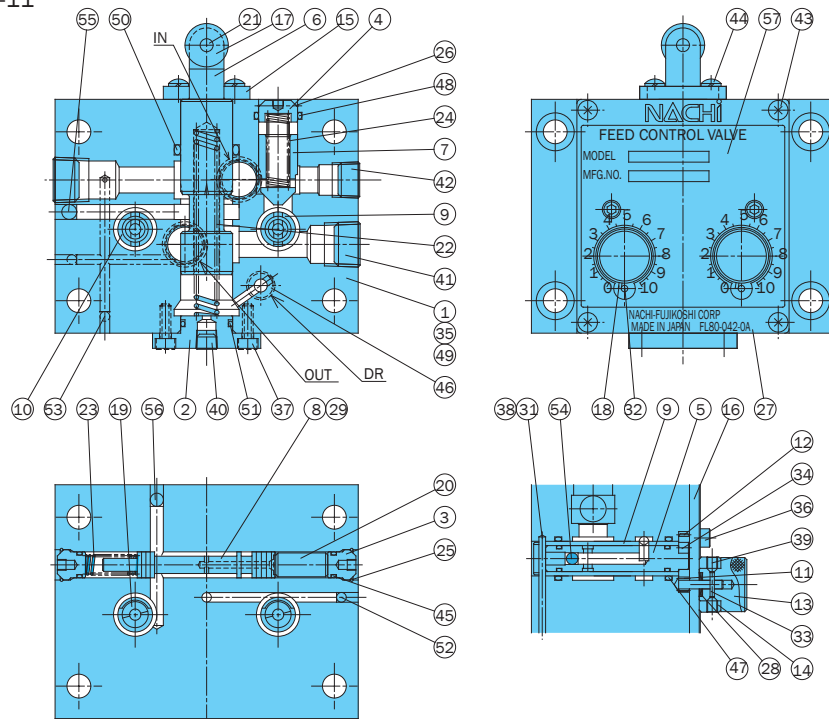
Graph of Flow rate (gpm) vs Scale for three different scales. The y-axis ranges from 0 to 3.1 gpm, and the x-axis ranges from 0 to 10. Three curves are shown: 1 (2.0 l), 2 (2.8 l), and 3 (1.5 l). Curve 2 is the steepest, reaching 2.1 gpm at scale 10. Curve 1 reaches 0.52 gpm at scale 10. Curve 3 reaches 0.4 gpm at scale 10.

Figure 1 is a line graph showing Pressure Loss (psi) on the Y-axis versus Flow rate (gpm) on the X-axis. The Y-axis ranges from 0 to 101 psi in increments of 14.5. The X-axis ranges from 0 to 15.8 gpm in increments of 2.6. There are two main data series: TL-G03 (solid lines) and TL-G04 (dashed lines). Each series has two curves: 'IN-OUT Scale 0' and 'OUT-IN Scale 0 Spool pressed'. The TL-G04 curves are consistently higher than the TL-G03 curves. Arrows 1 and 2 indicate flow directions.

Flow rate (gpm)	TL-G03 IN-OUT Scale 0 (psi)	TL-G03 OUT-IN Scale 0 Spool pressed (psi)	TL-G04 IN-OUT Scale 0 (psi)	TL-G04 OUT-IN Scale 0 Spool pressed (psi)
0	0	0	0	0
2.6	~5	~10	~10	~15
5.2	~10	~20	~20	~30
7.9	~15	~30	~30	~45
10.5	~25	~45	~45	~65
13.2	~40	~65	~65	~90
15.8	~60	~90	~90	~105

Cross-sectional Drawing

TLT-G04-*-11

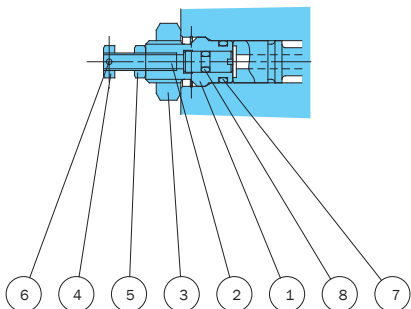


Note: The drawings on the left are TLT cross sections. In the case of TL, there is no knob on the right side.

Anti-jumping mechanism

TL-G03-*-F-11

TL(T)-G04-*-F-11



Part No.	Part Name
1	Retainer
2	Bolt
3	Nut
4	Nut
5	Nut
6	Spring pin
7	O-ring
8	O-ring

Seal Part List

Part No.	Part Name	Part Number	Q'ty
7	O-ring	IA-P9	1
8	O-ring	IA-P3	1

Note: 1. #7 O-ring and #45 O-ring are interchangeable.
2. O-ring 1A-** refers to JIS B2401-1A-**.

Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	20	Spacer	39	Screw
2	Cover	21	Pin	40	Plug
3	Plug	22	Spring	41	Plug
4	Plug	23	Spring	42	Plug
5	Throttle	24	Spring	43	Screw
6	Spool	25	Snap ring	44	Screw
7	Poppet	26	Snap ring	45	O-ring
8	Piston	27	Plate	46	O-ring
9	Sleeve	28	Washer	47	O-ring
10	Sleeve	29	Pin	48	O-ring
11	Gear	30	Pin	49	O-ring
12	Gear	31	Pin	50	O-ring
13	Knob	32	Pin	51	O-ring
14	Ring	33	Pin	52	Ball
15	Stopper	34	Pin	53	Ball
16	Plate	35	Pin	54	Ball
17	Roller	36	Screw	55	Ball
18	Pin	37	Screw	56	Ball
19	Spacer	38	Screw	57	Plate

Seal Part List (Kit Model Number FLS-**(2))

Part No.	Part Name	TL-G03-*-11		TL-G04-*-11		TLT-G04-*-11	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
45	O-ring	IA-P9	4	IA-P9	4	IA-P9	6
46	O-ring	-	-	IA-P10	1	IA-P10	1
47	O-ring	IA-P16	2	IA-P16	2	IA-P16	4
48	O-ring	IA-P14	1	IA-P18	1	IA-P18	1
49	O-ring	IA-P14	2	IA-P20	2	IA-P20	2
50	O-ring	IA-P18	2	IA-P24	1	IA-P24	1
51	O-ring	-	-	IA-P20	1	IA-P20	1

Note: 1. ** in the kit number is used for specification of the valve size. To specify TLT, add 2 to the end.
2. O-ring 1A-** refers to JIS B2401-1A-**.



Right Angle Check Valve In-Line Check Valve

84.5 gpm
3045 psi

Features

The right angle type check valve changes the flow direction of fluid 90 degrees, while the in-line check valve allows only axial direction flow.

The cracking pressures of these valves are fixed, so fluid passes freely in one direction, but is restricted from flowing in the opposite direction.

Specifications

	Model No.		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Cracking Pressure psi	Weight lbs	
	Screw Mounting	Gasket Mounting					T Type	G Type
Right Angle Check Valve	CA-T03-1-20 2 3	CA-G03-1-20 2 3	3/8	3045	10.5	5.8 50 72	2.2	3.9
	CA-T06-1-20 2 3	CA-G06-1-20 2 3	3/4		29	5.8 50 72	4.8	8.5
	CA-T10-1-20 2 3	CA-G10-1-20 2 3	1 1/4		84.5	5.8 50 72	8.8	13.4
In-line Check Valve	CN-T03-1-11 2 3	-	3/8		7.9	5.8 50 72	.8	-
	CN-T06-1-11 2 3		3/4		19.8	5.8 50 72	1.5	
	CN-T10-1-11 2 3		1 1/4		50	5.8 50 72	4.8	

• Handling

- 1 Use the following table for specification when a sub plate is required.
- 2 The following are the bundled mounting bolts.

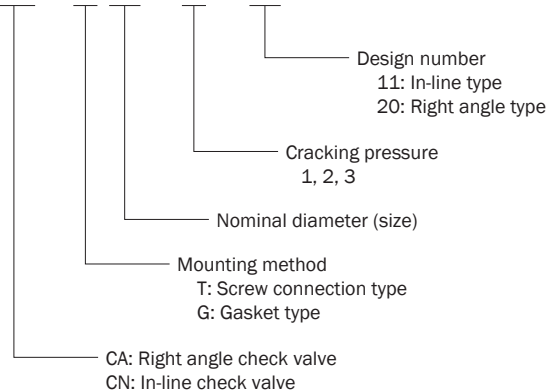
Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MCA-03-20	3/8	10.5	3	CA-G03-*-20
MCA-06-20	3/4	29	7.7	CA-G06-*-20
MCA-10-20	1 1/4	84.5	13.4	CA-G10-*-20

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
CA-G03-*-20	M8 × 45 ℓ	4	14.7 to 18.4
CA-G06-*-20	M16 × 65 ℓ	4	140 to 173
CA-G10-*-20	M20 × 75 ℓ	4	272 to 339

Note: For mounting bolts, use 12T or equivalent.

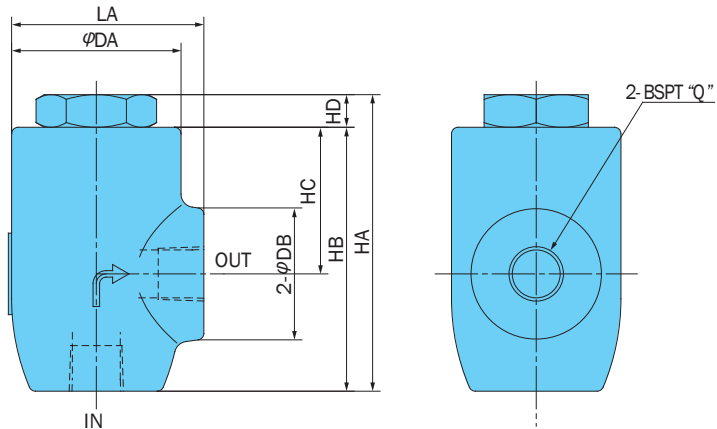
Understanding Model Numbers

CA - T 03 - 1 - 20



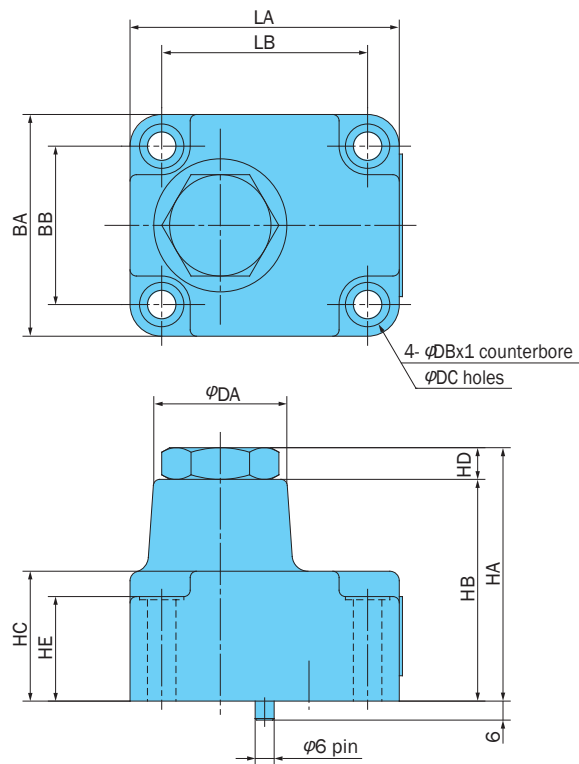
Installation Dimension Drawings

CA-T**-20(Screw Mounting)

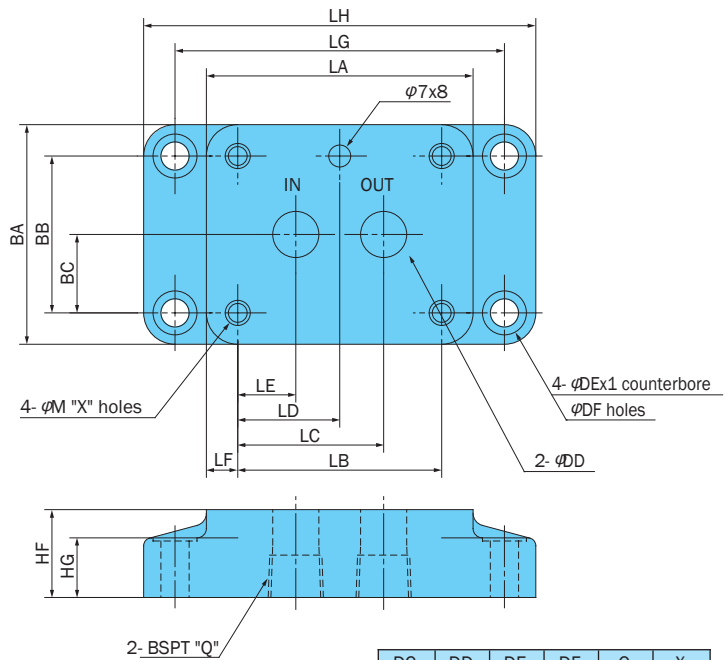


Model No.	LA	HA	HB	HC	HD	DA	DB	Q
CA-T03*-20	59	91	81	45	10	52	40	3/8
CA-T06*-20	72	106	96	55	10	60	45	3/4
CA-T10*-20	96	139	127	70	12	80	62	1 1/4

CA-G**-20(Gasket Mounting)



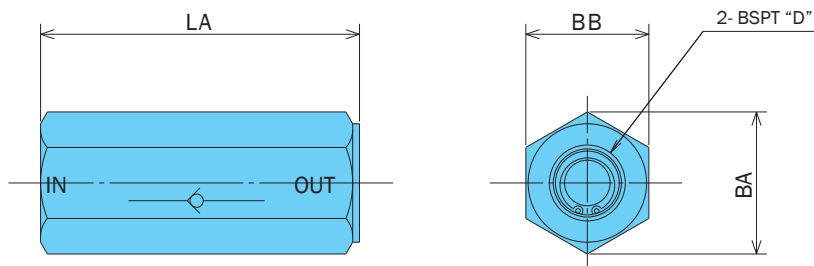
Sub Plate MCA**-20



DC	DD	DE	DF	Q	X
9	14.7	14	9	3/8	8
17	23	20	14	3/4	16
22	30	20	14	1 1/4	20

Model No.	LA	LB	LC	LD	LE	LF	LG	LH	BA	BB	BC	HA	HB	HC	HD	HE	HF	HG	DA	DB
CA-G03*-20	86	65	46.5	32.5	18.5	10.5	105	125	71	50	25	80	70	41	10	33	28	19	42	14
CA-G06*-20	117	81	68.2	40.5	22.2	18	140	172	101	65	32.5	98	88	58	10	43	31	19	52	26
CA-G10*-20	133	92	71.4	46	20.6	20.5	152	187	133	92	46	119	107	65	12	46	40	28	68	32

CN-T**-11(Screw Mounting)



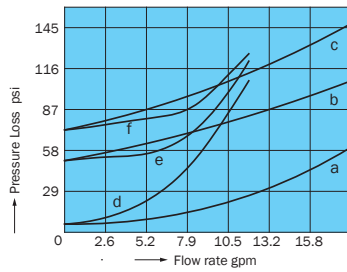
Model No.	LA	BA	BB	D
CN-T03*-11	70	31.2	27	3/8
CN-T06*-11	95	43.9	38	3/4
CN-T10*-11	130	69.3	60	1 1/4

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

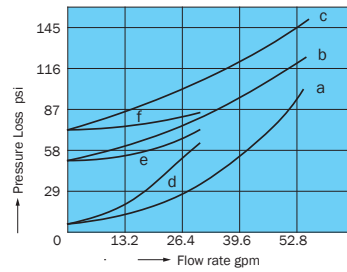
CA-*03 CN-T03



Applicable Valve Type

- a. CA-*03-1-20
- b. CA-*03-2-20
- c. CA-*03-3-20
- d. CN-T03-1-11
- e. CN-T03-2-11
- f. CN-T03-3-11

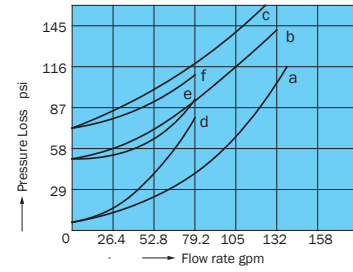
CA-*06 CN-T06



Applicable Valve Type

- a. CA-*06-1-20
- b. CA-*06-2-20
- c. CA-*06-3-20
- d. CN-T06-1-11
- e. CN-T06-2-11
- f. CN-T06-3-11

CA-*10 CN-T10

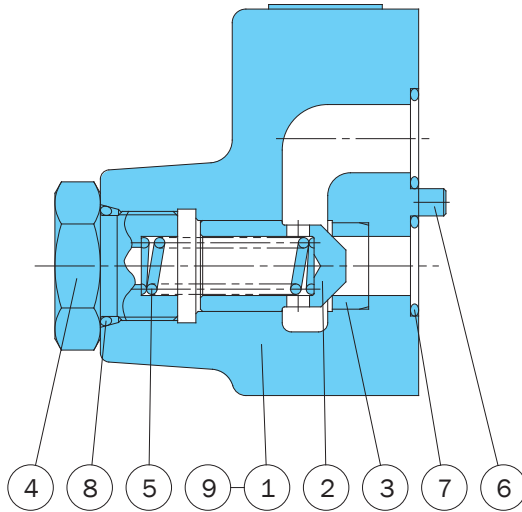


Applicable Valve Type

- a. CA-*10-1-20
- b. CA-*10-2-20
- c. CA-*10-3-20
- d. CN-T10-1-11
- e. CN-T10-2-11
- f. CN-T10-3-11

Cross-sectional Drawing

CA-G**-*-20



Part No.	Part Name
1	Body
2	Poppet
3	Seat
4	Plug
5	Spring
6	Pin
7	O-ring
8	O-ring
9	Nameplate

Seal Part List (Kit Model Number DAS-***)

Part No.	Part Name	Type/Part Number			Q'ty
		CA-G03	CA-G06	CA-G10	
7	O-ring	1B-P18	1B-G30	1B-G40	2
8	O-ring	1B-P22	1B-P30	1B-P42	1

Note: O-ring 1B-** refers to JIS B2401-1B-**.

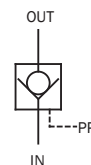
*** in the kit number is used for specification of the valve size (G03, G06, G10, etc.)

Pilot Check Valve

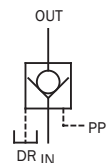
84.5 gpm
3045 psi



Normal form



External drain type



Features

Normally, fluid is allowed to flow in a single direction, just as with a standard check valve. Reverse flow can be enabled,

however, when the check valve is pushed upwards by external pilot pressure. Very compact configuration.

Specifications

Model No		Nominal Diameter (Size)	Maximum Working Pressure psi	Maximum Flow Rate gpm	Cracking Pressure psi	Weight lbs		Area Ratio		
Screw Mounting	Gasket Mounting					T Type	G Type	Pilot Piston	Valve	Small Valve
CP-T03-1-*-20 2	CP-G03-1-*-20 2	3/8	3045	10.5	29 72.5	8.3 (10.3)	9.4 (11.4)	1	0.35	0.05
CP-T06-1-*-20 2	CP-G06-1-*-20 2	3/4		29.0	29 72.5	15.4 (18)	14.5 (17.1)	1	0.37	0.03
CP-T10-1-*-20 2	CP-G10-1-*-20 2	1 1/4		84.5	29 72.5	26.4 (31.5)	27.5 (32.6)	1	0.36	0.03

Note: Weight values in parentheses are for the external drain type.

• Handling

- The following explains how to use the external drain. Be sure to always use the external drain type when back pressure is applied to fluid outlet port side A during reverse flow as in the circuit illustrated below.

- Minimum pilot pressure is altered by input side B pressure during reverse flow. Because of this, operate the valve so pressure is at least twice as high as the required pilot pressure obtained using the minimum pilot pressure characteristics.

- Use the following table for specification when a sub plate is required.

Model No.	Pipe Diameter	Recommended Flow Rate gpm	Weight lbs	Applicable Valve Type
MCP-03-20	3/8	10.5	2.4	CP-G03-*-20
MCP-06-20	3/4	29	3.7	CP-G06-*-20
MCP-10-20	1 1/4	84.5	7.9	CP-G10-*-20

- The following are the bundled mounting bolts.

Model No.	Bolt Dimensions	Q'ty	Tightening Torque ft lbs
CP -G03-*-20	M8 × 45 ℓ	4	14.7 to 18.4
-G06-	M10 × 55 ℓ	4	33 to 40.5
-G10-	M10 × 65 ℓ	6	33 to 40.5

Note: For mounting bolts, use 12T or equivalent.

Understanding Model Numbers

CP - G 03 - 1 - B - 20

Design number

Auxiliary symbol

None: Standard

B: External drain type

F: With anti-shock mechanism (decompression type)

BF: With external drain, with shock-resistant mechanism

Cracking pressure
1, 2

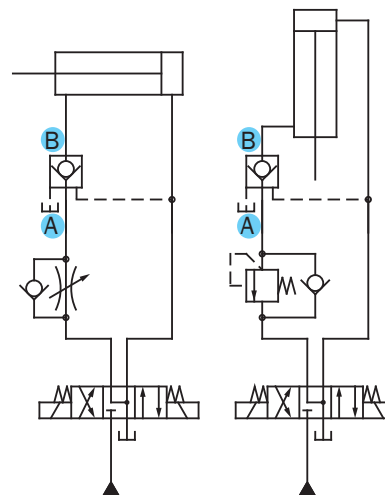
Nominal diameter (size)

Mounting method

T: Screw connection type

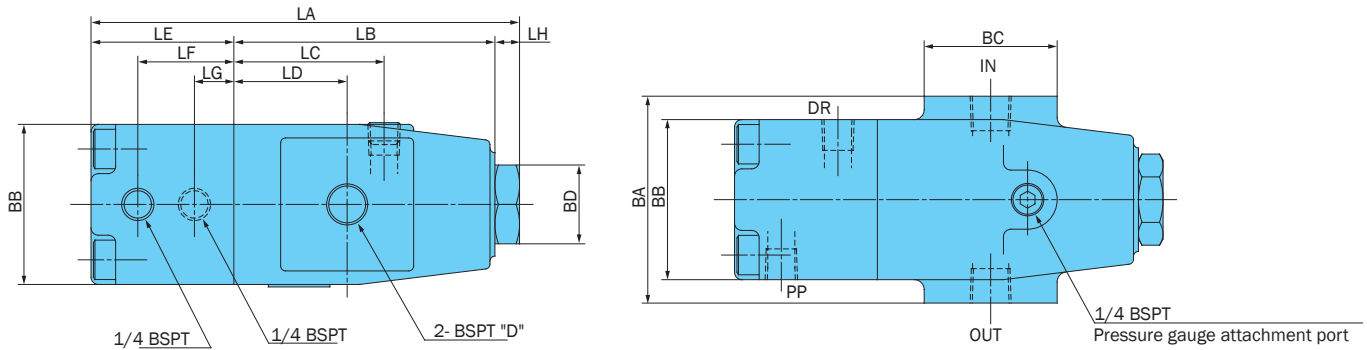
G: Gasket type

Pilot check valve



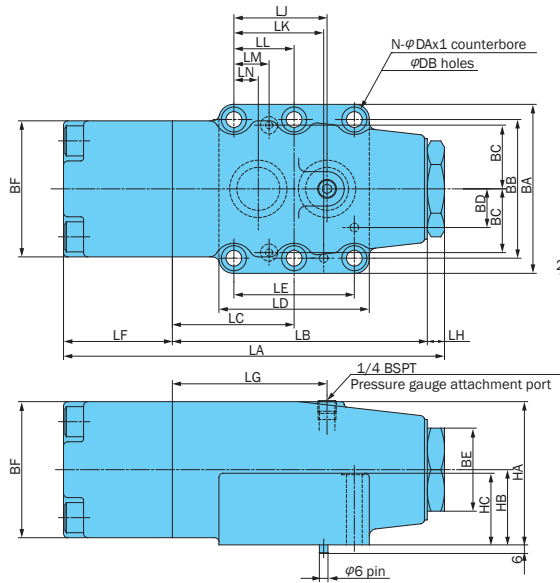
Installation Dimension Drawings

CP-T**-**-20 (Screw Mounting)

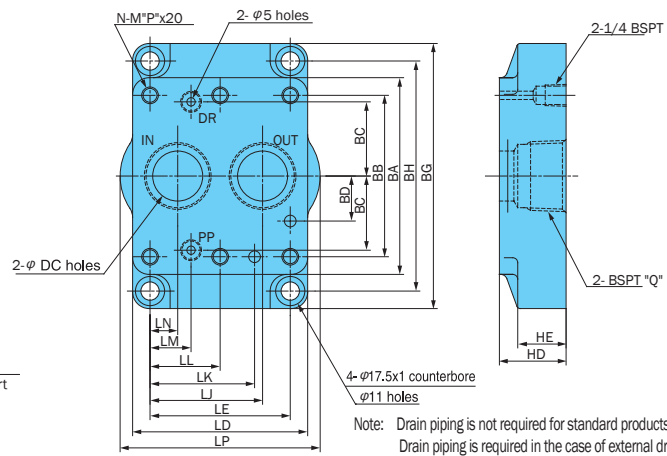


Model No.	LA	LB	LC	LD	LE	LF	LG	LH	BA	BB	BC	BD	D
CP-T03-*(F)-20	146	106	61	46	30	15	-	10	84	65	54	32	3/8
CP-T03-*(B(F))-20	174				58	39	16						
CP-T06-*(F)-20	180	140	85	66	30	15	-	10	122	76	64	41	3/4
CP-T06-*(B(F))-20	212				62	43	16						
CP-T10-*(F)-20	225	178	108	85	35	15	-	12	150	95	85	58	1 1/4
CP-T10-*(B(F))-20	266				76	57	16						

CP-G**-**-20 (Gasket Mounting)



Sub Plate MCP**-**-20



BH	HA	HB	HC	HD	HE	DA	DB	DC	N	P	Q
106	68	35.5	33	30	19	14	9	14.7	4	8	3/8
124	79	41	38	30	19	17.5	11	22	4	10	3/4
138	100	52.5	50	40	29	17.5	11	30	6	10	1 1/4

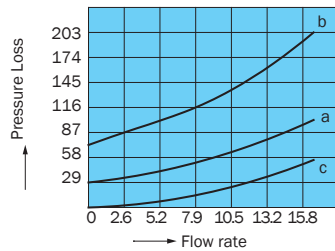
Model No.	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LM	LN	LP	BA	BB	BC	BD	BE	BF	BG
CP-G03-*(F)-20	146	106	51	64	44	30	61	10	37	-	-	16	7	-	82	64	23	18	32	65	126
CP-G03-*(B(F))-20	174					58															
CP-G06-*(F)-20	180	140	66	83	60.3	30	85	10	49.2	44.5	-	20.6	11.1	-	102	79.4	33.3	-	41	76	146
CP-G06-*(B(F))-20	212					62															
CP-G10-*(F)-20	225	178	85	105	84.1	35	108	12	67.5	62.7	42.05	24.6	16.6	120	118	96.8	44.5	-	58	95	159
CP-G10-*(B(F))-20	266					76															

Performance Curves

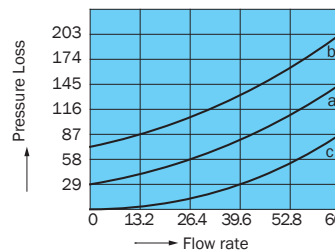
Hydraulic Operating Fluid Viscosity 32 centistokes

Pressure Loss Characteristics

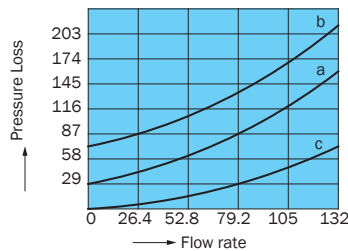
- CP-*03 Applicable Valve Type
 a. CP-*03-1-*20 Free Flow
 b. CP-*03-2-*20 "
 c. CP-*03-*-*20 Reverse Flow



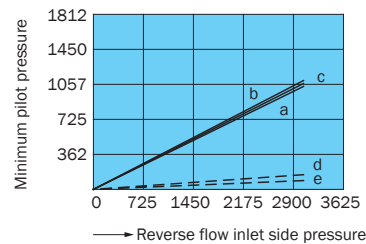
- CP-*06 Applicable Valve Type
 a. CP-*06-1-*20 Free Flow
 b. CP-*06-2-*20 "
 c. CP-*06-*-*20 Reverse Flow



- CP-*10 Applicable Valve Type
 a. CP-*10-1-*20 Free Flow
 b. CP-*10-2-*20 "
 c. CP-*10-*-*20 Reverse Flow



Minimum Pilot Pressure Characteristics



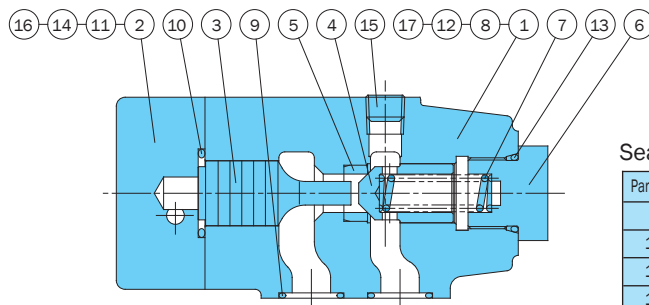
Applicable Valve

Model No.	Valve Open	Small Valve Open
CP-*03	a	d
CP-*06	b	e
CP-*10	c	e

Cross-sectional Drawing

Note: O-ring 1B-** refers to JIS B2401-1B-**.

CP-G**-*20



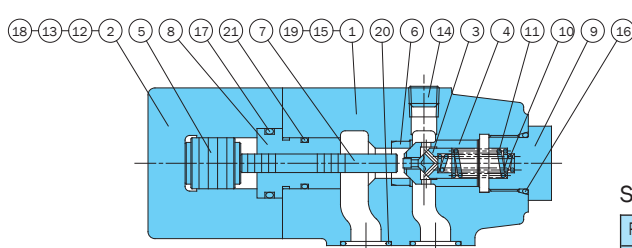
Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	7	Spring	13	O-ring
2	Cover	8	Pin	14	Screw
3	Piston	9	O-ring	15	Plug
4	Poppet	10	O-ring	16	Plug
5	Seat	11	O-ring	17	Plate
6	Plug	12	O-ring		

Seal Part List (Kit Model Number DPS-***)

Part No.	Part Name	CP-G03-*20	CP-G06-*20	CP-G10-*20	Q'ty
9	O-ring	1B-P18	1B-G25	1B-G35	2
10	O-ring	1B-G25	1B-G40	1B-G55	1
11	O-ring	1B-P7	1B-P9	1B-P9	2
12	O-ring	1B-P9	1B-P9	1B-P9	2
13	O-ring	1B-P22	1B-P30	1B-P42	1

***in the kit number is used for specification of the valve size.

CP-G**-*BF20



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	9	Plug	17	O-ring
2	Cover	10	Spring	18	O-ring
3	Poppet	11	Spring	19	O-ring
4	Poppet	12	Screw	20	O-ring
5	Piston	13	Plug	21	O-ring
6	Seat	14	Plug	22	Plate
7	Rod	15	Pin		
8	Bushing	16	O-ring		

Seal Part List (Kit Model Number DPS-***R)

Part No.	Part Name	CP-G03-*BF20	CP-G06-*BF20	CP-G10-*BF20	Q'ty
16	O-ring	1B-P22	1B-P30	1B-P42	1
17	O-ring	1B-G25	1B-G40	1B-G55	1
18	O-ring	1B-P7	1B-P9	1B-P9	2
19	O-ring	1B-P9	1B-P9	1B-P9	2
20	O-ring	1B-P18	1B-G25	1B-G35	2
21	O-ring	1B-P18	1B-P30	1B-G45	1

***in the kit number is used for specification of the valve size.



Gauge Cock

5075 psi

Features

Ultra-compact configuration requires minimal installation space. Intelligent design packs plenty of function into a simple configuration.

Maximum operating pressure of 5075 psi allows operation across a wide range.

Specifications

Model No.		G "A" (Nominal Dimension)	B mm	C mm	Maximum Working Pressure psi	Weight lbs
Float Type	Flange Type					
K2-T02-11	K2-F02-11	G1/4 (BSPP)	10	19	3045	.77
K2-T03-10	K2-F03-10	G3/8 (BSPP)	16	23	5075	
K2-T04-10	K2-F04-10	G1/2 (BSPP)	16	26		

Understanding Model Numbers

K2 - T 02 - 10(11)

Design number
11: For K2-T02, F02

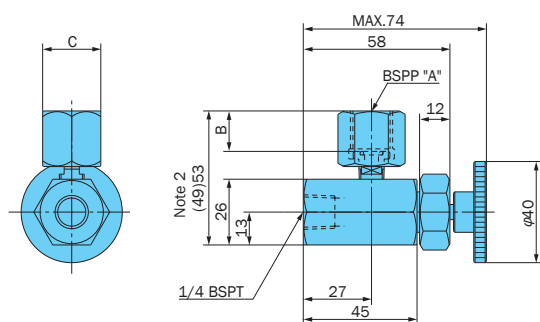
Nominal diameter (size)

Mounting method
T: Float type F: Flange type

Gauge cock K2: Rotatable pressure gauge attachment.

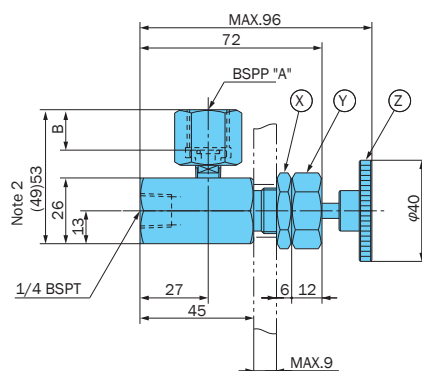
Installation Dimension Drawings

K2-T**-10 (11)



Note: 1. Maximum iron plate thickness: 9t; Mounting Bolt Hole Diameter: $\phi 20$
When mounted to panel
Loosen the X lock nut and Y cap nut, and pull out the Z adjusting screw. To return to its original position, reverse this process.
2. Dimensions in parentheses are for the 02 size.

K2-F**-10 (11)



3. For information about G "A" and B, see the specifications. The O-ring shown below is used as a pressure gauge seal beneath screw G.
G1/4 JIS B2401-1B-P5
G3/8 JIS B2401-1B-P6
G1/2 JIS B2401-1B-P9



Flange Type Check Valve / Throttle Valve Pilot Operated Check Valve

33 to 343 gpm
3625 psi

Features

This series provides high capacity and flange connection, as well as compliance with new standards.

Measurable higher pressure and higher capacity than previous models.

Specifications

Contact your agent for more information about mounting methods, etc.

	Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Rated flow rate gpm	Cracking pressure psi	Weight lbs
	Flange Mounting					
Right-Angle Check Valve	CA-F06-1-30 2 3	3/4	3625	33	5.8 50 72	8.3
	CA-F10-1-30 2 3	1 1/4		79	5.8 50 72	16.5
	CA-F16-1-30 2 3	2		158	5.8 50 72	44.3
	CA-F24-1-30 2 3	3		343	5.8 50 72	139
Pilot Operated Check Valve	CP-F06-1*-30 2	3/4	3625	33	29 72	14.1
	CP-F10-1*-30 2	1 1/4		66	29 72	25.3
	CP-F16-1*-30 2	2		158	29 72	70.5

	Model No.	Nominal Diameter (Size)	Maximum Working Pressure psi	Rated flow rate gpm	Cracking pressure psi	Weight lbs
	Flange Mounting					
Slot Valve	(C)FR-F06-30	3/4	3625	22.4	14.5	10.3
	(C)FR-F10-30	1 1/4		60.7		24.2
	(C)FR-F16-30	2		132		47.4



Vertical Power Unit

NACHI Standard Vertical Hydraulic Power Units offer standard systems complete with:

- Reservoir, Pump, Pump Motor Adaptor, Electric Motor, Flexible Coupling, Pressure Control Relief Valve for Gear Pumps.
- Remote Compensator for Pressure

Features

Noise Levels:

Noise levels are well below the 90db (a) specified under the WALSH-HEALY ACT.

Standard Units:

Standard units can be ordered using the simple model codes. Optional selections can be obtained with the same codes. Custom units can be manufactured using standard unit components.

Capacities:

Reservoir capacities available from 5 gallon to 30 gallons (specials upon request). Reservoir capacities vs. pump

Compensated Piston or Vane pumps.

- Pressure Gauge w/Shut Off, Air Breather/Filter Combination, Sight Gauge w/Thermometer, Drain Plug, Pressure and Return Connections, Suction Strainer w/3PSI By-Pass (except on 5 gallon) and check valve.

flow can vary depending on specific applications. Generally a 2:1 reservoir to pump ratio is acceptable. Pressures at specific pump flow will determine the hydraulic horsepower required. Refer to "TABLE A", below.

Quality:

Quality components and high manufacturing standards make these factory assembled units fit virtually any application. The wide variety of pumps, motors, reservoirs, manifolds and choice of options enable you to match

your application requirements for optimum productivity and Cost-Effective operation.

Reliability:

Strict control of accepted hydraulic assembly practices, testing procedures, plus high quality components assure successful operation in a variety of industrial applications.

Low Cost:

Production line assembling, combined with minimal piping offers compact systems at low cost.

Operating Instructions

Fill reservoir with new premium grade hydraulic fluid (Mobil DTE26 or equal). It is highly recommended to filter all hydraulic fluid before filling the reservoir. Fluid level gauge will indicate proper level. Electric motor wiring must conform to the motor wiring nameplate. Jog motor to check proper rotation, indicated by the rotation arrow on the unit. Incorrect rotation can be reversed by interchanging any two lines on a three phase motor. Relief or compensator control valve should be set at lowest pressure setting for startup. Decrease pressure by turning the adjusting screw counterclockwise. If pump does not prime, vent pump pressure line to atmosphere and into an open container to establish flow. After pump has primed, reconnect pressure line and run at lowest pressure setting to purge air from the system piping. Recheck the fluid level in the reservoir, as some fluid could be lost in the filling of piping and components. Most foreign material and contaminants will be trapped by the return line filter after a few hours of operation. The return line filter element should be replaced when gauge indicates. Most industrial applications should operate at a temperature below 140 degrees fahrenheit. At higher temperatures, problems are often experienced in maintaining reliable and consistent hydraulic control. Component service life is also reduced and hydraulic oil deteriorates. If the system tends to operate at an elevated temperature level, steps must be taken to reduce this elevated operating temperature.

Once a year or every 4000 hours of operation, the reservoir's air breather filter and the suction strainer should be replaced. The reservoir oil should be drained, and the reservoir cleaned. Dusty or contaminated environments may require more frequent cleaning and maintenance.

Pressures shown will load AC electric motors to their nameplate horsepower rating. Pressures shown should not be exceeded when system must be started at full pressure. Momentary pressures higher than those listed can be applied if sufficient operating time at lower pump

pressure or lower motor load during the cycle will provide for motor cooling. Dead head pressure loading would require full motor HP using a constant displacement gear pump. Dead head pressure with a pressure compensated Piston or Vane pump would require a small percentage of the full flow loading, consequently generating less heat. Actual HP requirements depend on the duty cycle and operating conditions. This is many times best determined by actual testing by the customer.

The components and piping are designed for the use of petroleum base fluids.

THEORETICAL PRESSURE TABLE (PSI)

Table "A"

GPM	HORSEPOWER REQUIREMENTS ▲									
	1	1.5	2	3	5	7.5	10	15	20	
GEAR PUMPS										
1.6	1071	1607	2143	*						
2.4	714	1071	1428	2143	*					
3.0	571	857	1143	1714	2857	*				
5.2		494	659	989	1648	2472	*			
7.0		367	490	735	1224	1836	2449	*		
9.0			381	571	952	1428	1904	2857	*	
10.4				494	824	1236	1648	2472	*	
12.3				418	697	1045	1393	2090	*	
PISTON PUMPS										
3.8	451	677	902	1353	2255	*				
7.8	220	330	439	659	1099	1648	2197	*		
10.5	163	245	326	490	816	1224	1632	*		
VANE PUMPS										
7.9		325	434	651	1085	1627	*			
10.5		245	325	490	816	*				
14.2			241	362	604	905	1207	1811	*	

▲ 5 Horsepower and larger can only be used on 10 gallon and larger reservoirs.

* Using this horsepower could cause pump to exceed maximum rated pressure

THEORETICAL PRESSURE TABLE (PSI)

Table "B"

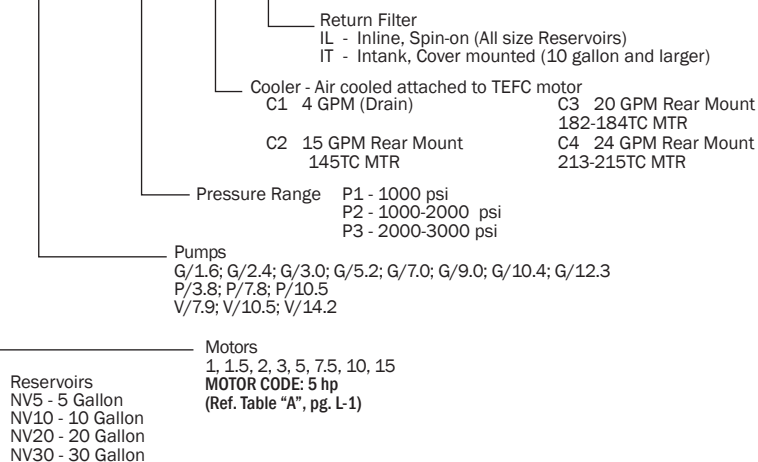
ORDERING CODE	THEORETICAL FLOW (GPM)	DISPLACEMENT CU IN/REV
GEAR PUMPS		
G/1.6	1.63	0.21
G/2.4	2.41	0.31
G/3.0	3.03	0.39
G/5.2	5.22	0.67
G/7.0	7.09	0.91
G/9.0	9.03	1.16
G/10.4	10.44	1.34
G/12.3	12.38	1.59

ORDERING CODE	THEORETICAL FLOW (GPM)	DISPLACEMENT CU IN/REV
PISTON PUMPS		
P/3.8	3.80	0.49
P/7.8	7.80	1.01
P/10.5	10.50	1.34
VANE PUMPS		
V/7.9	7.90	1.02
V/10.5	10.50	1.34
V/14.2	14.20	1.83

Reservoir Code

NV20 - 5 - G/5.2 - P1~3 - N - IL

How to Order



NOTE: Piston and Vane Pumps must use 10 gallon or larger reservoir

Replacement Items:

FILTER ELEMENT (INLINE)	#72-001
FILTER ELEMENT (INTANK)	#72-015
AIR BREATHING FILTER	#42-001
SUCTION STRAINER (5GPM)	#70-001
SUCTION STRAINER (8GPM)	#70-002
SUCTION STRAINER (10GPM)	#70-003
SUCTION STRAINER (20GPM)	#70-004

Motor Enclosure

Totally enclosed motors (TEFC) are intended for use where moisture, dirt, and/or corrosive materials are present in indoor or outdoor locations.

Motor Voltage

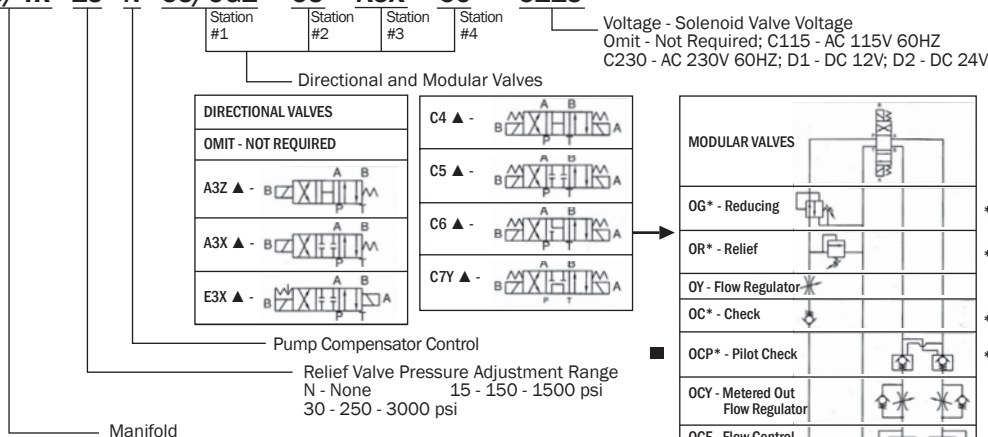
3 PHASE - 208-230/460V, 60HZ
 (Special voltages upon request)

*Combination of reservoir and pumps are generally a 2:1 reservoir to pump flow ratio. Smaller pump and motor combinations may be mounted on larger reservoirs.

Manifold Code

D05/4R - 15 - N - C5/OG1 - C5 - A3X - C6 - C115

How to Order



EASY WIRING: Directional control valves come standard with a large waterproof wiring box with terminal screws, solenoid indicator light(s) and (2) PF 1/2 conduit connections.

Pressure Adjusting Range
 C: 21 - 500 PSI (D03 & D05 ONLY)
 1: 114 - 1000 PSI
 2: 500 - 2286 PSI

Pressure Adjusting Range
 1: 0 - 1000 PSI
 3: 500 - 3000 PSI

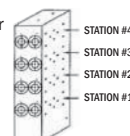
Cracking Pressure
 1: 5.7 PSI
 2: 50 PSI
 3: 71 PSI

Cracking Pressure
 1: 29 PSI
 2: 71 PSI

Station #1 is closest to reservoir on a multiple station manifold

▲ ADD "F" FOR OPTIONAL HYDRAULIC SHOCKLESS SOLENOID

■ "D03" SIZE ONLY



ALUMINUM MANIFOLD BLOCKS

D03/*R - D03 Directional valve manifold with relief valve.
 (*Number of valve stations required, 4 maximum. Consult factory if more stations are required.)



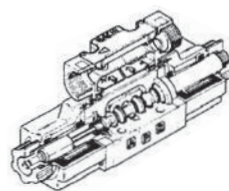
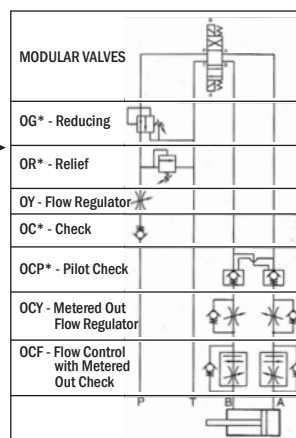
PB3R - Pressure block (#8SAE pressure connection) with relief valve for gear pumps.
 PB3C - Pressure block (#8SAE pressure connection) with compensator control for piston and vane pumps.



D05/*R - D05/(D02) Directional valve manifold with relief valve.
 (*Number of valve stations required, 4 maximum. Consult factory if more stations are required. 8 gallon and larger reservoir only)



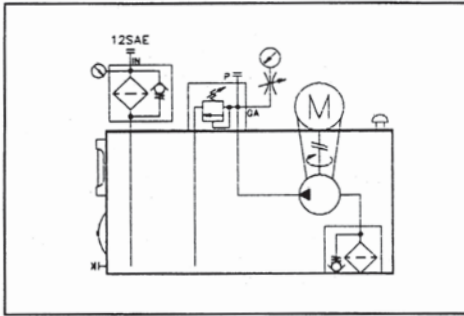
PB5R - Pressure block (#12SAE pressure connection) with relief valve for gear pumps. (8 gallons and larger reservoir only)
 PB5C - Pressure block (#12SAE pressure connection) with compensator control for piston and vane pumps. (8 gallons and larger reservoir only)



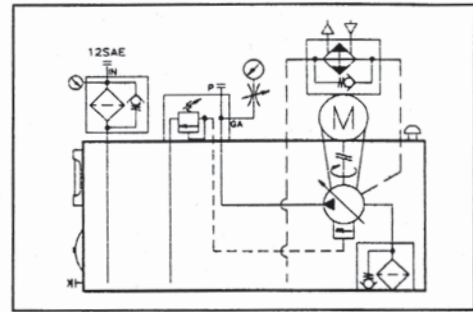
Note: "A" and "B" port connections on "D03" and "D05" manifolds are #8SAE (3/4 - 16 UNF).

Consult factory for additional configurations.

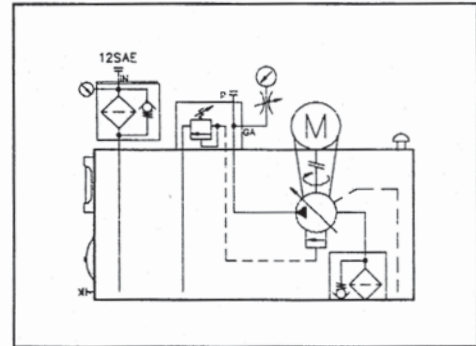
Schematics



Gear Pump Unit
with Manifold Option "PB3R" (8SAE)
or "PB5R" (12SAE)



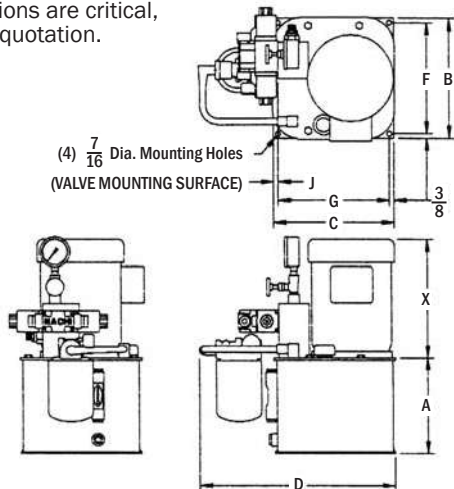
Piston/Vane Pump Unit
with Case Drain Air Cooler with By-Pass



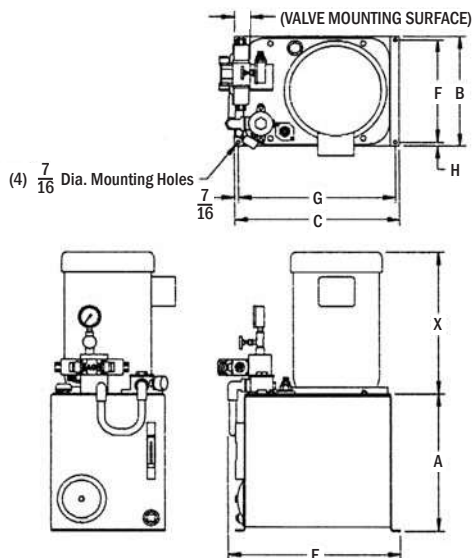
Piston/Vane Pump Unit
with Manifold Option "PB3C" (8SAE)
or "PB5C" (12SAE)

Dimensional Drawings

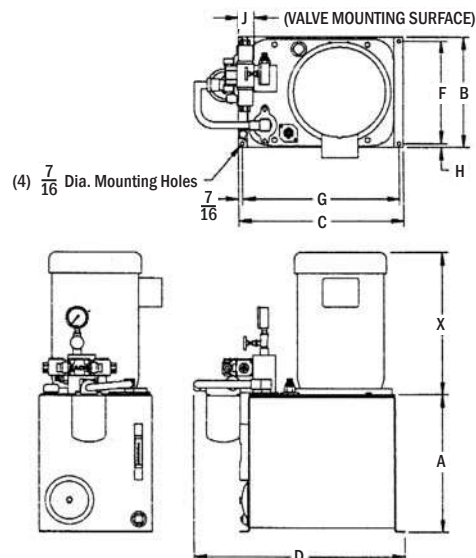
Measurements are approximate.
Where dimensions are critical,
obtain special quotation.



NV5 Gallon w/Inline Filter

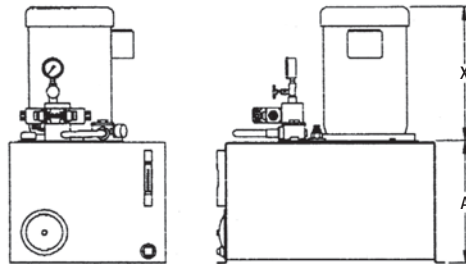
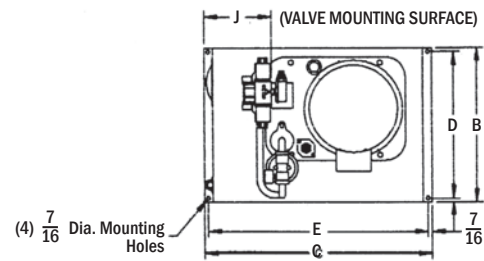
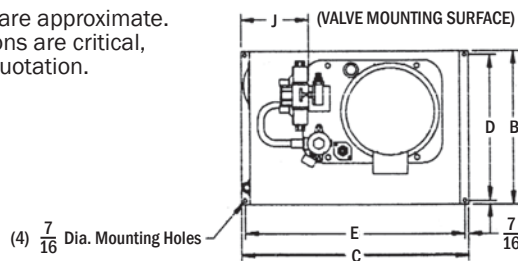


NV10 Gallon w/Intank Filter

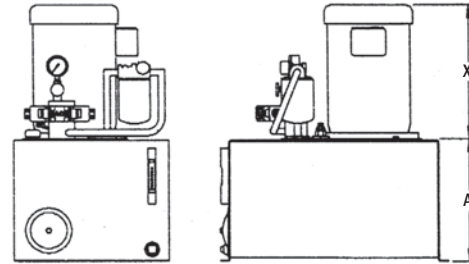


NV10 Gallon w/Inline Filter

Measurements are approximate.
Where dimensions are critical,
obtain special quotation.



NV20 Thru NV30 Gallon w/Intank Filter

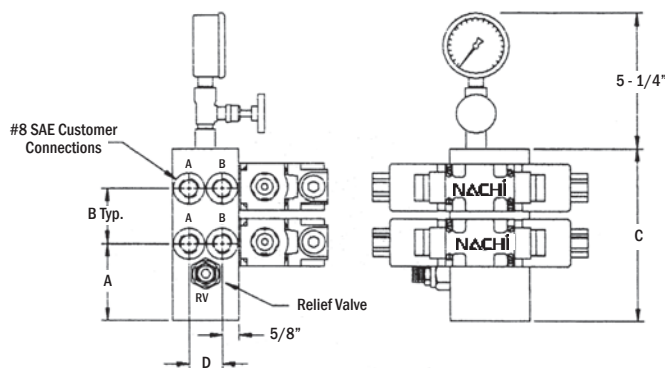


NV20 Thru NV30 Gallon w/Inline Filter

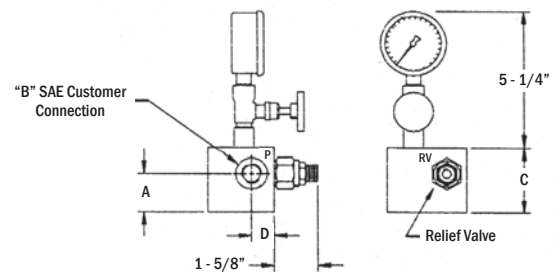
RESERVOIR	UNIT DIMENSIONS (INCHES)								
	A	B	C	D	E	F	G	H	J
NV5	10"	12.5"	14.5"	-	-	10"	13.5"	1.25"	.05"
NV10	19.7"	16.5"	19"	-	-	14"	13.5"	1.25"	.075"
NV20	23.7"	16.5"	19"	-	-	14"	17.5"	1.25"	.075"
NV30	35.7"	16.5"	19"	-	-	14"	17.5"	1.25"	.075"

HORSEPOWER	"X" (TEFC)
1	10 5/8
1.5	10 5/8
2	11 5/8
3	12 1/4
5	14 1/2
7.5	16 1/4
10	18 1/8
15	20 3/8

Manifold Dimensions



Manifold Option "D03/2R" shown

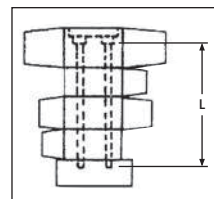


Manifold Option "PB3R" shown

MANIFOLD OPTIONS	MANIFOLD DIMENSION (INCHES)			
	A	B	C	D
PB3*	1.50	8	2.50	.84
PB5*	1.63	12	2.75	1.13

MANIFOLD OPTIONS	MANIFOLD DIMENSION (INCHES)			
	A	B	C	D
D03/1"	1.06"	2.13"	2.13"	1.75"
D03/2"	1.06"	2.13"	4.25"	1.75"
D03/3"	1.06"	2.13"	6.38"	1.75"
D03/4"	1.06"	2.13"	8.50"	1.75"
D05/1"	1.56"	3.25"	3.25"	2.12"
D05/2"	1.56"	3.25"	6.50"	2.12"
D05/3"	1.56"	3.25"	9.75"	2.12"
D05/4"	1.56"	3.25"	13.0"	2.12"

Optional Component Information - Bolt Kit Length



Bolt Length for D03	
Valve - 10 - 24 x 1 3/4	
Valve & module - 10 - 24 x 3 1/4	
Valve & 2 modules - 10 - 24 x 5	
Bolt Length for D05	
Valve - 1/4 - 20 x 2 3/4	
Valve & module - 1/4 - 20 x 5	
Valve & 2 modules - 1/4 - 20 x 7	

Note:

1. Bolt kits to be ordered separately when using modulators.
2. Bolt kits are furnished with directional valves when no modulators are required.
3. All "D03" modulators are 40mm thick.
4. "D05" modulators are 55mm thick.



Horizontal Power Unit

NACHI Standard Horizontal Hydraulic Power Units offer standard systems complete with:

- Reservoir, Pump, Pump Motor Adaptor, Electric Motor, Motor Channel, Flexible Coupling, Pressure Control Relief Valve for

Gear Pumps.

- Pressure Compensated Piston or Vane pumps.
- Pressure Gauge w/Shut Off, Air Breather/Filter Combination, Sight Gauge w/Thermometer, Drain Plug, Pressure and

Return Connections, Return Line Filter w/By-pass and Dirt Indicator, Suction Strainer w/3PSI By-Pass.

Features

Noise Levels:

Noise levels are well below the 90db (a) specified under the WALSH-HEALY ACT.

Standard Units:

Standard units can be ordered using the simple model codes. Optional selections can be obtained with the same codes. Custom units can be manufactured using standard unit components.

Capacities:

Reservoir capacities available from 10 gallon to 40 gallons. Reservoir capacities vs. pump flow can vary depending on

specific applications. Generally a 2:1 reservoir to pump ratio is acceptable. Pressures at specific pump flow will determine the hydraulic horsepower required. Refer to "TABLE A", below.

Quality:

Quality components and high manufacturing standards from such companies as VESCOR, DAMAN and others, make these factory assembled units fit virtually any application. The wide variety of pumps, motors, reservoirs, manifolds and choice of

options enable you to match your application requirements for optimum productivity and Cost-Effective operation.

Reliability:

Strict control of accepted hydraulic assembly practices, testing procedures, plus high quality components assure successful operation in a variety of industrial applications.

Low Cost:

Production line assembling, combined with minimal piping offers compact systems at low cost.

Operating Instructions

Fill reservoir with new premium grade hydraulic fluid (Mobil DTE26 or equal). It is highly recommended to filter all hydraulic fluid before filling the reservoir. Fluid level gauge will indicate proper level. Electric motor wiring must conform to the motor wiring nameplate. Jog motor to check proper rotation, indicated by the rotation arrow on the unit. Incorrect rotation can be reversed by interchanging any two lines on a three phase motor.

Relief or compensator control valve should be set at lowest pressure setting for startup. Decrease pressure by turning the adjusting screw counterclockwise. If pump does not prime, vent pump pressure line to atmosphere and into an open container to establish flow. After pump has primed, reconnect pressure line and run at lowest pressure setting to purge air from the system piping. Recheck the fluid level in the reservoir, as some fluid could be lost in the filling of piping and components.

Most foreign material and contaminants will be trapped by the return line filter after a few hours of operation. The return line filter element should be replaced when gauge indicates. (See pg. 8 for spare element numbers). Most industrial applications should operate at a temperature below 140 degrees fahrenheit. At higher temperatures, problems are often experienced in maintaining reliable and consistent hydraulic control. Component service life is also reduced and hydraulic oil deteriorates. If the system tends to operate at an elevated temperature level, steps must be taken to reduce this elevated operating temperature.

Once a year or every 4000 hours of operation, the reservoir's air breather filter and the suction strainer should be replaced. The reservoir oil should be drained, and the reservoir cleaned. Dusty or contaminated environments may require more frequent cleaning and maintenance.

Pressures shown will load AC electric motors to their nameplate horsepower rating. Pressures shown should not be exceeded when system must be started at full pressure. Momentary pressures higher than those listed can be applied if sufficient operating time at lower pump

pressure or lower motor load during the cycle will provide for motor cooling. Dead head pressure loading would require full motor HP using a constant displacement gear pump. Dead head pressure with a pressure compensated Piston or Vane pump would require a small percentage of the full flow loading, consequently generating less heat. Actual HP requirements depend on the duty cycle and operating conditions. This is many times best determined by actual testing by the customer.

The components and piping are designed for the use of petroleum base fluids.

PRESSURE TABLE (PSI) AT 1800 RPM
Table "A"

GPM	HORSEPOWER REQUIREMENTS						
	2	3	5	7.5	10	15	20
GEAR PUMPS							
1.6	1821	2732	*				
2.4	1214	1821	*				
3.0	971	1457	2428	*			
5.2	560	841	1401	2101	2802		
7.0	416	624	1041	2101	2802		
9.0	325	486	809	1214	1619		
10.4	280	420	700	1051	1401	2101	2802
12.3	237	355	592	88	1185	1777	2369
PISTON PUMPS							
3.8	767	1150	1917	2876	*		
7.8	374	560	934	1401	1868	*	*
10.5	n/a	416	694	1041	1388	2081	2775
16.6	n/a	n/a	439	658	878	1317	1775
21.5	n/a	n/a	339	508	678	1017	1355
VANE PUMPS							
4.0	728	*					
7.9	369	553	992	1383	1844	*	
10.5	278	416	694	*			
14.2	n/a	309	513	770	1026	1539	*
7.9	n/a	238	396	594	792	*	

* Using this horsepower could cause pump to exceed maximum rated pressure

THEORETICAL PRESSURE TABLE (PSI)

Table "B"

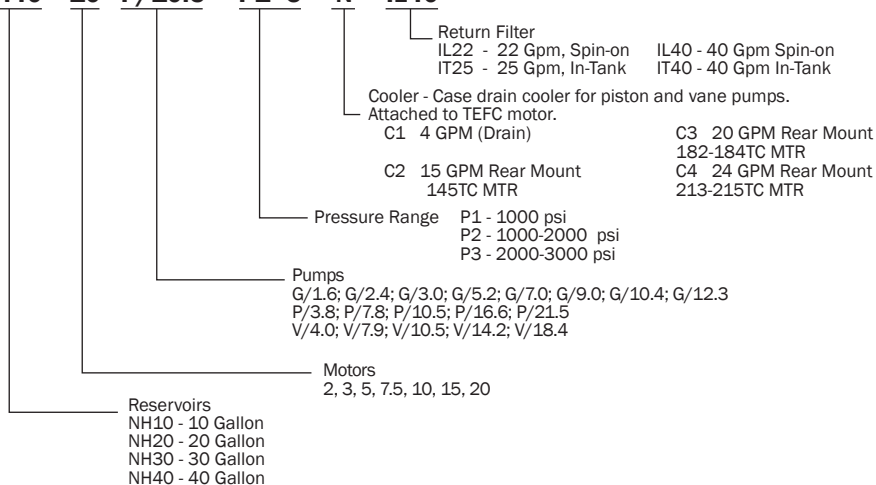
ORDERING CODE	THEORETICAL FLOW (GPM)	DISPLACEMENT CU IN/REV
GEAR PUMPS		
G/1.6	1.63	0.21
G/2.4	2.41	0.31
G/3.0	3.03	0.39
G/5.2	5.22	0.67
G/7.0	7.09	0.91
G/9.0	9.03	1.16
G/10.4	10.44	1.34
G/12.3	12.38	1.59

ORDERING CODE	THEORETICAL FLOW (GPM)	DISPLACEMENT CU IN/REV
PISTON PUMPS		
P/3.8	3.80	0.49
P/7.8	7.80	1.01
P/10.5	10.50	1.34
P/16.6	16.60	2.14
P/21.5	21.50	6.10
VANE PUMPS		
V/4.0	4.00	0.51
V/10.5	7.90	1.02
V/14.2	10.50	1.34
V/14.2	14.20	1.83
V/18.4	18.40	2.38

Reservoir Code

How to Order

NH40 - 10 - P/10.5 - P1~3 - N - IL40



NOTE: Piston and Vane Pumps must use 10 gallon or larger reservoir

Motor Enclosure

Nachi standard horizontal power units come with totally enclosed fan cooled motors (TEFC). These motors are intended for use where moisture, dirt, and/or corrosive materials are present in indoor or outdoor locations.

Motor Voltage

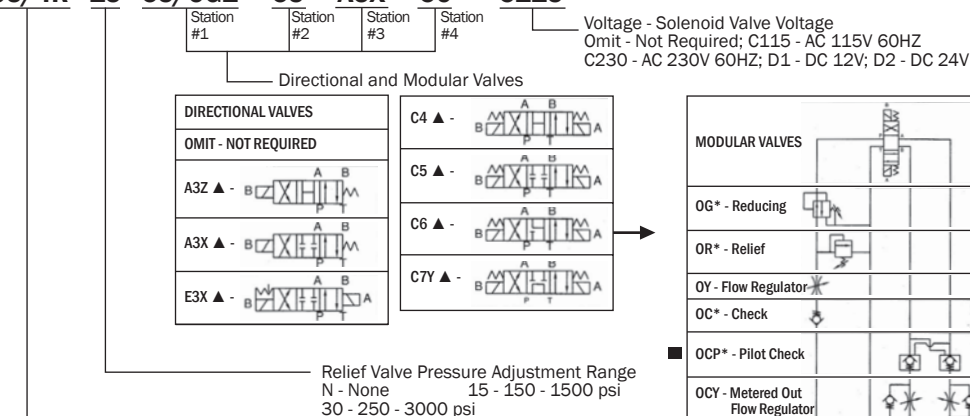
All standard horizontal power units come with 3 PHASE - 208-230/460V, 60HZ (Single phase and special voltages available upon request)

*Combination of reservoir and pumps are generally a 2:1 reservoir to pump flow ratio. Smaller pump and motor combinations may be mounted on larger reservoirs.

Manifold Code

How to Order

D05/4R - 15 - C5/OG1 - C5 - A3X - C6 - C115



EASY WIRING: Directional control valves come standard with a large waterproof wiring box with terminal screws, solenoid indicator light(s) and (2) PF 1/2 conduit connections.

Pressure Adjusting Range
 C: 21 - 500 PSI (D03 & D05 ONLY)
 1: 114 - 1000 PSI
 2: 500 - 2286 PSI

Pressure Adjusting Range
 1: 0 - 1000 PSI
 3: 500 - 3000 PSI

Cracking Pressure
 1: 5.7 PSI
 2: 50 PSI
 3: 71 PSI

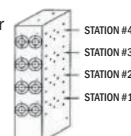
Cracking Pressure
 1: 29 PSI
 2: 71 PSI

Station #1 is closest to reservoir on a multiple station manifold

▲ ADD "F" FOR OPTIONAL HYDRAULIC SHOCKLESS SOLENOID

■ "D03" SIZE ONLY

○ "D03" & "D05" SIZE ONLY



ALUMINUM MANIFOLD BLOCKS

D03/*R - D03 Directional valve manifold with relief valve.
 (*Number of valve stations required, 6 maximum. Consult factory if more stations are required.)

D05/*R - D05 Directional valve manifold with relief valve.
 (*Number of valve stations required, 6 maximum. Consult factory if more stations are required.)

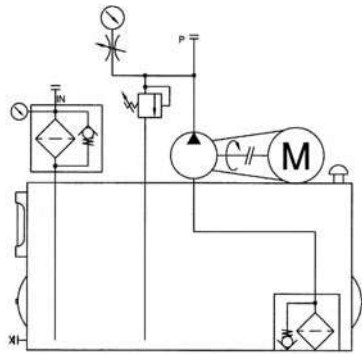
D08/*R - D08 Directional valve manifold with relief valve.
 (*Number of valve stations required, 2 maximum. Consult factory if more stations are required.)

N - No Manifold, Pressure Connection at Pump (Piston and Vane Pumps Only)
 RV1 - No Manifold with 50 - 1000 PSI Relief Valve (Required for Gear Pumps)
 RV2 - No Manifold with 500 - 3000 PSI Relief Valve (Required for Gear Pumps)

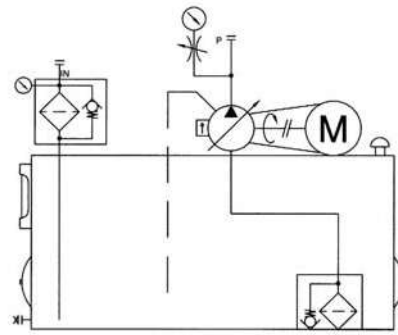
Note: "A" and "B" port connections on "D03" and "D05" manifolds are #8SAE (3/4 - 16 UNF).

Consult factory for additional configurations.

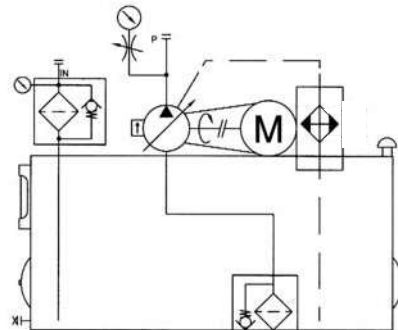
Schematics



Gear Pump Unit
with Manifold Option "RV*"



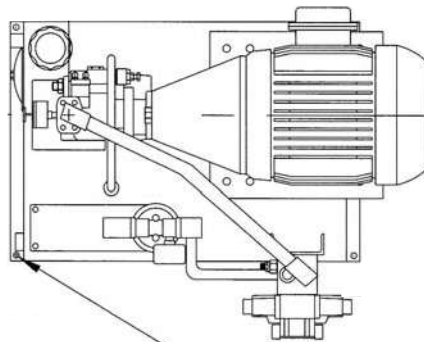
Piston/Vane Pump Unit
with Manifold Option "N"



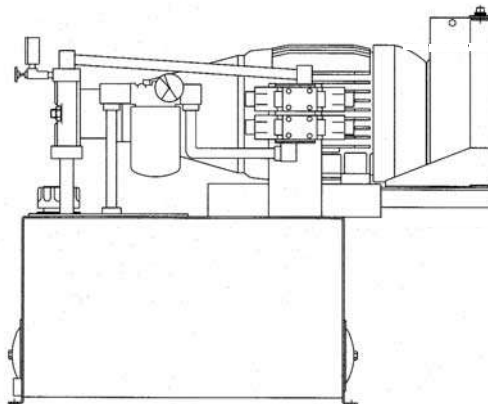
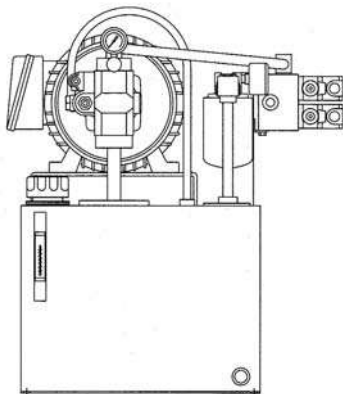
Piston/Vane Pump Unit
with "AO*" Cooler Option

Dimensional Drawings

Measurements are approximate.
Where dimensions are critical,
obtain special quotation.



(4) 7/16" DIA. MOUNTING HOLES



Dimensional Information

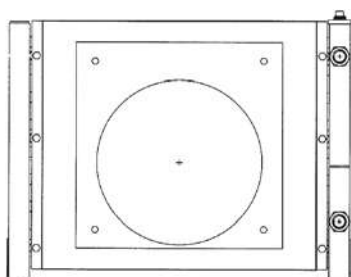
UNIT DIMENSIONAL INFORMATION

NHID	BASIC RESERVOIR DIMENSIONS						
	A	B	C	D	E	F	G
NH10	26	16	9.5	25.2	15	3.38	7
NH20	26	16	15.5	25.2	15	3.38	7
NH30	26	16	21.5	25.2	15	3.38	7
NH40	26	16	27.5	25.2	15	5.38	9.25

NHID	MANIFOLD ASSEMBLY HEIGHT (L DIMENSION)		
	D03	D05	D08
1 Station	12.00	12.00	CONSULT FACTORY
2 Station	12.00	12.00	
3 Station	12.00	12.00	
4 Station	12.00	15.25	
5 Station	14.25	18.50	
6 Station	16.25	21.75	

	MOTOR HORSEPOWER						
	2	3	5	7.5	10	15	20
J	9.95	11.88	11.88	13.50	13.50	16.59	16.59
K	7.04	8.08	8.08	9.31	9.31	10.96	10.96

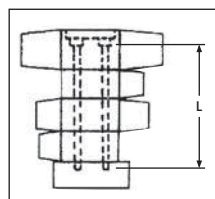
		PUMP/MOTOR ASSEMBLY LENGTH CHART (H DIMENSION)						
		MOTOR HORSEPOWER						
		2	3	5	7.5	10	15	20
AVAILABLE PUMPS	G/1.1	17.58						
	G/1.6	17.68	20.26					
	G/2.4	17.8	20.38					
	G/3.0	17.48	19.62	20.62				
	G/5.2	17.8	19.94	20.94	24.03	25.53		
	G/7.0	17.8	19.94	20.94	24.03	25.53		
	G/9.0	18.06	20.18	21.18	24.27	25.77	28.98	
	G/10.4	18.14	20.25	21.25	24.34	25.84	29.05	30.8
	G/12.3	18.14	20.25	21.25	24.34	25.84	29.05	30.8
	P/3.8	21.64	23.09	24.09	27.75			
	P/7.8	22.84	24.29	25.29	28.95	30.45	33.09	
	P/10.5	N/A	24.29	25.29	28.95	30.45	33.09	34.84
	P/16.6	N/A	N/A	27.44	30.29	31.79	34.43	36.18
	P/21.5	N/A	N/A	27.44	30.29	31.79	34.43	36.18
	V/4.0	16.75						
	V/7.9	17.26	18.96	19.96	23.05	24.55		
	V/10.5	17.26	18.96	19.96				
	V/14.2	N/A	19.74	20.74	23.83	25.33	27.97	
	V/18.4	N/A	19.74	20.74	23.83	25.33	27.97	



Air/Oil Return Oil Cooler

	GPM	Max Hp Removed
A01	15	.85 HP
A02	20	1.50 HP
A03	24	2.50 HP
A04	24	2.85 HP

Optional Component Information - Bolt Kit Length



Bolt Length for D03	
Valve - 10 - 24 x 1 3/4	
Valve & module - 10 - 24 x 3 1/4	
Valve & 2 modules - 10 - 24 x 5	
Bolt Length for D05	
Valve - 1/4 - 20 x 2 3/4	
Valve & module - 1/4 - 20 x 5	
Valve & 2 modules - 1/4 - 20 x 7	

Note:

1. Bolt kits to be ordered separately when using modulators.
2. Bolt kits are furnished with directional valves when no modulators are required.
3. All "D03" modulators are 40mm thick.
4. "D05" modulators are 55mm thick.



NCP Series Standard Variable Pump Unit

NCP Series is a compact, low-cost standard unit that includes a variable vane pump (VDS, VDR, VDC Series) or a variable piston pump (PVS/PZS Series). The power unit is low-noise, low-heat, energy-efficient, and highly reliable. The NCP Series has been expanded to include a choice of models that are optimized for a very wide range of needs. Available tank capacities range from 30 ℓ to 650 ℓ.

Features

Low energy, high efficiency

A built-in low-noise, high-efficiency NACHI variable pump ensures low heat, high-efficiency, low-energy operation.

A rich range of options

A full selection of options include base block, cooler, terminal box, microseparator, oil pan, return filter, and more, so you can configure a unit that meets your particular needs.

A selection of versatile circuits

Virtually any type of circuit can be configured using ganged type NACHI modular valves.

Low cost, short lead time

Components are all standard and mass produced, so parts are readily available at low prices.

• Handling

- 1 All pump rotation is clockwise (rightward) when viewed from the shaft side.
- 2 See the table below for information about adjusting discharge volume and pressure.
- 3 For operating fluid, use regular oil equivalent to ISO VG 32 to 68 (Viscosity Index: 90 or greater).

	Adjusting Screw Rotation Direction	Pump type	
		VDS·VDC·PVS·PZS	VDR
Pressure	Clockwise	Increase	Decrease
	Counterclockwise	Decrease	Increase
Discharge rate	Clockwise	Decrease	
	Counterclockwise	Increase	

Specifications

- Note: 1. For direct connect type, use a Nachi Uni-pump.
 2. Fluid temperature limit is room temperature +25 °C setting conditions are full cutoff continual operation, tank located in a well-ventilated area.
 3. An unload circuit is required when the motor is started under condition -Δ. Contact your agent about the unload circuit.
 4. Unless specified otherwise, electrical systems and paint colors are NACHI standards (see page L-13).

Variable Vane Pump Series

Power supply for all types is 200V AC.

Model No.	Pump Model No.	Conne- ction	Motor (All External) kW, 4P	Tank Capacity ℓ	Full Cutoff Pressure at Tank Fluid Temperature Limit Note 3) MPa(kgf/cm ²)			Approximate Weight kg
					No Fan Cooler	With Standard Fan Cooler	With High- power Fan Cooler	
(VC1A2) NCP-40-0.7VD1A2- M-12(21)	(VDC-1B-1A*-20) VDR-1B-1A*-22	Direct	0.75	40	3.0 (30.6)	8.0 (81.6)	-	70
(VC1A*) NCP-60-**VD1A*- M-12(21)	(VDC-1B-1A*-20) VDR-1B-1A*-22	Direct	1.5 2.2 3.7	60	4.5 (45.9)	9.0 (91.8)	-	90 95 115
(VC q A3) NCP-100-3.7VD q A3-C-12(21)	(VDC-1B-2A3-20) VDR-1B-2A3-22	Direct	3.7	100	7.0 (71.4)	-	-	155
2A* NCP-160-**VC w A*-M-12	VDC-2A-1A*-20 2A*	Coupling	5.5 7.5 11	160	3.5 (35.7)	6.5 (66.3)	8.5 (86.7)	240 250 300
2A* NCP-250-**VC w A*-M-12	VDC-2A-1A*-20 2A*	Coupling	7.5 11 15	250	4.5 (45.9)	7.0 (71.4)	9.5 (96.9)	300 350 375
NCP-400-**VC3A*- M-12	VDC-3A-1A*-20	Coupling	7.5 11 15 18.5 22	400	4.5 (45.9)	7.0 (71.4)	8.5 (86.7)	475 505 525 560 590
NCP-650-**VC3A*- M-12	VDC-3A-1A*-20	Coupling	11 15 18.5 22 30	650	6.0 (61.2)	8.5 (86.7)	10.0 (102.0)	600 620 660 685 750

- Note: 1. Contact your agent when mounting motors enclosed in parentheses. These motors require special handling concerning operating pressure, heat generation, etc.
 2. Equip a return filter for pressures of 7MPa or greater.
 3. A radiator is equipped as standard with the 100 ℓ type.

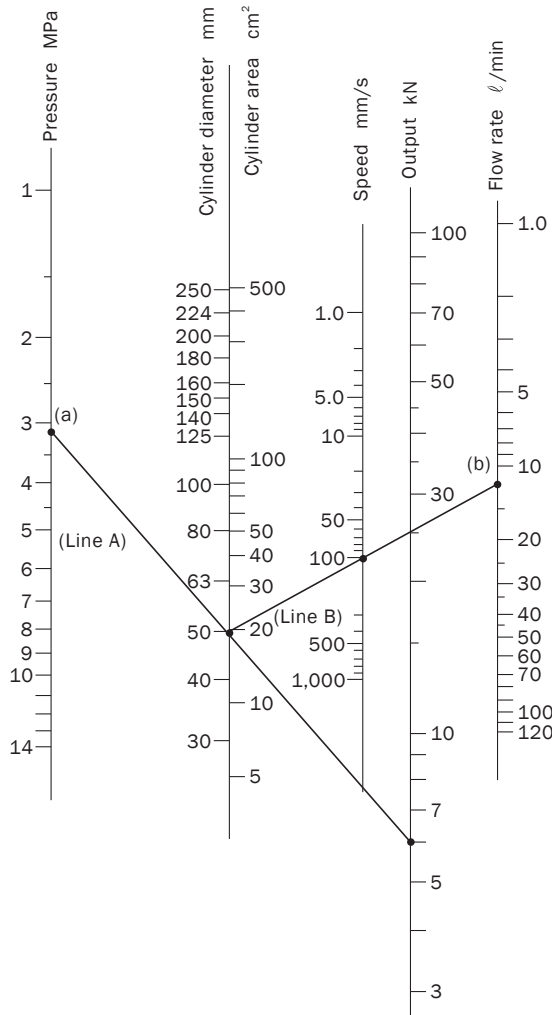
Variable Piston Pump Series

Power supply for all types is 200V AC.

Model No.	Pump Model No.	Conne- ction	Motor (All External) kW, 4P	Tank Capacity ℓ	Full Cutoff Pressure at Tank Fluid Temperature Limit Note 3) MPa(kgf/cm ²)			Approximate Weight kg
					No Fan Cooler	With Standard Fan Cooler	With High- power Fan Cooler	
NCP-30-**PV8N*-R-12	PVS-0B-8N*-30	Direct	0.75 1.5	30	5.0 (51.0)	-	-	43 46
NCP-40-**PV8N*-R-12	PVS-0B-8N*-30	Direct	0.75 1.5	40	5.0 (51.0)	21.0 (214.1)	-	75 80
NCP-60-**PV8N*-R-12	PVS-0B-8N*-30	Direct	1.5 2.2 3.7	60	7.0 (71.4)	21.0 (214.1)	-	90 95 115
NCP-40-**PV16N*-R-12(21)	PVS-1B-16N*-12	Direct	0.75 1.5	40	4.5 (45.9)	21.0 (214.1)	-	75 80
NCP-60-**PV16N*-R-12(21)	PVS-1B-16N*-12	Direct	1.5 2.2 3.7	60	7.0 (71.4)	21.0 (214.1)	-	90 95 115
NCP-100-**PV ¹⁶ ₂₂ N*-R-12(21)	PVS-1B- ¹⁶ ₂₂ N*-12	Coupling	3.7 5.5 7.5	100	8.5 (86.7)	21.0 (214.1)	-	145 170 185
NCP-160-**PV35N*-R-12	PVS-2B-35N*-12	Coupling	5.5 7.5 11	160	7.0 (71.4)	14.0 (142.7)	21.0 (214.1)	235 245 295
NCP-250-**PV ³⁵ ₄₅ N*-R-12	PVS-2B- ³⁵ ₄₅ N*-12	Coupling	7.5 11 15	250	9.5 (96.9)	17.0 (173.3)	21.0 (214.1)	295 345 370
NCP-400-**PV70N*-R-12	PZS-3B-70N*-10	Coupling	7.5 11 15 18.5 22	400	5.5 (56.1)	14.0 (142.7)	16.0 (163.1)	490 525 545 580 605
NCP-650-**PV70N*-R-12	PZS-3B-70N*-10	Coupling	11 15 18.5 22 30	650	8.5 (86.7)	16.0 (163.1)	18.0 (183.5)	620 640 680 705 770

Note: All models in this series are equipped with a return filter as standard.

Specifications



[Example]

To determine the NCP Series model that drives a $\phi 50$ cylinder with an output of 6kN and speed of 100mm/s.

- Draw a line (Line A) between 6kN on the output line and the $\phi 50$ point on the cylinder diameter line. Extend Line A until it intersects with the pressure line at Point (a). Though Point (a) indicates a pressure of 3.1MPa, we need to add about 1MPa to compensate for pressure loss due to piping and other factors, so a pressure of 4MPa is required.
- From the $\phi 50$ point on the cylinder diameter line, draw a line (Line B) to the

100 mm/s point on the speed line. Extend Line B until it intersects with the flow rate line at Point (b), which indicates a required flow rate of 11.8 l/min.

- Based on the required flow rate of 11.8 l/min. and required pressure of 4MPa obtained above, we can now check the selection chart where we easily find out that the required model is NCP-60-1.5 VD1A3-12. Next, select the required option from Table 1 on the following page.

Flow rate l / min	Area	Pressure MPa	NCP Series Model	
			Variable Vane Pump Series	Variable Piston Pump Series
5	50/60Hz	3.5 to 5.0		NCP -30-0.7V8N1-R-12
10		4.5 to 8.0 8.0 to 14.0		NCP -40-1.5PV16N2-CR-12(21) -60-2.2PV16N2-CR-12(21)
15		1.0 to 3.0 3.0 to 4.5 4.5 to 7.0 7.0 to 14.0	NCP -40-0.7V*1A2-12(21) -60-1.5V*1A3-12(21)	NCP -60-2.2PV16N1-R-12(21) -60-3.7PV16N2-CR-12(21)
20		1.0 to 3.0 3.0 to 5.0 5.0 to 10.0 10.0 to 14.0	NCP -40-0.7V*1A2-12(21) -60-1.5V*1A3-12(21)	NCP -60-3.7PV16N2-CR-12(21) NCP -100-5.5PV16N2-CR-12(21)
25	50Hz	1.0 to 3.0 3.0 to 5.0 5.0 to 12.0 12.0 to 14.0	NCP -60-1.5V* q A2-12(21) -100-3.7V* q A3-C-12(21)	NCP -100-5.5PV22N2-CR-12(21) -100-7.5PV22N2-CR-12(21)
	60Hz	1.0 to 3.5 3.5 to 5.0 5.0 to 12.0 12.0 to 14.0	NCP -60-1.5V*1A2-12(21) -60-2.2V*1A3-C-12(21)	NCP -100-5.5PV16N2-CR-12(21) -100-7.5PV16N2-CR-12(21)
30	50/60Hz	1.0 to 3.5 3.5 to 5.0 5.0 to 8.0 8.0 to 14.0	NCP -60-2.2V* q A2-12(21) -100-3.7V* q A3-C-12(21)	NCP -100-5.5PV22N2-CR-12(21) -100-7.5PV22N2-CR-12(21)
35	50Hz	2.0 to 7.0 7.0 to 10.5 10.5 to 14.0	NCP -160-5.5VC2A3-C-12	NCP -160-7.5PV35N2-CR-12 -160-11PV35N2-CR-12
	60Hz	2.0 to 6.0 6.0 to 10.5 10.5 to 14.0	NCP -100-3.7V* q A3-C-12(21)	NCP -100-7.5PV22N2-CR-12(21)
40	50/60Hz	2.0 to 7.0 7.0 to 10.0 10.0 to 14.0	NCP -160-5.5VC2A3-C-12	NCP -160-7.5PV35N2-CR-12 -160-11PV35N2-CR-12
50		2.0 to 5.0 5.0 to 7.0 7.0 to 11.5 11.5 to 14.0	NCP -160-5.5VC w A3-C-12 -160-7.5VC w A3-C-12	NCP -160-11PV35N2-CR-12 -250-15PV45N2-CR-12
60	50Hz	2.0 to 7.0 7.0 to 10.0 10.0 to 14.0		NCP -250-7.5PV45N2-R-12 -250-11PV45N2-CR-12 -250-15PV45N2-CR-12
	60Hz	2.0 to 4.5 4.5 to 7.0 7.0 to 10.0 10.0 to 13.5	NCP -250-5.5VC w A3-12 -250-7.5VC w A3-C-12	NCP -250-11PV35N2-CR-12 -250-15PV35N2-CR-12
75	50Hz	2.0 to 4.5 4.5 to 7.0 7.0 to 10.0 10.0 to 13.0	NCP -400-7.5VC3A3-12 -400-11VC3A3-C-12	NCP -400-15PV70N3-CR-12 -400-18.5PV70N3-CR-12
	60Hz	2.0 to 5.5 5.5 to 8.0 8.0 to 11.0 11.0 to 13.5		NCP -250-7.5PV45N1-R-12 -250-11PV45N2-CR-12 -250-15PV45N2-CR-12 -250-18.5PV45N2-CR-12
90	50/60Hz	2.0 to 4.0 4.0 to 6.5 6.5 to 9.0 9.0 to 11.5 11.5 to 13.5	NCP -400-7.5VC3A3-12 -400-11VC3A3-C-12	NCP -400-15PV70N3-CR-12 -400-18.5PV70N3-CR-12 -400-22PV70N3-CR-12
100	50Hz	2.0 to 6.0 6.0 to 8.0 8.0 to 10.0 10.0 to 12.0 12.0 to 14.0		NCP -650-11PV70N1-R-12 -650-15PV70N3-R-12 -650-18.5PV70N3-CR-12 -650-22PV70N3-CR-12 -650-30PV70N3-CR-12
	60Hz	2.0 to 6.0 6.0 to 8.0 8.0 to 10.0 10.0 to 12.0 12.0 to 14.0	NCP -650-11VC3A3-12	NCP -650-15PV70N3-R-12 -650-18.5PV70N3-CR-12 -650-22PV70N3-CR-12 -650-30PV70N3-CR-12
110	60Hz	2.0 to 5.5 5.5 to 7.0 7.0 to 9.0 9.0 to 11.0 11.0 to 14.0	NCP -650-11VC3A3-12 -650-15VC3A3-C-12	NCP -650-18.5PV70N3-CR-12 -650-22PV70N3-CR-12 -650-30PV70N3-CR-12
120	60Hz	2.0 to 5.0 5.0 to 7.0 7.0 to 8.5 8.5 to 10.0 10.0 to 13.5		NCP -650-11PV70N1-R-12 -650-15PV70N3-R-12 -650-18.5PV70N3-CR-12 -650-22PV70N3-CR-12 -650-30PV70N3-CR-12

- Note: 1. Contact your agent if you need a low-pressure NCP unit with piston pump.
 2. If flow rate and pressure are not specified, products are configured with company standard settings before shipping.
 3. When running items marked with a star (★) to the right of the table for long periods at pump setting pressure, fluid temperature may exceed 60 °C even when a fan cooler is used. In this case, use a water cooler.
 4. Contact your agent for applications where there is the chance of frequent momentary return flow due to the use of ACC, or surge voltage generated due to the use of fast switching valve response and a high cycle.

Understanding Model Numbers

NCP - 100 - 3.7 * * * * - - 12(21)

Design number

21: Additional base block type

Option (Table 1)

Pump function

For variable vane pump

For variable piston pump

Capacity \ Pressure	2 MPa	3.5 MPa	7 MPa	10.5 MPa	14 MPa
8.3cm³/rev	OA1	OA2	OA3		
16.7cm³/rev	1A2		1A3	1A4	(1A5)
22.0cm³/rev	q A2		q A3		
30.0cm³/rev	2A2		2A3	2A4	(2A5)
38.9cm³/rev	w A2		w A3		
66.7cm³/rev	3A2		3A3	3A4	(3A5)

Capacity \ Pressure	2 to 7MPa	7 to 14MPa
8.0cm³/rev	8N1	8N2
16.5cm³/rev	16N1	16N2
22.0cm³/rev	22N1	22N2
35.0cm³/rev	35N1	35N2
45.0cm³/rev	45N1	45N2
70.0cm³/rev	70N1	70N2

Pump type

VC, VD: Variable vane

PV: Variable piston

Motor capacity

(0.4 to 30) kW, 4P (0.75kW only indicated as 0.7)

Tank volume

(30, 40, 60, 100, 160, 250, 400, 650) ℓ

NCP Series (standard variable pump unit)

Table 1: Option Symbols

Symbol	Description	Model Number and Description	30L	40 to 100L	160, 250L	400, 650L
B	Base Block (Design No. 12 Only)	MPU Series built-in	○ Note 2	○	○	○
C	Radiator	3A92-001-1050	○	○		
C1	General-purpose Fan Cooler	3A92-001-0000 16/15W Single-phase 200V AC 50/60Hz		○	○	○
C2	High-power Fan Cooler	3A92-002-0000 33/30W Single-phase 200V AC 50/60Hz			○	○
D	Terminal Wiring (Drive System + Control System)	Wiring from each electrical device to the terminal box (Drive System + Control System)	○	○	○	○
E	Terminal Wiring (Control System Only)	Wiring from each electrical device to the terminal box (Control System Only)	○	○	○	○
F	Mounting Foot for Forklift	See mounting foot for forklift specifications.		○		
M	Microseparator	MSB-110	○	○	○	○
N	Noise Control	Motor 6P specifications				○
P	Oil pan	See oil pan specifications.		○	○	○
R	Return Filter	WS-20-20-V(20 μ paper)	○			
R1	Return Filter	CF-0*(10 μ paper) FRS-**-20P*** (20 μ paper)		○ Note 3	○ Note 3	
R2	Return Filter	FPL-O*(10 μ paper)		○	○	
T	Temperature Gauge (With Fluid Level Gauge)	φ6 × 80L φ 25 φ8 × 120L φ 35 (0 to 100°C) with guard	○	○	○	○
V	Vibration Control	Anti-vibration rubber, rubber hoses, etc.				○
W1	Self Leak Test	Tank leak test by NACHI		○	○	○
W2	Government-mandated Leak Test	Tank leak test by fire department		○	○	○
TH	Thermostat (Abnormal fluid temperature detection: Contact a)	TNS-C1070C (Contact on: 65° C and above)		○	○	○
PS	Pressure Switch (Abnormal pressure detection: Contact a)	CP20-223 Contact ON: (Pump Setting Pressure) -(1.5MPa) and above		○	○	○
FS	Float Switch (Low fluid level detection: Contact a)	OLV-2A Contact on: (Fluid Level Gauge Visual Low Level) -(10mm) or less		○	○	○
G	Fluid Level Gauge Guard	Protective cover installation	○	○	○	○
R3	Return Filter (Tank Top Type)	VLR**-**P-S				
L	Anchor Hole Outer Side	Anchor hole set on outer side				
	Motor Abnormal Voltage	Reference Voltage Other than 200V AC 50/60Hz; 220V AC 60Hz		Supported for Design Number 5100A		
	Special Paint (Exterior)	Other than standard lacquer paint (phthalates, epoxy, etc.)				
	Piston Pump Variable Control Option	Other than standard control system N (NQ, RS, WS, RQS, etc.)				
	Fire Resistant Operating Fluid (W/G Type)	Water- or glycol-based hydraulic operating fluid (Contact your agent about other fluid types.)				
	Water Cooler	When capacity of pump DR fan cooler is insufficient				
	Electric Oil Heater	When there is the possibility of fluid pressure dropping below 0° C				

Note: 1. Design 12 when option symbol B is selected. (Base block additional 21 design is not applicable)

2. With the optional Symbol B capacity 30L, a special base block can be used in a configuration of up to 01 × 3.

3. Option symbol R1 CF-0* is applicable to pump functions *A2 and *NO only.

4. FRS-08-20P08T for option symbol R1, capacity 250L using a 45cm³/rev type.

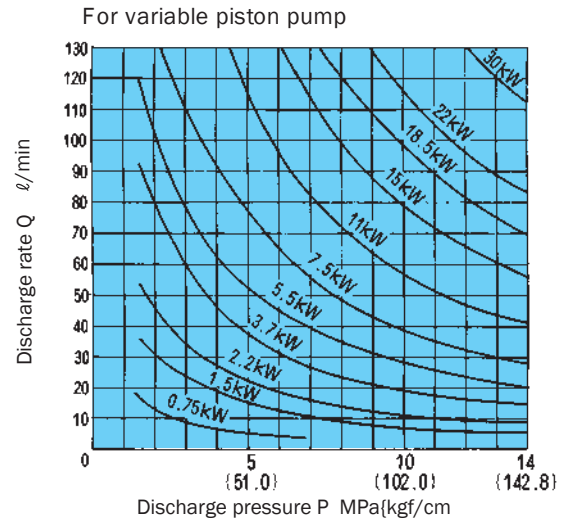
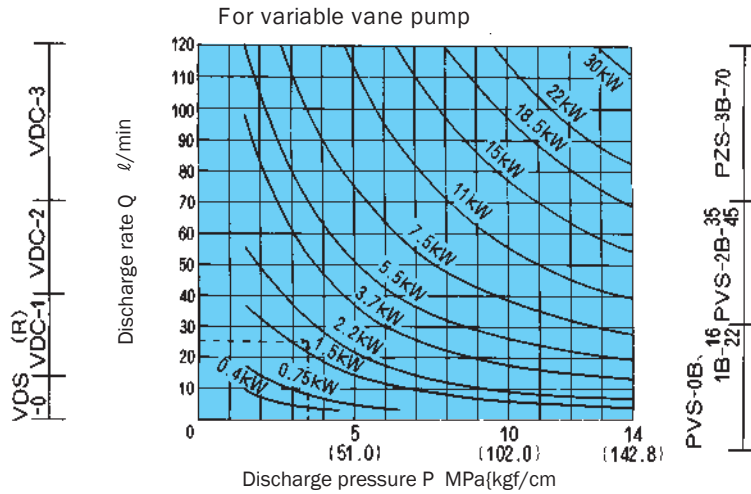
5. Contact Nachi for information about design number 5100A.

Selecting a Motor

- The lower side of the output curves for each of the motors shown in the graph indicates the operating range under rated output for that motor.
- Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.

Example: To find the motor that can produce pressure of 3.5MPa {35.7kgf/cm²} and a discharge rate of 25r/min.
Since the intersection of the two broken

lines from a pressure of 3.5MPa {35.7kgf/cm²} and discharge rate of 25r/min intersect in the area under the 2.2kW curve, it means that a 2.2kW motor should be used.

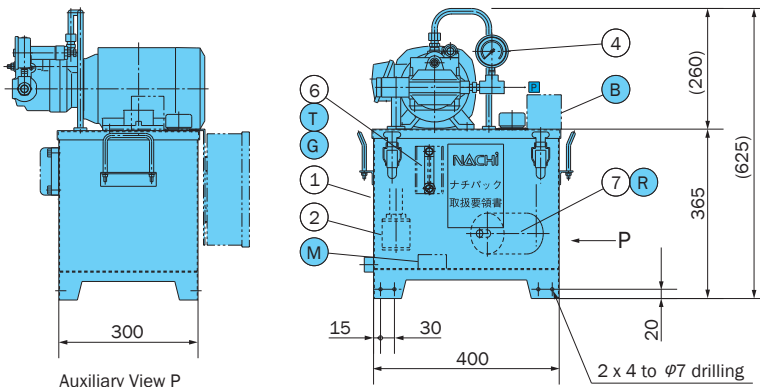
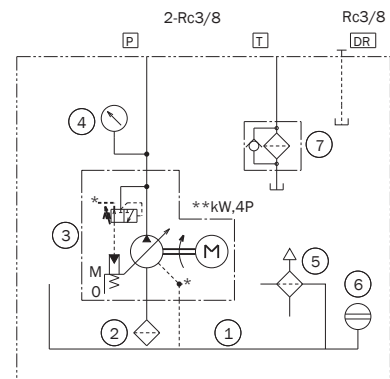
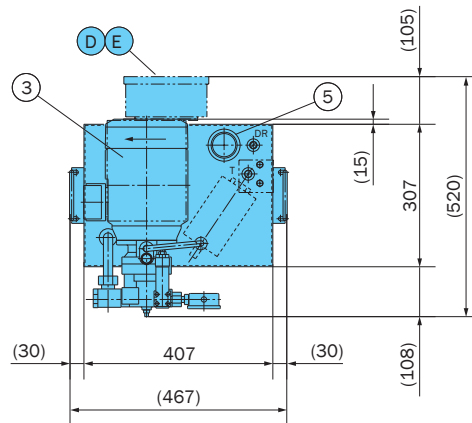


Installation Dimension Drawings

- Mini NCP Series
- NCP-30-**PV8N*-*-12

Note: Catalog dimensions, layout, and used devices are subject to change without notice. In particular, be sure to check in cases where dimensions are limited.

- Option item numbers are colored.

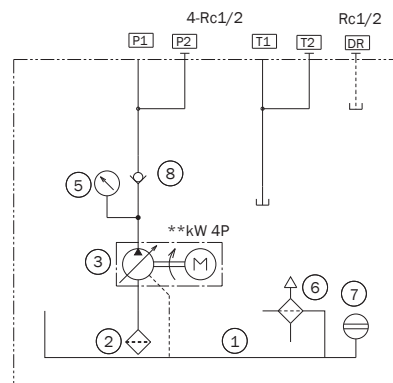
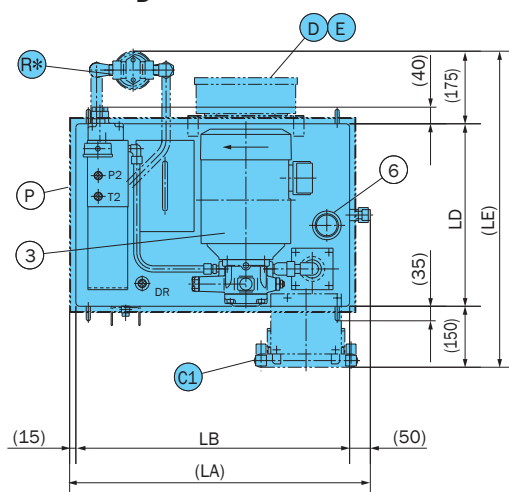


Part No.	Name	Model No.	Q'ty
1	Tank	30 l	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UPV-0A-8N-**-A-4-31	1
4	Pressure gauge	AUR1/4-φ60 × **M	1
5	Fluid supply port/air breather	MSA-V30	1
6	Fluid level gauge	φ6 × 80L	1
7	Return filter	WS-20-20-V	1

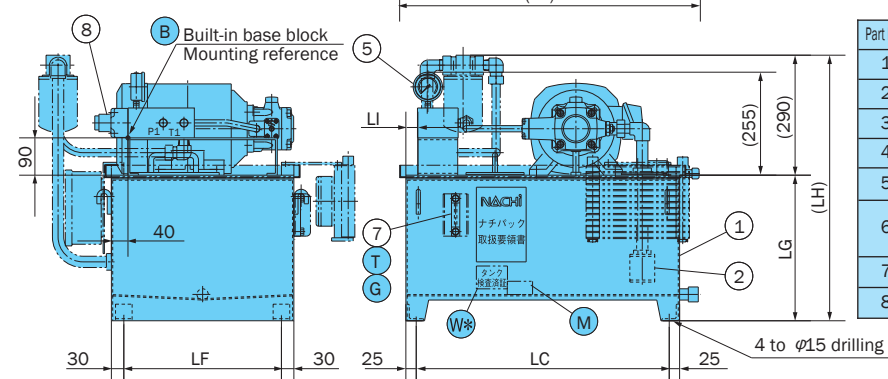
NCP-40-0.7V^C_D 1A2-*-12

NCP-60-**V^C_D 1A*-*-12

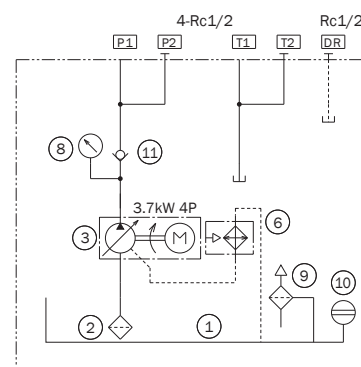
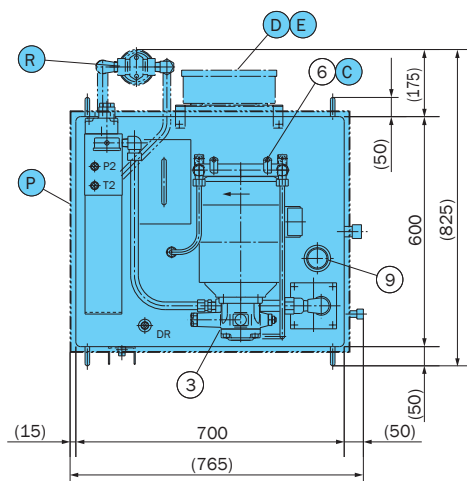
Symbol	Dimensions (mm)	
	40 l	60 l
LA	625	725
LB	560	660
LC	510	610
LD	350	440
LE	675	765
LF	290	380
LG	300	350
LH	590	640
LI	31	33



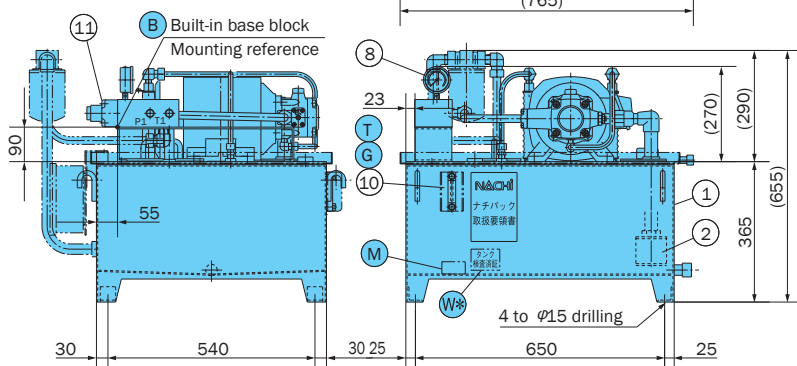
Part No.	Name	Model No.	Q'ty
1	Tank	**l	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UVC(D)-1A-A-*-**4-26	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Check valve	CA-G03-1-20	1



NCP-100-3.7V^C_D 1A3-C-12



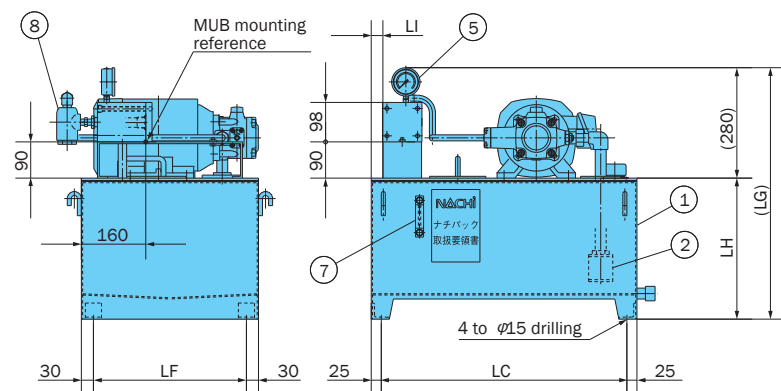
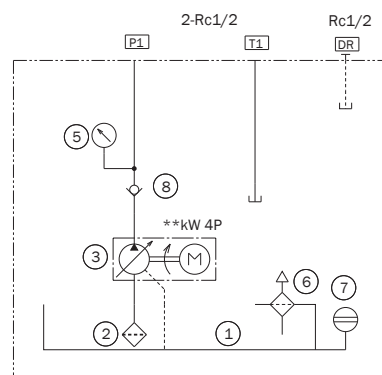
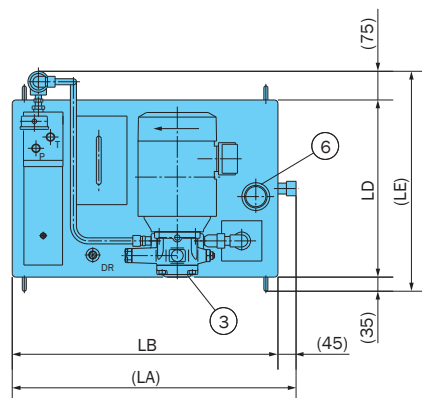
Part No.	Name	Model No.	Q'ty
1	Tank	100 l	1
2	Strainer	CS-08(150 mesh)	1
3	Uni-pump	UVC(D)-1A-2A3-3.7-4-26	1
4			
5			
6	Radiator	3A92-001-1050	1
7			
8	Pressure gauge	AUR1/4-φ60 × **M	1
9	Fluid supply port/air breather	MSA-V30	1
10	Fluid level gauge	φ6 × 80L	1
11	Check valve	CA-G03-1-20	1



NCP-40-0.7VD1A2*-21

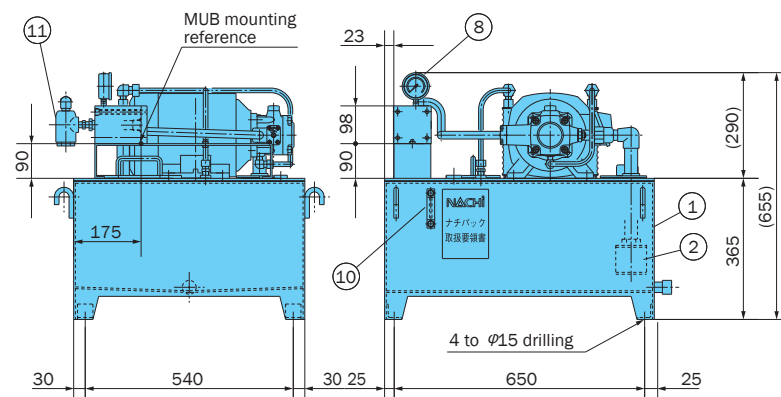
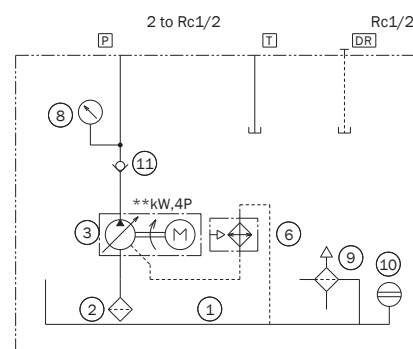
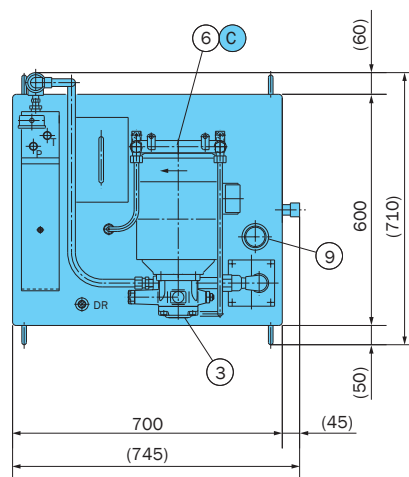
NCP-60-**VD1A*-21

Symbol	Dimensions (mm)	
	40 ℓ	60 ℓ
LA	605	705
LB	560	660
LC	510	610
LD	350	440
LE	460	550
LF	290	380
LG	580	630
LH	300	350
LI	31	33



Part No.	Name	Model No.	Q'ty
1	Tank	** ℓ	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UVD-1A-A*-**4-26	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Check valve	CA-T03-1-20	1

NCP-100-3.7VD1A3-C-21

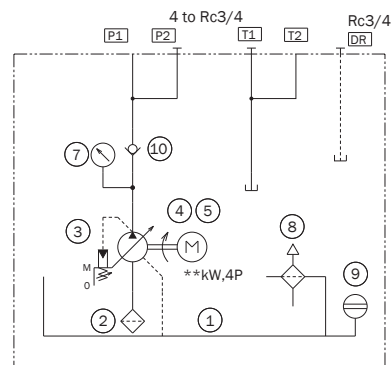
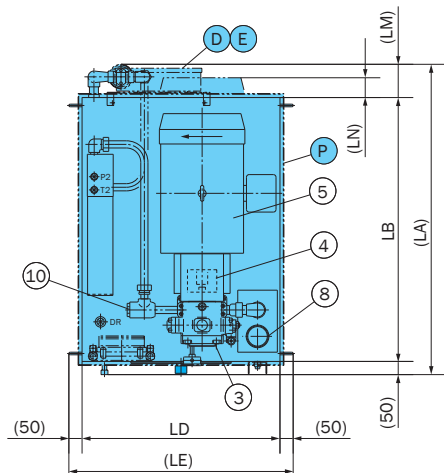


Part No.	Name	Model No.	Q'ty
1	Tank	100 ℓ	1
2	Strainer	CS-08(150 mesh)	1
3	Uni-pump	UVD-1A-2A3-3.7-4-26	1
4			
5			
6	Radiator	3A92-001-1050	1
7			
8	Pressure gauge	AUR1/4-φ60 × 16M	1
9	Fluid supply port/air breather	MSA-V30	1
10	Fluid level gauge	φ6 × 80L	1
11	Check valve	CA-T03-1-20	1

NCP-160-**VC2A*-12

Symbol	Dimensions (mm)	
	160 ℓ	250 ℓ
LA	1120	1175
LB	850	1000
LC	780	930
LD	650	750
LE	750	850
LF	580	680
LG	415	495
LH	835	995
LI	385	420
LJ	420	500
LK	0	20
LL	100	215
LM	220	125
LN	75	0

NCP-250-**VC2A*-12

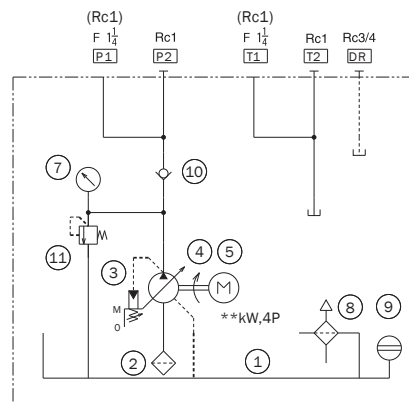
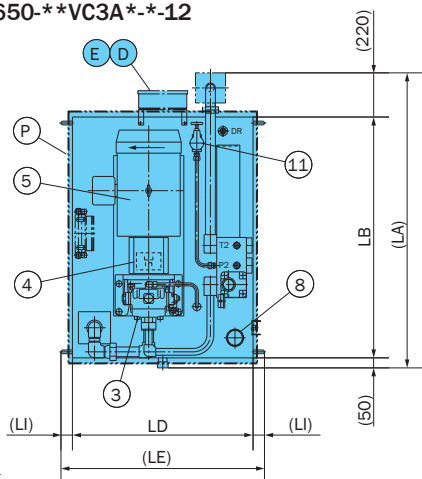


Part No.	Name	Model No.	Q'ty
1	Tank	** ℓ	1
2	Strainer	CS-10(150 mesh)	1
3	Uni-pump	VDC-2A-A*-20	1
4	Coupling	CR-***J	1
5	Motor	Fully closed external fan Terminal B **kW-4P	1
6			
7	Pressure gauge	AUR1/4-φ60 × **M	1
8	Fluid supply port/air breather	MSA-V50-VS10	1
9	Fluid level gauge	φ8 × 120L	1
10	Check valve	CA-T06-1-20	1

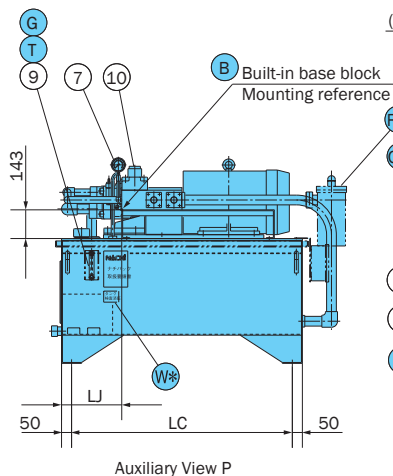
NCP-400-**VC3A*-12

Symbol	Dimensions (mm)	
	400 ℓ	650 ℓ
LA	1470	1790
LB	1200	1520
LC	1100	1420
LD	900	1010
LE	1014	1164
LF	800	910
LG	620	670
LH	1120	1170
LI	57	77
LJ	300	450

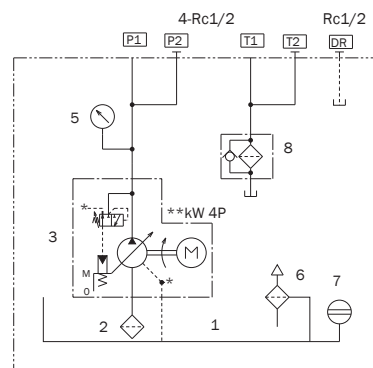
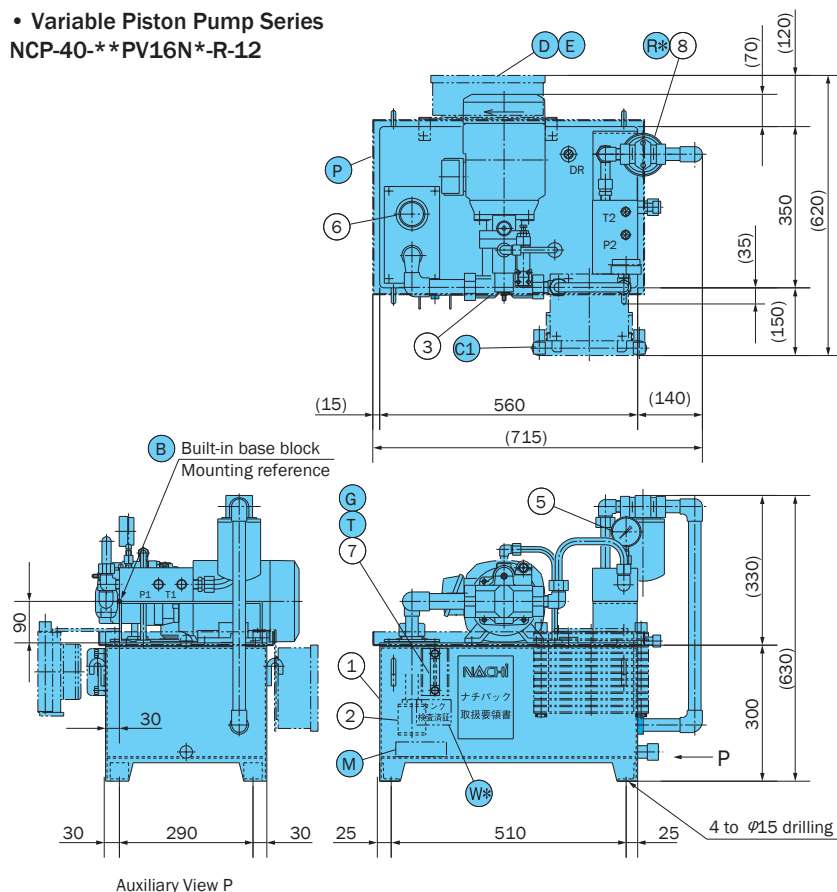
NCP-650-**VC3A*-12



Part No.	Name	Model No.	Q'ty
1	Tank	** ℓ	1
2	Strainer	CS-12(150 mesh)	1
3	Uni-pump	VDC-3A-1A*-20	1
4	Coupling	CR-***J	1
5	Motor	Fully closed external fan A terminal **kW-4P	1
6			
7	Pressure gauge	AUR1/4-φ60 × **M	1
8	Fluid supply port/air breather	MSA-V50-VS10	1
9	Fluid level gauge	φ8 × 120L	1
10	Check valve	CA-G10-1-20	1
11	Relief valve	R-T03-3-11	1

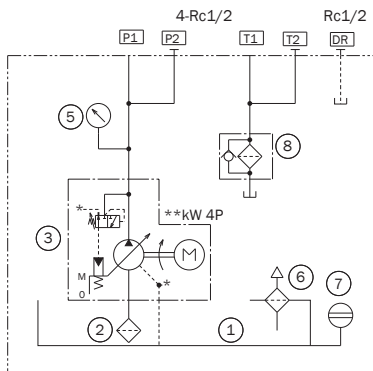
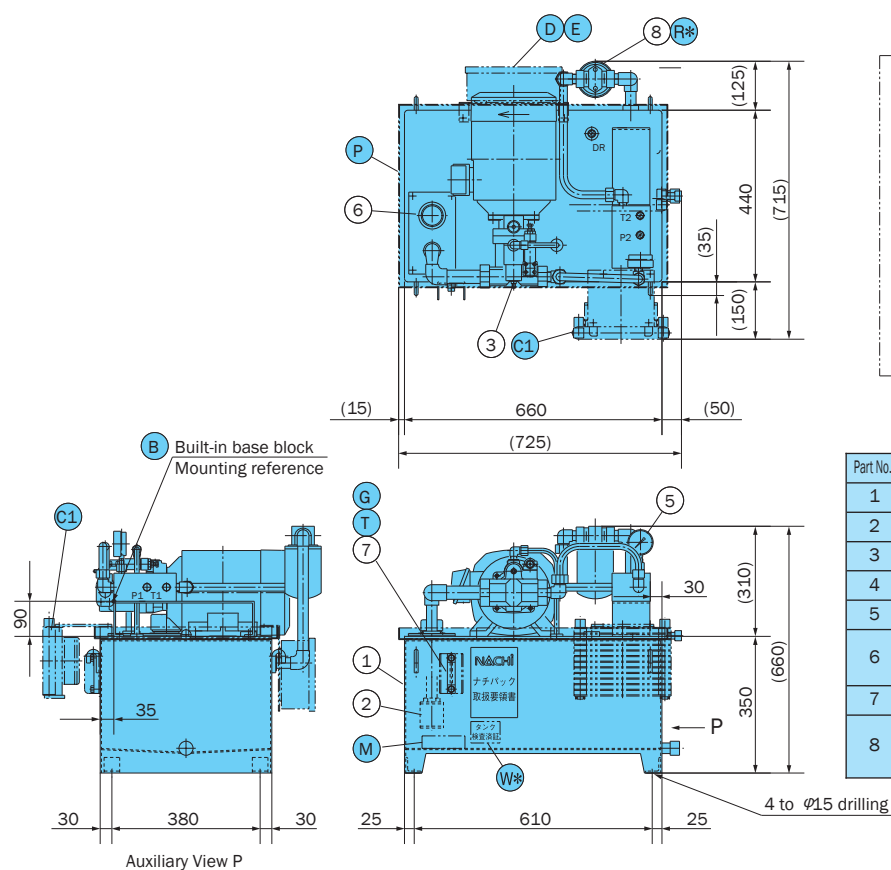


• Variable Piston Pump Series
NCP-40-**PV16N*-R-12



Part No.	Name	Model No.	Q'ty
1	Tank	40 l	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UPV-1A-16N-**-A-4-17	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Return filter	(FPL-06)CF-06 10μ paper	1

NCP-60-**PV16N*-R-12

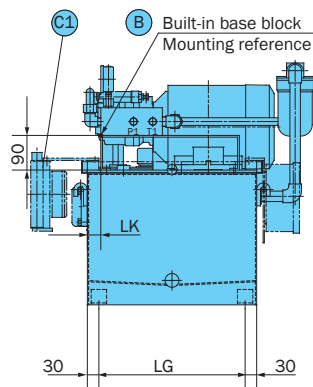
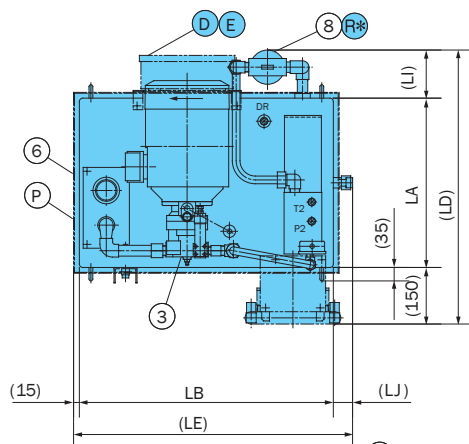


Part No.	Name	Model No.	Q'ty
1	Tank	60 l	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UPV-1A-16N-**-A-4-17	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Return filter	(FPL-06)CF-06 10μ paper	1

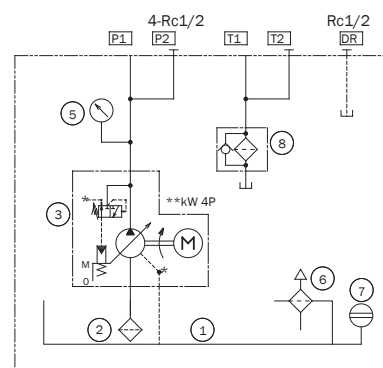
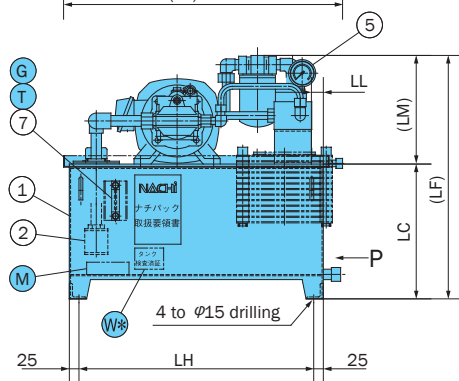
NCP-40-**PV8N*-12

NCP-60-**PV8N*-12

Symbol	Dimensions (mm)	
	40ℓ	60ℓ
LA	350	440
LB	560	660
LC	300	350
LD	620	715
LE	715	725
LF	630	660
LG	290	380
LH	510	610
LI	120	125
LJ	140	50
LK	30	35
LL	0	30
LM	330	310

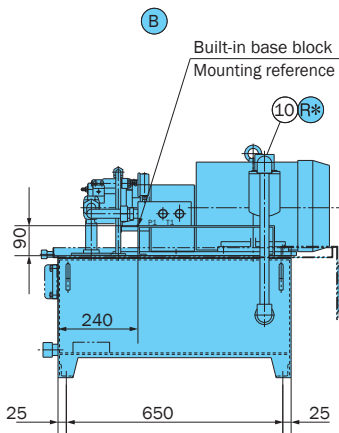
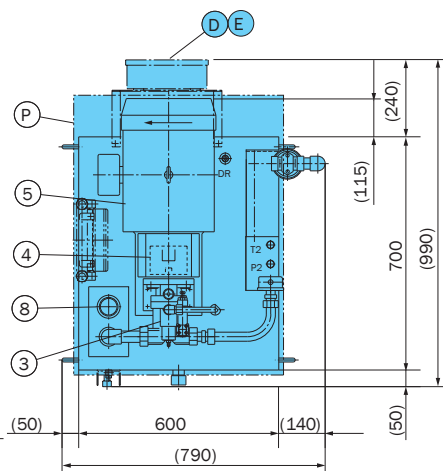


Auxiliary View P

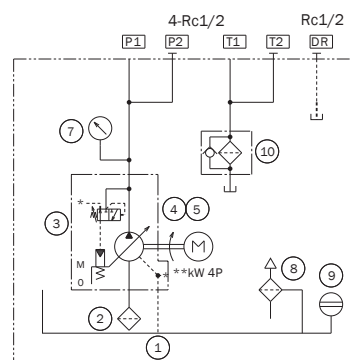
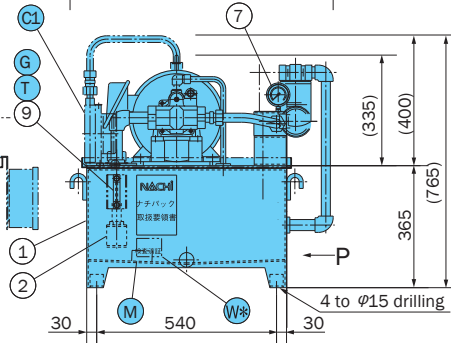


Part No.	Name	Model No.	Q'ty
1	Tank	** ℓ	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UPV-0A-8N-**-A-4-31	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Return filter	(FPL-06)CF-06 10μ paper	1

NCP-100-**PV¹⁶₂₂N*-12



Auxiliary View P

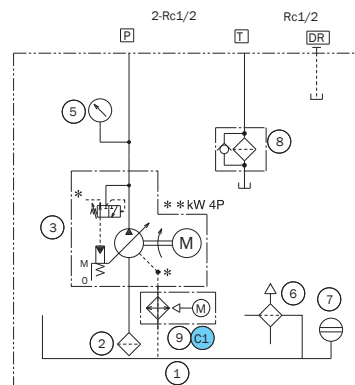
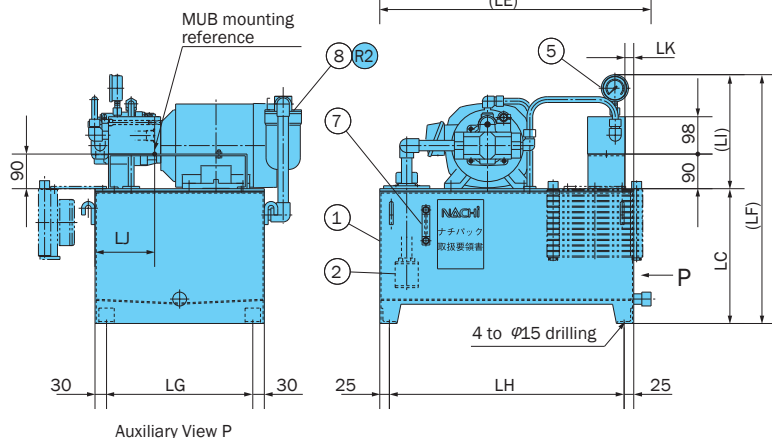
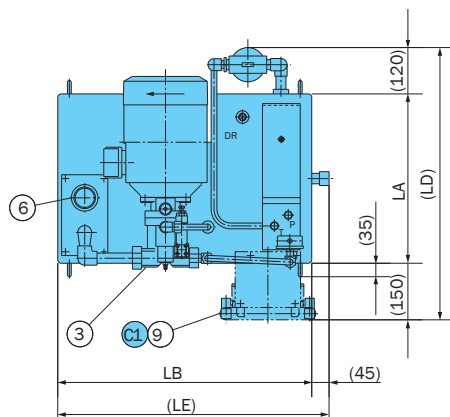


Part No.	Name	Model No.	Q'ty
1	Tank	100 ℓ	1
2	Strainer	CS-06(150 mesh)	1
3	Pump	PVS-1A-**N*-12	1
4	Coupling	CR-***J	1
5	Motor	Fully closed external fan A terminal **kW-4P	1
6			
7	Pressure gauge	AUR1/4-φ60 × **M	1
8	Fluid supply port/air breather	MSA-V30	1
9	Fluid level gauge	φ6 × 80L	1
10	Return filter	(FPL-06)CF-06 10μ paper	1

NCP-40-**PV16N*-(C1)R2-21

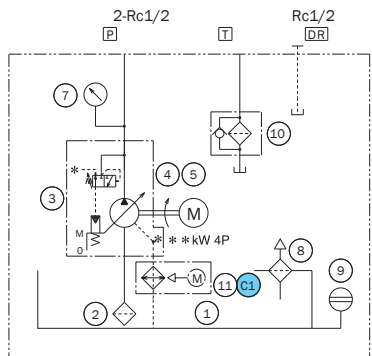
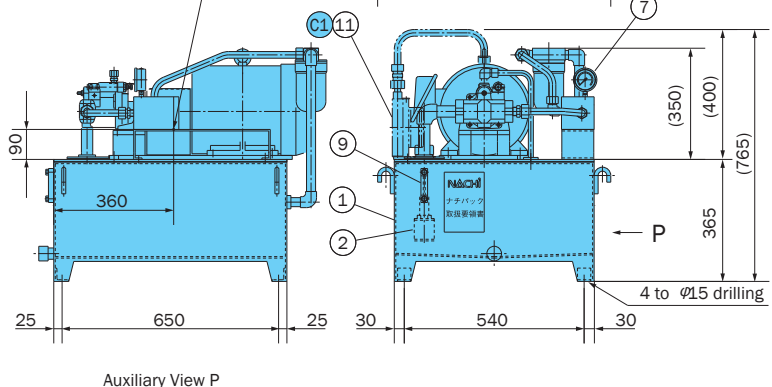
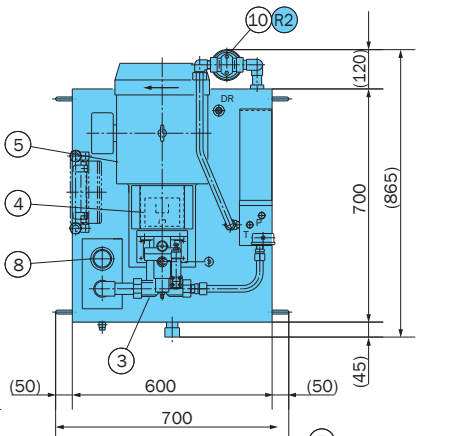
NCP-60-**PV16N*-(C1)R2-21

Symbol	Dimensions (mm)	
	40ℓ	60ℓ
LA	350	440
LB	560	660
LC	300	350
LD	620	710
LE	605	705
LF	630	665
LG	290	380
LH	510	610
LI	330	315
LJ	150	155
LK	0	30



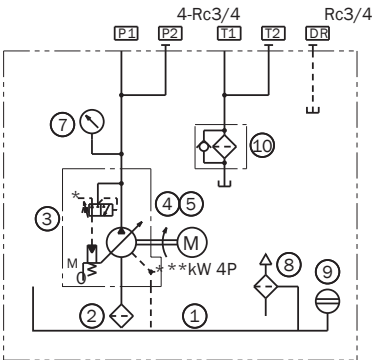
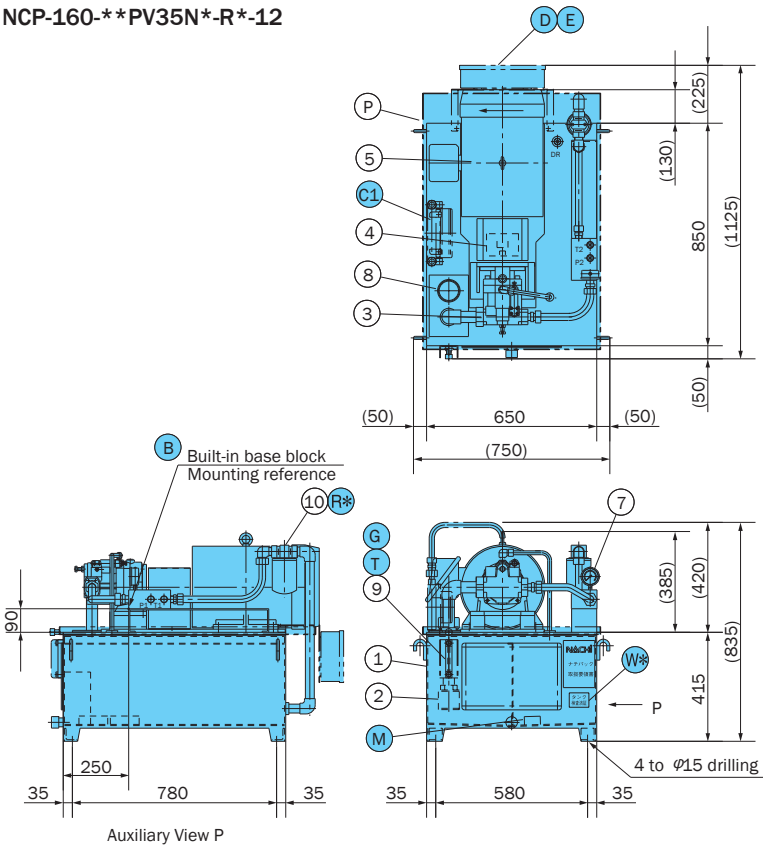
Part No.	Name	Model No.	Q'ty
1	Tank	**ℓ	1
2	Strainer	CS-06(150 mesh)	1
3	Uni-pump	UPV-1A-16N*-*A-4-17	1
4			
5	Pressure gauge	AUR1/4-φ60 × **M	1
6	Fluid supply port/air breather	MSA-V30	1
7	Fluid level gauge	φ6 × 80L	1
8	Return filter	FPL-06(10 μ paper)	1
9	Fan cooler	3A92-001-0000	1

NCP-100-**PV¹⁶₂₂N*-(C1)R2-21



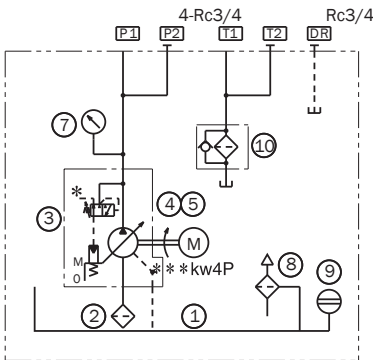
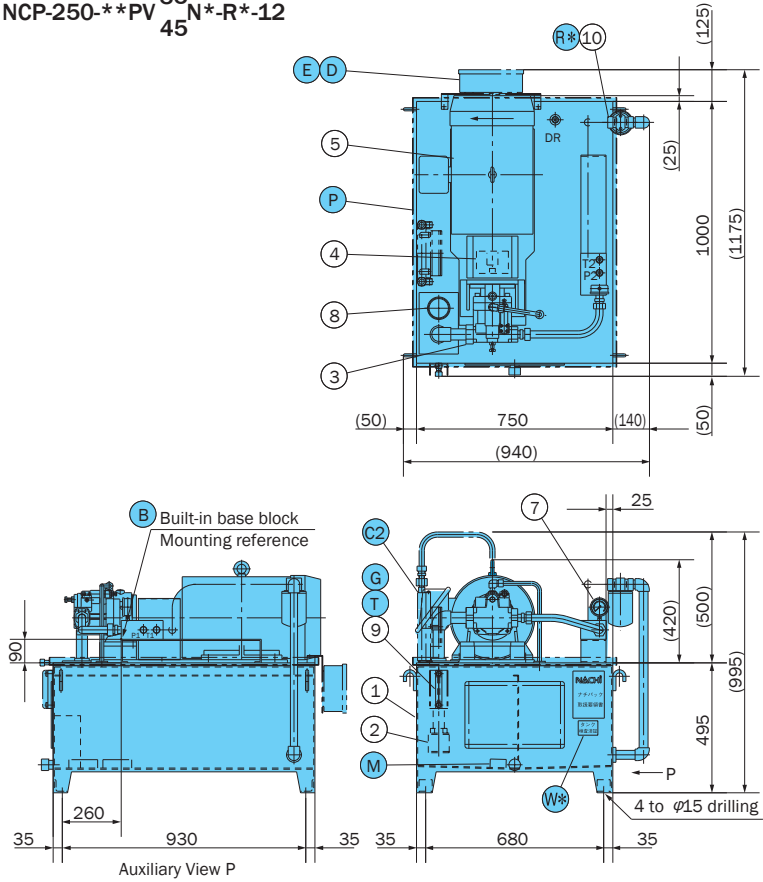
Part No.	Name	Model No.	Q'ty
1	Tank	100ℓ	1
2	Strainer	CS-06(150 mesh)	1
3	Pump	PVS-1A- ¹⁶ ₂₂ N*-12	1
4	Coupling	CR-***J	1
5	Motor	Fully closed external fan A terminal *kW-4P	1
6			
7	Pressure gauge	AUR1/4-φ60 × **M	1
8	Fluid supply port/air breather	MSA-V30	1
9	Fluid level gauge	φ6 × 80L	1
10	Return filter	FPL-06(10 μ paper)	1
11	Fan cooler	3A92-001-0000	1

NCP-160-**PV35N*-R*-12



Part No.	Name	Model No.	Q'ty
1	Tank	160r	1
2	Strainer	CS-10(150 mesh)	1
3	Uni-pump	PVS-2A-35N*-12	1
4	Coupling	CR-***J	
5	Motor	Fully closed external fan A terminal **kW-4P	1
6			
7	Pressure gauge	AUR1/4- φ60 × **M	1
8	Fluid supply port/air breather	MSA-V50-VS10	1
9	Fluid level gauge	φ8 × 120L	1
10	Return filter	(FPL-08)CF-08 10μ paper	1

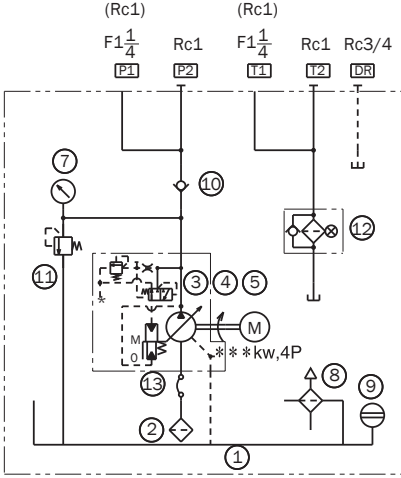
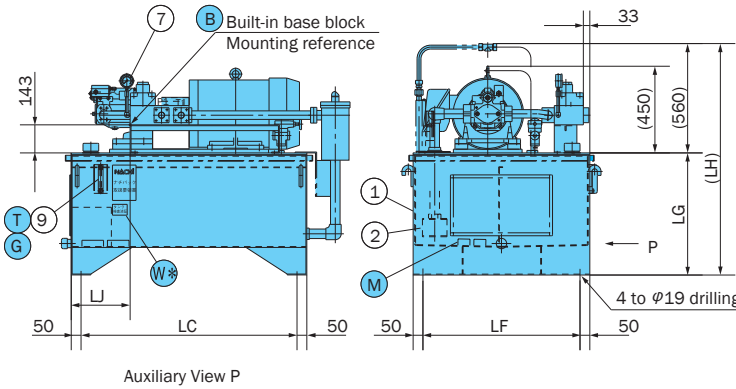
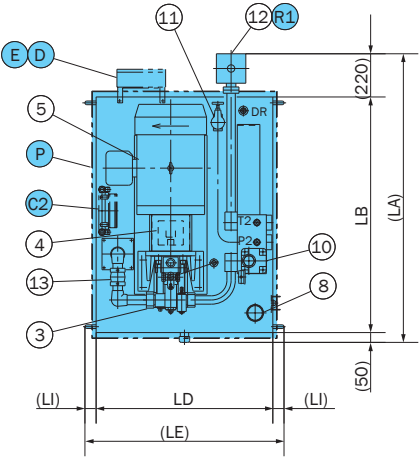
NCP-250-**PV³⁵₄₅N*-R*-12



Part No.	Name	Model No.	Q'ty
1	Tank	250l	1
2	Strainer	CS-10(150 mesh)	1
3	Uni-pump	PVS-2A-**N*-12	1
4	Coupling	CR-***J	1
5	Motor	Fully closed external fan A terminal **kW-4P	1
6			
7	Pressure gauge	AUR1/4- φ60 × **M	1
8	Fluid supply port/air breather	MSA-V50-VS10	1
9	Fluid level gauge	φ8 × 120L	1
10	Return filter	FRS-08-20P08T(20 μ) (FPL-08)CF-08 10μ paper	1

NCP-400-**PV70N*-R1*-12
NCP-650-**PV70N*-R1*-12

Symbol	Dimensions mm	
	400 ℓ	650 ℓ
LA	1470	1790
LB	1200	1520
LC	1100	1420
LD	900	1010
LE	1014	1164
LF	800	910
LG	620	670
LH	1180	1230
LI	57	77
LJ	300	450

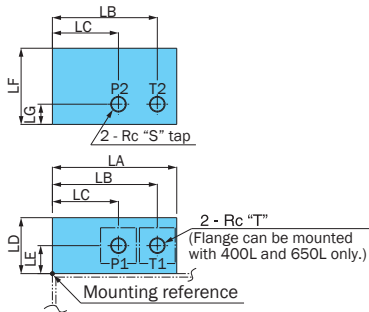


Part No.	Name	Model No.	Q'ty
1	Tank	** ℓ	1
2	Strainer	CS-12(150 mesh)	1
3	Uni-pump	PZS-3A-70N*-10	1
4	Coupling	CR-****J	
5	Motor	Fully closed external fan A terminal **kW-4P	1
6			
7	Pressure gauge	AUR1/4-φ60 × **M	1
8	Fluid supply port/air breather	MSA-V50-VS10	1
9	Fluid level gauge	φ8 × 120L	1
10	Check valve	CA-G10-1-20	1
11	Relief valve	R-T03-3-11	1
12	Return filter	FRS-12-20P-12F	1
13	Flexmaster joint	M1600-150-0350	1

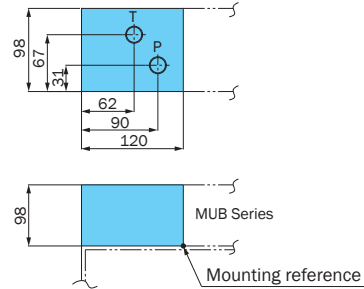
Note: Set (11) relief valve setting pressure so it is equivalent to pump setting pressure plus 1.0MPa {10.2kgf/cm²}.

Outlet Block Specifications

Design number 12
Outlet Block Dimensions



Design number 21
Outlet Block Dimensions

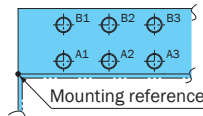


Tank Capacity	Dimensions (mm)							Outlet Size	
	LA	LB	LC	LD	LE	LF	LG	S	T
40L 60L 100L	160	135	85	72	36	98	26	1/2	1/2
160L 250L								3/4	3/4
400L 650L								1	JIS B 2291 SSA-32 (Rcl)

Option B

MPU Series Built-in

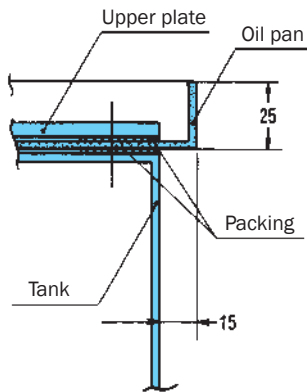
(See base block specifications for dimensions.)



Oil Pan Specifications

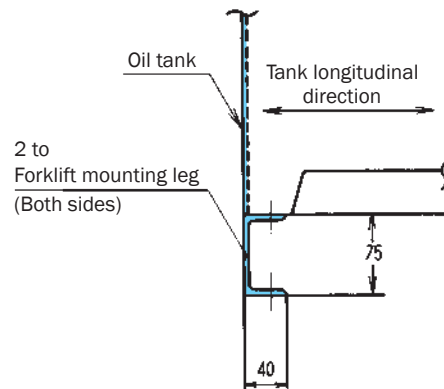
A "headband type" oil pan is standard, and an oil pan drain is provided at one location (Rc3/8).

Structural Diagram



Forklift Mounting Leg Specifications

Forklift Mounting Leg Specifications



Standard Specifications

1. Paint Color: Mancel No. 5B6/3 (lacquer)

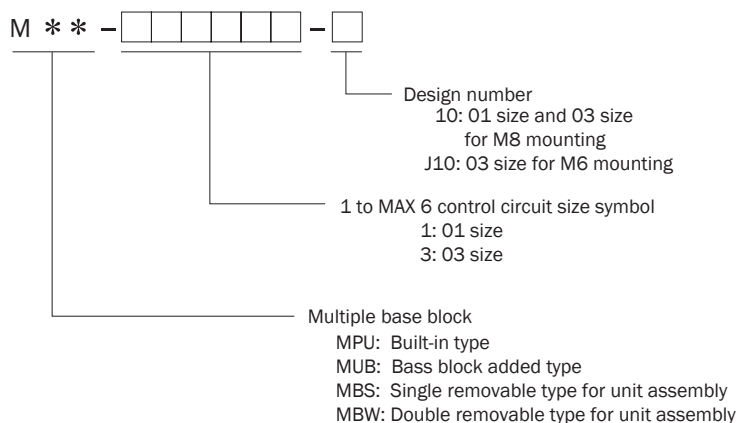
2. Motor Specifications:

Note: Mancel No. 5B/0.5 for tank capacity 30L uni-pump motor only.

		Wiring	Color Coding	Terminal number	Terminal	Terminal box specifications
Control System	SA SS	VCT-1.25mm ²	Single SOL White, Black	1, 2 - Consecutive numbers (Common: C)	Y Type Solderless	Inner : Mancel No. 2.5Y8/2 Dust-tight type, cover fastened by screws
			Double SOL Red, White, Black, Green			
Drive System	to 3.7kW 5.5kW to	VCT	Red, White, Black, Green	U, V, W, E	Round Solderless	Outer : Mancel No 5B6/3 (Lacquer)
		IV + PF	Black (3) + Green			

Base Block Specifications

Understanding Model Numbers

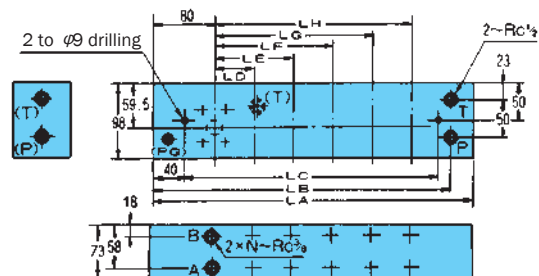


• MPU Series (Unit Built-in)

This base block is a special type built into the NCP Series.

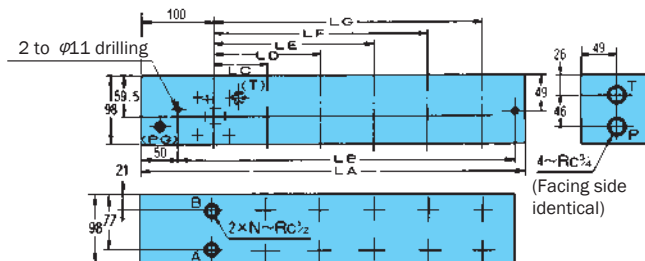
Block Model Numbers, Appearance, Dimensions

01 size



Model No.	Dimensions (mm)									Weight kg
	LA	LB	LC	LD	LE	LF	LG	LH	N	
MPU -1-10	160	130	75						1	8.3
-11-10	210	180	125	50					2	10.9
-111-10	260	230	175	50	100				3	13.4
-1111-10	310	280	225	50	100	150			4	16.0
-11111-10	360	330	275	50	100	150	200		5	18.6
-111111-10	410	380	325	50	100	150	200	250	6	21.2

03 size



Model No.	Dimensions (mm)								Weight kg
	LA	LB	LC	LD	LE	LF	LG	N	
MPU -3J10(10)	160	95						1	11.1
-33J10(10)	235	170	75					2	16.3
-333J10(10)	310	245	75	150				3	21.5
-3333J10(10)	385	320	75	150	225			4	26.7
-33333J10(10)	460	395	75	150	225	300		5	31.9
-333333J10(10)	535	470	75	150	225	300	375	6	37.0

Note: 1. There are two types of mounting bolts available for the 03 size: M6 and M8. Be sure to specify the type of bolt you need.

M6 : SA, SS-J Series

M8 : SS Series

2. When using the 01/03 combination type

a) The installation pitch uses the 03 size dimensions shown above, and for A and B ports only the 01 size installation part is Rc3/8.

b) In the case of MPU-313131-J10, for example, valve installation locations 1, 3, and 5 counting from the left are 03 size, while 2, 4, 6 are 01 size.

Other

Space is limited in accordance with tank capacity, so use the basic data in the following table when designing the circuit.

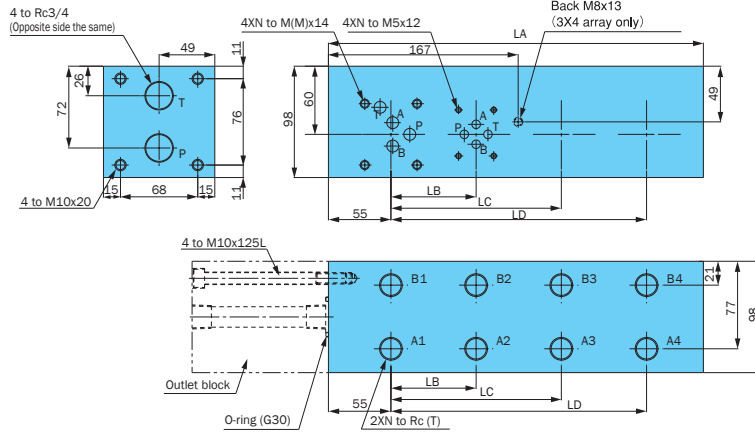
	Tank Capacity	01 Space Block	03 Space Block
VD* Series	30 l	Up to 3	
	40 l	Up to 4	Up to 3
	60 l	Up to 5	Up to 3
	100 l	Up to 6	Up to 5
	160 l	Up to 6	Up to 5
	250 l	Up to 6	Up to 6
PVS Series	400, 650 l		Up to (2, 4, 6) + Up to (3, 2, 1)
	30 l	Up to 3	
	40 l	Up to 4	Up to 3
	60 l	Up to 5	Up to 3
	100 l	Up to 6	Up to 4
	160, 250 l	Up to 6	Up to 6
	400, 650 l		Up to (2, 4, 6) + Up to (3, 2, 1)

Note: Using in series larger than those noted above causes overhang from the top plate.

• MUB Series (Base Block Additional Configurations)

This series makes it easy to add an option base block using only four mounting bolts. The following shows the range of the possible addition. In this configuration, the NCP unit design number becomes 21.

Block Model Numbers, Appearance, Dimensions



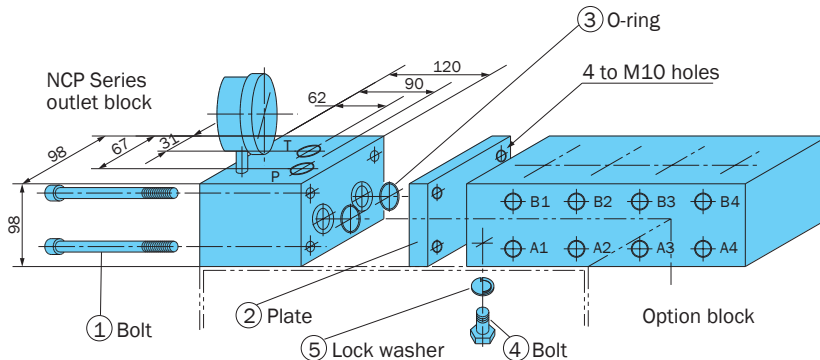
Model No.	Dimensions (mm)							Weight kg
	LA	LB	LC	LD	N	M	T	
MUB-1-10	105				1	-	3/8	7.6
MUB-3-J10(10)	105				1	6(8)	1/2	7.6
MUB-11-10	180	75			2	-	3/8	12.8
MUB-33-J10(10)	180	75			2	6(8)	1/2	12.8
MUB-111-10	255	75	150		3	-	3/8	18.0
MUB-333-J10(10)	255	75	150		3	6(8)	1/2	18.0
MUB-1111-10	330	75	150	225	4	-	3/8	23.2
MUB-3333-J10(10)	330	75	150	225	4	6(8)	1/2	23.2

- Note:
- There are two types of mounting bolts available for the O3 size: M6 and M8. Be sure to specify the type of bolt you need.
M6 : SA, SS-J Series
M8 : SS Series
 - When using the O1/O3 combination type
 - The installation pitch uses the O3 size dimensions shown above, and for A and B ports only the O1 size installation part is Rc3/8.
 - In the case of MUB-3131-J10, for example, valve installation locations 1 and 3 counting from the left are O3 size, while 2, 4 are O1 size.
 - When using a 2-speed plate, a special MUB type is used.
Contact your agent for more information.

Option Base Block Installation Procedure

Loosen bolts ① and ④ and remove plate ②. Next, after checking to ensure that O-ring ③ is installed, install the option base block using ①, ④, and ⑤.

- Note:
- ④ and ⑤ are used only in 3 and 4 multi configurations.
 - In single and double configurations, ④ and ⑤ are just removed.

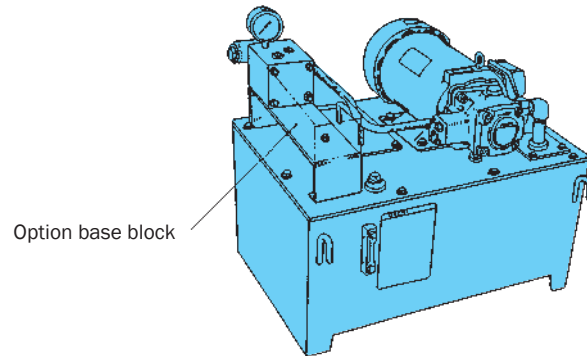


21 Design Series Scope

This series consists of a total of six best-seller piston and vane types with 40, 60, and 100 ℓ tanks. Note that piston Z type and vane VC type are not included.

Option Base Block Addition Scope

Tank Capacity	O1 Base Block	O3 Base Block
40 ℓ	Up to 2	Up to 2
60 ℓ	Up to 3	Up to 3
100 ℓ	Up to 4	Up to 4



Part No.	Name	Model No.
1	Hexagon Socket Head Bolt	M10 × 125
2	Plate	98 × 98 × 15t
3	O-ring	1B-G30
4	Hex bolt	M8 × 25
5	Lock washer	For M8

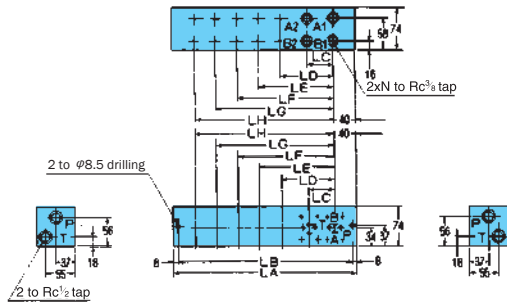
• MBS, MBW Series (Unit Assembly Type)

This base block is used to install the valve unit only around machinery.

Block Model Numbers, Appearance, Dimensions

MBS Series (Single Ejection Multi Block)

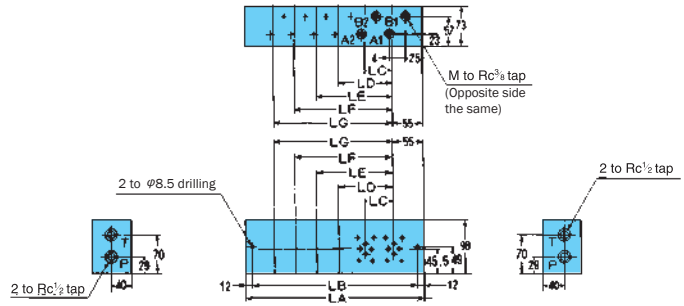
01 size



Model No.	Dimensions (mm)									Weight kg
	LA	LB	LC	LD	LE	LF	LG	LH	N	
MBS -1-10	80	64							1	3.4
-11-10	130	114	50						2	5.5
-111-10	180	164	50	100					3	7.6
-1111-10	230	214	50	100	150				4	9.8
-11111-10	280	264	50	100	150	200			5	11.9
-111111-10	330	314	50	100	150	200	250		6	14
-1111111-10	380	364	50	100	150	200	250	300	7	16

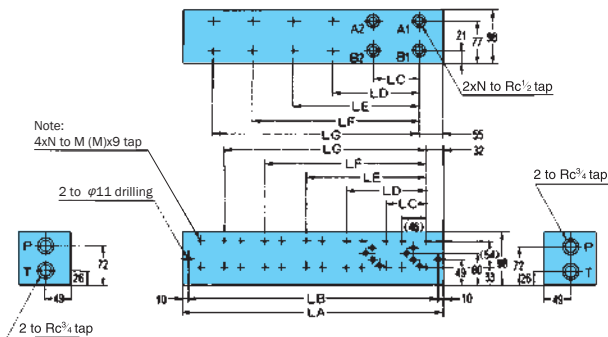
MBW Series (Double Ejection Multi Block)

01 size



Model No.	Dimensions (mm)									Weight kg
	LA	LB	LC	LD	LE	LF	LG	M	N	
MBW -1-10	110	86						2x2	1	5.7
-11-10	160	136	50					4x2	2	8.3
-111-10	210	186	50	100				6x2	3	10.9
-1111-10	260	236	50	100	150			8x2	4	13.4
-11111-10	310	286	50	100	150	200		10x2	5	16
-111111-10	360	336	50	100	150	200	250	12x2	6	18.6

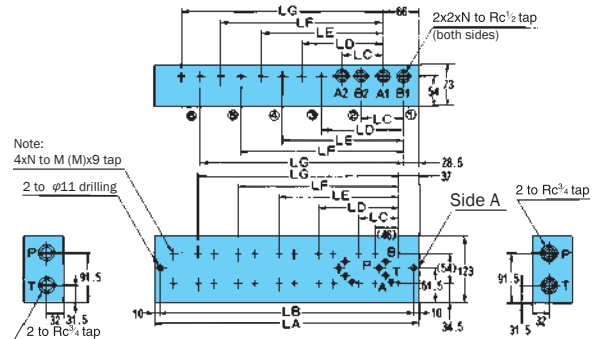
03 Size (01, 03 Connection Type)



Model No.	Dimensions (mm)									Weight kg
	LA	LB	LC	LD	LE	LF	LG	M ^{mm}	N	
MBS-3 -J10(10)	110	90						6(8)	1	8.2
-**-J10(10)	185	165	75					6(8)	2	13.8
-***-J10(10)	260	240	75	150				6(8)	3	19.4
-****-J10(10)	335	315	75	150	225			6(8)	4	25.0
-*****-J10(10)	410	390	75	150	225	300		6(8)	5	30.7
-*****-J10(10)	485	465	75	150	225	300	375	6(8)	6	36.3

Note: 1. There are two types of mounting bolts available for the 03 size: M6 and M8. Be sure to specify the type of bolt you need.
M6 : SA, SS-J Series
M8 : SS Series
2. When using the 01/03 combination type
a) The installation pitch uses the 03 size dimensions shown above, and for A and B ports only the 01 size installation part is Rc3/8.
b) In the case of MBS-313131-J10, for example, valve installation locations 1, 3, 5 counting from the right are 03 size, while 2, 4, 6 are 01 size.

03 Size (01, 03 Connection Type)



Model No.	Dimensions (mm)									Weight kg
	LA	LB	LC	LD	LE	LF	LG	M ^{mm}	N	
MBW-3-J10(10)	120	100						6(8)	1	8.4
-**-J10(10)	195	175	75					6(8)	2	13.6
-***-J10(10)	270	250	75	150				6(8)	3	18.9
-****-J10(10)	345	325	75	150	225			6(8)	4	24.1
-*****-J10(10)	420	400	75	150	225	300		6(8)	5	29.4
-*****-J10(10)	495	475	75	150	225	300	375	6(8)	6	34.6

Note: 1. There are two types of mounting bolts available for the 03 size: M6 and M8. Be sure to specify the type of bolt you need.
M6 : SA, SS-J Series
M8 : SS Series
2. When using the 01/03 combination type
a) The installation pitch uses the 03 size dimensions shown above, and for A and B ports only the 01 size installation part is Rc3/8.
b) In the case of MBS-313131-J10, for example, valve installation locations 1, 3, and 5 counting from the right are 03 size, while 2, 4, 6 are 01 size.



NSP Series Compact Variable Pump Unit

Compact hydraulic units are widely used as a power source in such machine tool applications as NC lathe check opening and closing, tool rotation, machining center spindle raise and lower operations, etc.

During pressure holding, NSP unit enables machine efficiency that delivers energy savings of approximately 40% when compared with standard Nachi units, all in a compact, lightweight hydraulic unit.

Features

Space-saving, lightweight design

A smaller tank capacity makes it easier for the unit to fit in, and greatly reduces space requirements.

New structure increases efficiency

A structure that draws on years of accumulated know-how includes an improved pump joint that provides more efficient operation.

Greatly improved cooling capacity

A powerful, energy-efficient built-in cooling system eliminates the need for fan motor wiring and coolant pipes.

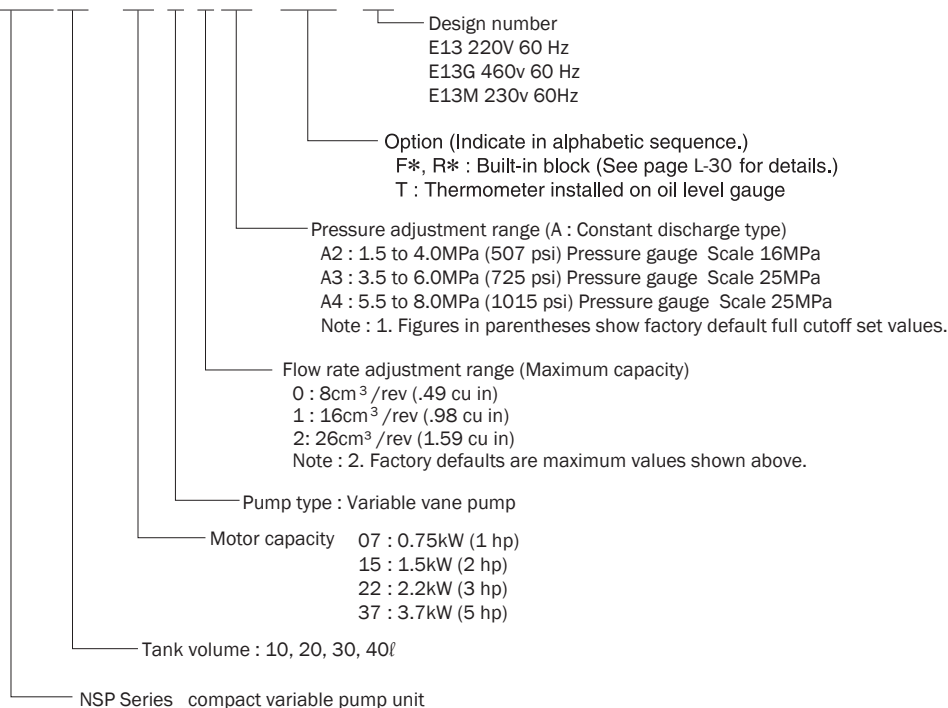
Specifications

Item	Model No.	NSP-*.V0A*	NSP-*.V1A*	NSP-*.V2A*
Pump Capacity	cm ³ /rev	8.0	16.0	26.0
Maximum Pressure	MPa (psi)	8.0 (1160 psi) (Full Cutoff Pressure)		7.0 (Full Cutoff Pressure) * Allowed peak pressure is 13.0
Motor Output	kW (hp)	0.75, 1.5 (1, 2)	1.5, 2.2 (2, 3)	2.2, 3.7 (3, 5)
Tank Capacity	ℓ	10, 20		30, 40
Installation Space	mm	300 × 400		340 × 450
Approximate Weight	kg	37 (10 ℓ, 1.5kW, excluding options)		63 (30 ℓ, 2.2kW, excluding options)
Pump Volume 60 Hz		3.8 gpm	7.6 gpm	12 gpm

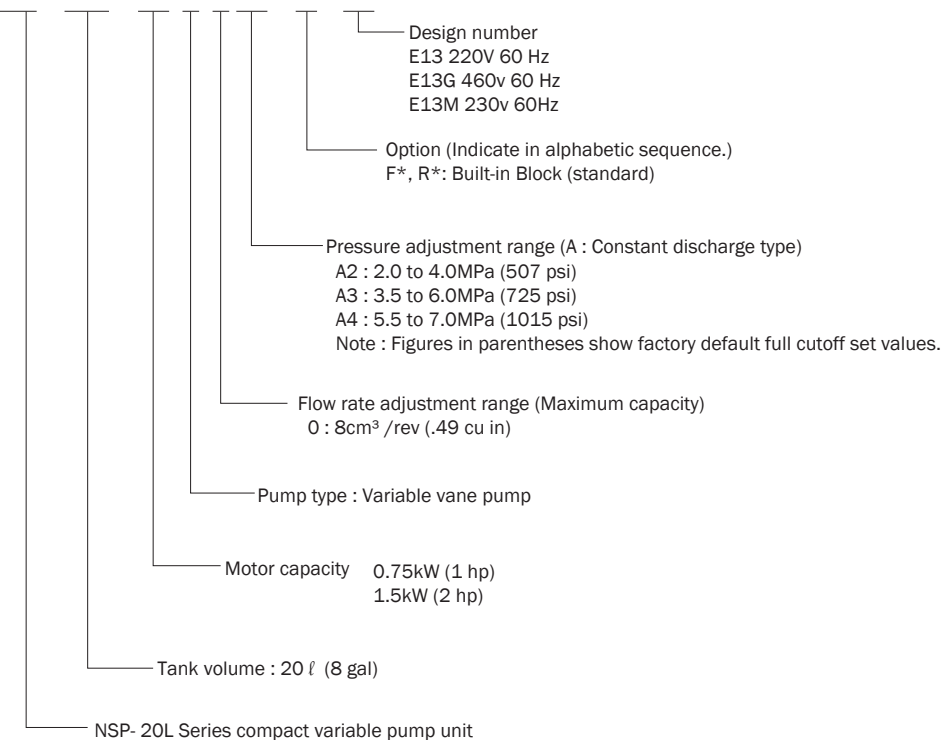
Understanding Model Numbers

- Note: 1. Note that there are certain restrictions on pump capacity and motor capacity combinations. See the Selection Precautions on page L-23 before selecting a model.
2. Design numbers are subject to change without notice.

NSP - 10 - 07 V 0 A2 - F2T - E13



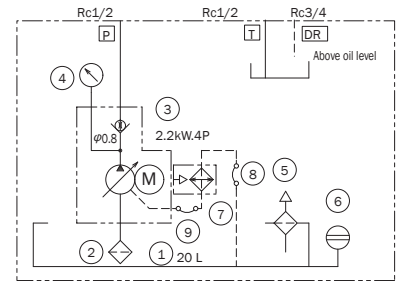
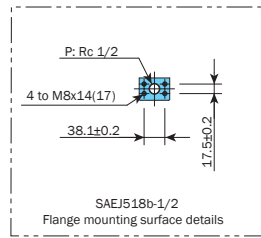
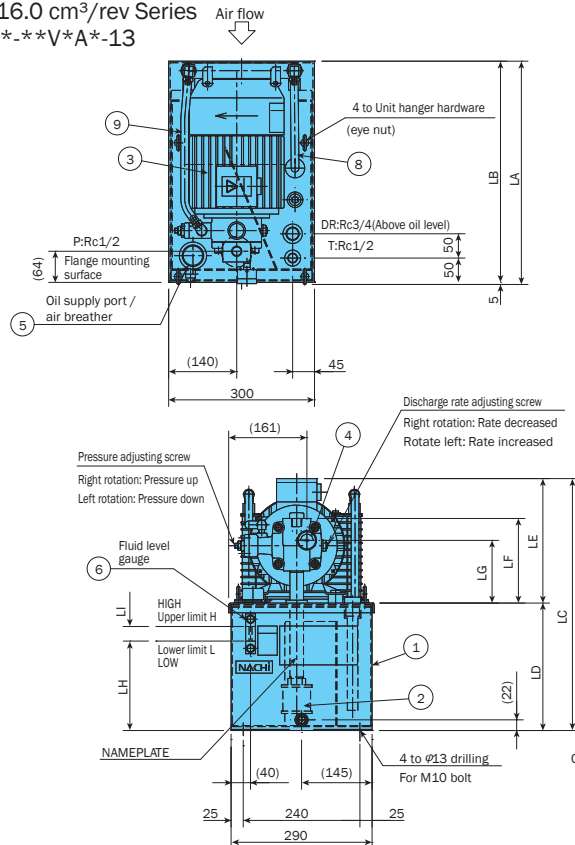
NSP - 20L - 07 V 0 A2 - F - 13



Design Drawings, Dimension Tables

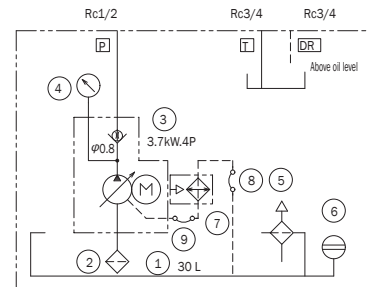
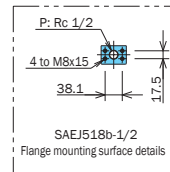
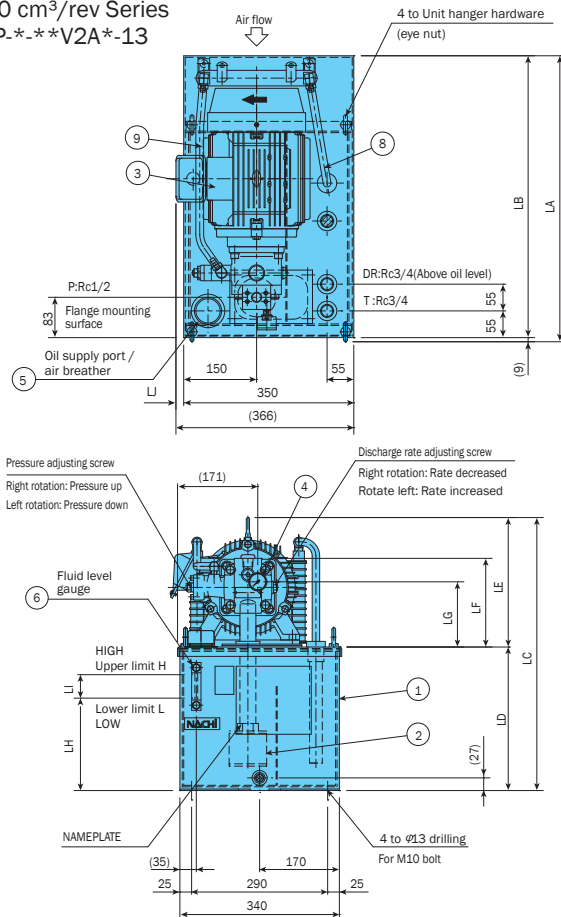
Note: See the following page for dimensions.

8.0, 16.0 cm³/rev Series
NSP-**-**V*A*-13



Part No.	Part Name
1	Oil tank
2	Suction strainer
3	Uni-pump
4	Pressure gauge
5	Fluid supply port/air breather
6	Fluid level gauge
7	Radiator
8	Flexible hose
9	Flexible hose

26.0 cm³/rev Series
NSP-**-**V2A*-13



Part No.	Part Name
1	Oil tank
2	Suction strainer
3	Uni-pump
4	Pressure gauge
5	Fluid supply port/air breather
6	Fluid level gauge
7	Radiator
8	Flexible hose
9	Flexible hose

8.0, 16.0cm³/rev Series

Model No.	Motor (kW-P)	Dimensions											Approximate Weight (kg)
		LA	LB	LC	LD	LE	LF	LG	LH	LI	H	L	
NSP-10-07V*A*-*-13	0.75 - 4	405	400	394	160	234	154	109	102	10	10L	9L	33
NSP-10-15V*A*-*-13	1.5 - 4	430	425	396		236	164	119					37
NSP-10-22V*A*-*-13	2.2 - 4	460	455	422		262	174	129					42
NSP-20-07V*A*-*-13	0.75 - 4	405	400	496	262	234	154	109	185	30	20L	17L	35
NSP-20-15V*A*-*-13	1.5 - 4	430	425	498		236	164	119					39
NSP-20-22V*A*-*-13	2.2 - 4	460	455	524		262	174	129					44

(Excluding operating fluid)

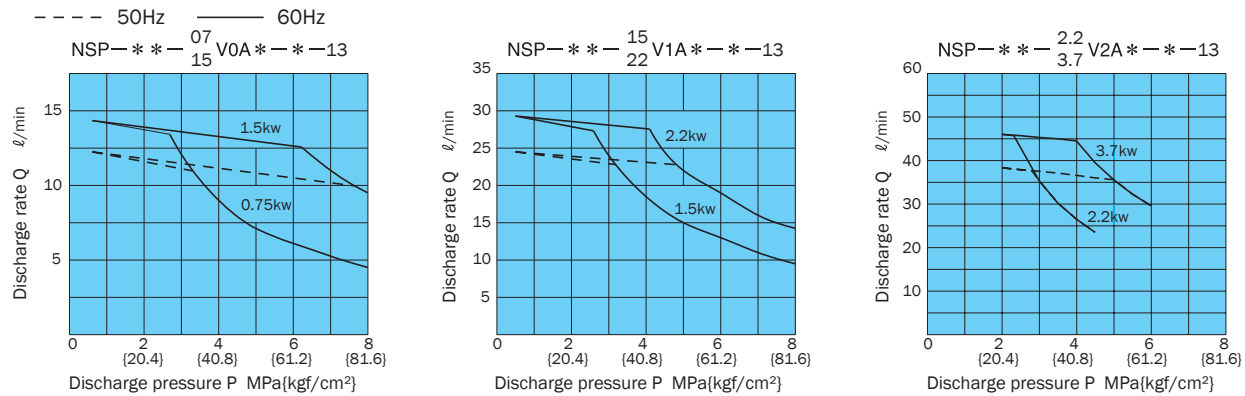
26.0cm³/rev Series

Model No.	Motor (kW-P)	Dimensions												Approximate Weight (kg)
		LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	H	L	
NSP-30-22V2A*-*-13	2.2 - 4	564	555	619	306	234	177	127	197	50	9	30L	23L	63
NSP-30-37V2A*-*-13	3.7 - 4	589	580	661		276	189	139			15			73
NSP-40-22V2A*-*-13	2.2 - 4	564	555	619	385	234	177	127	256	70	9	40L	31L	67
NSP-40-37V2A*-*-13	3.7 - 4	589	580	661		276	189	139			15			77

(Excluding operating fluid)

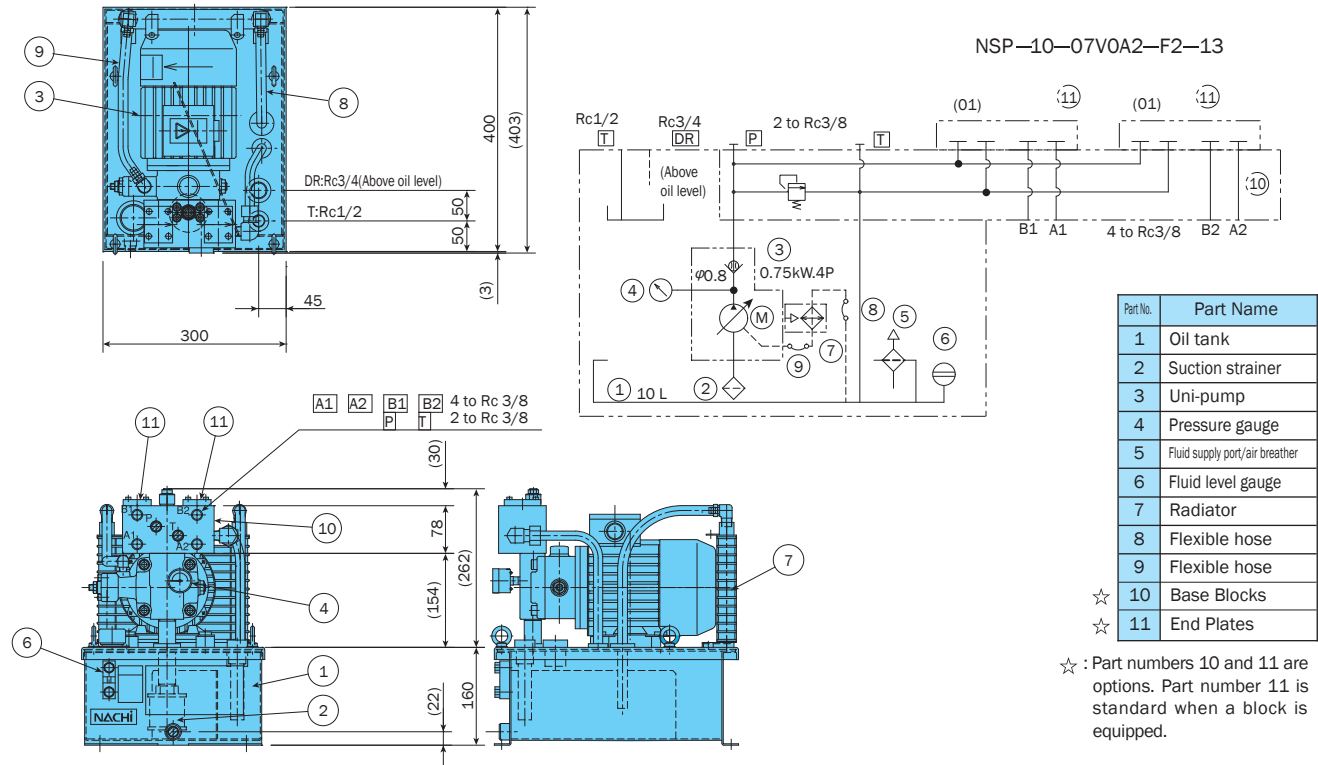
Selecting a Motor

NSP Motor Selection Curves (Standard voltage for drive motor is 200 VAC, 50/60 Hz or 220 VAC, 60 Hz.)



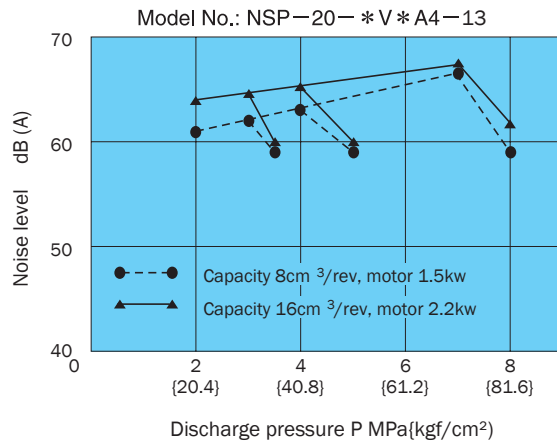
* See page B-40 for the characteristics of the drive motor.

[Block Addition Example]
NSP-10-07V0 A2-F2-13

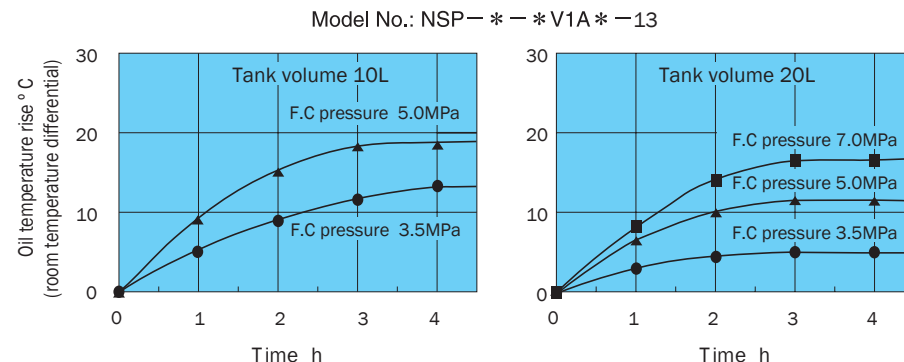


Performance Characteristics

Noise Characteristics



Fluid Temperature Characteristics



Note: For information about power consumption, see the data for the UVN Series variable vane uni-pump on page B-41.

Conditions

(The values shown in the graph to the left are typical characteristics under the following conditions.)

Operating Fluid: ISO VG32 equivalent

Fluid Temperature: 40±5°C

Revolution Speed: 1800min⁻¹

Measurement Distance:

1 meter around the unit
(Average value from four directions)

Note: Noise characteristics are affected by the condition of the floor and stand where the unit is mounted, whether there are noise reflective items nearby, and other factors. Such factors can produce different characteristics than those indicated above.

Conditions

(The values shown in the graph to the left are typical characteristics under the following conditions.)

Operating Fluid: ISO VG32 equivalent

Revolution Speed: 1800min⁻¹

Room Temperature: 29 °C

Motor: 0.75 to 2.2kW

Note) 1. Note that continuous operation at pressures of 5.0MPa or greater with the 10 l tank cause a large rise in fluid temperature. A 20 l tank is recommended in this case.
2. Rises in fluid temperature depend on actual operating conditions, and so actual temperatures may be different from those indicated above.

Selection Precautions

• Model Combinations

The table below shows the standard pump and motor combinations.

Pump \ Motor kW	0.75	1.5	2.2	3.7
0A*	○	○	○	○
1A*		○	○	○
2A2			○	○
2A3			○	○
2A4				○

A 30ℓ tank capacities with 8.0 or 16.0 cm³/rev are special specifications.

A model equipped with a block comes with a stopper plate on the block.

• Circuit Configuration

The basic configuration is a standard NSP-** plus an external manifold (circuit).

Provide piping with sufficient flexibility between the unit and external manifold.

Make sure the maximum peak pressure (setting pressure + surge pressure) during operation does not exceed 14MPa.

The following are typical pipe conditions at a reference maximum peak pressure at 14MPa or less as reference.

Rubber hose (for 14MPa) 1/2" x 2m
(Pipe Capacity: 250cm³) pump operating conditions: 1MPa→7MPa, full cutoff

At pressures in excess of 14MPa, equip a circuit side surge cutoff relief valve.

• Built-in Manifold Block

When a manifold block (optional) is built

into the pump, make sure the block and valve total weight is not greater than 15kg.

Block Type	F1R1	F2R2	F3
Block Weight (kg)	4.5	6.5	8.5
Allowable Additional Weight (kg)	10.5	8.5	6.5

Contact your agent for information about equipping a circuit.

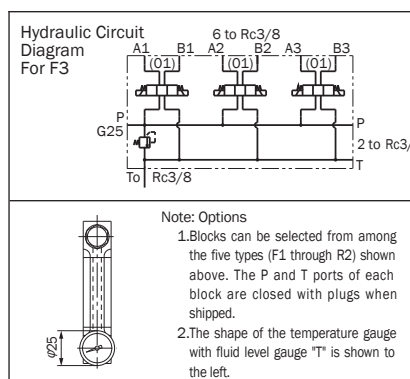
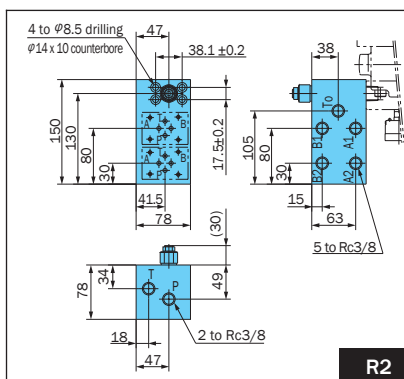
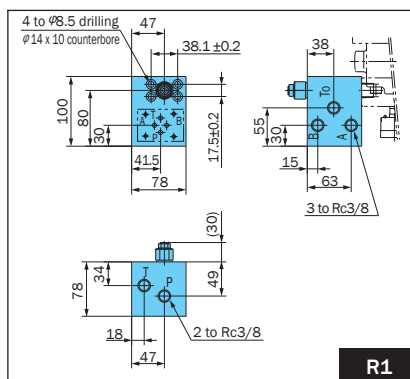
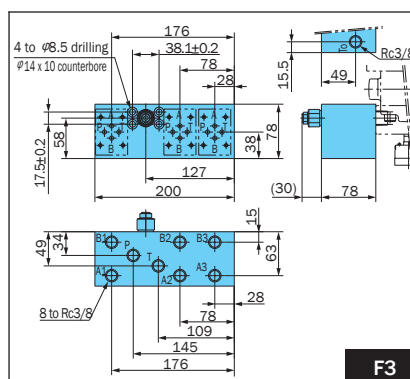
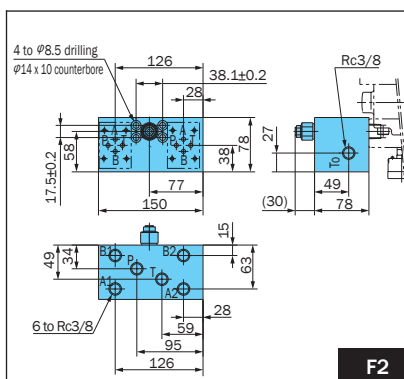
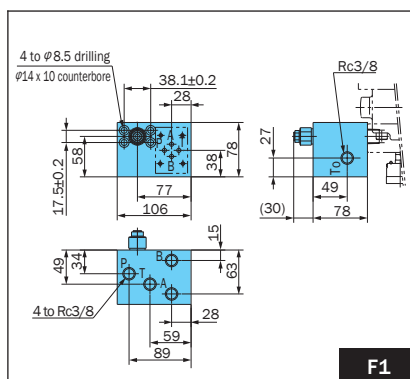
The 26 cm³/rev series blocks are different, contact us for information.

• Paint Specifications

The interior and exterior of the tank and the motor are covered with a melanin baked-on resin coating, while the pump is spray painted with a lacquer finish. Color is Nachi standard color (Mancel No. 5B6/3).

Contact your agent about specifying external paint colors.

Option Details



Handling Overview

Startup Precautions

Check to make sure that the operating fluid in the tank is at the prescribed level.

- Upper Limit Mark (Yellow): Prescribed fluid level (nominal capacity)
- Lower Limit Mark (Red): Minimum fluid level

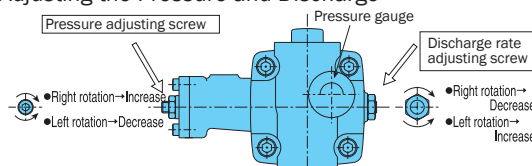
Hydraulic Operating Fluid: General oil-based operating fluid equivalent to ISO VG32

Perform electrical wiring exactly as shown below.

Motor and Power Supply Polarity	If wiring is performed incorrectly...
R → U	• Electric pump rotates in reverse, fluid is not discharged
S → V	Continued operation can damage the pump.
T → W	• Attach a pressure gauge to the discharge side and check for pressure rise.

Perform repeated motor starts and stops to bleed air from the interior of the pump and the suction piping. A no-load circuit allows faster bleeding.

• Adjusting the Pressure and Discharge



Note: Do not touch anything except the adjustment screw shown above.

• Maintenance and Inspection

Fluid Temperature: Use in an area where the temperature is 15° C to 60° C.

Operating Fluid Replacement Cycle: Perform the initial fluid replacement after three months of operation. After that, replace fluid when it becomes dirty or once a year, whichever comes first.

Radiator Fin Cleaning and Fin Strainer Cleaning: Every six months or 4,000 hours of operation, whichever comes first.

• Environment

Temperature: 10 to 35° C

Avoid areas exposed to mist of water-soluble coolant.



NSP-L Series Compact Variable Pump Unit

Compact hydraulic units are widely used as a power source in such machine tool applications as NC lathe check opening and closing, tool rotation, machining center spindle raise and lower operations, etc.

During pressure holding, NSP-L unit enables machine efficiency that delivers energy savings of approximately 40% when compared with standard Nachi units, all in a compact, lightweight hydraulic unit.

Features

Space-saving, lightweight design

A smaller tank capacity makes the power unit more compact, and greatly reduces space requirements.

New structure increases efficiency

Based on years of experience, the structure includes an improved pump joint that provides more efficient operation.

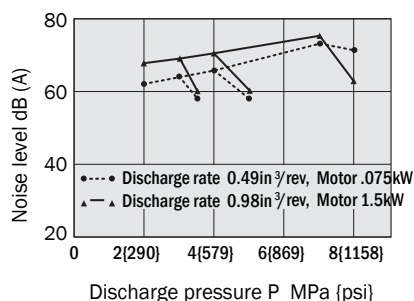
Greatly improved cooling capacity

A powerful, energy-efficient built-in cooling system eliminates the need for fan motor wiring and coolant pipes.

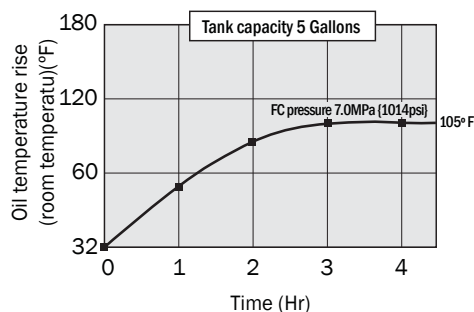
Specifications

Item	Model No.	NSP-*.VOA*	NSP-*.V1A*
Pump Capacity	cm ³ /rev	8.0	16.0
Maximum Pressure	MPa (psi)	8.0 (1160 psi) (Full Cutoff Pressure)	
Motor Output	kW (hp)	0.75, 1.5 (1, 2)	1.5, 2.2 (2, 3)
Tank Capacity	ℓ	20	
Installation Space	mm	300 × 400	
Approximate Weight	kg	39 (20 ℓ, 1.5kW, excluding options)	
Pump Volume 60 Hz		3.8 gpm	7.6 gpm

Noise Characteristics



Oil Temperature Characteristics



Conditions

The value on the left-hand drawing represents typical characteristics under the following conditions:
Oil used: ISO VG32 or its equivalent
Speed: 1800 min-1
Room temperature: 65°F
Motor: 0.75~1.5kW

Understanding Model Numbers

NSP - 20L - 07 V 0 A2 - F - 13

Design number

E13 220 Volt 60 Hz
E13G 460 Volt 60 Hz
E13M 230 Volt 60 Hz

Option (Indicate in alphabetic sequence.) F*: Built-in block*=1~2 Temp gauge standard

Pressure adjustment range (A: constant discharge type)

A2: 2.0 to 4.0 MPa (507 psi)

A3: 3.5 to 6.0 MPa (725 psi)

A4: 5.5 to 7.0 MPa (1015 psi)

Note: 1. Figures in parentheses show factory default full cutoff set values.

Flow rate adjustment range (Maximum capacity) 0: 8 cm³ / rev (.49 cu in)

1: 16 cm³ / rev (.98 cu in)

Pump type: Variable vane pump

Motor capacity: 0.75 kW (1 HP)

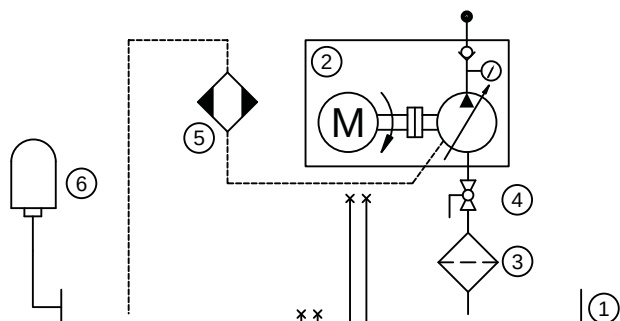
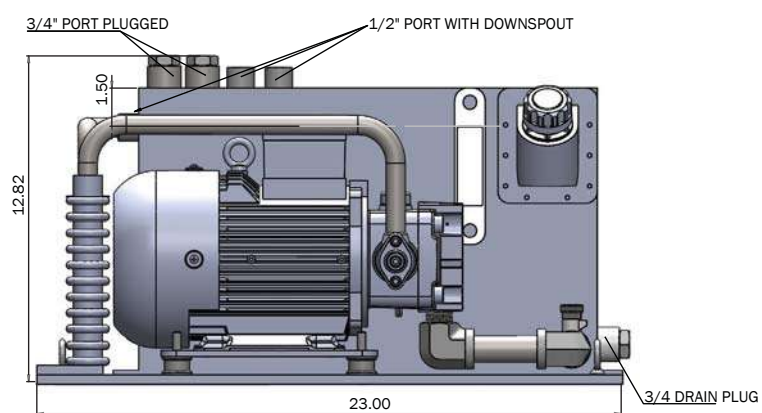
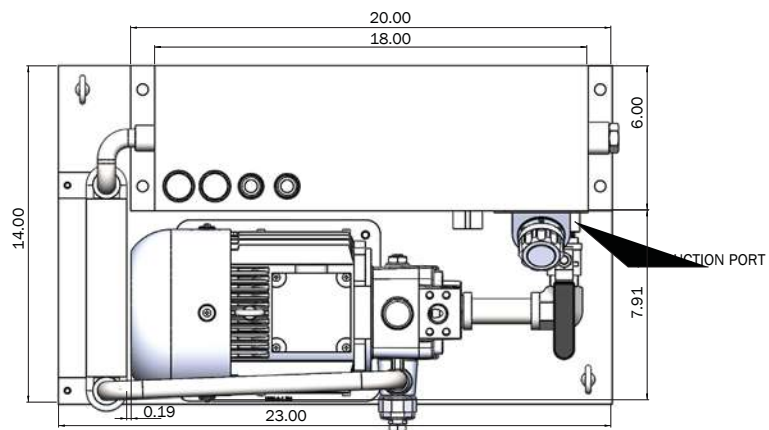
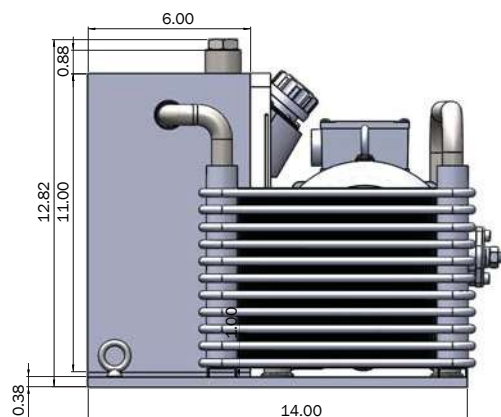
1.5 kW (2 HP)

Tank volume: 20 ℓ (5 gal)

NSP-20L Series compact variable pump unit

Design Drawings & Dimensions

8.0, 16.0 cm³ / rev Series
NSP-20L-**V*A*-13



NSP-20L-07V0A*-(*)-E13

NSP-20L-15V0A*-(*)-E13

NSP-20L-15V1A*-(*)-E13

() 220V 60 Hz

(G) 460V 60 Hz

(M) 230V 60 Hz

PART NO.	PART NAME
1	NL-4 L Shape Reservoir
2	UVN-1A-1A4-1.5-4-11 Pump Motor
3	SUS-A088-068-N16F Strainer
4	948-173 3/4' Ball Valve
5	3A92-001-1050 Cooler
6	SM57XL-10 Filler/Breather



Inverter Drive NSP Series Energy-saving Variable Pump Unit with Inverter Drive

The "Inverter Drive NSP Series" is a hydraulic unit that reduces energy consumption by approximately 60% (dwelling, in-house comparison) compared to the standard unit by adding an energy saving NSP Series inverter drive. They are great for jobs that need to dwell for long periods.

Features

Hydraulic fluid temperature is kept at room temperature +1.5°C

The NSP series benefits your entire system by lowering oil temperature to improve machining accuracy, lengthen the life of seals and hydraulic fluid, and reduce factory air conditioning costs.

NSP-20E-22V1A4-13

6.0MPa maintained while dwelling

Quiet operation at only 53dB (A)

NSP-20E-22V1A4-13

6.0MPa dwelling

4-directional average

Standard unit sound level is 64dB (A)

Easy Operation

Starts up as soon as the power is turned on

Absolutely no external commands or delicate electrical adjustments needed because the pump's RPMs are controlled automatically in response to the load.

Operates with the inverter removed also

Can operate as an NSP unit just by switching out the wiring in case of emergencies.

Production lines continue running even if there is trouble with the inverter because it is based on our reliable NSP unit and keeps running as a regular NSP unit.

Inverter drive function can be installed separately later

If you are already using an NSP unit, you can add the inverter drive function by installing the inverter control box kit, which is sold separately.

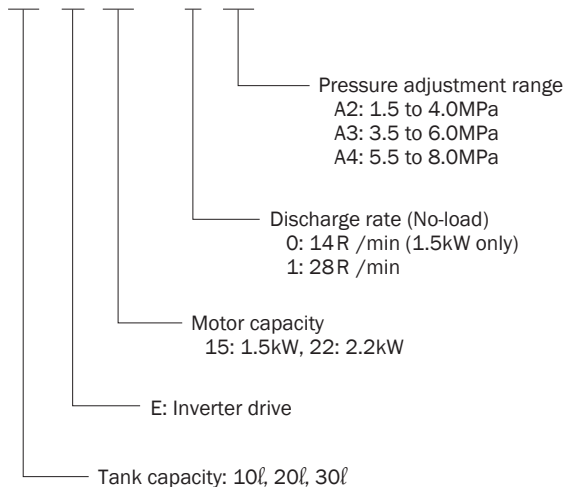
Specifications

1. Power Supply Rated Input Current	3φAC200 to 220V, 50/60Hz 9.7A/1.5kW, 13.4A/2.2kW 22.4A/3.7kW	
2. Pressure Adjustment Range	8, 16cm ³ /rev series A2: 1.5 to 4.0MPa A3: 3.5 to 6.0MPa A4: 5.5 to 8.0MPa	26cm ³ /rev series A2: 2.0 to 4.0MPa A3: 3.5 to 6.0MPa A4: 5.5 to 7.0MPa
3. Output Flow (at No-load)	0A*: 14ℓ /min, 1A*: 28ℓ /min 2A*: 46ℓ /min	
4. Hydraulic Fluid	Standard mineral-based hydraulic fluid (equivalent to ISO VG32)	
5. Hydraulic Fluid Temperature	10 to 60:	
6. Color of Paint	Munsell number 5B 6/3 (NACHI color)	
7. Ambient Temperature/ Humidity	0 to 35 / 20 to 85%RH (non-condensation) (Keep the unit away from water-soluble cutting fluid mist.)	

Understanding Model Numbers

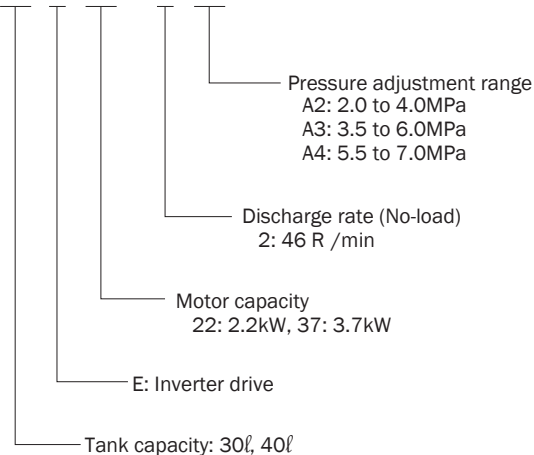
8.0, 16.0 cm³/rev Series

NSP - 20 - E - 15 V - 0 - A2 - 13



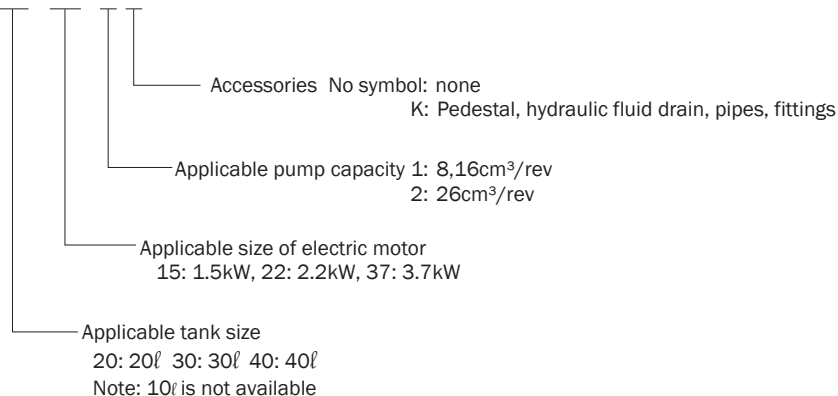
26.0 cm³/rev Series

NSP - 30 - E - 22 V - 2 - A2 - 13



Inverter Control Box Kit Specifications

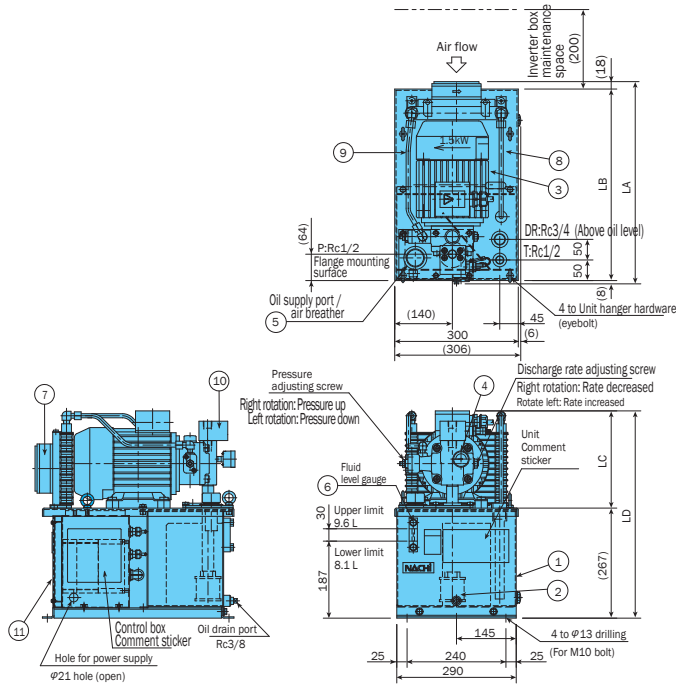
EBK - 20 - 22 - 1 K - 10



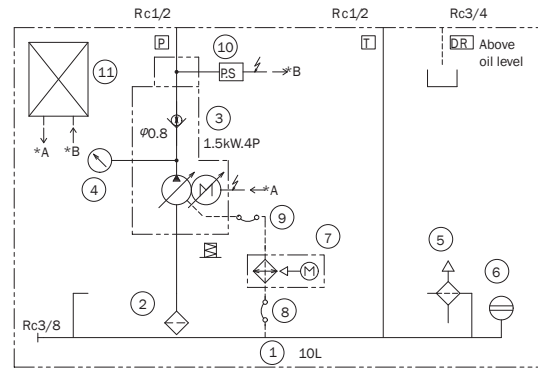
Design Drawings, Dimension Tables

8.0, 16.0cm³/rev Series

NSP-10E-**V*A-13

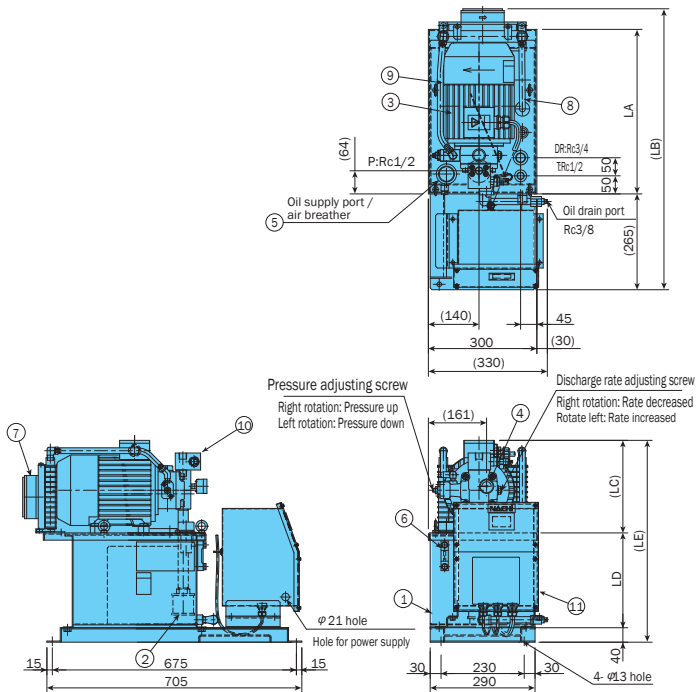


Note: See the following page for dimensions.



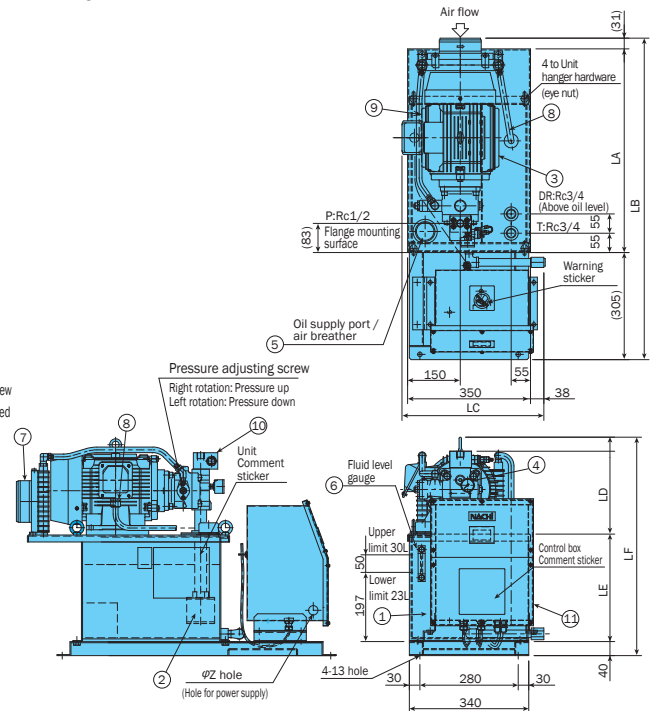
Part No.	Part Name	Part No.	Part Name
1	Oil tank	7	Fan cooler
2	Suction strainer	8	Flexible hose
3	Uni-pump	9	Flexible hose
4	Pressure gauge	10	Pressure sensor
5	Fluid supply port/air breather	11	Inverter control box
6	Fluid level gauge		

NSP- 20 E-**V*A*-13



26.0cm³/rev Series

NSP- 30 E-**V2A*-13



8.0, 16.0cm³/rev Series

Model No.	Dimensions					Approximate Weight (kg)
	LA	LB	LC	LD	LE	
NSP-10E-15V*A*-13	465	491	211	503	-	51
NSP-10E-22V1A*-13	485	521	221	523	-	56
NSP-20E-15V*A*-13	425	750	211	262	545	65
NSP-20E-22V1A*-13	455	780	221		564	71
NSP-30E-15V*A*-13	425	750	211	364	647	70
NSP-30E-22V1A*-13	455	780	221		666	76

26.0cm³/rev Series

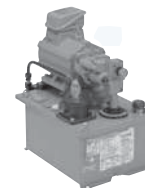
Model No.	Dimensions							Approximate Weight (kg)
	LA	LB	LC	LD	LE	LF	Z	
NSP-30E-22V2A*-13	555	895	409	229	306	582	21	84
NSP-30E-37V2A*-13	580	915	415	241			27	96
NSP-40E-22V2A*-13	555	895	409	229	385	661	21	89
NSP-40E-37V2A*-13	580	915	415	241			27	101

Precautions

- Turning the inverter on and off by cutting the main power supply (circuit breaker) significantly reduces the life of the inverter and should be limited to once an hour.
Contact us if you need to start and stop operations frequently.
- Do not change or adjust any switches except the inverter parameter settings and the pressure setting switches.
- Use a flexible hose with a 1/2 inch inner diameter that is 2 meters long and is rated for maximum pressure of 14MPa to connect the hydraulic unit's P port (output port) and the external manifold (or actuator).
- Maximum peak pressure (set pressure + surge pressure) must be 14MPa or below for the 8 and 16cm³/rev series, and 13MPa or below for the 26cm³/rev series.
Install a relief valve to cut surges in the circuit if the maximum peak pressure exceeds these figures.

[For 10ℓ tanks]

- Leakage amount in the hydraulic circuits must be 1ℓ/min or less. Contact us if leakage in the hydraulic circuit exceeds 1ℓ/min.
- Level of hydraulic fluid in the tank must stay within the visible range on the fluid level meter (approximately 1.5ℓ).



NACHI NN Pack High-Pressure Standard Variable Pump Unit

Newly developed compact variable pump unit has environmentally friendly low hydraulic fluid temperature for cutting and manufacturing equipment hydraulic units. Extensive lineup in the series to handle requirements exactly.

Features

Low hydraulic fluid temperature = room temperature + 7 °C

$\left[\begin{array}{l} \text{NNP-20-22P16N1-20} \\ 60\text{Hz, 7MPa Full cut-off in} \\ \text{continuous operation} \end{array} \right]$

Fan to cool pump drain is standard equipment, hydraulic fluid temperatures are kept low using tank construction focused on anti-foaming.

A wide selection of models from which to choose

$\left[\begin{array}{ll} \text{Basic Series:} & 10 \text{ types} \\ \text{Pump Variable Controllers:} & 5 \text{ types} \\ \text{Options:} & 8 \text{ types} \end{array} \right]$

A wide range of models provides a selection of capacity levels, and selecting a variable control mechanism helps to reduce energy needs.

Specifications

Power supply: AC200V-50/60Hz AC220V-60Hz

Model No.	Pump Capacity cm ³ /rev	Motor capacity kW-P	Maximum Pressure (Full Cutoff Pressure) MPa(kgf/cm ²)	Tank Capacity ℓ	Fan Cooler Motor Input W(at50/60Hz)	Standard Weight kg (Note)
NNP-20-22P8N***-20	8.0	2.2 - 4	21(214)	20	16/15W Single-phase	65
NNP-20-37P8N***-20		3.7 - 4		20		75
NNP-20-22P16N***-20	16.5	2.2 - 4	21(214)	20		70
NNP-30-37P16N***-20		3.7 - 4		30		80
NNP-20-22P22N***-20	22.0	2.2 - 4	14(143)	20	33/30W Single-phase	70
NNP-30-37P22N***-20		3.7 - 4		30		80
NNP-40-37P35N***-20	35.0	3.7 - 4	21(214)	40		105
NNP-60-55P35N***-20		5.5 - 4		60		125
NNP-80-37P45N***-20	45.0	3.7 - 4	14(143)	80		120
NNP-80-55P45N***-20		5.5 - 4		80		130

Note: Operating fluid is not included in options

Understanding Model Numbers

NNP - 20 - 22 P 16 N2 - ** - 20

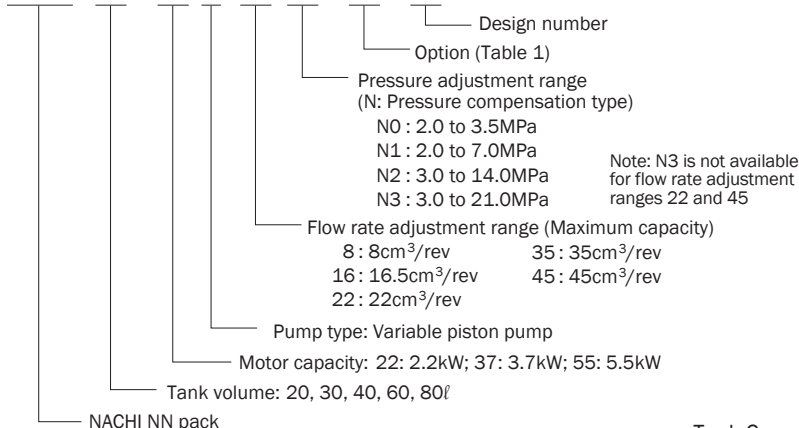


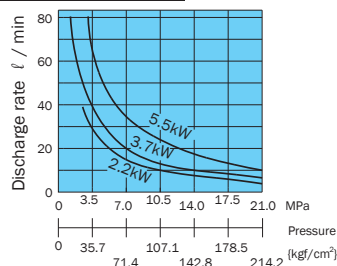
Table 1: Option Symbols (Specify in alphabetic sequence.)

Symbol	Description
F*	F*Type block (See block specifications.)
R*	R*Type block (See block specifications.)
G	Fluid level gauge guard
H	Temperature switch (Contact on at fluid temperature of 65 °C)
M	Microseparator
P	Bottom oil pan
S	Float switch (Contact on at fluid low limit level)
T	Fluid level gauge with temperature gauge (with guard)
W	Self Leak Test

Note: Return filter and fan cooler are equipped as standard.

Selecting a Motor

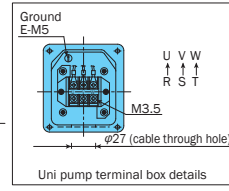
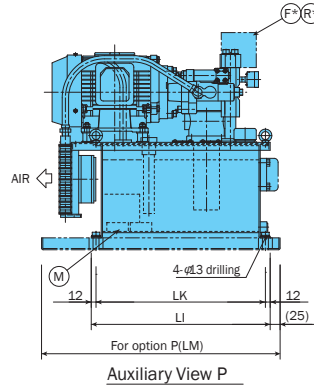
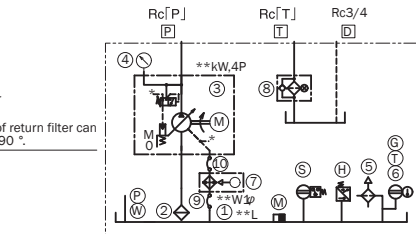
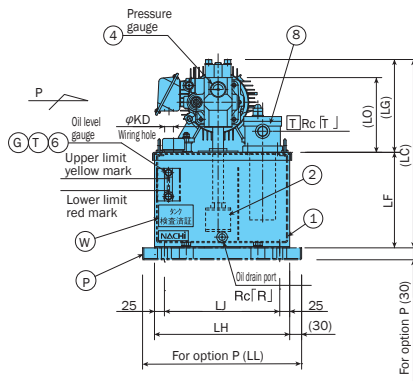
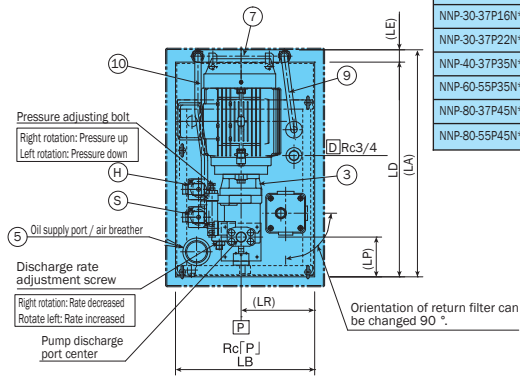
The lower sides of the curves for each of the motors shown in the graph, indicate the operating range under rated output for that motor.



Tank Capacity and Motor/Pump Combinations

	Motor capacity (kW-P)	2.2 – 4			3.7 – 4					5.5 – 4	
	Pump Capacity (cm³/rev)	8	16	22	8	16	22	35	45	35	45
Tank Capacity (ℓ)	20ℓ	○	○	○	○						
	30ℓ					○	○				
	40ℓ							○			
	60ℓ									○	
	80ℓ								○		○

Design Drawings, Dimension Tables



Model No.	Dimensions																	
	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LO	LP	LR	KD	P
NNP-20-22P 8N*.**+20			466				226							179			1/2	
NNP-20-22P16N*.**+20	571		474	540		240	234						600	188			3/4	
NNP-20-22P22N*.**+20		350	526					340	450	290	426	400		191			1/2	3/4
NNP-20-37P 8N*.**+20																	3/4	
NNP-30-37P16N*.**+20	601		605	570	31	319	286						630	200			3/4	3/4
NNP-30-37P22N*.**+20																		
NNP-40-37P35N*.**+20	711		575	680		267	308						820					
NNP-60-55P35N*.**+20	776		686	745		358	328						885	230			1	1
NNP-80-37P45N*.**+20	711	450	762	680		308		440	560	390	536	500	820		172	245	1	1
NNP-80-55P45N*.**+20	776		783	745		454	329						885	231			1	1

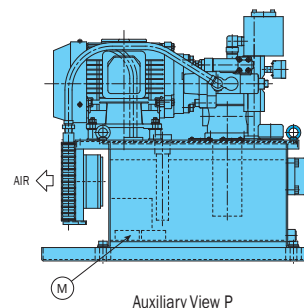
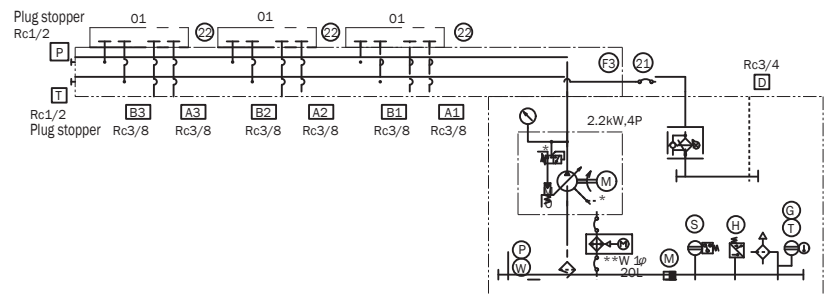
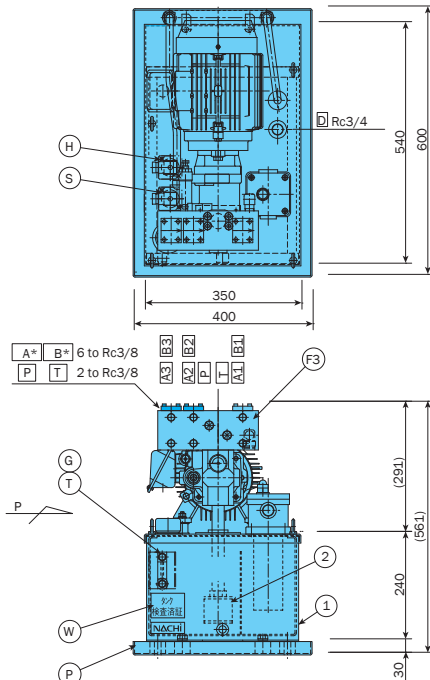
Part No.	Part Name
1	Fluid tank
2	Suction strainer
3	Uni-pump
4	Pressure gauge
5	Fluid supply port/air breather
6	Fluid level gauge
7	Fan cooler
8	Return filter
9	Flexible hose
10	Flexible hose

Options

Part No.	Part Name
F*	Built-in block (F Type)
R*	Built-in block (R Type)
G	Fluid level gauge with guard
H	Temperature switch
M	Microseparator
P	Bottom oil pan
S	Float switch
T	Fluid level gauge with temperature gauge (with guard)
W	Self leak test

Option Installation Example

Model No. : NNP-20-22P16N2-F3HMPSTW-20



Symbol	Name
11	Flexible hose
12	End Plates

Note: Part numbers 11 and 12 are standard with a built-in block.

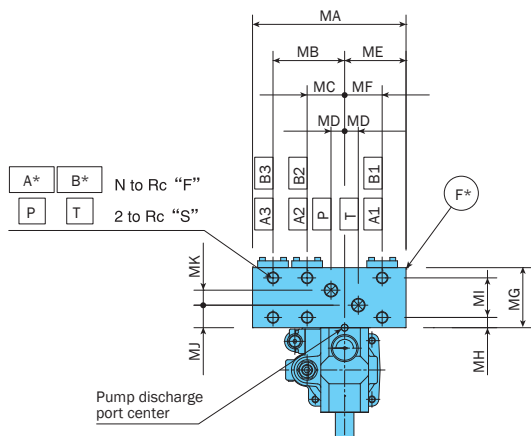
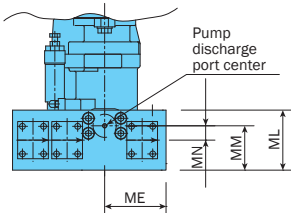
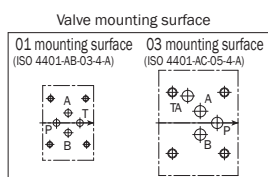
F* and R* Block Specifications

Note: Note that there are certain restrictions on block-equipped combinations. See the Selection Precautions on page L-32.

Options F1, F2, F3, F6

Symbol	Description	Model No.	
		Tank Capacity 20, 30 l	Tank Capacity 40, 60, 80 l
F1	F1 Type Block (01 x 1)	F1-1A	F1-2A
F2	F2 Type Block (01 x 2)	F2-1A	F2-2A
F3	F3 Type Block (01 x 3)	F3-1A	F3-2A
F6	F6 Type Block (03 x 1 - M6)	F6-1A-M6 (Standard M6)	F6-2A-M6 (Standard M6)

Tank Capacity	Options	Dimensions																
		MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	N	F	S
20r 30r	F1	133	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	F2	175	-	-	-	20	90	55	88	15	58	33	22	88	65	21	4	3/8 1/2
	F3	225	105	55	-	-	-	-	-	-	-	-	-	-	-	6	-	-
40r 60r 80r	F6	152	-	-	25	102	67	103	18	67	39	25	103	80	26	2	1/2	3/4
	F1	143	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	F2	183	-	-	20	96	58	88	15	58	33	22	98	68	24	4	3/8 1/2	-
	F3	233	108	58	-	-	-	-	-	-	-	-	-	-	-	6	-	-
	F6	155	-	-	25	105	70	103	18	67	39	25	103	73	-	2	1/2	3/4

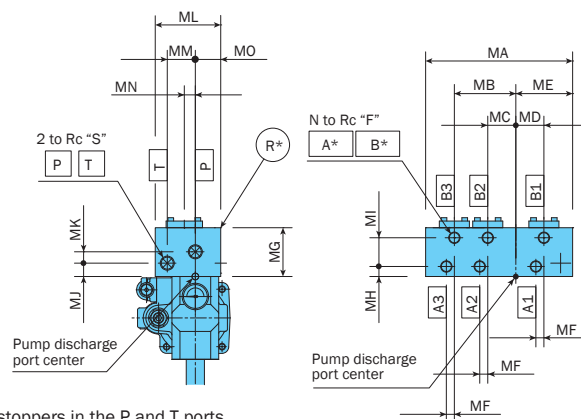
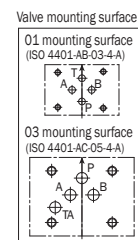
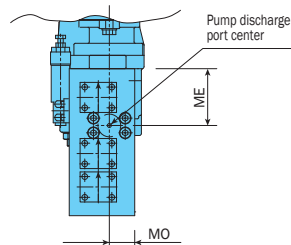


Note: Each block is shipped with plug stoppers in the P and T ports.

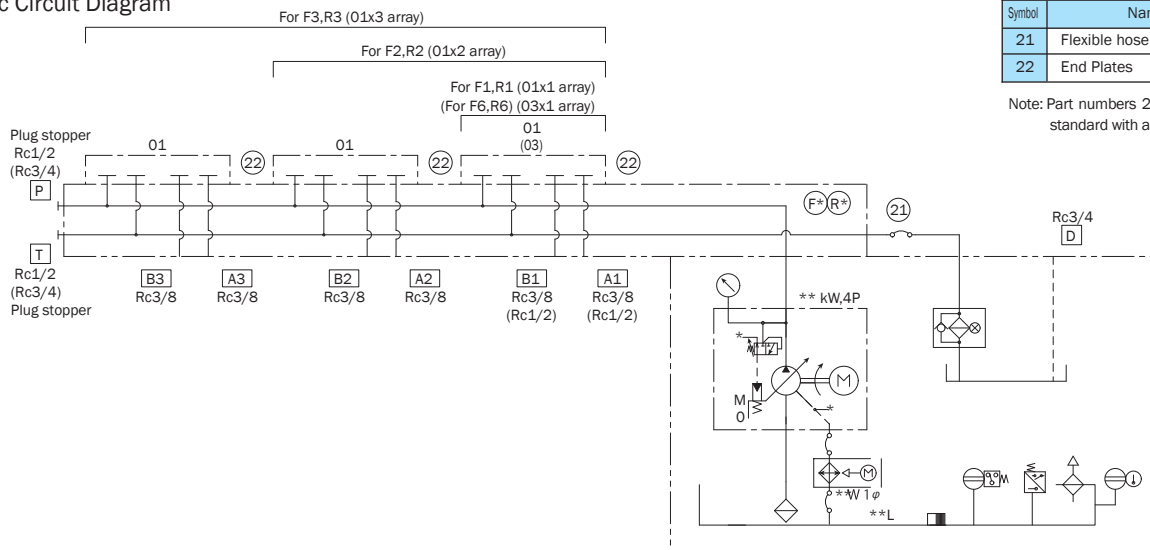
Options R1, R2, R3, R6

Symbol	Description	Model No.	
		Tank Capacity 20, 30 l	Tank Capacity 40, 60, 80 l
R1	R1 Type Block (01 x 1)	R1-1A	R1-2A
R2	R2 Type Block (01 x 2)	R2-1A	R2-2A
R3	R3 Type Block (01 x 3)	R3-1A	R3-2A
R6	R6 Type Block (03 x 1 - M6)	R6-1A-M6 (Standard M6)	R6-2A-M6 (Standard M6)

Tank Capacity	Options	Dimensions																
		MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	N	F
20r 30r	R1	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
	R2	170	-	-	42	85	12	73	15	43	20	17	98	42	16.5	38	4	3/8 1/2
	R3	220	92	42	-	-	-	-	-	-	-	-	-	-	-	6	-	-
40r 60r 80r	R6	160	-	-	54	119	0	98	18	62	49	0	108	47	9	2	1/2	3/4
	R1	132	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	R2	180	-	-	45	92	13	73	15	43	23	14	103	45	16.5	40	4	3/8 1/2
	R3	230	95	45	-	-	-	-	-	-	-	-	-	-	-	6	-	-
	R6	167	-	-	57	122	0	98	18	62	49	0	110	47	9	2	1/2	3/4



Hydraulic Circuit Diagram



Symbol	Name
21	Flexible hose
22	End Plates

Note: Part numbers 21 and 22 are standard with a built-in block.

Typical Performance Characteristics

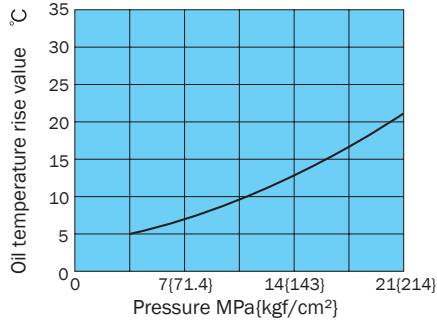
Fluid Temperature Rise Characteristics - Full Cutoff

These graphs show fluid temperature rise during continuous operation.

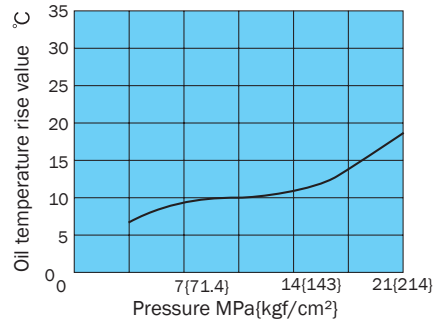
- Tank Fluid Pressure = Room Temperature + Fluid Temperature Rise Value
- Operating Fluid: ISO VG32 equivalent
- Revolution Speed: 1800min⁻¹ (60Hz)

Note: The fluid temperature rise value depends on actual operating conditions, and so actual temperatures may be different from those indicated above.

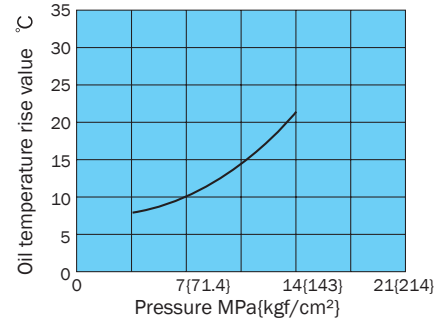
NNP-20-22P16N*-10



NNP-60-55P35N*-10



NNP-30-37P22N*-10



Noise Characteristics - Measurement Position

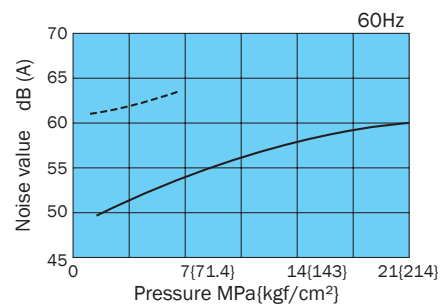
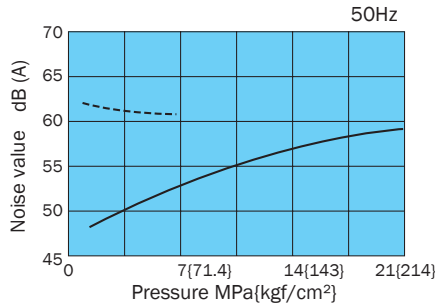
These graphs show noise values at locations one meter in front of and behind the pump.

- ISO VG32 equivalent
- Fluid Temperature: 40±5°C

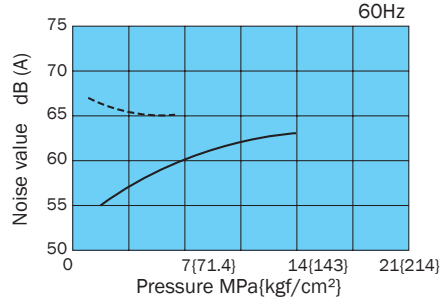
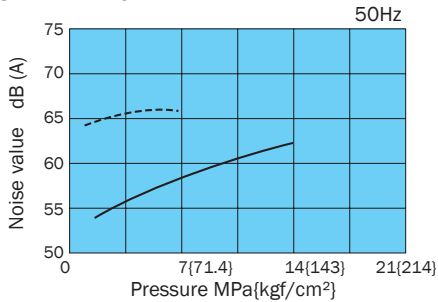
Note: Noise characteristics are affected by the condition of the floor and stand where the unit is mounted, whether there are noise reflective items nearby, and other factors. Such factors can produce different characteristics than those indicated below.

----- Full flow
—— Full cutoff

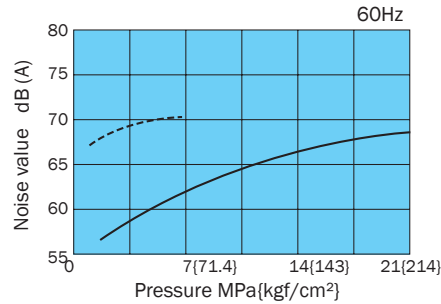
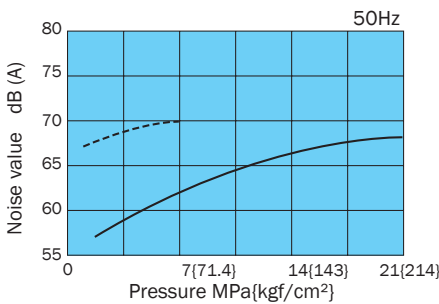
NNP-20-22P16N*-10



NNP-30-37P22N*-10



NNP-60-55P35N*-10



Selection Precautions

- **Standard Accessories**
A return filter with visual clogging inspection tool, and a fan cooler are equipped as standard.
- **Options**
Options F* and R* cannot be selected for inclusion with an 8N* pump (NNP-**-P8N* Type).
For optional F* and R* blocks, up to three blocks can be specified for O1 size, and only one block can be specified for O3 size. Note, however, that the total weight of blocks and valves should not exceed 20kg.

• Tank Capacity 20ℓ, 30ℓ

Block Type	F1	F2	F3	F6	R1	R2	R3	R6
Block Weight (kg)	7.5	9.5	12.5	11.5	6.5	8.5	11.0	12.0
Allowable Additional Weight (kg)	12.5	10.5	7.5	8.5	13.5	11.5	9.0	8.0

• Tank Capacity 40ℓ, 60ℓ, 80ℓ

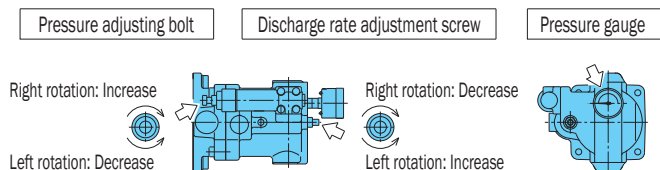
Block Type	F1	F2	F3	F6	R1	R2	R3	R6
Block Weight (kg)	8.5	11.0	14.0	11.5	7.0	9.5	12.0	12.5
Allowable Additional Weight (kg)	11.5	9.0	6.0	8.5	13.0	10.5	8.0	7.5

Note: M6 is the standard mounting tap for O3 size.

Handling Overview

- **Hydraulic Operating Fluid**
Use general oil-based operating fluid equivalent to viscosity grade ISO VG32 or 46. Just contact us regarding options to petroleum based hydraulic operating fluid. The following is the viscosity grade and operating pressure.
 • Up to 7.0MPa: ISO VG32
 • 7.0MPa or higher: ISO VG46
 Keep the moisture content of the operating fluid below 0.1% vol. Excessive moisture in the fluid creates the risk of short-circuiting and current leakage.
 Contaminated operating fluid can lead to malfunction and shortened pump life. Manage operating fluid so that contamination is maintained at class NAS10 or lower.
- **Startup Precautions**
Before starting the pump, inch the electric drive to make sure there is hydraulic fluid being sucked up.
Check to make sure that the operating fluid in the tank is at the prescribed level.
 • Upper Limit Mark (Yellow): Prescribed fluid level (nominal capacity)
 • Lower Limit Mark (Red): Minimum fluid level
 Do not touch the surface of the pump while it is operating, it is very hot.

Adjusting the Pressure and Discharge Rate



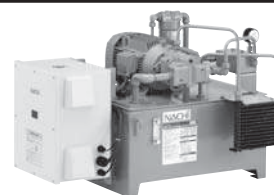
- O1, O3 size solenoid valves and modular valves can be selected.
- With option F* and R*, block and cylinder piping is hoses, configured by Nachi.
- Contact your agent for information about equipping a circuit.
- Option P is a bottom type oil pan.
The oil pan does not have an oil drain port.
The oil drain port is secured in place with the same mounting holes as the hydraulic unit.
- Option W is a leak test performed by Nachi.
- **Circuit Configuration**
Allow for sufficient flexibility in the piping between the NN pack, external manifold, and actuator.
- **Paint**
Nachi-Fujikoshi standard color: Mancel No. 5B6/3 (lacquer)
However, the electric drive is Munsell No. N7.
Contact your agent about specifying external paint colors.

- **Electrical Wiring**
Perform electrical wiring exactly as shown below.

Motor and Power Supply	If wiring is performed incorrectly...
R - U S - V T - W	• Electric pump rotates in reverse, fluid is not discharged • Attach a pressure gauge to the discharge side and check for pressure rise.

- Do not forget to ground the pump!
 • After wiring is complete, be sure to cover the terminal box with the cover that comes with it.
 • Do not forget to wire the fan motor of the fan cooler. The power supply is single-phase 200V AC, non-polarity.
 Provide a no fuse breaker on the main power supply to protect electric circuitry against shorts and other current leakage, and as protection against motor overload. Also provide a leak breaker to protect against the risk of electric shock, etc.
- **Air intake and Exhaust**
Take care so there is nothing blocking the area around air intake and exhaust of the pump drain fan cooler. Also, be sure to locate the pump in an well-ventilated area where heat will not build up.
- **Transport and Installation**
Use the hangers when transporting the pump.
Since this is a stationary type pump, secure it with bolts on a vibration-free, level surface.

- **Maintenance and Inspection**
Fluid Temperature: Use the pump in an area where the temperature is 10°C to 60°C.
Operating Fluid Replacement Cycle: Perform the initial fluid replacement after three months of operation. After that, replace fluid when it becomes dirty or once a year, whichever comes first.
Strainer and Tank Internal Inspection and Cleaning: Every three months
Return Filter Element Inspection: Every three months (replace as required)
Fan Cooler Fin Inspection and Cleaning: Every six months
- **Environment**
Temperature: 10 to 35°C
Avoid areas exposed to mist of water-soluble coolants, etc.



Inverter Drive NCP/NNP Series Energy-Saving Variable Pump Unit with Inverter Drive

By adding an inverter drive to our NCP/NNP series standard variable pump unit, we created the inverter drive NCP/NNP series hydraulic units to achieve great energy savings. They are great for jobs that need to dwell for long periods.

Features

Low increase in hydraulic fluid temperature

Maintained at room temperature +2.5:.

- NNP-60E-55P35N1-10
- 7MPa maintained while dwelling

40% energy savings compared to the NCP unit

- NCP-60E-3.7PV16N3-C1R2-12
- 21MPa while dwelling (in contrast to standard unit)

Quiet

Sound level is 52dB (A).

- NNP-20E-22P16N1-10
- 7MPa while dwelling
- One meter behind pump

Easy Operation

Can start as soon as power is turned on. Absolutely no external commands or delicate electrical adjustments needed.

- Operates even with the inverter removed in emergencies.

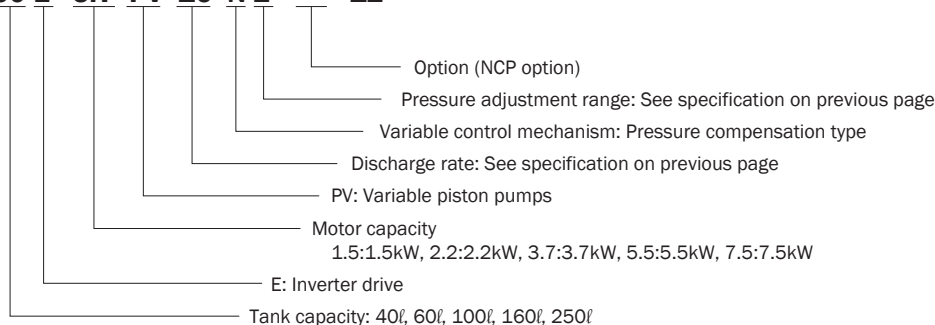
Specifications

1. Power Supply Rated Input Current	3φ AC200 to 220V, 50/60Hz 9.8A/1.5kW (NCP series only) 13.5A/2.2kW 22.5A/3.7kW 21.4A/5.5kW 29.1A/7.5kW (NCP series only)
2. Pressure Adjustment Range	N0: 2.0 to 3.5MPa N1: 2.0 to 7.0MPa N2: 3.0 to 14.0MPa N3: 3.0 to 21.0MPa
3. Output Flow (Theoretical Value at No-load)	8: 14.4ℓ /min 16: 29.7ℓ /min 22: 39.6ℓ /min 35: 63.0ℓ /min 45: 81.0ℓ /min
4. Hydraulic Fluid	Standard mineral-based hydraulic fluid ISO VG32 or 46
5. Hydraulic Fluid Temperature	0 to 60:
6. Ambient Temperature/Humidity	10 to 35: /20 to 85%RH (non-condensation)
7. Color of Inverter Box	Munsell no. 2.5Y9/1 (cream)

Understanding Model Numbers

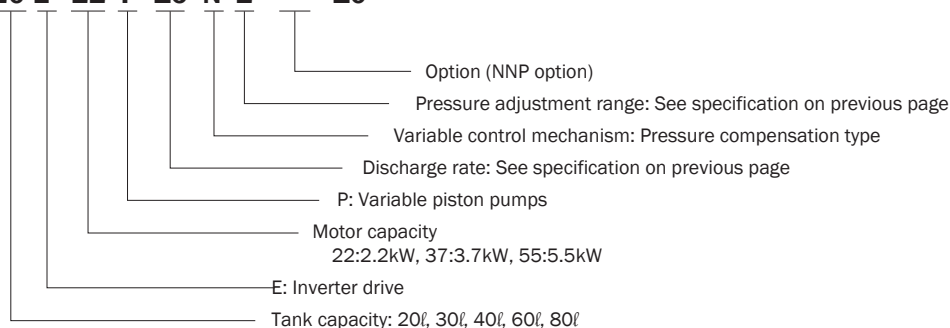
Inverter Drive NCP Series

NCP - 60 E - 3.7 PV 16 N 2 - ** - 12



Inverter Drive NNP Series

NNP - 20 E - 22 P 16 N 2 - ** - 10



Design Drawings, Dimension Tables

Contact us for more information.

Precautions

- Turning the inverter on and off by cutting the main power supply (circuit breaker) significantly reduces the life of the inverter and should be limited to once an hour.
Contact us if you need to start and stop operations frequently.
- Do not change or adjust any switches except the inverter parameter settings and the pressure setting switches.
- Allow for sufficient flexibility in the piping between the hydraulic unit, external manifold, and actuator.
(Recommended: Flexible hose that is at least 1 meter long)
- Some options are not compatible with the inverter drive models, contact us for more information.
- Contact us if excessive leakage in the external hydraulic circuit limits energy saving efficiency.

Power Meister



By adding an inverter drive to our NCP/NNP series standard variable pump unit, we created the inverter drive NCP/NNP series hydraulic units to achieve great energy savings. They are great for jobs that need to dwell for long periods.

Features

Compact Hydraulic System

- Superior energy savings
- High precision

AC servo motor controls rotational speed and direction of pump.
Generates flow and pressure to match the operating cycle of machinery and to stop during idle times.

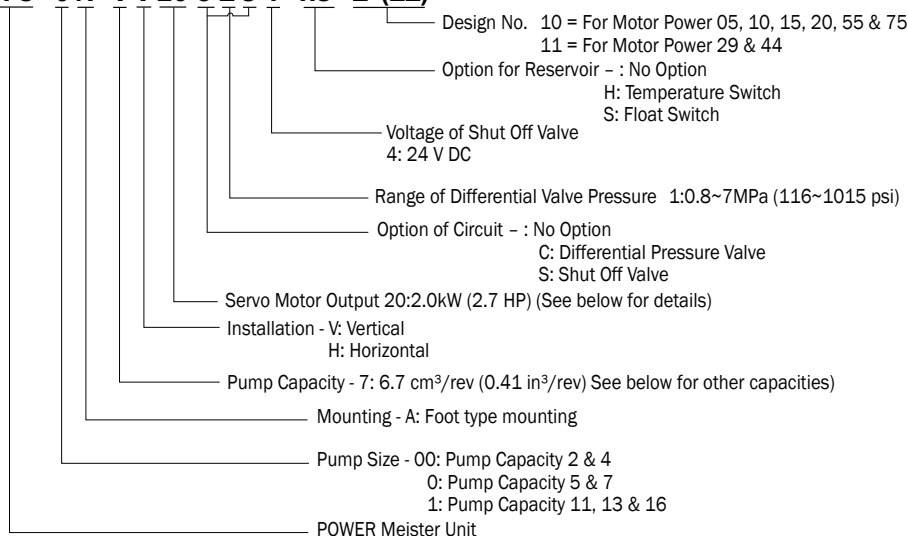
Incredible energy savings by only operating when necessary.
Position, Speed and Pressure are controlled with great precision by using a high-speed digital processing servo controller.

Specifications

Electric Motor	AC servo motor (0.5~7.5kW) (0.7~10.0HP)
Piston Pump	(2.0~15.8 cm ³ /rev) (0.12~0.96 in ³ /rev)
Ambient Temperature/ Humidity	0~+40 °C (32~104 °F) / 20~90% RH
Fluid Temperature	5~60 °C (41~140 °F)
Recommended Fluid	ISO VG32~68 (VG 46 recommended)
Range of Viscosity	20~200 mm ² /s (cSt)
Cleanliness Level	NAS class 10
Setting Range of Relief Valve	3.5~30MPa (508~4350 psi)
Maximum Pressure	30MPa (4350 psi)
Color	Black

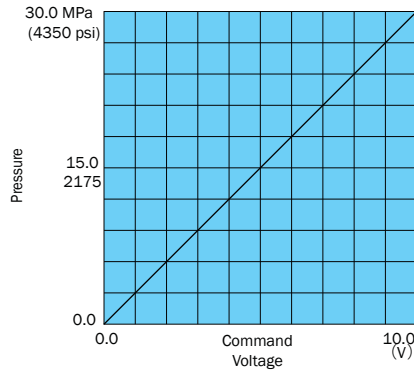
Understanding Model Numbers

UPS - 0 A - 7 V 20 C 1 S 4 - HS - 1 - (11)



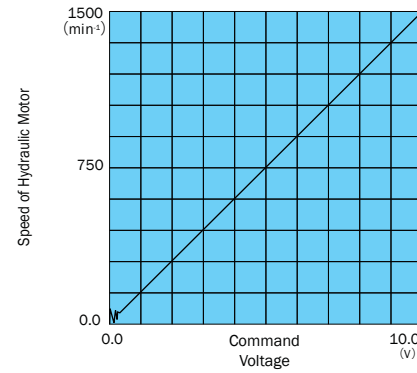
Performance Characteristics

Pressure: Pressure Command Voltage - Pressure Characteristic (0-100%)



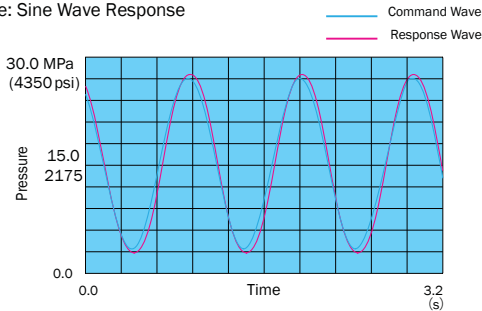
30MPa (4350 psi) at 10V Minimum Pressure: 0.15 MPa (22 psi)
Command of 0V → 10V → 0V Maximum Pressure: 30 MPa (4350 psi)

Speed: Speed Command Voltage- Speed Characteristic (0-100%)



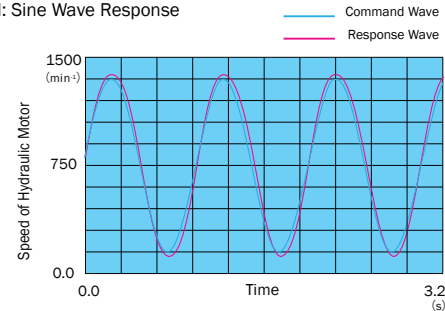
1500 min⁻¹ at 10V Minimum Speed: 50 min⁻¹
Command of 0V → 10V → 0V Maximum Speed: 1500 min⁻¹
(In case of oil motor as actuator)

Pressure: Sine Wave Response



Sine Wave of 1HZ Command
Range of Wave 10-90%

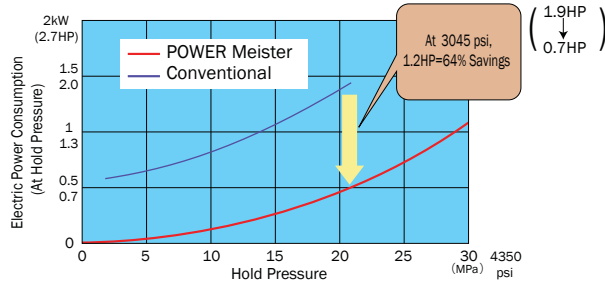
Speed: Sine Wave Response



Sine Wave of 1HZ Command
Range of Wave 10-90%
(In case of oil motor as actuator)

Hold Pressure: Electric Power Consumption Characteristic

Hydraulic Unit (UPS)
Pump 0.29 in³/rev, Motor 2.7HP



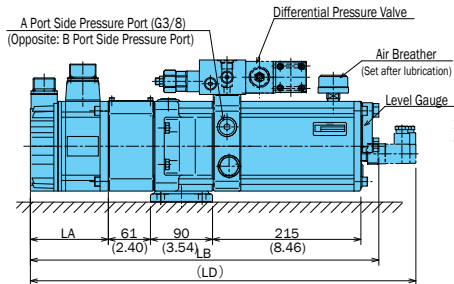
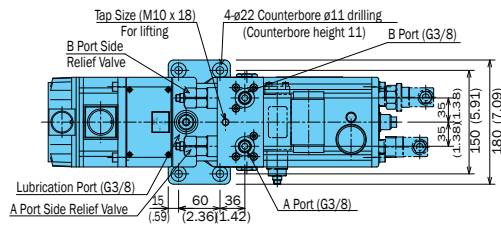
Ref. 2.2kW unipump (variable piston pump)
Consumption at full cut off (N=1.800 min⁻¹)

Installation Dimensional Drawings

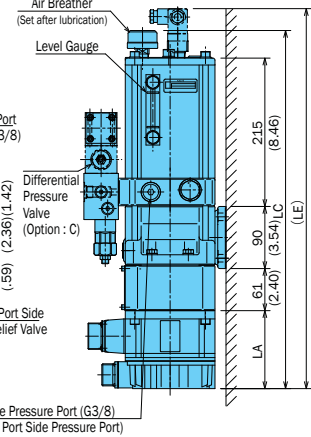
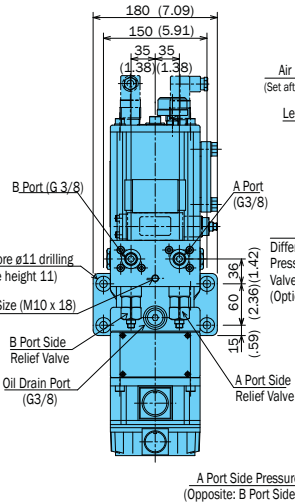
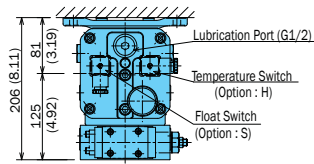
UPS-00A Series

Option : Without option S (Shut Off Valve)

UPS-00A-*H**** (Horizontal type)



UPS-00A-*V**** (Vertical type)



mm (inch) / kg (lbs)						
UPS Model	L A	L B	LC	LD	LE	(Note 2) Weight
UPS-00A- * V05	113 (4.45)	505 (19.88)	519 (20.43)	559 (20.01)	551 (21.69)	28 (61.7)
UPS-00A- * V10	133 (5.24)	525 (20.67)	539 (21.22)	579 (22.80)	571 (22.48)	30 (66.2)
UPS-00A- * V15	152 (5.98)	544 (21.42)	558 (21.97)	598 (23.54)	590 (23.23)	31 (68.4)
UPS-00A- * V20	171 (6.73)	563 (22.17)	577 (21.93)	617 (24.29)	609 (23.98)	33 (72.8)

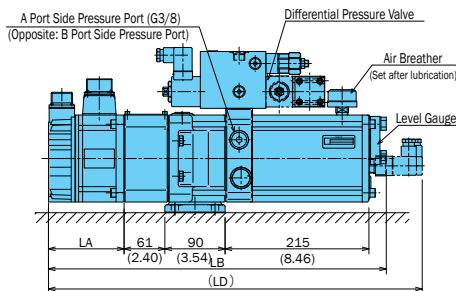
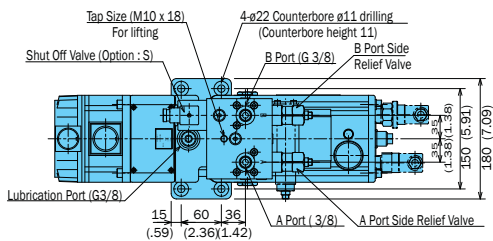
Note 1: Dimensions in (parentheses) and two dot chain lines are for circuit options C and S and tank options H and S.

Note 2: Does not include circuit or tank options or weight of hydraulic fluid.

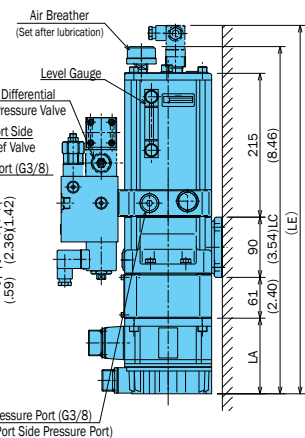
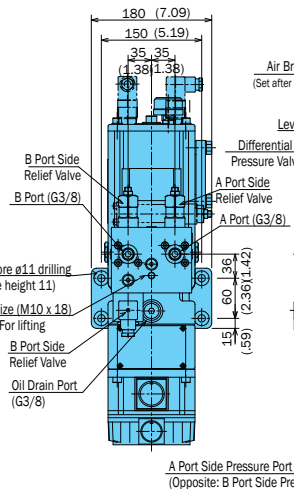
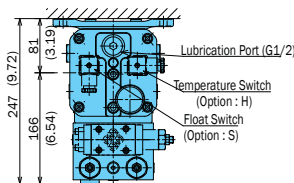
Note 3: Install the air breather face up.

Option : With option S (Shut Off Valve)

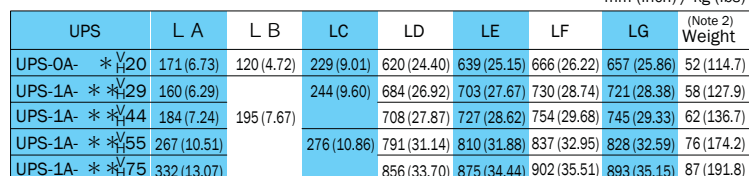
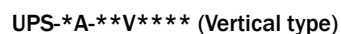
UPS-00A-*H****S4 (Horizontal type)



UPS-00A-*V****S4 (Vertical type)

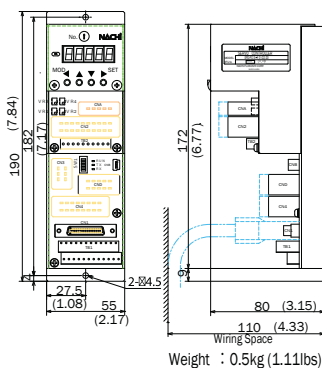
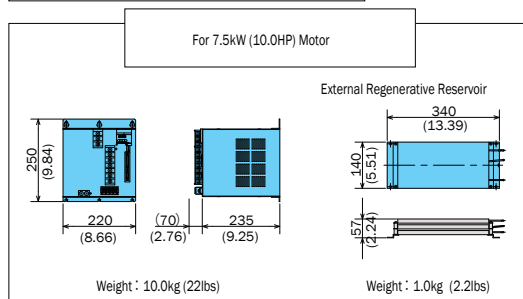
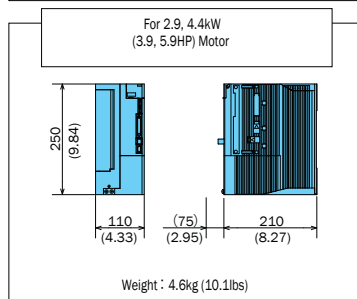
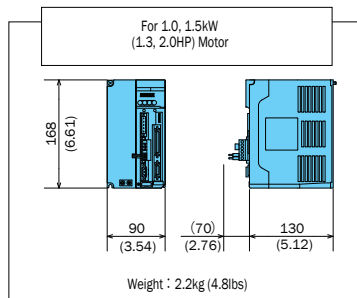


UPS-00*A-**H*** (Horizontal type)



Note 1: Dimensions in (parentheses) and two dot chain lines are for circuit options C and S and tank options H and S.
 Note 2: Does not include circuit or tank options or weight of hydraulic fluid.
 Note 3: Install the air breather face up.

Servo Controller - EPD-PD3-10-D2-20





Power Fit

Energy-Saving Power Unit - Variable Displacement Piston Pumps Driven by AC Servo Motor. Precise Pressure Flow Control Based on Machine Motion

Features

- Energy saving type power unit with two displacement piston pumps driven by AC servo motor.
- Pressure and flow is controlled by motor drive speed and pump displacement.

Pressure and flow can be set digitally at given value by control panel.

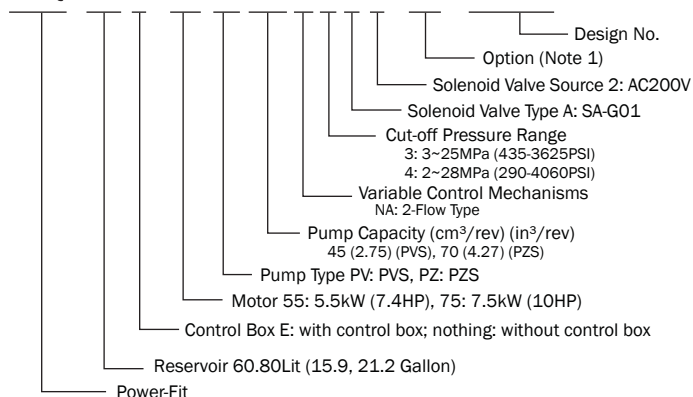
- Multiple settings of pressure and flow are possible by an external signal input.

Specifications

Model	Max. pressure	Max. flow	Pump Displacement Hi/Lo (initial setting)	Servo motor	Reservoir
NPQ-60E-55PV45N3A2-6161A	3625PSI (25MPa)	23.8GPM (90 L/min)	2.74 / 0.73"cu in (45 / 12cm ³ /rev)	7.37HP (5.5kW)	15.85GAL (60L)
NPQ-80E-75PZ70N4A2-6161A	4061PSI (28MPa)	37GPM (140 L/min)	4.27 / 1.04"cu in (70 / 17cm ³ /rev)	10.05HP (7.5kW)	21.13GAL (80L)

Understanding Model Numbers

NPQ - 60 E - 55 PV 45 N 3 A 2 - ** - 6161A

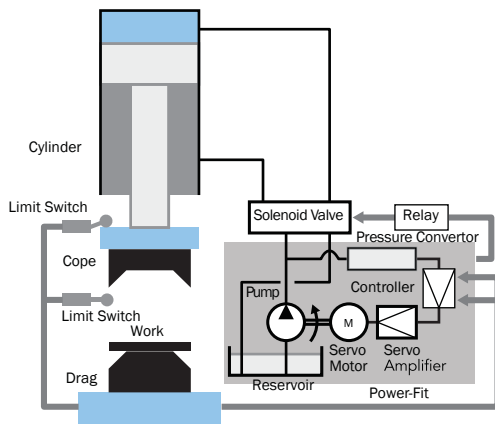


Notes: G: Guard Level Gauge H: Thermostat M: Microseparator P: Oil Pan
S: Float Switch (for lower) T: Level Gauge with Thermometer

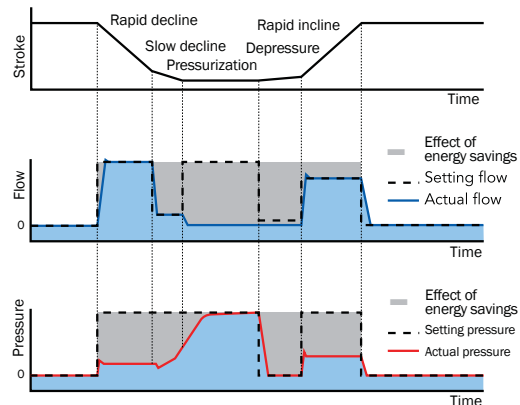
Outline Diagram

- Speed (flow) and force (pressure) are automatically controlled by controller based on load situation.

- No need to use additional valves for flow and pressure control.



Example of Press Motion





PHV Track Motors

Features

This product is the 2 speed hydraulic motor with reduction gear for the crawler type machine, which is a mini-excavator or a similar one in the operating condition and the operating rate.

Remove the upper side plug of "DRAIN PORTS"(DR1 or DR2), and then connect directly to the tank after installing this track motor to the machine.

Please refer to page M3 and the instruction manual for other notes.

Specifications

Model No.	SPECIFICATION (THEORETICAL)								(Note 3)	(Note 4)		(Note 5)	(Note 6)		(Note 7)		
	Code for Hyd.Motor Displacement				Code for Gear Ratio		Final Displacement	Max. Pressure	Max.Output Torque (Theoretical, Lo mode)		Max. Flow	Max.Output Speed (Theoretical, Hi mode)		Option			
	Lo mode		Hi mode		code:*3	ratio			Lo mode	Hi mode		psi	Intermittent	Continuous	gpm	Track Motor	Hyd.Motor
	code:*1	in ³	code:*2	in ³			code:*3	ratio			Lo mode						
PHV-1B-1213A(P)-10	1	.57	3	.28	A	1/25.26	240.0	118.7	3552		689		2.5	80	(2021)	365	14.5
PHV-1B-1213B(P)-10					B	1/36.96	351.1	173.7			1010		3.6		(2957)	533	
PHV-1B-1223A(P)-10	2	.66	3	.34	A	1/25.26	275.3	141.5	3407		791	556	2.9		(2021)	365	
PHV-1B-1223B(P)-10					B	1/36.96	402.9	207.0			1113		4.3		(2957)	533	
PHV-1B-1233A(P)-10	3	.69	3	.35	A	1/25.26	288.0	146.5	3552		953		3.0		(2021)	365	
PHV-1B-1233B(P)-10					B	1/36.96	421.3	214.4	3262	1113	4.5		(2957)		533		
PHV-1B-1243A(P)-10	4	.75	3	.37	A	1/25.26	313.2	156.6	3552		900		3.3		(2021)	365	
PHV-1B-1243B(P)-10					B	1/36.96	458.3	229.2	3000	1113	4.8		(2957)		533		

Note 1: Use this track motor within the Specification.

Note 2: The Specification is theoretical value. Real torque at 10 rpm (lo) should be approximately 83% of Theoretical Torque.

Real Speed at Hi(P<1493 psi) should be approximate 96% of Theoretical Speed.

The particular performance is shown on page M3.

Note 3: Max. Pressure is 3550 psi. However, the value in () is limited by Max. Output Torque.

Note 4: Max. Output Torque is 1113 Ft. Lbs. However, the value in () is limited by Max. Pressure.

"Intermittent" means less than 7% of operating time.

Note 5: Max. Flow is 5.2 gpm. However, the value in () is limited by Max. Output Speed (track motor or hydraulic motor).

Note 6: Max. Output Speed is 80 rpm (track motor), 3000 rpm (hydraulic motor).

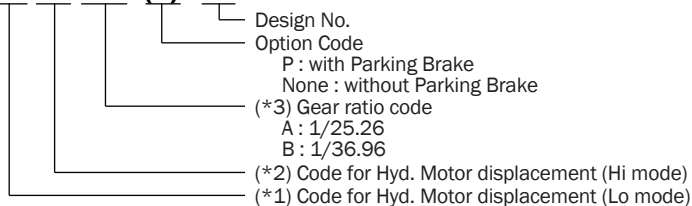
However, the value in () is limited by Max. Flow or Max. Output Speed (track motor or hydraulic motor).

Note 7: Parking Brake Torque (hydraulic motor) is 14.5 Ft Lbs.

Therefore, Parking Brake Torque (track motor) is different value between Gear Ratio "A(1/25.26)" and "B(1/36.96)".

Understanding Model Numbers

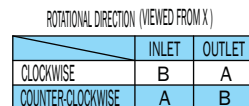
PHV-1B-12 *- (*) - 10**



M

Track Motors

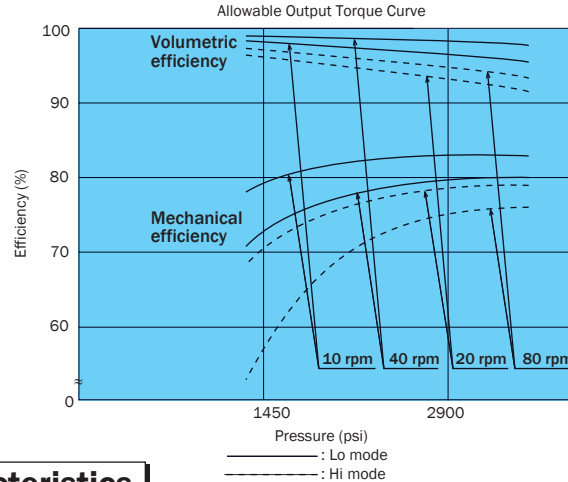
- M 2



Performance Curves

PHV-1B-12 *** - (P) - 10

Condition:
Hydraulic Fluid: ISO VG46
Oil Temperature: 50±5 °C



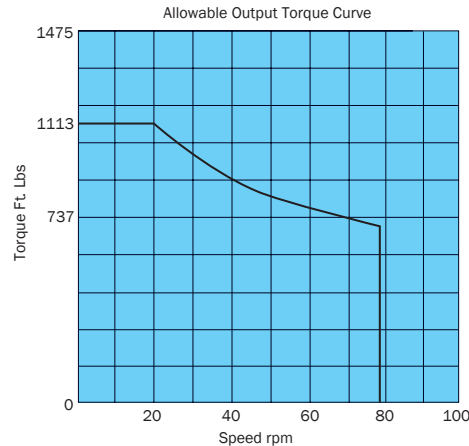
Performance Characteristics

PHV-1B-12 *** - (P) - 10

Condition of allowable output torque

Life: 200 hr (driving time)
Clockwise - 100 hr
Counterclockwise - 100 hr

Reduction gear life under your using condition



$$L_h = 200 \frac{20}{N} \left(\frac{T_o}{T} \right)^3$$

Lh: Life (hr)
N: Your using speed (min⁻¹)
To: Torque on curve at N
T: Your using Torque (N • m) (Theoretical)

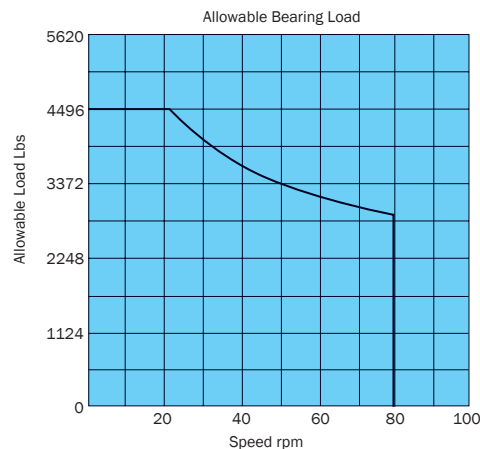
Note: When the track motor is driven only side direction, the life is reduced by half.

Condition of allowable bearing load

Life: 500 hr
Bearing life under your using condition

$$L_h = 500 \left(\frac{W_o}{W} \right)^3$$

Lh: Life (hr)
Wo: Load on curve at your using speed
W: Your using equivalent load (N) [*1]

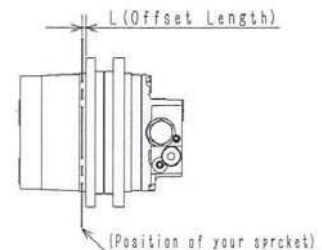


[*1] Figure that W (your using equivalent load) is the following:

$$W = \frac{L+38.7}{74.8} W_r \frac{(D/2)}{74.8} W_{th}$$

L: Offset length [*2] of your sprocket (mm)
D: Pitch circle diameter of your sprocket (mm)
Wr: Your using radial load (N)
Wth: Your using thrust load (N)

[*2] Refer to the figure below



Instructions:

1. Use this track motor within 'Specification' shown in DWG. No. AM-2101ME-1.
2. Use an installation mounting with stiffness and clean the mounting before installing this track motor to the machine.
3. Install this track motor horizontally.
4. Remove the upper side plug of 'Drain ports' (DR1 or DR2: refer to DWG. No. AM-2101ME-1) and then connect to the tank after installing this track motor to the machine.
5. Fill the motor case with clean hydraulic fluid through the 'Drain port' before starting.
6. When the 'PP port' (refer to DWG. No. AM-2101ME-1) is connected to the tank, this track motor is operated at Lo mode. (permitted back pressure: 0.5 MPa)
7. When the 'PP port' is supplied pressure, this track motor is operated at Hi mode. (speed control pressure: min. 1.5 MPa)
8. The parking brake (option) of this track motor is negative brake system. Parking brake is working when 'A port' and 'B port' (refer to DWG. No. AM-2101ME-1) are not supplied pressure; is not working when 'A port' or 'B port' is supplied pressure. (parking brake releasing pressure: 1.5 MPa)
9. Change the gear oil to the new one each following period. First: 200 hr or 2 months; Second and after: 1000 hr or 1 year
10. Please refer to the instruction manual for other notes.



PHV Track Motors

Features

This product is the 2 speed hydraulic motor with reduction gear for the crawler type machine, which is a mini-excavator or a similar one in the operating condition and the operating rate.

Remove the upper side plug of "DRAIN PORTS" (DR1 or DR2), and then connect directly to the tank after installing this track motor to the machine.

Please refer to page M6 and the instruction manual for other notes.

Specifications

Model No.	SPECIFICATION (THEORETICAL)								(Note 3)		(Note 4)		(Note 5)	(Note 6)		(Note 7)	
	Code for Hyd.Motor Displacement				Code for Gear Ratio		Final Displacement		Max. Pressure	Max.Output Torque (Theoretical, Lo mode)		Max. Flow	Max.Output Speed (Theoretical, Hi mode)		Option		
	Lo mode		Hi mode												Parking Brake Torque		
	code:*1	in ³	code:*2	in ³	code:*3	ratio	Lo mode	Hi mode		psi	Intermittent		Continuous	rpm	rpm	Ft. Lbs.	Ft. Lbs.
PHV-2B-2012A-(P)-10	1	.98	2	.55	A	1/31.00	499.1	282.1	3552	1435	892	5.6	75	(2325)	694	22.4	
PHV-2B-2012B-(P)-10					B	1/39.00	627.9	354.9	3509	1784		7.0		(2925)	874		
PHV-2B-2013A-(P)-10			3	.51	A	1/31.00	499.1	260.4	3552	1435		5.1		(2325)	694		
PHV-2B-2013B-(P)-10					B	1/39.00	627.9	327.6	3509	1784		6.5		(2925)	874		
PHV-2B-2022A-(P)-10	2	1.04	2	.57	A	1/31.00	533.2	294.5	3552	1553	892	5.8	75	(2325)	694		
PHV-2B-2022B-(P)-10					B	1/39.00	670.8	370.5	3277	1784		7.3		(2925)	874		
PHV-2B-2023A-(P)-10			3	.52	A	1/31.00	533.2	266.6	3552	1533		5.2		(2325)	694		
PHV-2B-2023B-(P)-10					B	1/39.00	670.8	335.4	3277	1784		6.6		(2925)	874		

Note 1: Use this track motor within the Specification.

Note 2: The Specification is theoretical value. Real torque at 10 rpm (lo) should be approximately 85% of Theoretical Torque.

Real Speed at Hi(P<1493 psi) should be approximate 96% of Theoretical Speed.

The particular performance is shown on page M6.

Note 3: Max. Pressure is 3552 psi. However, the value in () is limited by Max. Output Torque.

Note 4: Max. Output Torque is 1784 Ft. Lbs. However, the value in () is limited by Max. Pressure.

"Intermittent" means less than 7% of operating time.

Note 5: Max. Flow is 5.2 gpm. However, the value in () is limited by Max. Output Speed (track motor or hydraulic motor).

Note 6: Max. Output Speed is 70 rpm (track motor), 3500 rpm (hydraulic motor).

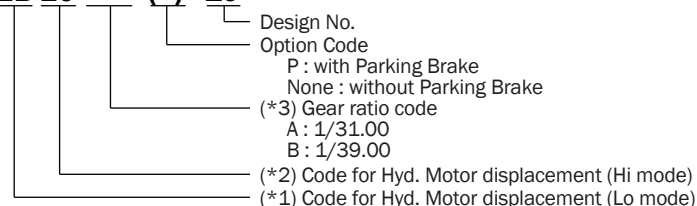
However, the value in () is limited by Max. Flow or Max. Output Speed (track motor or hydraulic motor).

Note 7: Parking Brake Torque (hydraulic motor) is 22.4 Ft. Lbs.

Therefore, Parking Brake Torque (track motor) is different value between Gear Ratio "A(1/31.00)" and "B(1/39.00)".

Understanding Model Numbers

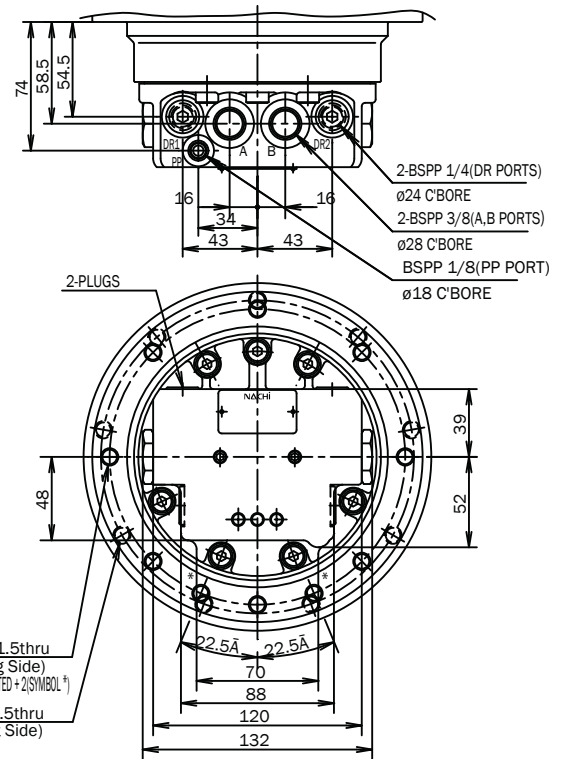
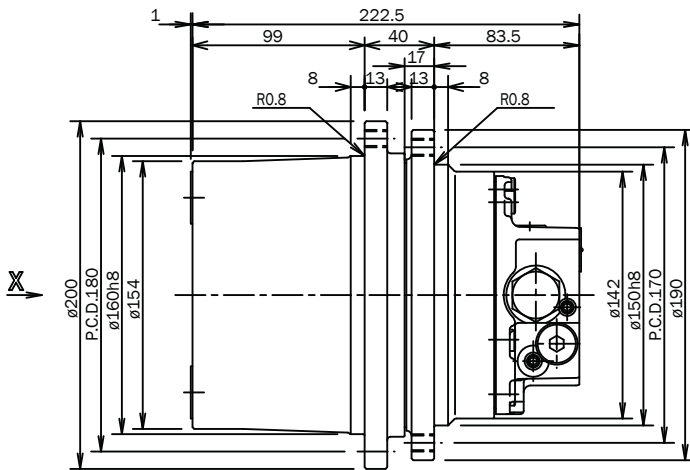
PHV-2B-20 *- (*) - 10**



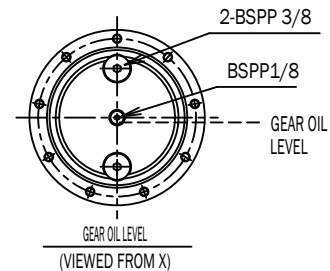
Installation Dimension Drawings

CAUTION

1. Speed Control Pressure: min. 217 psi
2. Hydraulic Fluid: ISO VG46
(Anti-Wear Hydraulic Fluid)
3. Contamination: within NAS Grade 10
4. Oil Temp: -4 ~ 180° F
5. Filter: 10µm
6. Gear Oil: SAE-30-CD (Amount of Oil 20 in³)
7. Mass: 53 lbs
8. Paint Color: Black (Under Coat)



JIS SYMBOL			
MODEL NO.	PHV-2B-20***-10	MODEL NO.	PHV-2B-20***-P-10
NAME	2 speed type TRACK MOTOR		
DWG. NO.	AM-2201ME-1-A		



ALLOWED DRAIN PRESSURE

RATED	Max. 43 psi
SURGE	Max. 145 psi

ROTATIONAL DIRECTION (VIEWED FROM X)

	INLET	OUTLET
CLOCKWISE	B	A
COUNTER-CLOCKWISE	A	B

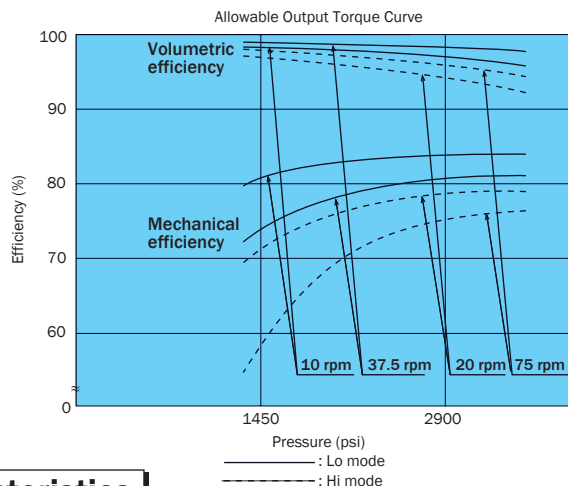
Performance Curves

PHV-2B-20 *** - (P) - 10

Condition:

Hydraulic Fluid: ISO VG46

Oil Temperature: 50±5 °C



Performance Characteristics

PHV-2B-20 *** - (P) - 10

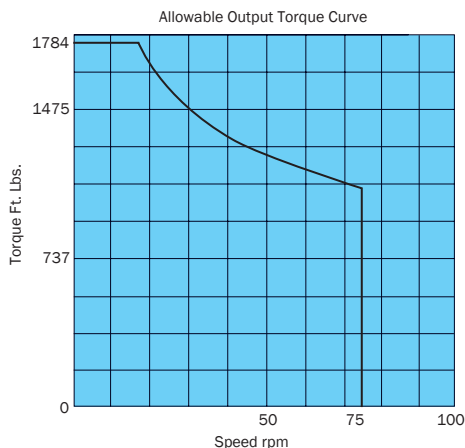
Condition of allowable output torque

Life: 200 hr (driving time)

Clockwise - 100 hr

Counterclockwise - 100 hr

Reduction gear life under your using condition



$$L_h = 200 \frac{20}{N} \left(\frac{T_o}{T} \right)^3$$

Lh: Life (hr)
N: Your using speed (min⁻¹)
To: Torque on curve at N
T: Your using Torque (N • m) (Theoretical)

Note: When the track motor is driven only side direction, the life is reduced by half.

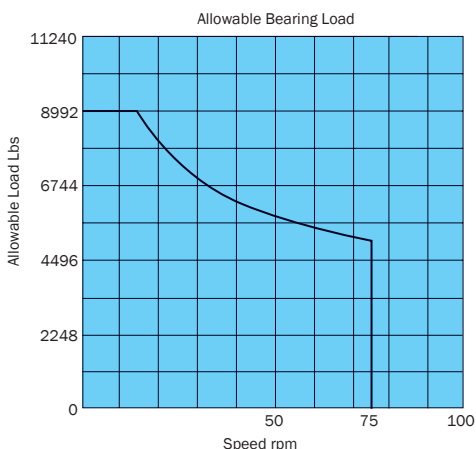
Condition of allowable bearing load

Life: 500 hr

Bearing life under your using condition

$$L_h = 500 \left(\frac{W_o}{W} \right)^3$$

Lh: Life (hr)
Wo: Load on curve at your using speed
W: Your using equivalent load (N) [*1]



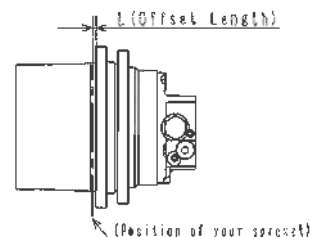
[*1] Figure that W (your using equivalent load) is the following:

$$W = \frac{52.9-L}{92} W_r \frac{(D/2)}{92} W_{th} (L \leq 6.9)$$

$$W = \frac{39.1+L}{92} W \frac{(D/2)}{92} W_{th} (6.9 \leq L)$$

L: Offset length [*2] of your sprocket (mm)
D: Pitch circle diameter of your sprocket (mm)
Wr: Your using radial load (N)
Wth: Your using thrust load (N)

[*2] Refer to the figure below



Instructions:

1. Use this track motor within 'Specification' shown in DWG. No. AM-2201ME-1.
2. Use an installation mounting with stiffness and clean the mounting before installing this track motor to the machine.
3. Install this track motor horizontally.
4. Remove the upper side plug of 'Drain ports' (DR1 or DR2: refer to DWG. No. AM-2201ME-1) and then connect to the tank after installing this track motor to the machine.
5. Fill the motor case with clean hydraulic fluid through the 'Drain port' before starting.
6. When the 'PP port' (refer to DWG. No. AM-2201ME-1) is connected to the tank, this track motor is operated at Lo mode. (permitted back pressure: 0.5 MPa)
7. When the 'PP port' is supplied pressure, this track motor is operated at Hi mode. (speed control pressure: min. 1.5 MPa)
8. The parking brake (option) of this track motor is negative brake system. Parking brake is working when 'A port' and 'B port' (refer to DWG. No. AM-2201ME-1) are not supplied pressure; is not working when 'A port' or 'B port' is supplied pressure. (parking brake releasing pressure: 1.5 MPa)
9. Change the gear oil to the new one each following period. First: 200 hr or 2 months; Second and after: 1000 hr or 1 year
10. Please refer to the instruction manual for other notes.



PHV Track Motors

Features

This product is the 2 speed hydraulic motor with reduction gear for the crawler type machine, which is a mini-excavator or a similar one in the operating condition and the operating rate.

Remove the upper side plug of "DRAIN PORTS"(DR1 or DR2), and then connect directly to the tank after installing this track motor to the machine.

Please refer to page M9 and the instruction manual for other notes.

Specifications

Model No.	SPECIFICATION (THEORETICAL)								(Note 3)	(Note 4)		(Note 5)	(Note 6)		(Note 7)	
	Code for Hyd.Motor Displacement				Code for Gear Ratio		Final Displacement		Max. Pressure	Max.Output Torque (Theoretical, Lo mode)		Max. Flow	Max.Output Speed (Theoretical, Hi mode)		Option	
	Lo mode		Hi mode							Intermittent	Continuous		Track Motor	Hyd.Motor	Parking Brake Torque	
	code:*1	in ³	code:*2	in ³	code:*3	ratio	Lo mode	Hi mode	psi			Ft. Lbs.			Ft. Lbs.	gpm
PHV-3B-3513A-(P)-11	1	1.26	3	.66	A	1/36.51	755.8	398.0	3552	2173	1517	7.37	70	(2556)	977	26.7
PHV-3B-3513B-(P)-11					B	1/45.20	935.6	492.7		2690		9.11		(3164)	1210	
PHV-3B-3521A-(P)-11	2	1.30	1	.78	A	1/36.51	781.3	471.0		2247		8.71		(2556)	977	
PHV-3B-3521B-(P)-11					B	1/45.20	967.3	583.1		2781		10.77		(3164)	1210	
PHV-3B-3531A-(P)-11	3	1.44	1	.95	A	1/36.51	861.6	573.2	2478	10.59	(2556)	977				
PHV-3B-3531B-(P)-11					B	1/45.20	1066.7	709.6	3509	3034	11.1	(59.2)	(2675)	1210		
PHV-3B-3532A-(P)-11	3	1.44	2	.78	A	1/36.51	861.6	471.0	3552	2478	8.71	(2446)	977			
PHV-3B-3532B-(P)-11					B	1/45.20	1066.7	583.1	3509	3034	10.77	(3164)	1210			
PHV-3B-3533A-(P)-11	3	1.44	3	.73	A	1/36.51	861.6	438.1	3552	2478	8.11	(2556)	977			
PHV-3B-3533B-(P)-11					B	1/45.20	1066.7	542.4	3509	3034	10.0	(3164)	1210			
PHV-3B-3542A-(P)-11	4	1.53	2	.86	A	1/36.51	916.4	518.4	3552	2635	9.66	(2556)	977			
PHV-3B-3542B-(P)-11					B	1/45.20	1134.5	641.8	3291	3034	11.0	(65.4)	(2958)	1210		

Note 1: Use this track motor within the Specification.

Note 2: The Specification is theoretical value. Real torque at 10 rpm (lo) should be approximately 85% of Theoretical Torque.

Real Speed at Hi(P<1493 psi) should be approximate 96% of Theoretical Speed.

The particular performance is shown on page M9.

Note 3: Max. Pressure is 3552 psi. However, the value in () is limited by Max. Output Torque.

Note 4: Max. Output Torque is 3034 Ft. Lbs. However, the value in () is limited by Max. Pressure.

"Intermittent" means less than 7% of operating time.

Note 5: Max. Flow is 11 gpm. However, the value in () is limited by Max. Output Speed (track motor or hydraulic motor).

Note 6: Max. Output Speed is 70 rpm (track motor), 3500 rpm (hydraulic motor).

However, the value in () is limited by Max. Flow or Max. Output Speed (track motor or hydraulic motor).

Note 7: Parking Brake Torque (hydraulic motor) is 26.7 Ft. Lbs.

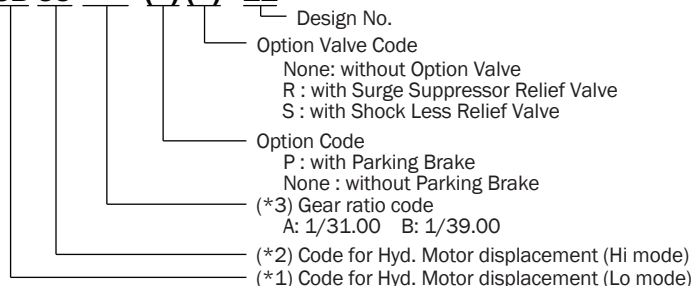
Therefore, Parking Brake Torque (track motor) is different value between Gear Ratio "A(1/36.51)" and "B(1/45.20)".

Note 8: You can select "Option Valve". This drawing is showing the track motor without Option Valve.

Other options available are Surge Suppressor Relief Valve and Shock Less Relief Valve.

Understanding Model Numbers

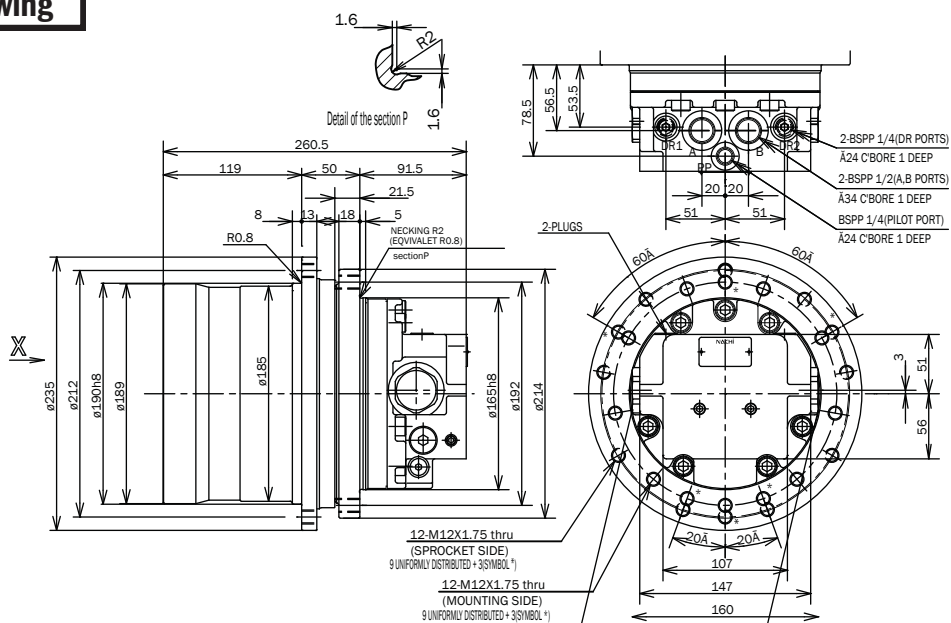
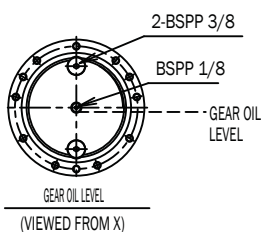
PHV-3B-35 *- (*) (*) - 11**



Installation Dimensional Drawing

CAUTION

1. Speed Control Pressure: min. 217 psi
2. Hydraulic Fluid: ISO VG46
(Anti-Wear Hydraulic Fluid)
3. Contamination: within NAS Grade 10
4. Oil Temp: -4 ~ 180° F
5. Filter: 10µm
6. Gear Oil: SAE-30-CD (Amount of Oil 20 in³)
7. Mass: 79 lbs
8. Paint Color: Ebony Gray (Under Coat)



JIS SYMBOL

MODEL NO.	PHV-3B-35***-11	MODEL NO.	PHV-3B-35***-P-11
NAME	2 speed type TRACK MOTOR		
DWG. NO.	AM-2301ME-1-0A		

ROTATIONAL DIRECTION (VIEWED FROM X)

	INLET	OUTLET
CLOCKWISE	B	A
COUNTER-CLOCKWISE	A	B

ALLOWED DRAIN PRESSURE

RATED	Max. 43 psi
SURGE	Max. 145 psi

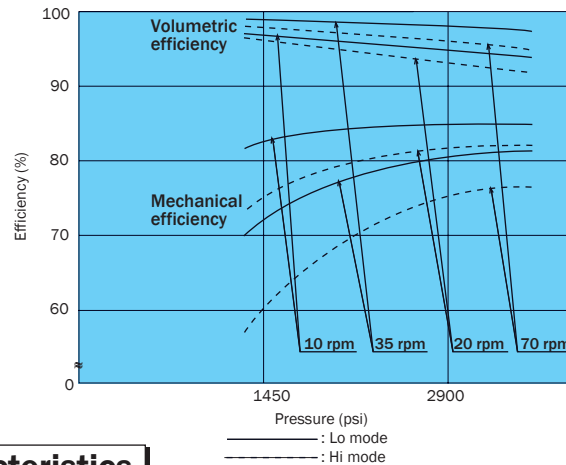
Performance Curves

PHV-3B-35 *** - (*) (*) - 11

Condition:

Hydraulic Fluid: ISO VG46

Oil Temperature: 50±5 °C



Performance Characteristics

PHV-3B-35 *** - (*) (*) - 11

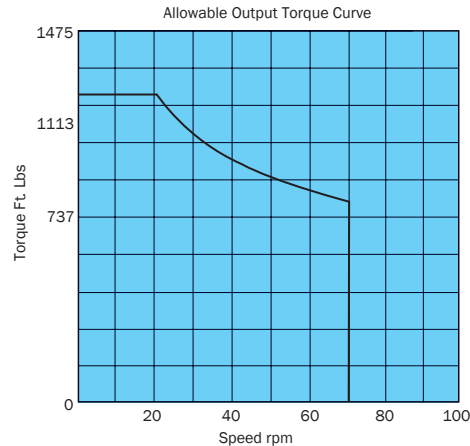
Condition of allowable output torque

Life: 200 hr (driving time)

Clockwise - 100 hr

Counterclockwise - 100 hr

Reduction gear life under your using condition



$$L_h = 200 \frac{20}{N} \left(\frac{T_o}{T} \right)^3$$

Lh: Life (hr)
N: Your using speed (min⁻¹)
To: Torque on curve at N
T: Your using Torque (N • m) (Theoretical)

Note: When the track motor is driven only side direction, the life is reduced by half.

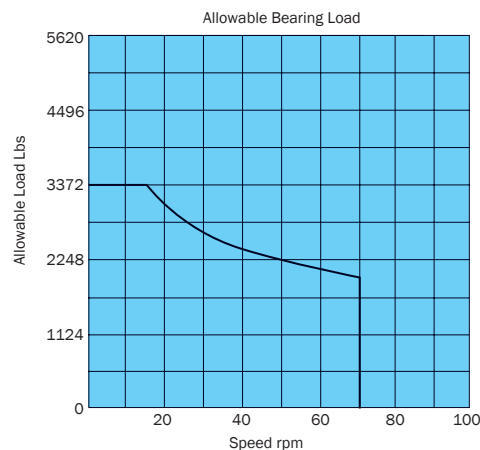
Condition of allowable bearing load

Life: 500 hr

Bearing life under your using condition

$$L_h = 500 \left(\frac{W_o}{W} \right)^3$$

Lh: Life (hr)
Wo: Load on curve at your using speed
W: Your using equivalent load (N) [*1]



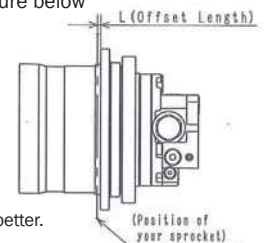
[*1] Figure that W (your using equivalent load) is the following:

$$W = \frac{64.1 \cdot L}{106.4} W_r \frac{(D/2)}{106.4} W_{th} (L \leq 10.9)$$

$$W = \frac{42.3 + L}{106.4} W \frac{(D/2)}{106.4} W_{th} (10.9 \leq L)$$

L: Offset length [*2] of your sprocket (mm)
D: Pitch circle diameter of your sprocket (mm)
Wr: Your using radial load (N)
Wth: Your using thrust load (N)

[*2] Refer to the figure below



Instructions:

1. Use this track motor within 'Specification' shown in DWG. No. AM-2301ME-1, -2, -3.
2. A machining process is necessary on the track motor installation face of the track frame. Flatness of the installation face should be 0.1 mm or better.
3. Use an installation mounting with stiffness and clean the mounting before installing this track motor to the machine.
4. Install this track motor horizontally.
5. The sprocket should be a flat type - see drawing:
6. Remove the upper side plug of 'Drain ports' (DR1 or DR2: refer to DWG. No. AM-2301ME-1, -2, -3) and then connect to the tank after installing this track motor to the machine.
7. Fill the motor case with clean hydraulic fluid through the 'Drain port' before starting.
8. When the 'PP port' (refer to DWG. No. AM-2101ME-1, -2, -3) is connected to the tank, this track motor is operated at Lo mode. (permitted back pressure: 0.5 MPa)
9. When the 'PP port' is supplied pressure, this track motor is operated at Hi mode. (speed control pressure: min. 1.5 MPa)
10. The parking brake (option) of this track motor is negative brake system. Parking brake is working when 'A port' and 'B port' (refer to DWG. No. AM-2101ME-1, -2, -3) are not supplied pressure; is not working when 'A port' or 'B port' is supplied pressure. (parking brake releasing pressure: 1.5 MPa)
11. Change the gear oil to the new one each following period. First: 200 hr or 2 months; Second and after: 1000 hr or 1 year
12. Please refer to the instruction manual for other notes.

Example of the flat type sprocket.





PHV Track Motors

Features

This product is the 2 speed hydraulic motor with reduction gear for the crawler type machine, which is a mini-excavator or a similar one in the operating condition and the operating rate.

Remove the upper side plug of "DRAIN PORTS"(DR1 or DR2), and then connect directly to the tank after installing this track motor to the machine.
Following drawings show the models

"PHV-4B-60***-10" and "PHV-4B-60***-P-10" Other models not shown.

Specifications

Model No.	SPECIFICATION (THEORETICAL)								(Note 3)	(Note 4)		(Note 5)	(Note 6)		(Note 7)	
	Code for Hyd.Motor Displacement				Code for Gear Ratio		Final Displacement		Max. Pressure	Max.Output Torque (Theoretical, Lo mode)		Max. Flow	Max.Output Speed (Theoretical, Hi mode)		Option	
	Lo mode		Hi mode		code:*3	ratio	Lo mode	Hi mode		Intermittent	Continuous		Track Motor	Hyd.Motor	Parking Brake Torque	
	code:*1	in³	code:*2	in³											Track Motor	Hyd.Motor
PHV-4B-6011A-(P)-10	1	1.74	1	1.06	A	1/36.80	1052.5	640.3	3552	3026	2542	10.9	65	(2392)	2342	63.6
PHV-4B-6011B-(P)-10					B	1/47.53	1359.4	827.0		3909		14.2		(3089)	3025	
PHV-4B-6021A-(P)-10	2	1.81	1	1.11	A	1/36.80	1093.0	673.4		3143		11.5		(2392)	2342	
PHV-4B-6021B-(P)-10					B	1/47.53	1411.6	869.8		4059		14.9		(3089)	3025	
PHV-4B-6032A-(P)-10	3	2.08	2	1.16	A	1/36.80	1258.6	702.9		3619		12.0		(2392)	2342	
PHV-4B-6032B-(P)-10					B	1/47.53	1652.5	907.8		4672		15.5		(3089)	3025	
PHV-4B-6041A-(P)-10	4	2.15	1	1.29	A	1/36.80	1299.0	783.8		3735		13.4		(2392)	2342	
PHV-4B-6041B-(P)-10					B	1/47.53	1677.8	1012.4		4824		15.8		(59.3)	(2817)	

Note 1: Use this track motor within the Specification.

Note 2: The Specification is theoretical value. Real torque at 10 rpm (lo) should be approximately 85% of Theoretical Torque.

Real Speed at Hi(P<1493 psi) should be approximate 96% of Theoretical Speed.

The particular performance is shown in "DWG.NO. AM-2301ME-4".

Note 3: Max. Pressure is 3552 psi. However, the value in () is limited by Max. Output Torque.

Note 4: Max. Output Torque is 4824 Ft. Lbs. However, the value in () is limited by Max. Pressure.

"Intermittent" means less than 7% of operating time.

Note 5: Max. Flow is 15.8 gpm. However, the value in () is limited by Max. Output Speed (track motor or hydraulic motor).

Note 6: Max. Output Speed is 70 rpm (track motor), 3500 rpm (hydraulic motor).

However, the value in () is limited by Max. Flow or Max. Output Speed (track motor or hydraulic motor).

Note 7: Parking Brake Torque (hydraulic motor) is 63.6 Ft. Lbs.

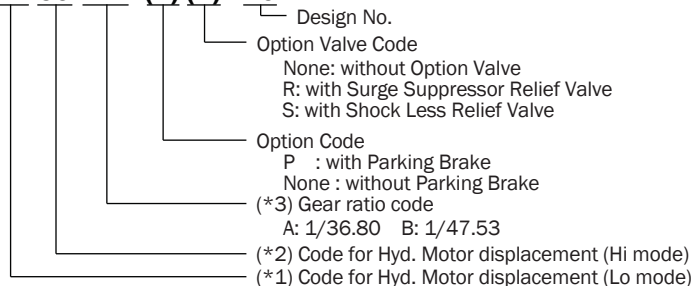
Therefore, Parking Brake Torque (track motor) is different value between Gear Ratio "A(1/36.80)" and "B(1/47.53)".

Note 8: You can select "Option Valve". This drawing is showing the track motor without Option Valve.

Other options available are Surge Suppressor Relief Valve and Shock Less Relief Valve.

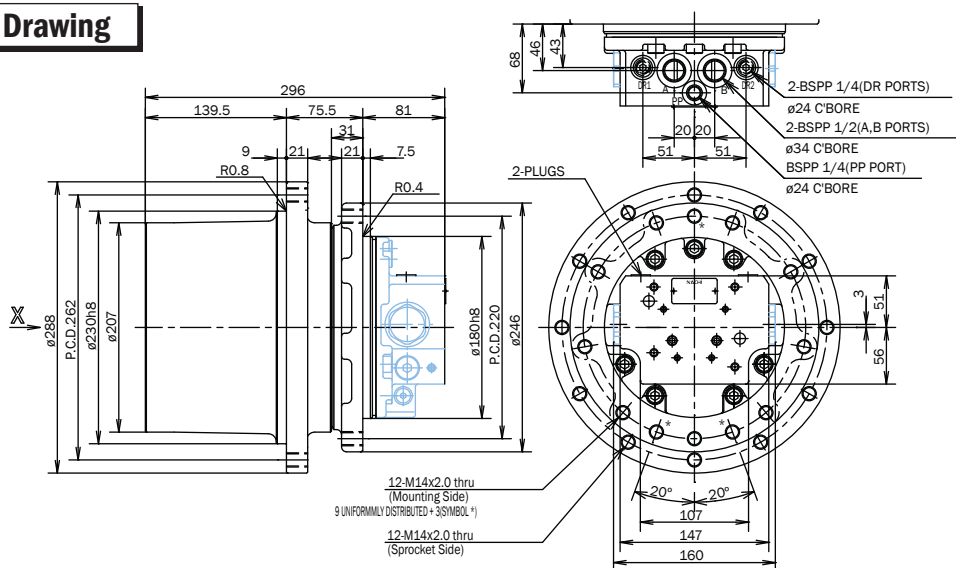
Understanding Model Numbers

PHV-4B-60 *- (*) (*) - 10**



CAUTION

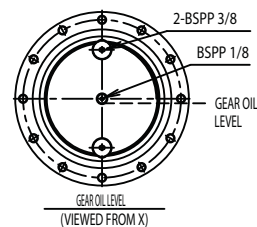
1. Speed Control Pressure: min. 217 psi
2. Hydraulic Fluid: ISO VG46
(Anti-Wear Hydraulic Fluid)
3. Contamination: within NAS Grade 10
4. Oil Temp: -4 ~ 180° F
5. Filter: 10µm
6. Gear Oil: SAE-30-CD
(Amount of Oil 20 in³)
7. Mass: 124 lbs.
8. Paint Color: Red (Under Coat),
Black (Top Coat)



MODEL NO.	PHV-4B-60***-10	MODEL NO.	PHV-4B-60***-P-10
NAME	2 speed type TRACK MOTOR		
DWG. NO.	AM-2401ME-1-B		

	INLET	OUTLET
CLOCKWISE	B	A
COUNTER-CLOCKWISE	A	B

RATED	Max. 43 psi
SURGE	Max. 145 psi





PHV Track Motors

Features

This product is the 2 speed hydraulic motor with reduction gear for the crawler type machine, which is a mini-excavator or a similar one in the operating condition and the operating rate.

Remove the upper side plug of "DRAIN PORTS"(DR1 or DR2), and then connect directly to the tank after installing this track motor to the machine.

Please refer to page M3 and the instruction manual for other notes.

Specifications

Model No.	SPECIFICATION (THEORETICAL)																(Note 3)		(Note 4)		(Note 5)		(Note 6)		(Note 7)		Shock Less Relief Valve	
	Code for Hyd.Motor Displacement				Code for Gear Ratio		Final Displacement		Max. Pressure	Max.Output Torque (Theoretical, Lo mode)		Max. Flow	Max.Output Speed (Theoretical, Hi mode)		Option		Cracking Pressure	Setting Pressure										
	Parking Brake Torque		Track Motor	Hyd.Motor						Track Motor	Hyd.Motor																	
	Lo mode				Hi mode		Intermittent	Continuous	Track Motor			Hyd.Motor	Track Motor	Hyd.Motor	psi	psi												
	code:*1	in ³	code:*2	in ³	code:*3	ratio	Lo mode	Hi mode	psi	Ft. Lbs	Ft. Lbs	gpm	rpm	rpm	Ft. Lbs.	Ft. Lbs.	psi	psi										
PHV-5B-11011A-PS-10	1	1.99	1	1.23	A	1/64.25	127.81	79.20	4640	(7869)	4794	(20.58)	60	(3855)	5019	78	4350 psi ⁺⁴³⁵ 0 at 0.26 gpm	4640 psi ⁺¹⁴⁵ 73 at 5.28 gpm										
PHV-5B-11032A-PS-10	2	2.26	2	1.25			145.45	80.37		(8954)		(20.87)																
PHV-5B-11043A-PS-10	3	2.58	3	1.30			165.84	83.51	(4350)	9588	21.14	(58.5)	(3756)															

Note 1: Use this track motor within the Specification.

Note 2: The Specification is theoretical value. Real torque at 10 rpm (Io) should be approximately 85% of Theoretical Torque.

Real Speed at Hi(P<1494 psi) should be approximate 96% of Theoretical Speed.

The particular performance is shown on page M3.

Note 3: Max. Pressure is 4640 psj. However, the value in () is limited by Max. Output Torque.

Note 4: Max. Output Torque is 9588 Ft. Lbs. However, the value in () is limited by Max. Pressure.

"Intermittent" means less than 7% of operating time.

Note 5: Max. Flow is 21.14 gpm. However, the value in () is limited by Max. Output Speed (track motor or hydraulic motor).

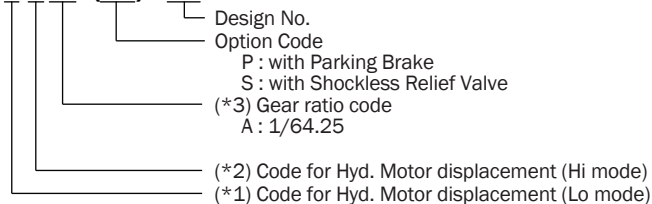
Note 6: Max. Output Speed is 60 rpm (track motor), 3855 rpm (hydraulic motor).

However, the value in () is limited by Max. Flow or Max. Output Speed (track motor or hydraulic motor).

Note 7: Parking Brake Torque (hydraulic motor) is 78 Ft Lbs.

Understanding Model Numbers

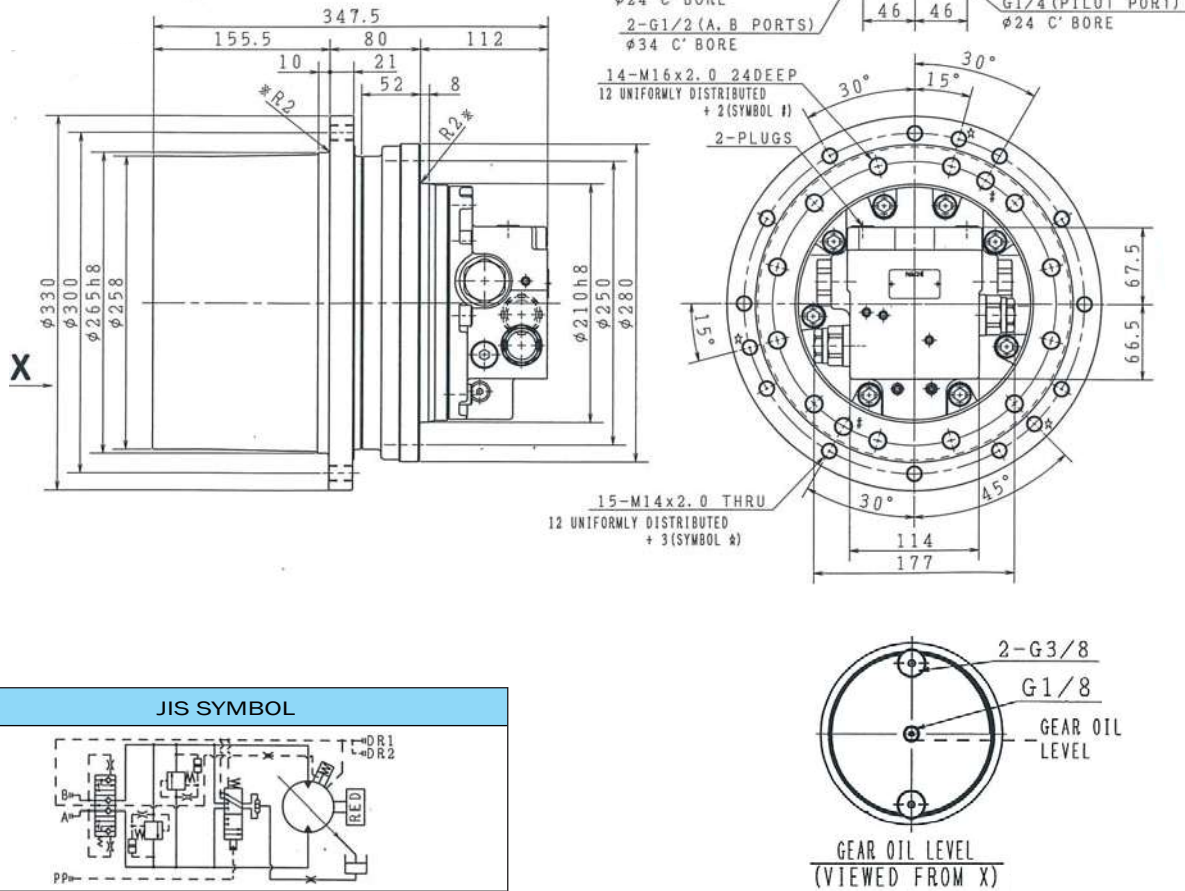
PHV-5B-110 * * A - (PS) - 10



Installation Dimension Drawings

CAUTION

1. Speed Control Pressure: min. 217 psi
2. Hydraulic Fluid: ISO VG46
(Anti-Wear Hydraulic Fluid)
3. Contamination: within NAS Grade 10
4. Oil Temp: -4 ~ 194° F (Instantaneous Max. 212° F)
5. Filter: 10µm
6. Gear Oil: SAE-30-CD (Amount of Oil 91.5 in³)
7. Mass: 192 lbs.
8. Paint Color: Ebony Gray (Under Coat)



JIS SYMBOL	
MODEL NO.	PHV-5B-110**A-PS-10
NAME	2 speed type TRACK MOTOR
DWG. NO.	AM-2701ME-2

ALLOWED DRAIN PRESSURE	
RATED	Max. 43.5 psi
SURGE	Max. 145 psi

ROTATIONAL DIRECTION (VIEWED FROM X)		
CLOCKWISE	INLET B	OUTLET A
COUNTER-CLOCKWISE	A	B

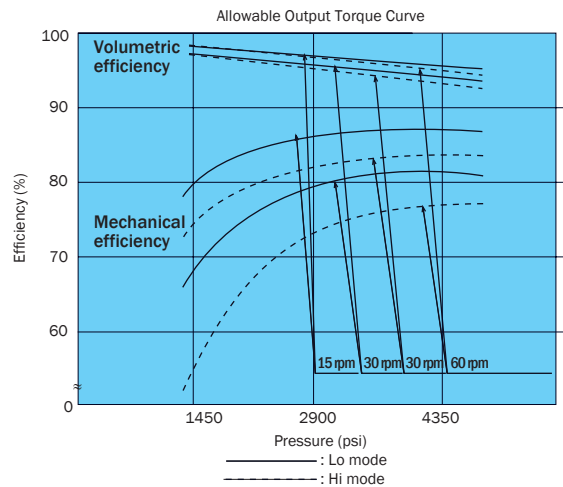
Performance Curves

PHV-5B-110**A-PS-10

Condition:

Hydraulic Fluid: ISO VG46

Oil Temperature: 122±41 ° F



Performance Characteristics

PHV-5B-110**A-PS-10

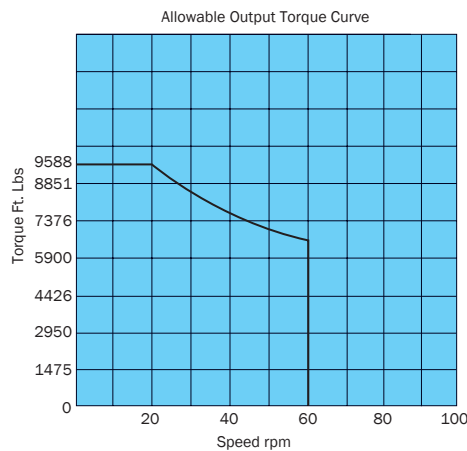
Condition of allowable output torque

Life: 300 hr (driving time)

Clockwise - 150 hr

Counterclockwise - 150 hr

Reduction gear life under your using condition



$$L_h = 300 \frac{20}{N} \left(\frac{T_o}{T} \right)^3$$

Lh: Life (hr)
N: Your using speed (min⁻¹)
To: Torque on curve at N
T: Your using Torque (N•m) (Theoretical)

Note: When the track motor is driven only side direction, the life is reduced by half.

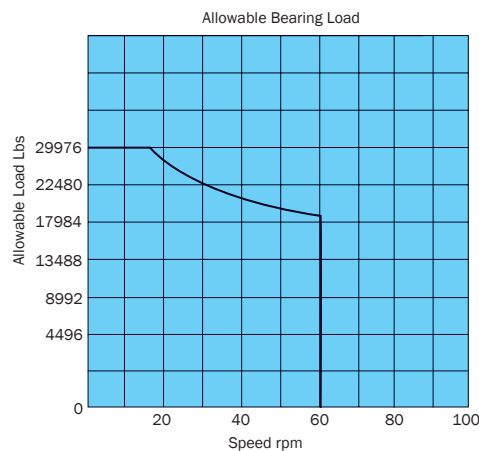
Condition of allowable bearing load

Life: 500 hr

Bearing life under your using condition

$$L_h = 500 \left(\frac{W_o}{W} \right)^3$$

Lh: Life (hr)
Wo: Load on curve at your using speed
W: Your using equivalent load (N) [*1]



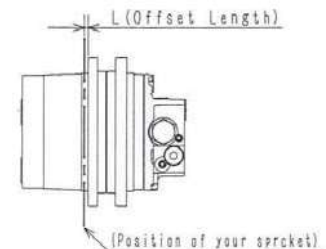
[*1] Figure that W (your using equivalent load) is the following:

$$W = \frac{73.5-L}{143.2} W_r \left(\frac{D/2}{143.2} \right) W_{th} (L \leq 1.9)$$

$$W = \frac{69.7+L}{143.2} W_r \left(\frac{D/2}{143.2} \right) W_{th} (1.9 < L)$$

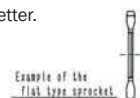
L: Offset length [*2] of your sprocket (mm)
D: Pitch circle diameter of your sprocket (mm)
Wr: Your using radial load (N)
Wth: Your using thrust load (N)

[*2] Refer to the figure below



Instructions:

1. Use this track motor within 'Specification' shown in DWG. No. AM-2701ME-1
2. A machining process is necessary on the track motor installation face of the track frame. Flatness of the installation face should be 0.1 mm or better.
3. Use an installation mounting with stiffness and clean the mounting before installing this track motor to the machine.
4. Install this track motor horizontally.
5. The sprocket should be a flat type. (Refer to drawing at right)
6. Remove the upper side plug of 'Drain ports' (DR1 or DR2: refer to DWG. No. AM-2701ME-1) and then connect to the tank after installing this track motor to the machine.
7. Fill the motor case with clean hydraulic fluid through the 'Drain port' before starting.
8. When the 'PP port' (refer to DWG. No. AM-2701ME-1) is connected to the tank, this track motor is operated at Lo mode. (permitted back pressure: 72 psi)
9. When the 'PP port' is supplied pressure, this track motor is operated at Hi mode. (speed control pressure: min. 217 psi)
10. The parking brake (option) of this track motor is negative brake system. Parking brake is working when 'A port' and 'B port' (refer to DWG. No. AM-2701ME-1) are not supplied pressure; is not working when 'A port' or 'B port' is supplied pressure. (parking brake releasing pressure: 217 psi)
11. Change the gear oil to the new one each following period. First: 200 hr or 2 months; Second and after: 1000 hr or 1 year
12. The neutral position of the control valve should be AB-T open. Please secure enough open area (more than 78 mm²), not to occur abnormal pressure rising at A•B port.
13. Please refer to the instruction manual for other notes.



Operating Fluid

Operating fluid is liquid inside of a hydraulic device that acts as a medium to transmit power. In addition to its operational task, hydraulic operating fluid also performs such

- Oil-based operating fluid

The most commonly used mineral oil hydraulic fluids are general operating fluid and anti-wear operating fluid. General operating fluid is called "R&O type." It is made by adding oxidation inhibitors, rust inhibitors, foam inhibitors, and other additives to a highly refined paraffin base oil to enhance its characteristics. Anti-wear operating fluid contains extreme pressure additives that enhances the extreme pressure characteristics required for high-pressure, high-speed hydraulic operations.

These oil-based operating fluid have a very wide range of application in hydraulic

tasks as lubrication, rust prevention, sealing, and cooling. Because of the vital contributions hydraulic operating fluid makes to the operation, efficiency, and

equipment, and account for most hydraulic operation fluid in use today.

- Fire-resistant Hydraulic Fluid

Fire-resistant hydraulic fluid (FRHF) is used in fire fighting equipment and in hydraulic equipment in applications where there is the danger of fire. There are two types of FRHF: water-containing and synthetic. The common types are water-glycol type and water in oil emulsion type for water-containing FRHF, and phosphate ester type and fatty acid ester type for synthetic FRHF.

Care is required when using an FRHF

reliability of hydraulic equipment, it is important to exercise sufficient care when selecting the correct type for your needs and when storing fluid.

concerning seal material, paint and metal compatibility (see table below), and because their lubrication characteristics are different from those of mineral oil.

- See the pages for each hydraulic device or contact your agent to find out if a fire-resistant hydraulic fluid can be used with a particular device.

Fire-resistant Hydraulic Fluid Seal Material Compatibility

Fluid Sea Material	Water In Oil Emul- sion	Water- glycol	Phos- phate Ester	Fatty Acid Ester
Nitril Rubber	○	○	×	○
E . P . R .	×	○	○	○
Fluro Rubber	○	×	○	○
Teflon	○	○	○	○
Butyl Rubber	×	○	▲	×
Urethane Rubber	×	×	×	○
Silicon Rubber	×	×	○	○
Leather (Wax Sealed)	×	×	○	○
Beech N	○	○	×	○
Beech S	○	○	×	○

Fire-resistant Hydraulic Fluid Paint Compatibility

Fluid Paint	Water In Oil Emul- sion	Water- glycol	Phos- phate Ester	Fatty Acid Ester
Epoxy Resin	×	×	×	○
Vinyl Resin	×	×	×	○
Urethane Resin	×	×	×	○
Phtalic Resin	×	×	×	×
Phenolic Resin	×	×	×	×

Fire-resistant Hydraulic Fluid Metal Compatibility (Δ indicates partial problem.)

Fluid Metal	Water In Oil Emul- sion	Water- glycol	Phos- phate Ester	Fatty Acid Ester
Aluminum	○	×	▲	○
Cast Iron	○	○	○	○
Steel	○	○	○	○
Brass	○	○	○	○
Copper	▲	○	○	○
Magnesium	○	×	▲	○
Cadmium	▲	×	▲	▲
Zinc	▲	×	○	▲

Note: The ▲ symbol indicates items that may have problems. For details, consult your agent or a hydraulic operating fluid manufacturer.
○ symbol indicates items that may be used. × symbol indicates not ok.

- General Properties of Hydraulic Fluid (Typical)

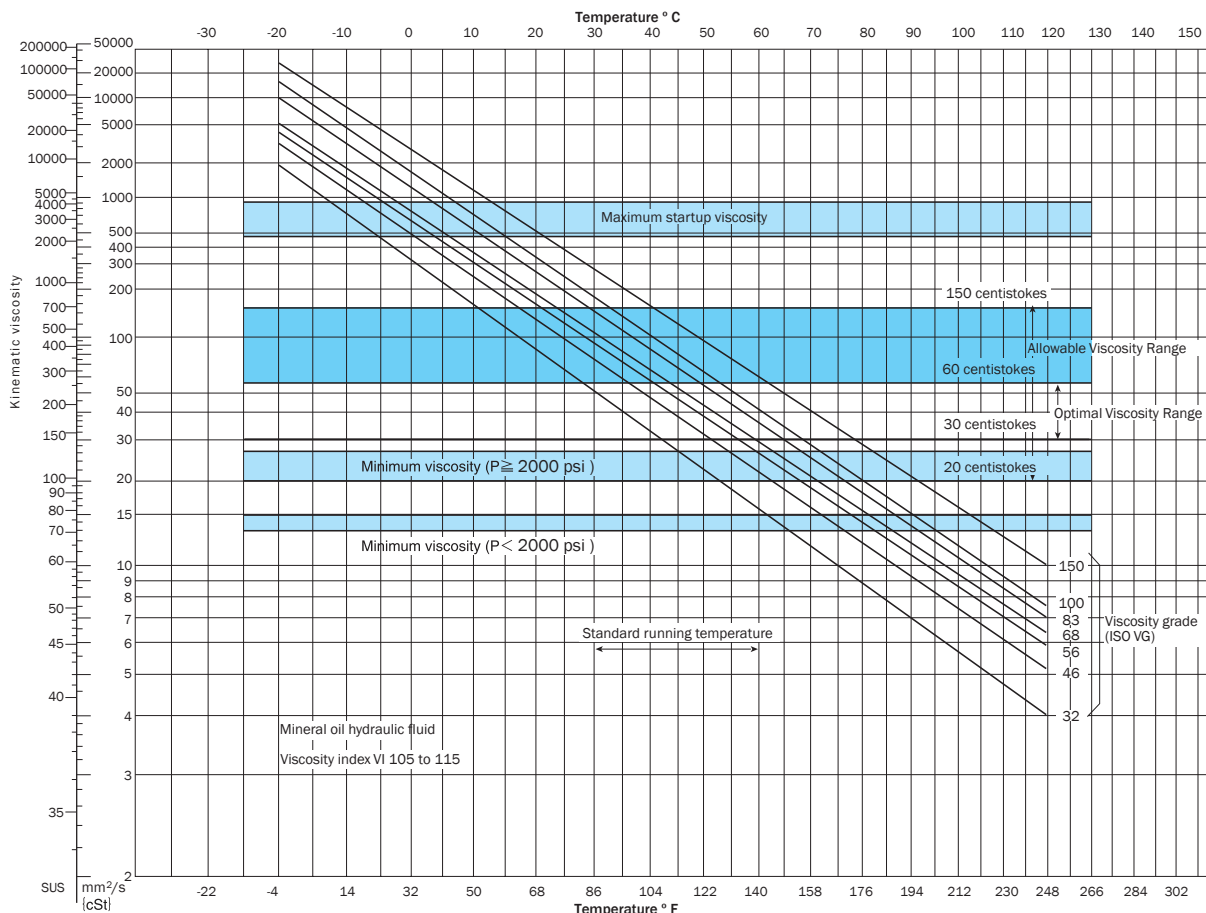
Item	Type	Oil-based operating fluid	Water-glycol	Water In Oil Emulsion	Phosphate Ester	Fatty Acid Ester
Specific Gravity 15/4 °C		0.874	1.072	0.890	1.152	0.900
Fire Point° F		435	None	None	503	494
Viscosity centistokes	40° C 100° F	59.8	45.5	67.9	36.4	43.6
	100° C 212° F	8.09	9.09	12.0	4.72	8.00
Viscosity index		113	206	146	110	165
Pour Point° C (F)		-25 (-13)	-40 (F/C)	-12.5 (9.5)	-20 (-4)	-10 (14) or less

- Viscosity-Temperature Characteristics (Oil-based operating fluid)

Viscosity is the most important factor to consider when selecting hydraulic operating fluid. Viscosity has a major effect on a variety of characteristics, including the volumetric efficiency, mechanical efficiency, and pipe resistance, valve leakage, operational characteristics, etc.

Though the overall efficiency and characteristics of the hydraulic device should be considered when determining the proper viscosity of the fluid, the main consideration should be the needs of the hydraulic pump at the heart of the hydraulic system. The following pages show typical Viscosity-Temperature

characteristics for oil-based operating fluid with viscosity indexes from 105 to 115, as well as ASTM Viscosity Index-Temperature tables with information about suitable and optimal viscosity ranges for hydraulic pumps.



• Fluid Cleanliness Levels

Today's high-pressure, high-speed, high-precision control hydraulic equipment is more susceptible than ever before to problems caused by hydraulic fluid contaminants. Fluid contaminants can cause a loss of machine performance, shorten machine life, and even lead to equipment malfunction. Because of this, the U.S. has taken the lead in defining numeric contamination limits to govern cleanliness levels for hydraulic operating fluid. Japan also applies the same standards (normally, NAS-1638) to classify fluid contamination limits. In the future, the world standard ISO cleanliness codes (ISO 4406) will use a range code to define the cumulative number of particles by diameter per milliliter. The range codes are separated by a slash in order of the diameter of the particle: larger than 4 μm (C), larger than 6 μm (C), and larger than 14 μm (C).

For example:

Larger than 4 μm (C) 1200 particles/mr

Larger than 6 μm (C) 300 particles/mr

Larger than 14 μm (C) 40 particles/mr

The cleanliness code looks like: 17/15/12

Allowable Number of Particles in Hydraulic Fluid - NAS-1638 (100 mℓ ; 6.1 in³)

Particle Size Class	5 to 15 μm	15 to 25 μm	25 to 50 μm	50 to 100 μm	100 μm or larger	Device	Filter	Remarks
00	125	22	4	1	0			
0	250	44	8	2	0			
1	500	89	16	3	1			
2	1,000	178	32	6	1			
3	2,000	356	63	11	2			
4	4,000	712	126	22	4			
5	8,000	1,425	253	45	8			
6	16,000	2,850	506	90	16			
7	32,000	5,700	1,012	180	32			
8	64,000	11,400	2,025	360	64	↓ Electric - Hydraulic Servo Device	From nominal 0.8 μm to absolute 3 μm	↓ Clean oil
9	128,000	22,800	4,050	720	128	↓ Electric - Hydraulic Pulse Motor	From nominal 10 μm to absolute 40 μm	↓ NC hydraulic fluid
10	256,000	45,600	8,100	1,440	256			↓ In drum General hydraulic fluid (new)
11	512,000	91,200	16,200	2,880	512			
12	1,024,000	182,400	32,400	5,760	1,024	↓ General Industrial Hydraulic Device		

Weight of Contaminants Per 100 mℓ (6.1 in³) of Hydraulic Fluid - NAS-1638

Class	100	101	102	103	104	105	106	107	108
Weight mg	0.02	0.05	0.01	0.30	0.50	0.70	1.0	2.0	4.0

ISO Contamination Limit Equivalents (ISO 4406:1999)

Number of particles show upper limit values for each scale number.

Number of Particles (Particles/mℓ)	Scale Number	Number of Particles (Particles/mℓ)	Scale Number	Number of Particles (Particles/mℓ)	Scale Number
2,500,000 +	>28	5,000	19	5	9
2,500,000	28	2,500	18	2.25	8
1,300,000	27	1,300	17	1.3	7
640,000	26	640	16	0.64	6
320,000	25	320	15	0.32	5
160,000	24	160	14	0.16	4
80,000	23	80	13	0.08	3
40,000	22	40	12	0.04	2
20,000	21	20	11	0.02	1
10,000	20	10	10	0.01 or less	0

Subplate/Conversion Chart

Hydraulic Component for use with Water - Glycol

Pump Specifications for Water - Glycol Oil

VDR22 Design Series Variable Vane Pump

Pump Model for W/G	Rated Pressure psi	Max. Pressure psi	Max. Drive Speed rpm	Suction Pressure psi
W-VDR-1 * - 1A2-(E)22	500	500	1800	-2.1 to 4.3
1A3	1000	1000		
2A2	500	500		
2A3	714	714		

VDC Series Variable Vane Pump

Pump Model for W/G	Rated Pressure psi	Max. Pressure psi	Max. Drive Speed rpm	Suction Pressure psi
W-VDC-1 * - 1A2-20, (E)35	500	500	1800	-2.1 to 4.3
1A3	1000	1000		
2A2	500	500		
2A3	714	714		
W-VDC-2 * - 1A2-20, (E)35	500	500	1800	-2.1 to 4.3
1A3	1000	1000		
2A2	500	500		
2A3	714	714		
W-VDC-3 * - 1A2-(E)35	500	500	1800	-2.1 to 4.3
1A3	1000	1000		

IPH Series Internal Gear Pump

Pump Model for W/G	Rated Pressure psi	Max. Pressure psi	Max. Drive Speed rpm	Suction Pressure psi
W-IPH-2 * - * - 11	3000	3571	1200	-2.1 to 4.3
W-IPH-3 * - * - 20				
W-IPH-4 * - * - 20				
W-IPH-5 * - * - 21(11)				
W-IPH-6 * - * - 21(11)				

PVS, PZS Series Variable Piston Pump

Pump Model for W/G	Rated Pressure psi	Max. Pressure psi	Max. Drive Speed rpm	Suction Pressure psi
W-PVS-0B- 8N *- (E)30	2000	2000	1200	-2.1 to 4.3
W-PVS-1B- 16N *- 11, E12	2000	2000	1200	-2.1 to 4.3
22N *	1500	1500		
W-PVS-2B- 35N *- 11, E12	2000	2000	1200	-2.1 to 4.3
45N *	1500	1500		
W-PZS-3B- 70N *- (E)10	2000	2000	1200	-2.1 to 4.3
W-PZS-4B- 100N *- (E)10				
W-PZS-5B- 130N *- (E)10				

Subplate/Conversion Chart Valve Specifications for Water - Glycol

Pressure Control Valve

Valve Name	Valve Model for W/G	Specifications	
		Max. Pressure psi	Max. Flow gpm
Relief Valve	R- * 03 - * - 11	3000	7.9 (5.3) Note
	R- * 06 - * - (E)20		39.7
	R- * 10 - * - (E)20		89.9
Relief Valve	RI- * G03 - * - (E)10	3000	22.5 (5.3) Note
	RI- * G06 - * - (E)10		44.9
Direct Type Relief Valve	RD- * G03 - * - 11	3000	11.9
	RD- * G06 - * - 11		19.8
Relief Valve for Remote Control	RCD- T02 - * - 11	3000	4.0
	RC- T02 - * - 12		0.5
	RC- G02 - * - 21		0.5
Solenoid Control Relief Valve	RSA- * 03 - * - * - 13	3000	7.9
	RSA- * 06 - * - * - 22		39.7
	RSA- * 10 - * - * - 22		89.9
	RSS- * 03 - * - * - 13		7.9
	RSS- * 06 - * - * - (E)22		39.7
	RSS- * 10 - * - * - (E)22		89.9
Solenoid Control Relief Valve	RIS- G03 - * - * - 11	3000	22.5
	RIS- G06 - * - * - 11		44.9
Reducing Valve	W-(C)G - * 03 - * - 21	3000	10.6 (5.3) Note
	W-(C)G - * 06 - * - 21		26.4
	W-(C)G - * 10 - * - 21		66.1
Balancing Valve	GR- G01 - A * - 20	2000	5.3
	GR- G03 - A * (B) - 20		10.6
Pressure Control Valve	(C)G - * 03 - * - 21	3000	10.6
	(C)G - * 06 - * - 21		26.4
	(C)G - * 10 - * - 21		66.1

Note: () value is for pressure range "A", "B" and "C".

Directional Control Valve

Valve Name	Valve Model for W/G	Specifications	
		Max. Pressure psi	Max. Flow gpm
Right Angle Check Valve	CA- * 03 - * - 20	3000	10.6
	CA- * 06 - * - 20		29.1
	CA- * 10 - * - 20		84.6
Inline Check Valve	W-CN - T03 - * - 10	3000	7.9
	W-CN - T06 - * - 10		19.8
	W-CN - T10 - * - 10		50.2
Pilot Check Valve	CP- * 03 - * - 20	3000	10.6
	CP- * 06 - * - 20		29.1
	CP- * 10 - * - 20		84.6
DMA Type Manual Valve	W-DMA- G01 - * - * - (E)20	3000	9.3
	W-DMA- G03 - * - * - (E)10		17.2
Manual Valve	W-DM- T03 - * - * - (B)-10	3000	11.9
	W-DM- T06 - * - * - (B)-10		26.4
SA Type Solenoid Valve	SA- G01 - * - * - (E)30	4000	Note. 22.5
	DSA- G04 - * - * - (E)21		66.1
	DSA- G06 - * - * - (E)21		132.2
SS Type Solenoid Valve	SS- G01 - * - * - (E)30	4000	Note. 22.5
	SS- G03 - * - * - (E)20		24.1
	DSS- G04 - * - * - (E)21		66.1
	DSS- G06 - * - * - (E)21	3000	132.2
	SS- G01 - * - FR - * - (E)30		Note. 11.9
	SS- G03 - * - FR - * - (E)20		17.2
	SS- G03 - * - * - (E)10		18.5
Fine Solenoid Valve	SF- G01 - * - * - 10 - (E)10	2000	Note. 9.0
Non Leak Type Solenoid Valve	SNH- G01 - * - * - 10	4500	Note. 4.5
	SNH- G03 - * - * - 10		9.0
	SNH- G04 - * - * - 10		13.2
	SNH- G06 - * - * - 10		22.5
Gauge Valve	W- K - * - * - 10	5000	-
	K2- * 02 - 10	3000	-
	K2- * 03/04 - 10	6000	-

Note: Max. flow capacity changes depending on spool type. Flow rating is 85% of standard max. oil flow.

Subplate/Conversion Chart

Valve Specifications for Water - Glycol

Flow Control Valve

Valve Name	Valve Model for W/G	Specifications	
		Max. Pressure psi	Max. Flow gpm
Flow Regulator	R- * 03 - * - 11	3000	7.9
	R- * 06 - * - (E)20		19.8
	R- * 10 - * - (E)20		50.2
FT Type Flow Control Valve	RI- * G03 - * - (E)10	3000	Note.
	RI- * G06 - * - (E)10		
F Type Flow Control Valve	RD- * G03 - * - 11	3000	
TN Type Flow Control Valve	RD- * G06 - * - 11	1500	
	RCD- T02 - * - 11		
TS Type Flow Control Valve	RC- T02 - * - 12	1500	
TL (TLT) Type Feed Control Valve	RC- G02 - * - 21	1000	
	RSA- * 03 - * - * - * - 13		
	RSA- * 06 - * - * - * - 22		

Note: Flow rating is 85% of standard max. oil flow.

Modular Valve

Valve Name	Valve Model for W/G	Specifications	
		Max. Pressure psi	Max. Flow gpm
Relief Valve	OR- G01 - * - 20 (21)	3000	7.9
	OR- G03 - * - (E)50		17.2
	OR- G06 - * - (E)10		31.7
Brake Valve	ORO- G01 - * - 20	3000	5.3
	ORO- G03 - * - (J)50		7.9
Direct Type Relief Valve	ORD- G01 - * - 20	3000	5.3
	ORD- G03 - * - (J)50		7.9
	OG- G01 - P * - (E)20		7.9
Reducing Valve	OGB- G01 - P * - 20	3000	7.9
	W-OG- G03 - P * - (E)50		17.2
	W-OG- G06 - P * - (E)12		31.7
	OGS- G01 - P * C - 20	1000	7.9
	OGC- G01 - P * - (E)12		4.0
Reducing Valve	OG- G01 - * - (E)20	3000	7.9
	OGB- G01 - * - 20		7.9
	W-OG- G03 - * - (E)50		17.2
	W-OG- G06 - * - (E)12		31.7
Sequence Valve	OCQ- G01 - P2 - 20	3000	7.9
	OCQ- G03 - P2 * - (J)50		17.2
	OCQ- G06 - P2 * - (E)11		31.7
Counter Balance Valve	OCQ- G01 - * 1 * - 20	3000	7.9
	OCQ- G03 - * 1 * - (J)50		17.2
	OCQ- G06 - * 1 * - (E)11		31.7
Pressure Switch	OW- G01 - * - 20	3000	7.9
Flow Regulator	OY- G01 - * - 20	3000	7.9
	OCY- G01 - P - 20		7.9
	OCY- G03 - P - (J)50		22.5
	OCY- G06 - P - 10		31.7
	OCY- G01 - * - X/Y - 20		7.9
	OCY- G03 - * - X/Y - (J)50		22.5
	OCY- G06 - * - X/Y - 11		31.7
Flow Control Valve	OF- G01 - P20 - 20	3000	Note.
	OF- G03 - P60 - J50		
	OCF- G01 - * 40 - X/Y - 30		
	OCF- G03 - * 60 - X/Y - (J)50		
Check Valve	OC- G01 - * - 20	3000	7.9
	OC- G03 - * - (J)50		22.5
	OC- G06 - * - 10		31.7
Vacuum Check Valve	OCV- G01 - W - 20	3000	7.9
	OCV- G03 - W - (J)50		17.2
Pilot Check Valve	OCP- G01 - * - (F) - 21	3000	7.9
	OCP- G03 - * - (J)50		22.5
	OCP- G06 - * - 11		31.7
D07 Relief Valve	ORH- G04 - P * - 10	4500	66.1
D07 Direct Type Relief Valve	ORH- G04 - D * - 10	4500	10.6
D07 Reducing Valve	OGH- G04 - * * - 10	4500	66.1
D07 Counter Balance Valve	OQH- G04 - * * - 10	4500	66.1
D07 Flow Regulator	OYH- G04 - * * - 10	4500	66.1
D07 Flow Control Valve	OFH- G04 - * 200 - X/Y - 10	4500	Note.
D07 Check Valve	OCH- G04 - * * - 10	4500	66.1
D07 Vacuum Check Valve	OVH- G04 - W - 10	4500	66.1
D07 Pilot Check Valve	OPH- G04 - * * - 10	4500	66.1

Note: Flow rating is 85% of standard max. oil flow.

Subplate/Conversion Chart

Valve Specifications for Water - Glycol

Proportional Valve

Valve Name	Valve Model for W/G	Specifications	
		Max. Pressure psi	Max. Flow gpm
Pilot Relief Valve	EPR- G01 - * - (E)11	4000	0.3
Relief Valve	ER- G03 - * - (E)10	3571	10.6
	ER- G06 - * - (E)10		39.7
Reducing Valve	W-EBG- G03 - * - (E)10	3571	10.6
	W-EBG- G06 - * - (E)10		21.2
Flow Control Valve	(O)ES- G02 - * - (F) - (E)11	3000	Note.
	ES- G03 - * - (F) - (E)11		
	(C)ES- G06 - 250 - (E)10		
	ES- G10 - 500 - (F) - (E)10		
Load Sensing Type Flow Control Valve	ESR- G03 - 125 - (E)11	3571	Note.
	ESR- G03 - 125R * - (E)11		
	ESR- G06 - 250 - (E)11		
	ESR- G06 - 250R * - (E)11		
	ESR- G10 - 500 - (E)11		
	ESR- G10 - 500R * - (E)11		
Directional and Flow Control Valve	ESD- G01 - *** - (E)11	3571	Note.
	ESD- G03 - *** - (E)11		
	ESD- G06 - *** - (E)11		
Modular Type Reducing Valve	EOG- G01 - P * - 10	3571	6.6
Modular Type Flow Control Valve	EOF- G01 - * 25 - 10	3000	Note.

Note: Flow rating is 85% of standard max. oil flow.

Conversions and Formulas

Conversions

TO CONVERT	INTO	MULTIPLY BY
Bar	PSI	14.5
cc	Cu. In.	0.06102
°C	°F	$(^{\circ}\text{C} \times \frac{9}{5}) + 32$
Kg	lbs.	2.205
KW	HP	1.341
Liters	Gallons	0.2642
mm	inches	0.03937
Nm	Lb. - ft.	0.7375
N	Lbs.	0.22481
Cu. In.	cc	16.39
°F	°C	$(^{\circ}\text{F} - 32) / 1.8$
Gallons	Liters	3.785
HP	KW	0.7457
Inches	mm	25.4
Lbs.	Kg	0.4535
Lb.-ft.	Nm	1.356
PSI	Bar	0.06896
In. of HG	PSI	0.4912
In. of H ₂ O	PSI	0.03613
Lbs.	Nm	4.4482

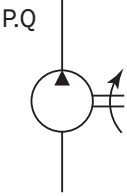
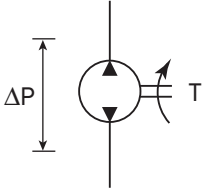
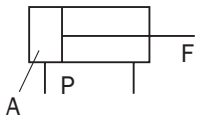
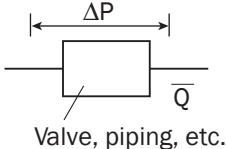
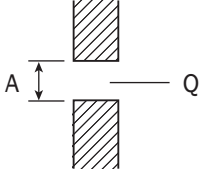
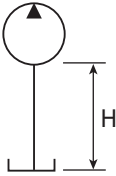
Formulas

CYLINDERS	Cylinder Area = $\text{diameter}^2 \times .7854$	Tube Area = $\frac{\text{GPM} \times .3208}{\text{oil velocity}}$
	Cylinder Force = pressure x area	Adjust GPM on Return = $\frac{\text{cyl area} \times \text{GPM}}{\text{area}}$
	Cylinder Time (in seconds) = $\frac{\text{area} \times \text{stroke} \times .26}{\text{GPM}}$	Cylinder Speed (Ft/Min) = $\frac{\text{stroke} \times 5}{\text{time (in secs)}}$
	Pneumatic HP = $\frac{\text{compressed CFM} \times \text{PSI} \times 144}{33,000}$	Cylinder Speed (Ft/Min) = $\frac{\text{GPM} \times 19.25}{\text{area}}$
	Cylinder HP = $\frac{\text{cyl speed} \times \text{cyl force}}{33,000}$	Comp CFM = $\frac{\text{area} \times \text{stroke} \times 60}{\text{time (in secs)} \times 1.728}$

PUMPS MOTORS	HP Out = $\frac{\text{HP IN} \times \text{overall Eff.}}{100}$	GPM = $\frac{\text{RPM} \times \text{disp. (in inches)}^3}{231}$
	Actual Torque = $\frac{\text{theo. torque} \times \text{mech. eff.}}{100}$	Hyd. HP = $\frac{\text{GPM} \times \text{PSI}}{1714}$
	Actual Motor RPM = $\frac{\text{theo. RPM} \times \text{vol. eff.}}{100}$	Torque (in lbs.) = $\frac{\text{PSI} \times \text{disp. (in inches)}^3}{6.28}$
	Overall Efficiency = $\frac{\text{mech. eff.} \times \text{vol. eff.}}{100}$	Torque (in lbs.) = $\frac{\text{HP} \times 63025}{\text{RPM}}$
	Actual Pump GPM = $\frac{\text{theo. GPM} \times \text{vol. eff.}}{100}$	

VEHICLE SIZING	$\text{RPM} = \frac{\text{MPH} \times 168}{\text{LR}}$
	$\text{Torque} = \text{TE} \times \text{LR}$
	$\text{Wheel Slip Torque} = \text{WD} \times \text{ADC} \times \text{LR}$
	$\text{TE} = \text{RR} + \text{GR} + \text{DP}$
	$\text{RR} = \frac{\text{GVW} \times \text{R}}{1000}$
	$\text{GR} = \frac{\% \text{Grade} \times \text{GVW}}{100}$

LEGEND	G = Gear Reduction Ratio	GR = Grade Resistance
	LR = Load Radius	DP = Draw Bar Pull Desired
	TE = Tractive Effort	TE = RR + GR + DP
	WD = Weight on Drive Wheels	R = Rolling Resistance Coefficient
	ADC = Adhesion Coefficient	GVW = Gross Vehicle Weight
	RR = Rolling Resistance	

	Item	SI units	Power (engineering) units
Requirement		$hp = \frac{P \cdot Q}{1714 \times \eta}$ L : Power Requirement [hp] P : Discharge Pressure [psi] Q : Discharge Rate [gpm] η : Pump Efficiency	$hp = \frac{P \cdot Q}{1714 \times \eta}$ L : Power Requirement [hp] P : Discharge Pressure [psi] Q : Discharge Rate [gpm] η : Pump Efficiency
Oil Motor Output Torque		$T = \frac{PQ \times 36.77}{RPM}$ T : Output Torque [in lbs] P : Inlet/Outlet Pressure Differential [psi] Q : Discharge rate [gpm] η : Torque Efficiency	$T = \frac{\Delta P \cdot q}{200 \times \pi} \times \eta$ T : Output Torque [kgf-m] ΔP : Inlet/Outlet Pressure Differential [kgf/cm²] q : Volume per Oil Motor Turn [cm³] η : Torque Efficiency
Cylinder Output		$F = PA \eta$ F : Cylinder Force [lbs] P : Working Pressure [psi] A : Cylinder Contact Area [in²] η : Cylinder Efficiency	$F = P \times A \times \eta$ F : Cylinder Output [kgf] P : Working Pressure [kgf/cm²] A : Cylinder Contact Area [cm²] η : Cylinder Efficiency
Pressur Loss Conversion Energy	 Valve, piping, etc.	$H = 60 \times P \times Q$ H : Heat Release [kJ/h] P : Pressure Loss [MPa] Q : Flow Rate [ℓ /min]	$H = 1.4 \times P \times Q$ H : Heat Release [kcal/h] P : Pressure Loss [kgf/cm²] Q : Flow Rate [ℓ /min]
Orifice Flow		$Q = 29.81 CA^2 \sqrt{\frac{\Delta P}{S}}$ Q : Flow Rate [gpm] C : Compressible Flow Coefficient [Dimensionless] A : Passage Area [Dia. in²] ΔP : Pressure Differential [psi] S : Sp. Gr.	$Q = CA \sqrt{\frac{2g \cdot \Delta P}{\gamma}} \times 0.06$ Q : Flow Rate [ℓ /min] C : Compressible Flow Coefficient [Dimensionless] (≈0.6) A : Passage Area [cm²] g : Gravitational Acceleration [980cm/s²] ΔP : Pressure Differential [kg/cm²] γ : Specific Gravity [kg/cm³] (≈0.87×10⁻³)
Pressure Loss		$\Delta P = \rho \times g \times H \times 10^{-6}$ ΔP : Pressure Loss [MPa] ρ : Density [kg/m³] g : Gravitational Acceleration [9.8m/s⁻²] H : Height [m]	$\Delta P = \gamma \times g \times H \times 10^{-4}$ ΔP : Pressure Loss [kg/m⁻²] γ : Specific Gravity [kgf/cm⁻³] H : Height [m]

Note: When performing calculations, make sure that you first convert values correctly. Cutting off and rounding up values can cause differences in calculation results.

(Alphabetic sequence)

Note: *Indicates value and symbol entries, but due to the amount of model numbers, they have been eliminated from this item. See the items in the catalog for specific details.

B

BRC41-01WC2
BRC41-01WD2

page
F-53
F-53

C

CA-F**.*-30
CA-G03.*-20
CA-G06.*-20
CA-G10.*-20
CA-T03.*-20
CA-T06.*-20
CA-T10.*-20
CAB-T02.*-11
CES-G02.*-(F)-12
CES-G06-250-12
CF-G00-170-20
CF-G10-373-20
CFR-F**.*-30
CFR-G03-10
CFR-G06-10
CFR-G10-10
CFR-T03-10
CFR-T06-10
CFR-T10-10
CFT-G02.*-22
CG-G03.*-21
CG-G06.*-21
CG-G10.*-21
CG-T03.*-21
CG-T06.*-21
CG-T10.*-21
CN-T03.*-11
CN-T06.*-11
CN-T10.*-11
CP-F**.*-30
CP-G03.*-(B)-(F)-20
CP-G03.*-(F)-20
CP-G06.*-(B)-(F)-20
CP-G06.*-(F)-20
CP-G10.*-(B)-(F)-20
CP-G10.*-(F)-20
CP-T03.*-(B)-(F)-20
CP-T03.*-(F)-20
CP-T06.*-(B)-(F)-20
CP-T06.*-(F)-20
CP-T10.*-(B)-(F)-20
CP-T10.*-(F)-20
CQ-G03.**-21
CQ-G06.**-21
CQ-G10.**-21
CQ-T03.**-21
CQ-T06.**-21
CQ-T10.**-21
CTN-G02.*-11
CTN-G02.*-F-11
CTS-G01-2-11

K-08
K-01
K-01
K-01
K-01
K-01
C-13
G-08
G-08
J-08
J-08
K-08
J-01
J-01
J-01
J-01
J-01
J-04
I-18
I-18
I-18
I-18
I-18
K-01
K-01
K-01
K-08
K-04
K-04
K-04
K-04
K-04
K-04
K-04
K-04
K-04
K-04
K-04
I-25
I-25
I-25
I-25
I-25
J-11
J-11
J-14

D

DMA-G01-***-E20

E-01

E

DMA-G03-***-E20
DSA-G04-***-(R)-**-E22
DSA-G06-***-(R)-**-E22
DSS-G04-***-(R)-**-E22
DSS-G06-***-(R)-**-E22

page
E-01
D-41
D-41
D-41
D-41

EA-PD4-***-*-10
EA41-1A
EA41-DR-1C
EA64-1GR**-*1C
EA41-R*-1C
EA42-1B
EA42-R*-1B
EAC64-C*
EAC64-D*
EAC64-E*
EBA-PD1-N-C1-10
EBA-PD1-NW-C1-10
EBA-PD1-NW-(Z)-D2-10
EBA-PD1-N(Z)-D2-10
EBB64-C*
EBB64-E*
EBB64-D*
ECB64-C*
ECB64-D*
ECB64-E*
EDA-PD1-NWZ-D2-11
EDC64-C* E-03
EDC64-D* E-03
EDC64-E* E-03
EDC-PC6-AWZ-D2-20
EGB-G03-*E11
EGB-G06-*E11
EMA-PD5-N20
EMC-PC6-A-20
EOF-G01-*25-11
EOG-G01-P*-11
EPR-G01-*,****-E12
ER-G03-*E21
ER-G06-*E21
ES-G03-*(F)-E12
ES-G06-F-250-11
ES-G10-500(F)-11
ESD-G01-***-E12
ESD-G03-***(**)-E12
ESD-G04-***(**)-E12
ESD-G06-***(**)-E12
ESH-G01-H*A-E10
ESH-G03-D****-(*)-
ESH-G04-D****-(*)-
ESH-G06-D****-(*)-
ESR-G03-125(**)-E12
ESR-G06-250(**)-E12
ESR-G10-500(**)-E12

G-44
D-22
D-22
D-22
D-22
D-22
D-18
D-18
D-18
G-30
G-30
G-30
D-18
D-18
D-18
D-06
D-06
G-34
D-06
D-06
G-34
G-06
G-06
G-26
G-26
G-24
G-22
G-02
G-04
G-04
G-08
G-08
G-08
G-14
G-14
G-14
G-38
G-40
G-40
G-11
G-11
G-11

F

F-G06-170-20
F-G10-373-20
FR-G03-10
FR-G06-10
FR-G10-10
FR-T03-10
FR-T06-10
FR-T10-10
FT-G02-*-E22
FT-G03-*-E22

J-08
J-08
J-01
J-01
J-01
J-01
J-01
J-01
J-04
J-04

G

G-G03*-21
G-G06*-21
G-G10*-21
G-T03*-21
G-T06*-21
G-T10*-21
GR-G01A*-20
GR-G03A*-(B)-20

I-18
I-18
I-18
I-18
I-18
I-18
I-23
I-23

1

IHAS-2S****
 IHF-2-T-20
 IHF-3-T-20
 IHF-4-T-20
 IHF-5-T-20
 IHF-6-T-20
 IHF-22-T-20
 IHF-23-T-20
 IHF-24-T-20
 IHF-25-T-20
 IHF-26-T-20
 IHF-33-T-20
 IHF-34-T-20
 IHF-35-T-20
 IHF-36-T-20
 IHF-44-T-20
 IHF-45-T-20
 IHF-46-T-20
 IHM-2-10
 IHM-4-10
 IHM-22-10
 IHM-44-10
 IHM-45-10
 IHM-46-10
 IHM-55-10
 IHM-66-10
 IPH-2A(B)-*.11
 IPH-3A(B)-*.20
 IPH-4A(B)-*.20
 IPH-5A(B)-*.21(11)
 IPH-6A(B)-*.21(11)
 IPH-22B-*.*(*)-11 C-14
 IPH-23B-*.*(*)-11 C-14
 IPH-24B-*.*(*)-11 C-14
 IPH-25B-*.*(*)-11 C-14
 IPH-26B-*.*(*)-11 C-14
 IPH-33B-*.*(*)-11 C-14
 IPH-34B-*.*(*)-11 C-14
 IPH-35B-*.*(*)-11 C-14
 IPH-36B-*.*(*)-11 C-14
 IPH-44B-*.*(*)-11 C-14
 IPH-45B-*.*(*)-11 C-14
 IPH-46B-*.*(*)-11 C-14
 IPH-55B-*.*(*)-11 C-14
 IPH-56B-*.*(*)-11 C-14

[illegible]

J

JHF-01027 I-20
JHF-03040(E) I-20
JHF-03080(E) I-20
JHF-06170(E) I-20

G-20
G-20
G-20
G-20

K2-F02-11
K2-F03/04-10
K2-T02-11
K2-T03/04-11

M

MBS*-10	L-22
MBW*-10	L-22
MCA-03-20	K-01
MCA-06-20	K-01
MCA-10-20	K-01
MCF-03-A-22	J-04
MCF-03-D-22	G-09
MCP-03-20	K-04
MCP-06-20	K-04
MCP-10-20	K-04
MDS-04-E10	D-43 · H-4
MDS-04X-E10	D-43 · H-4
MDS-06-T-E10	H-4
MDS-06X-T-E10	H-4
MDS-06-E30	D-43 · H-4
MDS-06X-E30	D-43 · H-4
MES-03*-E10	G-09
MES-06*-E10	G-09
MF-02X-10	J-04
MF-02Y-20	J-04
MF-03-10	J-04
MF-03Y-C-22	J-04
MF-03Y-20	J-04
MF-03Z-20	J-04
MF-03Z-C-22	J-04
MF-06-10	J-08
MF-06X-20	J-08
MFR-03-10	J-01
MFR-06-10	J-01
MFR-10-10	J-01
MFR**-*10	J-02
MG-03-20	I-18 · I-20
MG-03X-20	I-18 · I-20
MG-06-20	I-18 · I-20
MG-06X-20	I-18 · I-20
MG-10-20	I-18 · I-20
MG-10X-20	I-18 · I-20
MOB-G01-10	F-85
MOB-G01*-10	F-85
MOB-G03-J50	F-85
MOB-G03-H-50	F-85
MOB-G03*-J50	F-85
MOB-G03*-H-50	F-85
MOB-G03-AA-J50	F-85
MOB-01X-B*-10	F-90
MOB-01Y-W*-10	F-90
MOB-03X-B*-J30	F-91
MPU*-10 L-14	L-22
MPU*-J10 L-14	L-22
MRC-02-20 F-08	I-09
MR-03-10 F-01	I-01
MR-06X-20 F-01	I-01
MR-06-20 F-01	I-01
MR-10X-20 F-01	I-01
MR-10-20 F-01	I-01
MRI-03-10 F-5 · F-15 · I-5	I-5 · I-6 · G-5
MRI-03X-10 F-5 · F-15 · I-5	I-5 · I-6 · G-5
MRI-06-10 F-5 · F-15 · I-5	I-5 · I-6 · G-5
MRI-06X-10	I-3 · I-6 · G-5
MRI-10-10	I-3 · I-6
MRI-10X-10	I-3 · I-6
MS-03-T-10	F-90
MS-03X-T-10	H-1
MS-03-30	H-2
MS-03X-30	H-4
MSA-01Y-T-E10	H-4

page

MSA-01*-E10
MSA-03-E10
MSA-03X-E10
MSA-03-T-E10
MSR-03*-10
MSR-06*-10
MTL-03-10
MTL-04-10
MTS-01Y-10
MUB-*-10
MUB-*-J10
MVD-11-135-10
MVD-11-135X-10
MVD-1-115-10
MVD-1-115Y-10
MVD-1-135-10
MVD-1-135Y-10
MVD-2-*-10
MVD-2-160Z-10

N

NCP-100-**PV16N*-R-12
NCP-100-**PV16N*-R-21
NCP-100-**PV22N*-R-12
NCP-100-**PV22N*-R-21
NCP-100-3.7(VcQ3)-C-12
NCP-100-3.7(VcQ3)-C-21
NCP-100-3.7VdQ3-C-12
NCP-100-3.7VdQ3-A-C-21
NCP-100E-**PV16N*-*.12
NCP-30-**PV8N*-R-12
NCP-40-**PV16N*-R-12
NCP-40-**PV16N*-R-21
NCP-40-0.7VD1A2-*.12
NCP-40-0.7VC1A2-*.12
NCP-40E-**PV16N*-*.12
NCP-40Z-**PV16N*-R-12
NCP-60-**PV16N*-R-12
NCP-60-**PV16N*-R-21
NCP-60-**(VC1A)*-*.12
NCP-60-**(VC1A)*-*.21
NCP-60-**VD1A*-*.12
NCP-60-**VD1A*-*.21
NCP-60E-**PV16N*-*.12
NCP-60Z-**PV16N*-R-12
NCP-160-**PV35N*-R-12
NCP-160-**VCwA*-*.12
NCP-160-**VC2A*-*.12
NCP-160E-**PV16N*-R-12
NCP-250-**PV35N*-R-12
NCP-250-**PV45N*-R-12
NCP-250-**VCwA*-*.12
NCP-250-**VC2A*-*.12
NCP-250E-**PV16N*-*.12
NCP-400-**PV70N*-R-12
NCP-400-**VC3A*-R-12
NCP-650-**PV70N*-R-12
NCP-650-**VC3A*-*.12
NNP-20-*.P***-10
NNP-20E-*.P***-10
NNP-30-*.P***-10
NNP-30E-*.P***-10
NNP-40-*.P***-10
NNP-40E-*.P***-10
NNP-60-*.P***-10
NNP-60E-*.P***-10
NNP-80-*.P***-10
NNP-80E-*.P***-10
NSP-10-*.V*A*-13
NSP-10E-*.V*A*-13
NSP-20-*.V*A*-13
NSP-20E-*.V*A*-13
NSP-30-*.V*A*-13
NSP-30E-*.V*A*-13
NSP-40-*.V*A*-13
NSP-40E-*.V*A*-13

page

D-17 · H-4
D-17 · H-2
D-17 · H-4
H-4
G-12
G-12
J-11 · J-16
J-16
J-14
L-22
L-22
B-19
B-19
B-17
B-17
B-17
B-17
B-18
B-18

L-09	OCF-G03-**-D-J50
L-09	OCQ-G01-**-20
L-09	OCQ-G03-*.1*-J50
L-09	OCV-G01-W-20
L-09	OCV-G03-W-J50
L-09	OCY-G01-**-20
L-09	OCY-G01-P-20
L-09	OCY-G03-**-J51
L-42	OCY-G03-P-J50
L-09	OF-G01-P20-20
L-09	OF-G03-P60-J50
L-09	OGB-G01-**-20
L-09	OG-G01-**-21
L-09	OG-G01-P*-21
L-42	OG-G03-**-J51
L-09	OG-G03-P*-(V)-J51
L-09	OGH-G04-**-10
L-09	OGS-G01-PCC-K-**-22
L-09	OGS-G01-PIC-**-22
L-09	OK-G01-*.E20
L-09	OK-G01-*.H-E20
L-42	OK-G03-J50
L-09	OPH-G04-**-10
L-09	OPH-G04-**-D-10
L-09	QG-G01-P*-20
L-09	QQ-G03-P2*-J50
L-09	QQH-G04-B1*-.10
L-09	ORD-G01-**-20
L-09	ORD-G03-**-J50
L-09	OR-G01-**-20
L-09	OR-G01-**-21
L-42	OR-G03-**-J50
L-09	OR-G03-P*(V)-J50
L-09	ORH-G04-DA*-.10
L-09	ORH-G04-DB*-.10
L-36	ORH-G04-DW*-.10
L-42	ORO-G01-**-20
L-41	ORO-G03-**-J50
L-42	OTD-01*-.E10
L-36	OTD-03*-.E30
L-42	OTD-03*-.J30
L-41	OTD-04*-.10
L-42	OTH-01*-.E10
L-36	OTH-03*-.E30
L-42	OTH-03*-.J30
L-27	OTH-04*-.E10
L-33	OW-G01-**-30
L-27	OY-G01-T-20
L-33	OYH-G04-**-10
L-27	
L-33	
L-27	
L-33	

0

OB-G01-W-20	F-83
OB-G01-W-H-20	F-83
OB-G03-W-H-J30	F-83
OB-G03-W-J30	F-83
OCF-G01-*40*-*30	F-63
OCF-G03-*60*-*J50	F-63
OC-G01-A*-*21	F-69
OC-G01-AP*-*20	F-69
OC-G01-P*-*20	F-69
OC-G01-T*-*20	F-69
OC-G03-A*-*J50	F-69
OC-G03-AP*-*J50	F-69
OC-G03-P*-*J50	F-69
OC-G03-T*-*J50	F-69
OCH-G04-A*-*10	F-69
OCH-G04-P*-*10	F-69
OCH-G04-T*-*10	F-69
OCP-G01**-*21	F-76
OCP-G01**-*F-21	F-76
OCP-G03**-*J50	F-76
OCP-G03**-*D-J50	F-76
OCQ-G01**-*20	F-47
OCQ-G03*1*-*J50	F-47
OCV-G01-W-20	F-69
OCV-G03-W-J50	F-69
OCY-G01**-*20	F-55
OCY-G01-P-20	F-55
OCY-G03**-*J51	F-55
OCY-G03-P-J50	F-55
OF-G01-P20-20	F-63
OF-G03-P60-J50	F-63
OGB-G01**-*20	F-34
OG-G01**-*21	F-34
OG-G01-P*-*21	F-34
OG-G03**-*J51	F-34
OG-G03-P*-(V)-J51	F-34
OGH-G04**-*10	F-26 F-34
OGS-G01-PCC-K**-*22	F-41
OGS-G01-PIC**-*22	F-41
OK-G01*-*E20	F-81
OK-G01*-*H-E20	F-81
OK-G03-J50	F-81
OPH-G04**-*10	F-76
OPH-G04**-*D-10	F-76
OQ-G01-P*-*20	F-44
OQ-G03-P2*-*J50	F-44
OQH-G04-B1*-*10	F-47
ORD-G01**-*20	F-20
ORD-G03**-*J50	F-20
OR-G01**-*20	F-10
OR-G01**-*21	F-10
OR-G03**-*J50	F-10
OR-G03-P*(V)-J50	F-10
ORH-G04-DA*-*10	F-10
ORH-G04-DB*-*10	F-10
ORH-G04-DW*-*10	F-10
ORO-G01**-*20	F-16
ORO-G03**-*J50	F-16
OTD-01*-*E10	F-87
OTD-03*-*E30	F-87
OTD-03*-*J30	F-87
OTD-04*-*10	F-88
OTH-01*-*E10	F-87
OTH-03*-*E30	F-87
OTH-03*-*J30	F-87
OTH-04*-*E10	F-88
OW-G01***-30	F-52
OY-G01-T-20	F-55
OYH-G04**-*10	F-55

page

F-83
F-83
F-83
F-83
F-63
F-63
F-69
F-69
F-69
F-69
F-69
F-69
F-69
F-69
F-69
F-76
F-76
F-76
F-47
F-47
F-69
F-69
F-55
F-55
F-55
F-63
F-63
F-34
F-34
F-34
F-34
F-34
F-26 · F-34
F-41
F-41
F-81
F-81
F-81
F-76
F-76
F-44
F-44
F-47
F-20
F-20
F-10
F-10
F-10
F-10
F-10
F-10
F-16
F-16
F-87
F-87
F-87
F-87
F-87
F-87
F-88
F-52
F-55
F-55

P

PHV-1B-12***(*)-10	M-1
PHV-2B-20***(*)-10	M-4
PHV-3B-35***(*)-11	M-7
PHV-4B-60***(*)-10	M-10
PJF-10300E	A-34
PJF-10400E	A-34
PJF-10500E	A-34
PJF-10600E	A-34
PJF-10300T	A-34
PJF-10400T	A-34
PJF-10500T	A-34
PJF-10600T	A-34
PSF-101000	A-18
PSF-102000	A-18
PVS-0B-8**E30	A-03
PVS-1B-16***(*)-E13	A-03
PVS-1B-22***(*)-E13	A-03
PVS-2B-35***(*)-E13	A-03
PVS-2B-45***(*)-E20	A-03
PZ-2B-*35E*A-11	A-36
PZ-2B-*45E*A-11	A-36
PZ-3B-*70E*A-10	A-36
PZ-4B-*100E*A-10	A-36
PZ-5B-*130E*A-10	A-36
PZ-6B-*180E*A-20	A-36
PZ-6B-*220E*A-20	A-36
PZF-4-T-10	A-42
PZF-6-T-10	A-42
PZM-3-10	A-42
PZM-4-10	A-34 · A-42
PZMK-SAE A	A-27
PZMK-SAE A 5/8	A-27
PZS-3B-70**E10	A-22
PZS-4B-100**E10	A-22
PZS-5B-130**E10	A-22
PZS-6B-180**E10	A-22
PZS-6B-220**E10	A-22

Q

Q-G03**-21	I-25
Q-G06**-21	I-25
Q-G10**-21	I-25
Q-T03**-21	I-25
Q-T06**-21	I-25
Q-T10**-21	I-25

R

RC-G02*-21	I-08
RC-T02*-12	I-08
RCD-T02*-11	I-08
R-G03*-E12	I-01
R-G06*-E20	I-01
R-G10*-E20	I-01
R-T03*-12	I-01
R-T06*-E20	I-01
R-T10*-E20	I-01
RI-G03*-20	I-05
RI-G06*-20	I-05
RIS-G03*-F**-21	I-15
RIS-G03-AQ**-21	I-15
RIS-G03-AR**-21	I-15
RIS-G06*-F**-21	I-15
RIS-G06-AQ**-21	I-15
RIS-G06-AR**-21	I-15
RSA-G03*-F**-E23	I-10
RSA-G03-AQ**-E23	I-10
RSA-G03-AR**-E23	I-10
RSA-G06*-F**-E23	I-10
RSA-G06-AQ**-E23	I-10
RSA-G06-AR**-E23	I-10

page

RSA-G10*-F**-E23	I-10
RSA-G10-AQ**-E23	I-10
RSA-G10-AR**-E23	I-10
RSA-T03*-F**-E23	I-10
RSA-T03-AQ**-E23	I-10
RSA-T03-AR**-E23	I-10
RSA-T06*-F**-E23	I-10
RSA-T06-AQ**-E23	I-10
RSA-T06-AR**-E23	I-10
RSA-T10*-F**-E23	I-10
RSA-T10-AQ**-E23	I-10
RSA-T10-AR**-E23	I-10
RSS-G03*-F**-E23	I-10
RSS-G03-AQ**-E23	I-10
RSS-G03-AR**-E23	I-10
RSS-G06*-F**-E23	I-10
RSS-G06-AQ**-E23	I-10
RSS-G06-AR**-E23	I-10
RSS-G10*-F**-E23	I-10
RSS-G10-AQ**-E23	I-10
RSS-G10-AR**-E23	I-10
RSS-T03*-F**-E23	I-10
RSS-T03-AQ**-E23	I-10
RSS-T03-AR**-E23	I-10
RSS-T06*-F**-E23	I-10
RSS-T06-AQ**-E23	I-10
RSS-T06-AR**-E23	I-10
RSS-T10*-F**-E23	I-10
RSS-T10-AQ**-E23	I-10
RSS-T10-AR**-E23	I-10

S

SA-G01-A****-31	D-16
SA-G01-C****-E31	D-16
SA-G01-E****-E31	D-16
SA-G01-H****-E31	D-16
SA-G03-A****-E21	D-16
SA-G03-C****-E21	D-16
SA-G03-E****-E21	D-16
SA-G03-H****-E21	D-16
SAW-G01-A****-10 E-59	D-62
SAW-G01-C****-10 E-59	D-62
SCW-G03-A****-J10 E-68	D-71
SE-G01****-40 E-25	D-28
SE-G03****-30 E-25	D-28
SF-G01-C****-R-D*-10 E-46	D-49
SK-G01	D-76
SS-G01-A**R**-E31	D-04
SS-G01-C**R**-E31	D-04
SS-G01-E**R**-E31	D-04
SS-G01-H**R**-E31	D-04
SS-G03-A**R**-E21	D-04
SS-G03-C**R**-E21	D-04
SS-G03-E**R**-E21	D-04
SS-G03-H**R**-E21	D-04
SNH-G01****-11	D-53
SNH-G03****-10	D-53
SNH-G04****-10	D-53
SNH-G06****-10	D-53

T

TL-G03*-11	J-16
TL-G04*-11	J-16
TLT-G04*-11	J-16
TN-G02*-11	J-11
TS-G01-2-11	J-14

page

U

UPS-00A****-10	L-43
UPS-0A****-10	L-43
UPS-1A****-10	L-43
UPV-0A-8N**-*4-31	A-27
UPV-1A-16N**-*4-E20	A-27
UPV-1A-22N**-*4-E20	A-27
UPV-2A-35N**-*4-E20	A-27
UPV-2A-45N**-*4-E20	A-27
USV-0A-A**-*0.4-4-20	B-04
USV-0A-A**-*4-20	B-04
UVC-1A-A**-*4-E30	B-37
UVC-11A-A**-*4-E30	B-37
UVD-1A-A**-*4-E30	B-22, B-12
UVD-1A-A**-*4-E30	B-22, B-12
UVD-11A-A**-*4-E30	B-22, B-12
UVD-11A-A**-*4-E30	B-22, B-12
UVD-2A-A**-*4-E30	B-22, B-12
UVN-1A-A**-*4-E30	B-39

V

VDC-1A(B)-*A*-E20/35	B-25
VDC-2A(B)-*A*-11	B-25
VDC-3A(B)-1A*-E20/E35	B-25
VDC-11A(B)-*A**-*A*-E20	B-25
VDC-12A(B)-*A**-*A*-E20	B-25
VDC-13A(B)-*A**-*A*-E20	B-25
VDC-22A(B)-2A3-*A*-E20	B-25
VCM-11-20	B-36
VCM-22-20	B-36
VDR-1A(B)-*A*-E22	B-06, B-15
VDR-1A(B)-*A*-E22	B-06, B-15
VDR-2A(B)-*A*-E22	B-06, B-15
VDR-11A(B)-*A**-*A*-E22	B-06
VDR-11A(B)-*A**-*A*-E22	B-06
VDS-0A(B)-1A*-E11	B-01

page

D-16

D-16

D-16

D-16

D-16

D-16

D-16

D-16

D-62

D-62

D-71

D-28

D-28

D-49

D-76

D-04

D-04

D-04

D-04

D-04

D-04

D-04

D-04

D-53

D-53

D-53

D-53

J-16

J-16

J-16

J-11

J-14