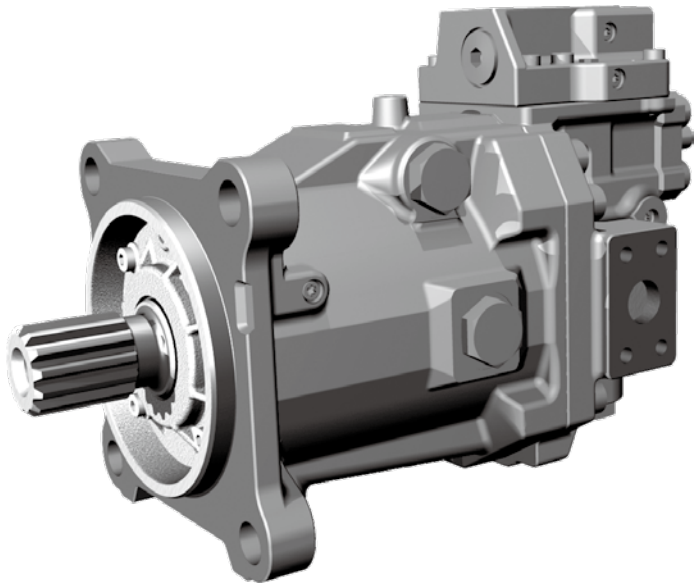
Variable Displacement Type Axial Piston Motors



■Specifications

Size : 85, 112, 160, 212
Nominal Pressure : 42 MPa (6,090 psi)
Maximum Pressure : 50 MPa (7,250 psi)

■General Descriptions

- Applicable to an open circuit and closed circuit.
- Applicable to construction machinery and industrial vehicles.
- Swash plate design allows for a compact motor.
- High power density
- Various control options make the motor suitable for a wide range of applications.

■Features

Superior performance at High and Low speed

Optimized rotary balance design enables high speed performance and excellent low speed characteristics.

Low noise

Swash plate configuration provides the low noise.

Compact size

Swash plate configuration provides the more compact structure and flexibility in system design.

Long bearing life

Swash plate configuration results in longer bearing life.

1 M7V Ordering Code

Model Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M7V	112	A	A	1	1	-	A	A	1	T1	X	X	X	N	-	01

1. M7V Series
M7V Series, Variable Displacement, Axial Piston Motor, Applicable in Both Open and Closed Loops.

2. Size

	85	112	160	212
Standard Size	●	●	●	●

3. Series Specifications

A	Standard

4. Mounting Flange and Port Position*

	Mounting	Port Position	85	112	160	212
A	SAE J744, 2-bolt Mount (for M7V85)	Rear	●	●	●	○
	SAE J744, 4-bolt Mount (for M7V112/160/212)					
B	SAE J744, 2-bolt Mount (for M7V85)	Side	●	●	●	○
	SAE J744, 4-bolt Mount (for M7V112/160/212)					
C	ISO 3019-2, 4-bolt Mount	Rear	●	●	●	●
D	ISO 3019-2, 4-bolt Mount	Side	●	●	●	●
E	SAE J744, 4-bolt Mount (for M7V85)	Rear	●	—	—	—
F	SAE J744, 4-bolt Mount (for M7V85)	Side	●	—	—	—

5. Port and Flange Fixing Thread*

	Threaded Port Type	Flange Fixing Thread Type	85	112	160	212
1	ANSI ISO11926	ANSI ASME B1.1	●	●	●	○
4	Parallel Piping ISO228	Metric ISO724	●	●	●	●

6. Shaft End*

	Standard	Specifications	85	112	160	212
1	ANSI B92.1	1 1/2 in 17T 12/24DP	●	—	—	—
2	ANSI B92.1	1 3/4 in 13T 8/16DP	—	●	●	—
3	ANSI B92.1	2 in 15T 8/16DP	—	—	●	○
4	ANSI B92.1	1 3/8 in 21T 16/32DP	●	—	—	—
5	DIN 5480	W35x2x16x9 g	●	—	—	—
6	DIN 5480	W40x2x18x9 g	●	●	—	—
7	DIN 5480	W45x2x21x9 g	—	●	●	—
8	DIN 5480	W50x2x24x9 g	—	—	●	●
9	ANSI B92.1	1 1/4 in 14T 12/24DP	●	—	—	—

*Following combination of code [4], [5], and [6] is available.

	Ordering Code		
	Code[4]	Code[5]	Code[6]
M7V85	A or B	1	1 or 9
	C or D	4	5 or 6
	E or F	1 or 4	4
M7V112	A or B	1	2
	C or D	4	6 or 7
M7V160	A or B	1	2 or 3
	C or D	4	7 or 8
M7V212	A or B	1	3
	C or D	4	8

● : Available
○ : Under development
— : Not available

1. M7V Ordering Code

Model Code

1	2	3	4	5	6		7	8	9	10	11	12	13	14		15
M7V	112	A	A	1	1	-	A	A	1	T1	X	X	X	N	-	01

7. Maximum Displacement

Size	85	A : 85	●	B : 80	●	C : 75	●	D : 70	●
	112	A : 112	●	B : 107	●	C : 100	●	D : 95	●
	160	A : 160	●	B : 155	●	C : 150	●	D : 140	●
	212	A : 215	●	B : 200	●	C : 190	●	D : 180	●

8. Minimum Displacement

Size	85	A : 51	●	B : 40	●	C : 30	●	D : —	—	D : —	—
	112	A : 68	●	B : 50	●	C : 40	●	D : 30	●	E : 22	●
	160	A : 96	●	B : 80	●	C : 60	●	D : 40	●	E : 32	●
	212	A : 86	●	B : 70	●	C : 60	●	D : —	—	E : —	—

9. Speed Sensor

		85	112	160	212
1	w/o Speed Sensor	●	●	●	●
2	w/ Speed Sensor (A port side)	●	●	●	●
B	w/ Speed Sensor (B port side)	●	●	●	●

○For code [10] [11] please refer to page 11.

12. Accessories

	Flushing Valve	Internal Cooling	Flushing Flow	85	112	160	212
X	w/o Flushing Valve	w/ Internal Cooling	1.8 L/min (M7V85/112), 5.0 L/min (M7V160/212) at ΔP(Lower Pressure - Drain Pressure)= 2.5MPa and ν =10mm²/s	●	●	●	●
1	w/o Flushing Valve	w/o Internal Cooling	—	●	●	●	●
2	w/ Flushing Valve	w/ Internal Cooling	1.8 L/min (M7V85/112), 5.0 L/min (M7V160/212) at ΔP(Lower Pressure - Drain Pressure)= 2.5MPa and ν =10mm²/s	○	○	○	○

13. Counter Balance Valve

		85	112	160	212
X	w/o Counter Balance Valve	●	●	●	●
1	w/ Counter Balance Valve Hoist at CW Rotation (A port inlet)	○	○	○	○
2	w/ Counter Balance Valve Hoist at CCW Rotation (B port inlet)	○	○	○	○

14. Response Speed of Control

		85	112	160	212
N	Standard	●	●	●	●

15. Design Code

		85	112	160	212
**	01~	●	●	●	●

● : Available
○ : Under development
— : Not available

1. M7V Ordering Code

Model Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M7V	112	A	A	1	1	-	A	A	1	T1	X	X	X	N	-	01

10. Regulator(See the table on possible combinations of optional valve and regulator options.)

				85	112	160	212
T	T1	Electric Two Position Displacement Control	Negative Control, 24V	●	●	●	●
	T2		Negative Control, 12V	●	●	●	●
Y	Y1	Hydraulic Two Position Displacement Control	Negative Control	●	●	●	●
	Y2		Positive Control	●	●	●	●
E	E1	Electric Proportional Control	Negative Control, 24V	●	●	●	●
	E2		Positive Control, 24V	●	●	●	●
	E3		Negative Control, 12V	●	●	●	●
	E4		Positive Control, 12V	●	●	●	●
P	P1	Hydraulic Proportional Control	Negative Control, Pi = 2.5MPa	●	●	●	●
	P2		Positive Control, Pi = 2.5MPa	●	●	●	●
	P3		Negative Control, Pi = 1.0MPa	●	●	●	●
	P4		Positive Control, Pi = 1.0MPa	●	●	●	●
H	H1	Pressure Related Control	w/o Pressure Increase	●	●	●	●
	H2		w/ Pressure Increase	●	●	●	●
	H3		w/ Pressure Increase and Hydraulic Remote Control	●	●	●	●

11. Options for Optional Valves (See the table on possible combinations of optional valve and regulator options.)

			85	112	160	212
X		w/o Any Optional Valve	●	●	●	●
A1		Pressure Control Valve	w/ a Pressure Control Valve	●	●	●	●
B	B1	Electric Two Position Control Valve	w/ Electric Two Position Control Valve, 24V	●	●	●	●
	B2		w/ Electric Two Position Control Valve, 12V	●	●	●	●
C	C1	Hydraulic Two Position Control Valve	w/ Hydraulic Two Position Control Valve, Negative Control	●	●	●	●
	C2		w/ Hydraulic Two Position Control Valve, Positive Control	●	●	●	●

★ M7V Control Options

Note: The control options are common for all motor sizes.

Regulator : Code [10]				Options for Optional Valves (code [11])					
				w/o Any Optional Valve	w/ a Pressure Control Valve	w/ Electric Two Position Control Valve, 24V	w/ Electric Two Position Control Valve, 12V	w/ Hydraulic Two Position Control Valve, Negative Control	w/ Hydraulic Two Position Control Valve, Positive Control
				X	A1	B1	B2	C1	C2
T	T1	Electric Two Position Displacement Control	Negative Control, 24V	●	–	–	–	–	–
	T2		Negative Control, 12V	●	–	–	–	–	–
Y	Y1	Hydraulic Two Position Displacement Control	Negative Control	●	–	–	–	–	–
	Y2		Positive Control	●	–	–	–	–	–
E	E1	Electric Proportional Control	Negative Control, 24V	●	●	–	–	–	–
	E2		Positive Control, 24V	●	○	–	–	–	–
	E3		Negative Control, 12V	●	●	–	–	–	–
	E4		Positive Control, 12V	●	○	–	–	–	–
P	P1	Hydraulic Proportional Control	Negative Control (Pi = 2.5MPa)	●	●	–	–	–	–
	P2		Positive Control (Pi = 2.5MPa)	●	○	–	–	–	–
	P3		Negative Control (Pi = 1.0MPa)	●	●	–	–	–	–
	P4		Positive Control (Pi = 1.0MPa)	●	○	–	–	–	–
H	H1	Pressure Related Control	w/o Pressure Increase	●	–	●	●	●	●
	H2		w/ Pressure Increase	●	–	●	●	●	●
	H3		w/ Pressure Increase and Hydraulic Remote Control	●	–	●	●	●	●

(Note)
For combination of two position control and pressure cut-off control, please select the pressure related control (code H) with two position control as option valve.

● : Available
○ : Under development
— : Not available

2 Technical Information

2-1 Specifications

M7V series

Size		85	112	160	212
Min. Displacement : q_{min}	cm^3 (in^3)	0 to 68 (0 to 4.2)	0 to 90 (0 to 5.5)	0 to 128 (0 to 7.9)	0 to 170 (0 to 10.5)
Max. Displacement : q_{max}	cm^3 (in^3)	68 to 88.5 (4.2 to 5.2)	90 to 112 (5.5 to 6.9)	128 to 160 (7.9 to 9.8)	170 to 215 (10.5 to 13.1)
Max. Speed : N_{nom} / N_{max} *1	min^{-1} (rpm)	3,900 / 6,150	3,550 / 5,600	3,100 / 4,900	2,900 / 4,600
Nominal pressure : P_{nom} *2	MPa (psi)	42 (6,090)			
Max. Pressure : P_{max}	MPa (psi)	50 (7,250)			
Theoretical output torque	Nm (lbf ft)	592 (437)	749 (552)	1,070 (789)	1,437 (1,060)
Power	kW (hp)	242 (325)	278 (373)	347 (465)	436 (585)
Max. Flow : Q	L/min (gallon/min)	345 (91)	398 (105)	496 (131)	623 (165)
Moment of inertia	$kg \cdot m^2$	0.011	0.017	0.030	0.054
Volume in the case	L (gallon)	0.8 (0.21)	1.0 (0.26)	1.5 (0.40)	2.0 (0.53)
Mass	kg (lb)	39 (86)	46 (101)	65 (143)	90 (198)
Temperature	℃ (°F)	−20 to +115 (−4 to +239) at drain port −20 to +90 (−4 to +194) at inlet port			
Coating		Red synthetic resin primer			

Values shown in the table above are theoretical values.

*1 : N_{nom} : Max. speed at q_{max}.
N_{max} : Max. speed at $q < 0.6q_{max}$.(M7V212 : Max speed at $q < 0.4q_{max}$.)
(In case that 1 is selected at ordering code [12] , N_{max} goes down up to N_{nom} regardless of displacement of the motor.)

*2 : Nominal pressure corresponds to the design pressure to provide proper performance, function, and service life.

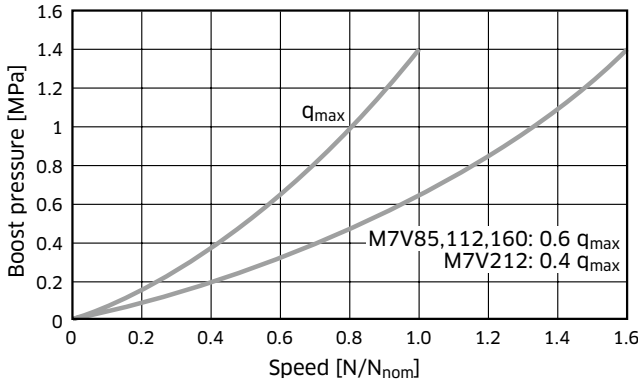
2-2 Precautions for System Design

M7V series

Minimum Boost Pressure

To prevent cavitation when the motor is operating in a pumping mode, a positive pressure is required at the suction port.
The figure on the right shows the minimum boost pressure requirement based on the regular operation. In case of a rapid change of the flow volume, more boost pressure must be applied.

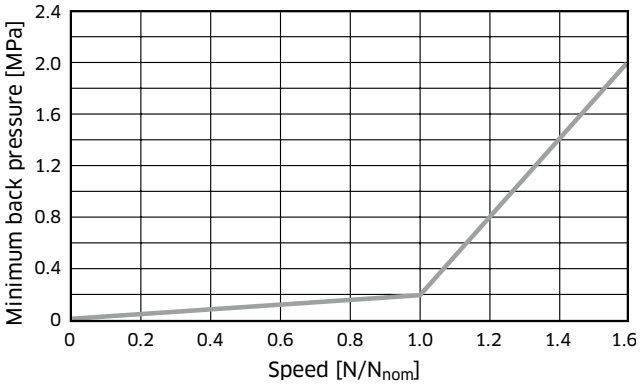
Minimum boost pressure



Minimum Back Pressure

To ensure the optimal performance and life time the back pressure is required at the lower pressure port.
Motor casing pressure must be ≦ 0.2 MPa.

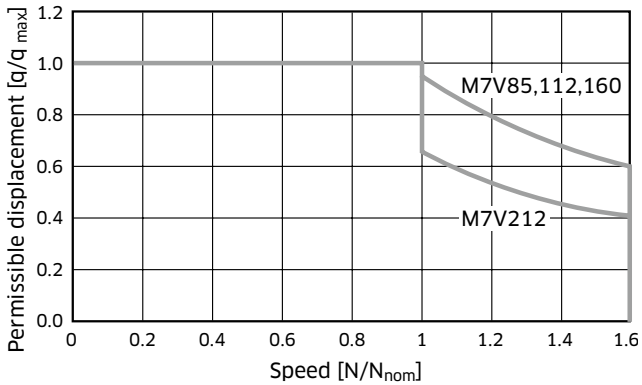
Minimum back pressure



Permissible Displacement, Speed Related

The figure on the right shows permissible displacement in relation to the motor operating speed. Design the system not to exceed this requirement.

Permissible displacement



Beginning of Control for Winch Device

For the safety reasons, winch devise are not permissible with beginning control at q_{min}.

2-3 Speed Sensor

Ordering Code [9] : 1, 2, B

◆ 1 : w/o Speed Sensor

●A speed sensor is not installed.

◆ 2 : w/ Speed Sensor (A port side)

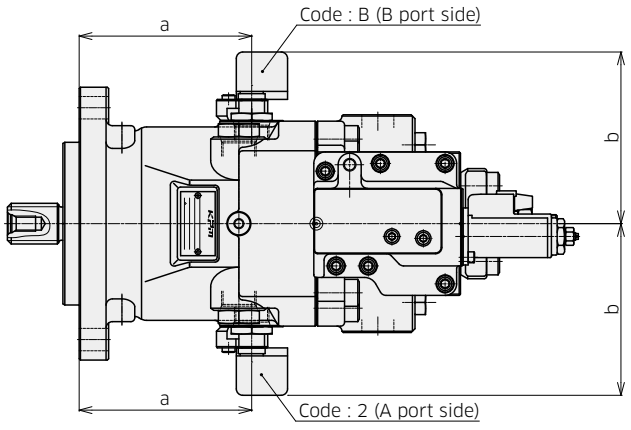
●A speed sensor that detects the motor speed and direction is installed at A port side.

◆ B : w/ Speed Sensor (B port side)

●A speed sensor that detects the motor speed and direction is installed at B port side.

Specification

Supply Voltage : 4.5V ~ 26V DC
Mating Connector : TE Connectivity AMP Superseal 1.5 series, 4 positions(part number : 282088)
IP Protection Rating : IP69K



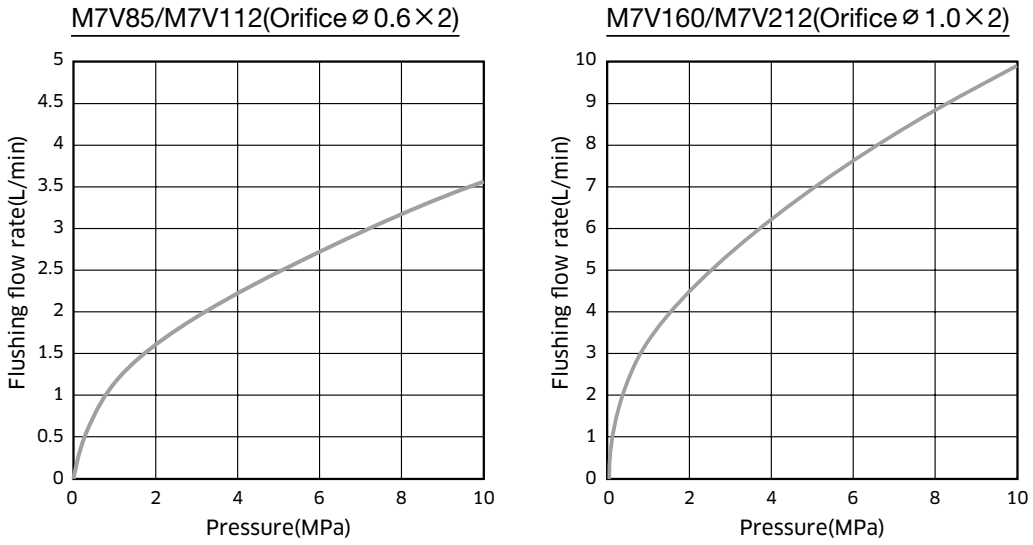
			M7V85	M7V112	M7V160	M7V212
a [mm]	Code [4]	A, B	134.5	144	158.5	175
		C, D	110.5	112	126.5	143
		E, F	151.5	–	–	–
b [mm]			134	139	147	155.5
Pulse Frequency [pulse/rev]			71	77	87	97

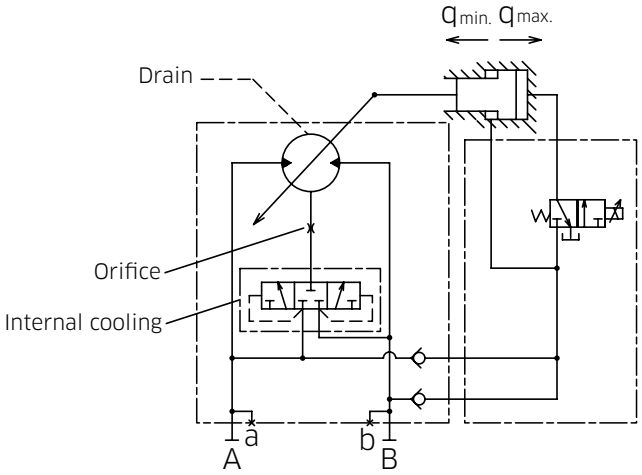
2-4 Accessory

Ordering Code [12] : X, 1, 2

◆ X : w/o Flushing Valve, w/ Internal Cooling

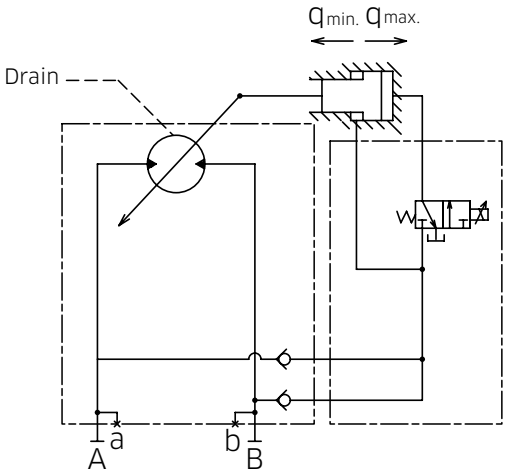
- N_{max} of motor spec is based on this configuration.
- A part of the hydraulic oil on the lower pressure is supplied to the inside of the motor casing to cool the rotary.
- When the motor is used in a series circuit, the internal cooling affects the performance of the second motor. Please contact Kawasaki to discuss in more detail. The graph below shows the relationship between lower pressure and the flushing flow.





1 : w/o Flushing Valve, w/o Internal Cooling

- The flushing flow into the motor case is blocked.
- N_{max} goes down up to N_{nom} regardless of displacement of the motor.
- When the motor is used above N_{nom} without internal cooling, excessive heat could be generated resulting in damage to the motor. Please contact Kawasaki to discuss in more detail.



2 : w/ Flushing Valve, w/ Internal Cooling(Under development)

- The function is chosen in case that the circuit needs additional cooling or minimum boost pressure needs to be ensured.

3 Regulators

3-1 Two Position Displacement Control

Function

Two types of two position displacement control, the electric control type and hydraulic pilot control type, are available.

Two position control can switch the displacement between maximum and minimum displacement by applying the input current to the solenoid in case of the electric control or the pilot pressure externally supplied to the regulator.

Control Options for Two Position Displacement Control

● Pressure control

An M7V motor with two position displacement control can additionally have pressure control function. Refer to page 29 for details.

If the motor is equipped with both two position displacement control and pressure control, pressure control overrides proportional displacement control.

Under pressure control the motor maintains minimum displacement until the operating pressure reaches the pressure setpoint. Upon reaching the pressure setpoint the motor increases displacement to maximum to obtain the required output torque, while controlling the operating pressure. If the motor reaches maximum displacement without sufficient output torque, the motor increases pressure until the required output torque is attained.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-1 Two Position Displacement Control – Electric Control

Ordering Code [10] [11] : T1X and T2X

Function

Motor displacement is controlled between minimum and maximum by energizing the solenoid.

Control pressure is internally supplied by the port with the highest pressure.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

[Note]

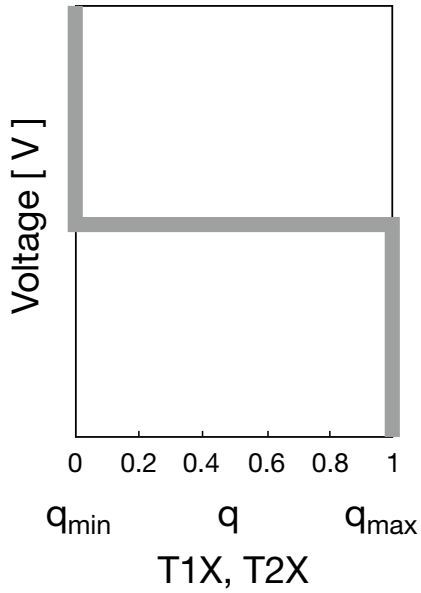
Required minimum operating pressure for control : 2.0MPa

Control type	T1X, T2X	
Electric signal	OFF	ON
Displacement	Max.	Min.
Speed	Min.	Max.

Solenoid Specifications

Code	T1X	T2X
Voltage	DC24V	DC12V
Resistance (20℃)	41.5 Ω	9.4 Ω
Rated electric power consumption (20℃)	≦ 17 W	
Connector type	Tyco Electronics Japan DT04-2P	

Control Characteristics

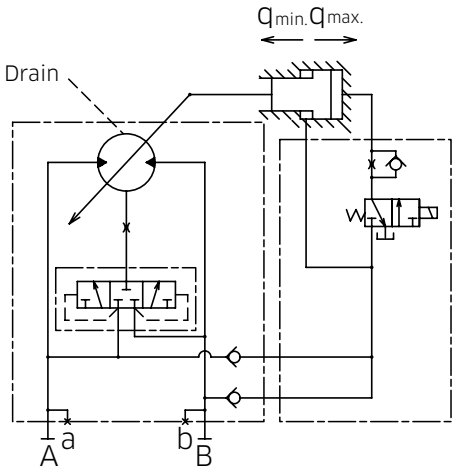


T1X, T2X

The control characteristics in the above is not adjustable.

The above data are independent of the motor size.

Hydraulic Circuit



T1X, T2X

3-1 Two Position Displacement Control - Hydraulic Control

Ordering Code[10][11] : Y1X, Y2X

Function

Motor displacement is controlled between minimum and maximum by pilot pressure externally supplied.

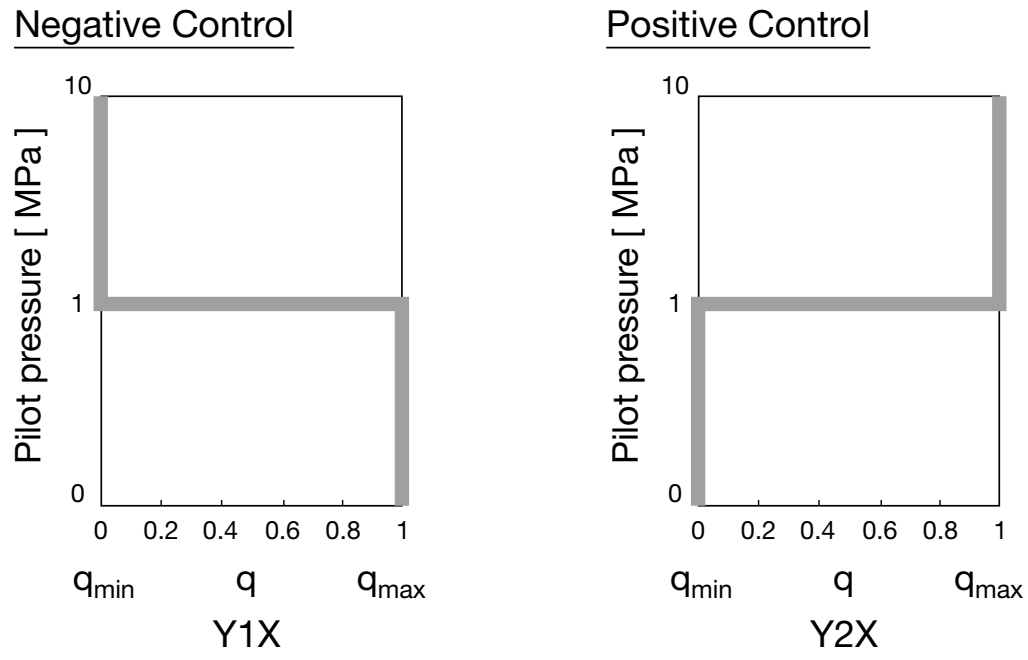
Control pressure is internally supplied by the port with the highest pressure.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

[Note]
Required minimum operating pressure for control: 2.0 MPa
Max. permissible pilot pressure : 10.0 MPa

Control type	Y1X		Y2X	
Pilot pressure	OFF	ON (>1.0 MPa)	OFF	ON (>1.0 MPa)
Displacement	Max.	Min.	Min.	Max.
Speed	Min.	Max.	Max.	Min.

Control Characteristics



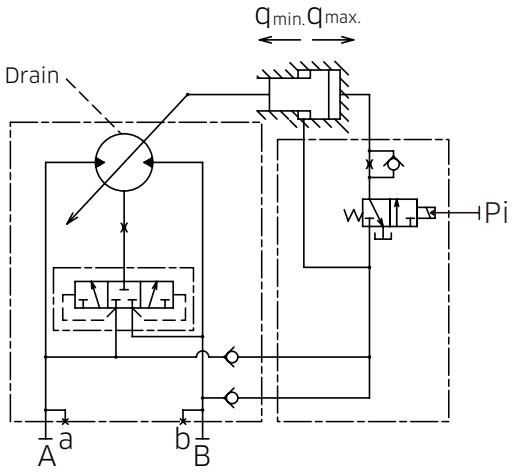
The control characteristics in the above is not adjustable.
The above data are independent of the motor size.

3-1 Two Position Displacement Control - Hydraulic Control

Ordering Code[10][11] : Y1X, Y2X

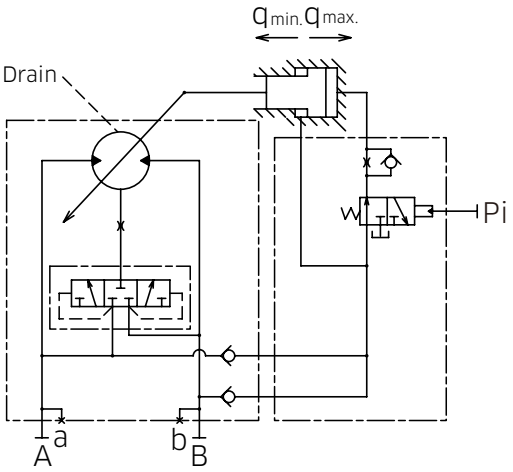
Hydraulic Circuit

Negative Control



Y1X

Positive Control



Y2X

3-2 Proportional Displacement Control

Function

There are two kinds of control methods in the proportional displacement control, namely electric proportional control and hydraulic proportional control. Proportional displacement control regulates motor displacement in proportion to either the input current of solenoid or external pilot pressure .

[Note]
As stated in page 6, casing pressure has influence on proportional displacement control both electric and hydraulic. An increase in casing pressure induces an increase in control pressure at the beginning of control, and hence parallel shift of control characteristics.

Control Options for Proportional Displacement Control

● Pressure control

An M7V motor equipped with proportional control (either electric or hydraulic) can have pressure control function by using an optional valve (see page 11).

If the motor has both proportional control (either electric or hydraulic) and pressure control, pressure control overrides proportional displacement control.

Under pressure control the motor maintains minimum displacement until the operating pressure reaches the pressure setpoint. Upon reaching the pressure setpoint the motor increases displacement to maximum to obtain the required output torque, while controlling the operating pressure. If the motor reaches maximum displacement without sufficient output torque, the motor increases pressure until the required output torque is attained.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-2 Proportional Displacement Control – Electric Proportional Control

Ordering Code [10] [11] : E1X, E2X, E3X and E4X.

Function

Displacement is steplessly controlled between two preset values, from maximum to minimum and vice versa, in proportion to the input current of solenoid.

Electric proportional control delivers negative or positive displacement controls which are proportional to the input current: negative control type E1X and E3X reduce displacement from maximum to minimum against an increase in the input current, while positive control type E2X and E4X increase displacement from minimum to maximum with an increase in the input current.

Control pressure is internally supplied by the port with the highest pressure.

Solenoid Specifications

Control type	E1*, E2*	E3*, E4*
Voltage	DC24V	DC12V
Rated current (20℃)	0.7 A	1.6 A
Resistance (20℃)	15.0 Ω	3.3 Ω
Rated power consumption (20℃)	≦ 17 W	
Connector type	Tyco Electronics Japan DT04-2P	
Recommended dither condition	100 Hz, 200 mAp-p	150 Hz, 600 mAp-p

"∗" = "X" (without any optional valve)
"A" (with a pressure control valve)

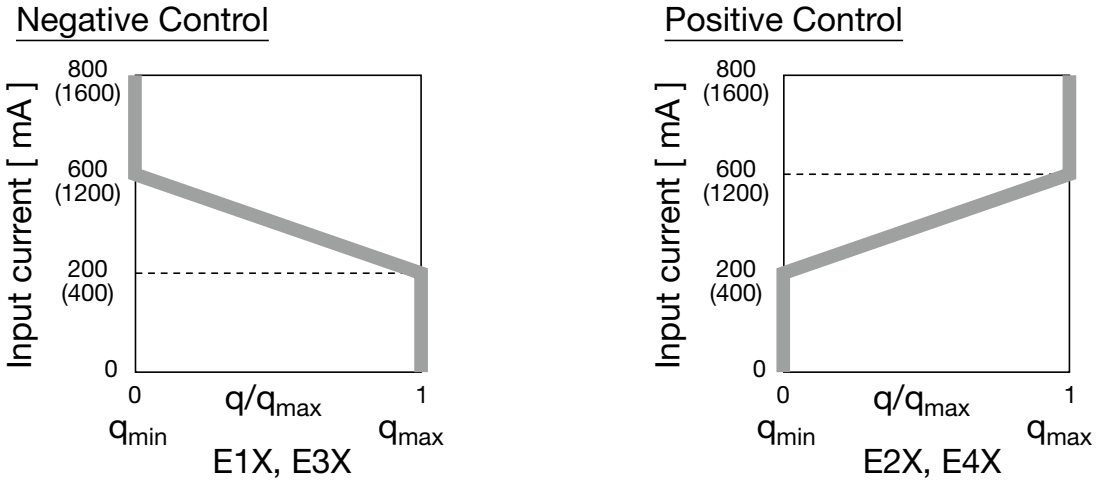
[Note]
Required minimum operating pressure for control: 2.0 MPa.

The above data are independent of the motor size.

3-2 Proportional Displacement Control – Electric Proportional Control

Ordering Code [10] [11] : E1X, E2X, E3X and E4X.

Control Characteristics

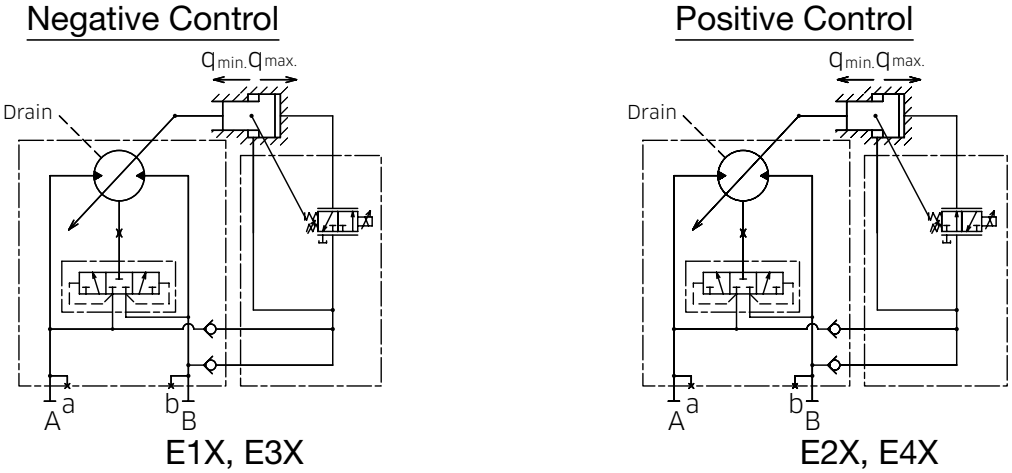


Control type		E1X, E3X (Negative control)		E2X, E4X (Positive control)	
Input current	DC 24V (DC 12V)	200mA (400mA)	600mA (1200mA)	200mA (400mA)	600mA (1200mA)
Displacement		Max.	Min.	Min.	Max.
Speed		Min.	Max.	Max.	Min.

Input current in ( ) is for the voltage of 12 V DC.

The control characteristics of E1X, E2X, E3X and E4X are not adjustable.These control points value are in case that the solenoid is mounted horizontal. In case that the solenoid is mounted vertical downward, the control point shifts -35mA (-70mA). In case that the solenoid is mounted vertical upward, the control point shifts +35mA (+70mA).

Hydraulic Circuit



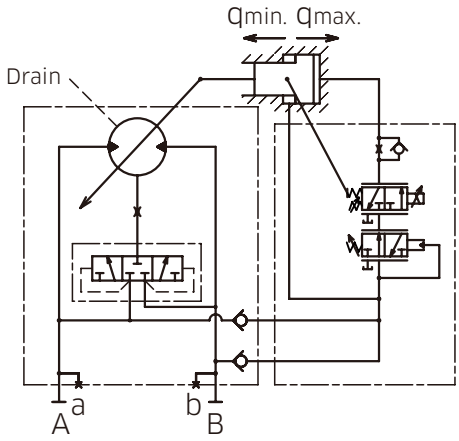
The above data are independent of the motor size.

3-2 Proportional Displacement Control – Electric Proportional Control with Pressure Control Valve

Ordering Code [10] [11] : E1A1, E2A1, E3A1 and E4A1.

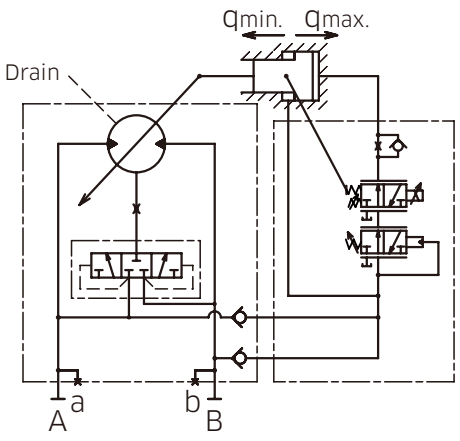
Hydraulic Circuit

Negative Control with Pressure Control Valve



E1A1, E3A1

Positive Control with Pressure Control Valve



E2A1, E4A1

Electric proportional control can be combined with pressure control by using an optional valve. If the motor is equipped with electric proportional control and pressure control, pressure control overrides electric proportional control.

Under pressure control the motor maintains minimum displacement until the operating pressure reaches the pressure setpoint. Upon reaching the pressure setpoint the motor increases displacement to maximum to obtain the required output torque, while controlling the operating pressure. If the motor reaches maximum displacement without sufficient output torque, the motor increases pressure until the required output torque is attained.

Adjustable setting range of the pressure valve: 8~35 MPa

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-2 Proportional Displacement Control – Hydraulic Proportional Control

Ordering Code [10] [11] : P1X, P2X, P3X and P4X.

Function

Hydraulic proportional control regulates motor displacement between maximum to minimum in response to pilot pressure externally supplied to a regulator.

This control delivers negative or positive displacement controls which are proportional to an increase in external pilot pressure: negative control type P1X and P3X reduce displacement from maximum to minimum against an increase in pilot pressure, while positive control type P2X and P4X increase displacement from minimum to maximum with an increase in pilot pressure.

Control pressure is internally supplied by the port with the highest pressure.

[Note]
Required minimum operating pressure for control: 2.0 MPa
Max. permissible pilot pressure : 10.0 MPa

Control type	P1X		P2X		P3X		P4X	
Pilot pressure	1.0 MPa*	3.5 MPa	1.0 MPa*	3.5 MPa	0.5 MPa*	1.5 MPa	0.5 MPa*	1.5 MPa
Displacement	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
Speed	Min.	Max.	Max.	Min.	Min.	Max.	Max.	Min.

The pressure with * in the above table is the standard start pressure at the beginning of each control. Adjustable range of pilot pressure at the beginning of control is shown in each control characteristics.

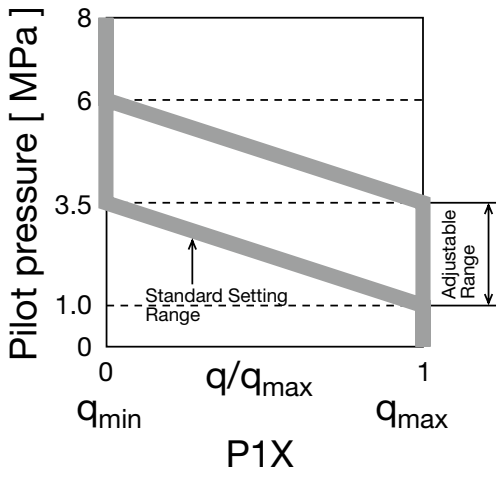
The above data are independent of the motor size.

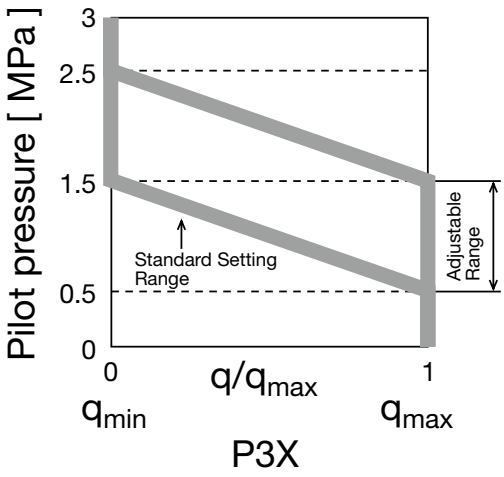
3-2 Proportional Displacement Control – Hydraulic Proportional Control

Ordering Code [10] [11] : P1X, P2X, P3X and P4X.

Control Characteristics

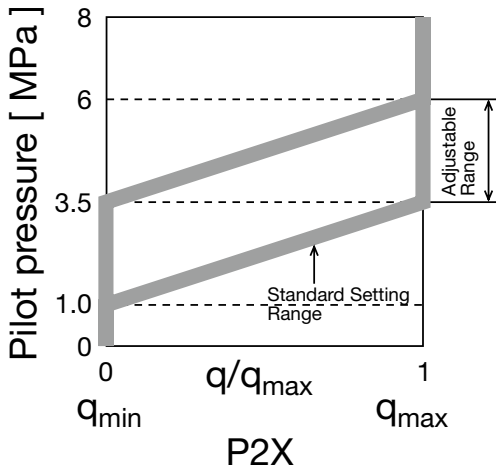
Negative Control

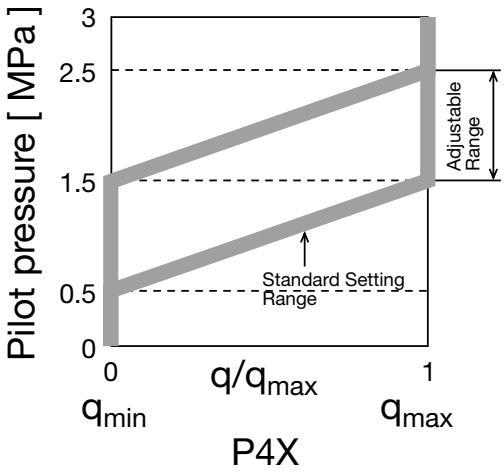




P1X is different from P3X in adjustable range and the control start pressure. Adjustable range of P1X is 2.5 MPa, while that of P3X is 1.0 MPa. Also, the control start pressure of P1X is 1.0 MPa, while that of P3X is 0.5 MPa.

Positive Control





P2X is different from P4X in adjustable range and the control start pressure. Adjustable range of P2X is 2.5 MPa, while that of P4X is 1.0 MPa.
Also, the control start pressure of P2X is 1.0 MPa , while that of P4X is 0.5 MPa.

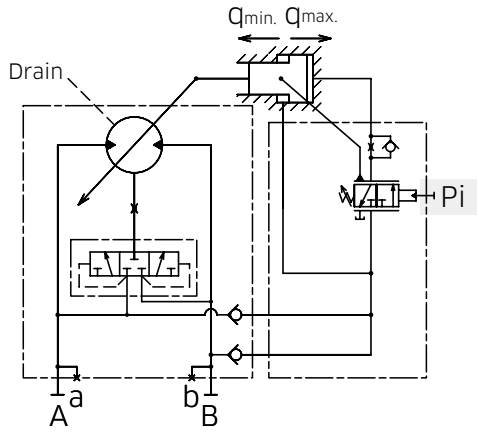
[Note]
The above are the standard control characteristics of hydraulic proportional control. If non-standard characteristics is required, please contact Kawasaki.

3-2 Proportional Displacement Control – Hydraulic Proportional Control

Ordering Code [10] [11] : P1X, P2X, P3X and P4X.

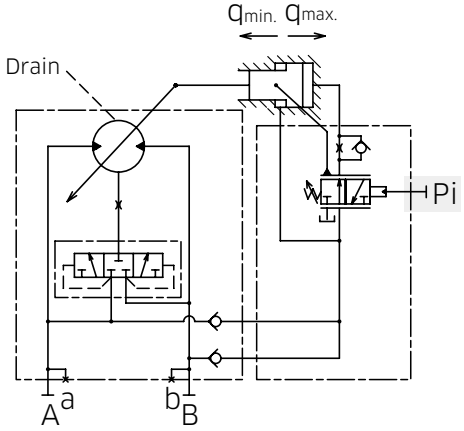
Hydraulic Circuit

Negative Control



P1X, P3X

Positive Control



P2X, P4X

External pilot pressure is supplied via port Pi.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.
The above data are independent of the motor size.

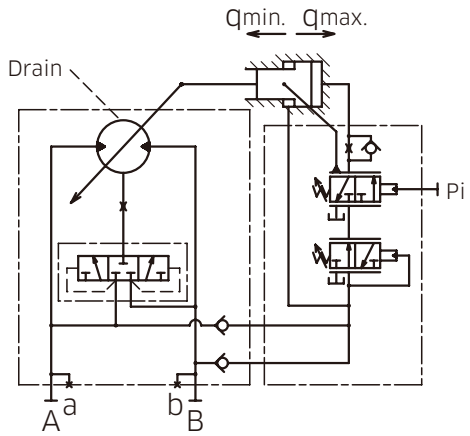
Allowable maximum pilot pressure (Pi): 10 MPa

3-2 Proportional Displacement Control – Hydraulic Proportional Control with Pressure Control Valve

Ordering Code [10] [11] : P1A1, P2A1, P3A1 and P4A1.

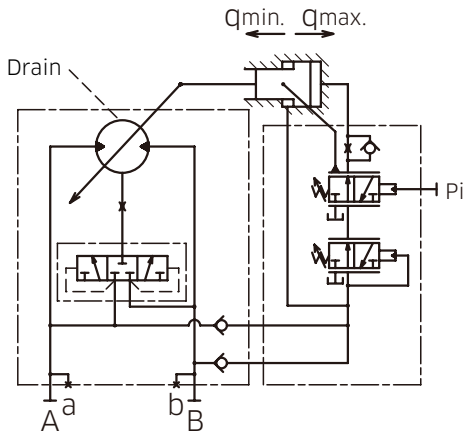
Hydraulic Circuit

Negative Control with Pressure Control Valve



P1A1, P3A1

Positive Control with Pressure Control Valve



P2A1, P4A1

Hydraulic proportional control can be combined with pressure control by using an optional valve in an M7V motor. If it is equipped with both hydraulic proportional control and pressure control, the latter overrides the former.

Displacement shifts from minimum to maximum, when the operating pressure reaches the pressure setpoint. The motor increases displacement by gradually increasing the operating pressure until the required output torque is attained. If displacement reaches its maximum value without sufficient output torque, the operating pressure will rise until the required output torque is obtained.

Setting range of the pressure control valve: 8 to 35 MPa

For safety reasons, winch devices are not permissible with beginning control at q_{min}.
The above data are independent of the motor size.

3-3 Pressure Related Control

Function

There are three kinds of control types in the pressure related control, that is constant pressure control (pressure control without pressure increase), pressure control with pressure increase, and pressure control with pressure increase and hydraulic remote control.

Displacement is controlled between minimum and maximum in line with the operating pressure.

Minimum displacement is maintained until the operating pressure reaches the pressure setpoint, and upon reaching the pressure setpoint of control it shifts to maximum displacement by controlling the operating pressure until the required output torque is obtained.

[Note]
As stated in page 6, casing pressure affects the pressure related control. An increase in casing pressure induces an increase in control pressure at the beginning of control, and thus the parallel shift of the control characteristics.

Control Options for Constant Pressure Control

● Two position displacement control

An M7V motor with constant pressure control can add two position control by adopting an optional two position control valve (see page 11).

When an M7V motor is equipped with both constant pressure control and two position displacement control, constant pressure control overrides two position displacement control.

For detail of two position displacement control see page 18.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-3 Pressure Related Control – Without Pressure Increase

Ordering Code [10] [11] : H1X

Function

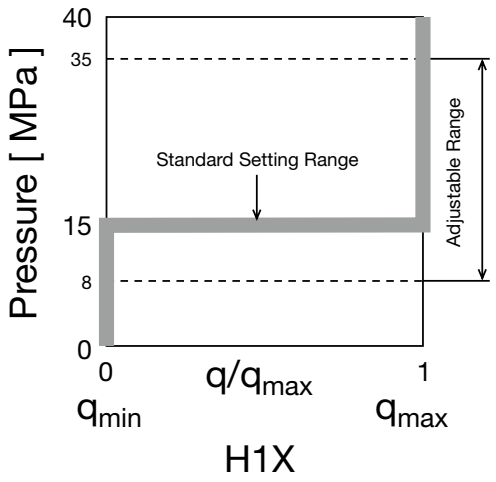
Displacement is controlled between minimum and maximum in line with the operating pressure. Minimum displacement is maintained until the operating pressure reaches a setpoint, and upon reaching the pressure setpoint it shifts to maximum displacement until the required output torque is obtained, while maintaining the set pressure.

Control pressure is internally supplied by the port with the highest pressure.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Control type	H1X	
Displacement	Min.	Max.
Speed	Max.	Min.
Adjustable range for the control start pressure	8 to 35 MPa	

Control Characteristics

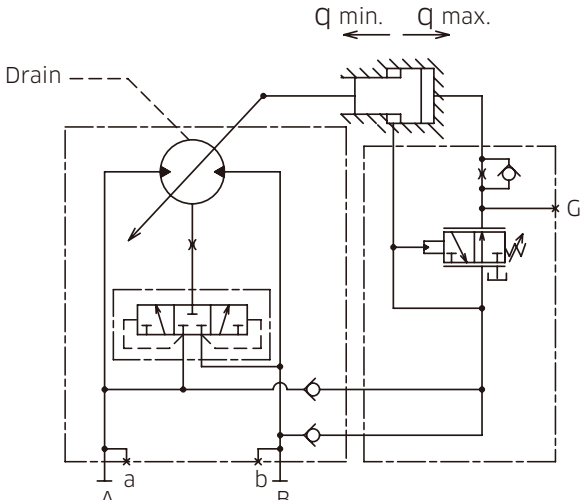


H1X

Control pressure in H1X is factory set at 15 MPa, and the above shows the standard control characteristics.
If non-standard characteristics is required, please contact Kawasaki.

The above data are independent of the motor size.

Hydraulic Circuit

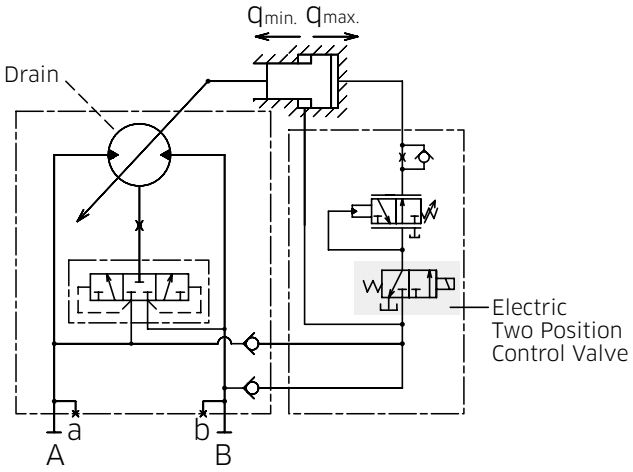


H1X

3-3 Pressure Related Control – Without Pressure Increase with Two Position Control Valve

Ordering Code [10] [11] : H1B1 and H1B2

Hydraulic Circuit



H1B1, H1B2

Pressure related control (pressure control without pressure increase) can be combined with electric two position displacement control by using an electric two position control valve. If the motor has both pressure related control and electric two position displacement control, pressure related control overrides electric two position displacement control.
Specifications of electric two position control valve is shown below.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Solenoid Specifications

Code	B1	B2
Voltage	DC24V	DC12V
Resistance (20℃)	41.5 Ω	9.5 Ω
Rated power consumption (20℃)	≦ 17 W	
Connector type	Tyco Electronics Japan DT04-2P	

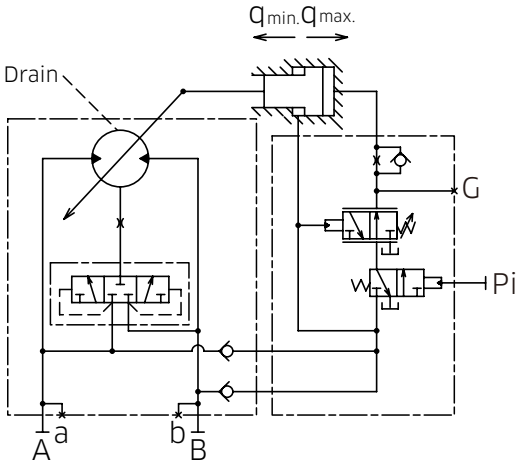
The above data are independent of the motor size.

3-3 Pressure Related Control – Without Pressure Increase with Hydraulic Two Position Control Valve

Ordering Code [10] [11] : H1C1, H1C2

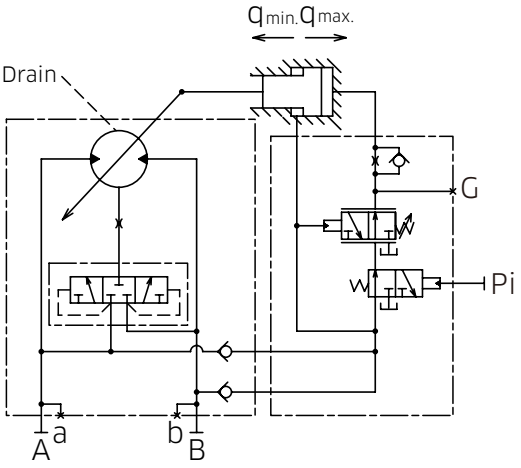
Hydraulic Circuit

Pressure Control with
Negative Two Position Control



H1C1

Pressure Control with
Positive Two Position Control



H1C2

Pressure related control (pressure control without pressure increase) can be combined with hydraulic two position displacement control by using an hydraulic two position control valve. If the motor has both pressure related control and hydraulic two position displacement control, pressure related control overrides hydraulic two position displacement control.
For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-3 Pressure Related Control – With Pressure Increase

Ordering Code [10] [11] : H2X

Function

Displacement is controlled in line with operating pressure and load conditions.

The motor maintains minimum displacement until the operating pressure reaches a setpoint, and when it exceeds the pressure setpoint it shifts to maximum displacement.

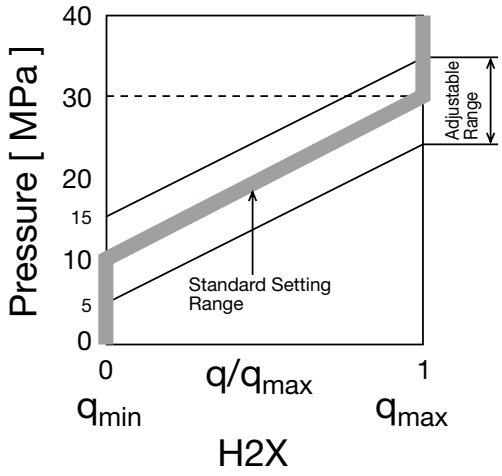
Displacement increases until the required output torque is obtained. If displacement reaches maximum without sufficient output torque, the operating pressure will rise until the required motor output torque is attained.

Control pressure is internally supplied by the port with the highest pressure.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Control type	H2X	
Displacement	Min.	Max.
Speed	Max.	Min.
Factory setting of the control start pressure	10 MPa	
Pressure increment	20 MPa	

Control Characteristics

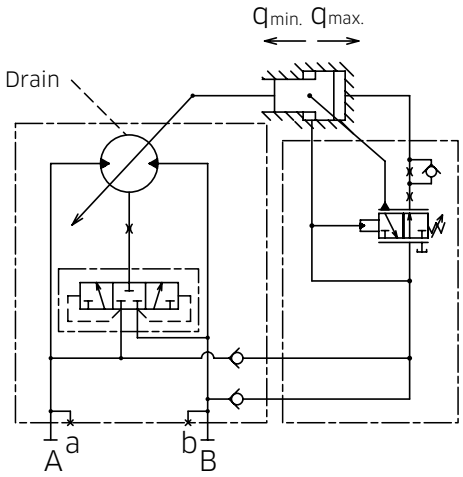


H2X

In H2 control the start of control pressure is factory set at 10 MPa, and the above shows the standard control characteristics.
If non-standard characteristics is required, please contact Kawasaki.

The above data are independent of the motor size.

Hydraulic Circuit

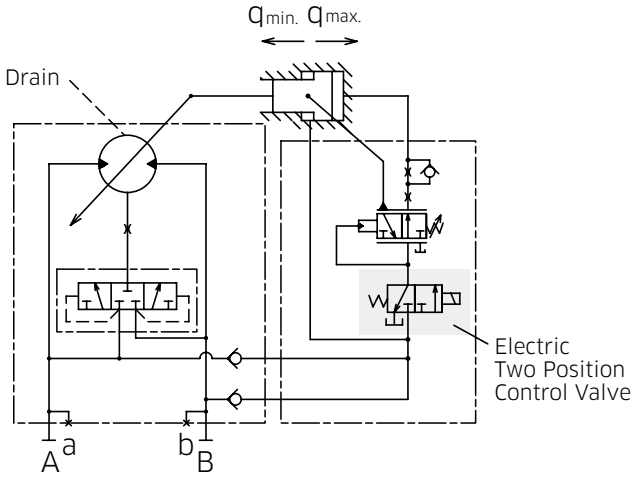


H2X

3-3 Pressure Related Control – With Pressure Increase and Two Position Control Valve

Ordering Code [10] [11] : H2B1 and H2B2

Hydraulic Circuit



H2B1, H2B2

Pressure related control (Pressure control with pressure increase) can be combined with electric two position displacement control by using an optional two position control valve. If the motor has both pressure related control and electric two position displacement control, pressure related control overrides electric two position displacement control.

Specifications of electric two position control valve is shown below.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Solenoid Specifications

Code	B1	B2
Voltage	DC24V	DC12V
Resistance (20℃)	41.5 Ω	9.5 Ω
Rated power consumption (20℃)	≦ 17 W	
Connector type	Tyco Electronics Japan DT04-2P	

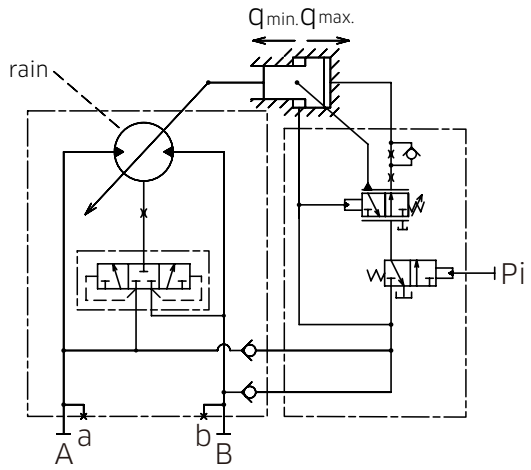
The above data are independent of the motor size.

3-3 Pressure Related Control – With Pressure Increase and Hydraulic Two Position Control Valve

Ordering Code [10] [11] : H2C1, H2C2

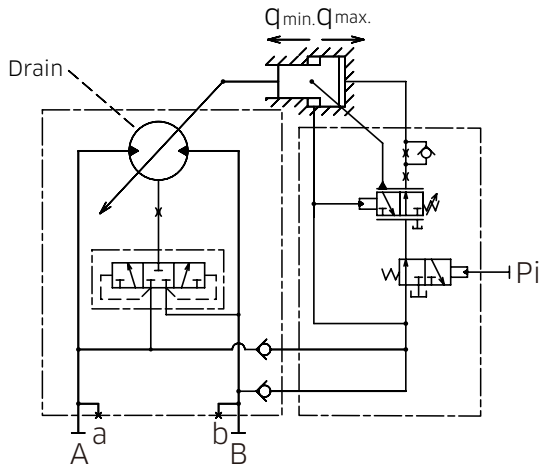
Hydraulic Circuit

Pressure Control with Negative Two Position Control



H2C1

Pressure Control with Positive Two Position Control



H2C2

Pressure related control (pressure control with pressure increase) can be combined with hydraulic two position displacement control by using an hydraulic two position control valve. If the motor has both pressure related control and hydraulic two position displacement control, pressure related control overrides hydraulic two position displacement control.
For safety reasons, winch devices are not permissible with beginning control at q_{min}.

3-3 Pressure Related Control – With Pressure Increase and Hydraulic Remote Control

Ordering Code [10] [11] : H3X

Function

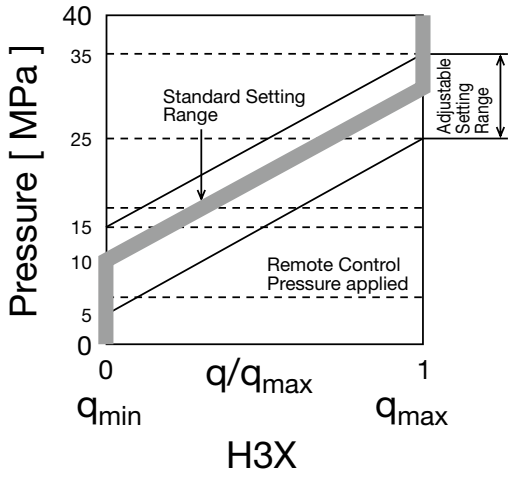
H3X control allows variations at the start of control pressure and control characteristics by applying the external remote control pressure. The application of external remote control pressure in H3X control reduces the control pressure at the beginning of the constant pressure control, and induces a parallel shift in the control characteristics.

Control pressure is internally supplied by the port with the highest pressure.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Control type	H3X
Standard setting of the control start pressure	10 MPa
External remote control sensitivity at port Pi	1.7 MPa / 0.1 MPa
Max. permissible remote control pressure	≦10 MPa

Control Characteristics



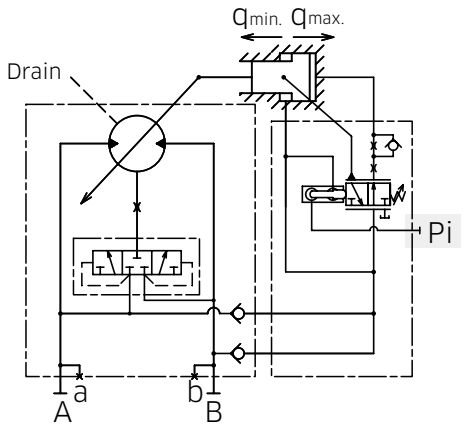
H3X

The remote pressure control in H3 type control provides variations in the control characteristics of H3 pressure related control.

For 0.1 MPa of remote control pressure the pressure at the start of control reduces by 1.7 MPa. With the remote pressure control the control characteristics shifts in parallel.

The above data are independent of the motor size.

Hydraulic Circuit



H3X

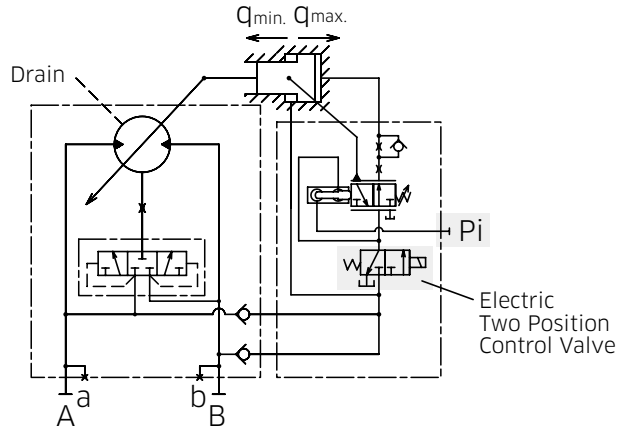
External remote control pressure is supplied via port Pi.

(Note)
In case Pi port is not used please connect the port Pi to drain line.
Allowable maximum pilot pressure (Pi): 10 MPa

3-3 Pressure Related Control
– With Pressure Increase and Hydraulic Remote Control, and Two Position Control Valve

Ordering Code [10] [11] : H3B1 and H3B2

Hydraulic Circuit



H3B1, H3B2

Pressure related control (Pressure control with pressure increase and hydraulic remote control) can be combined with electric two position displacement control by using an optional two position control valve. If the motor has both pressure related control and electric two position displacement control, pressure related control overrides electric two position displacement control.

Specifications of electric two position control valve is shown below.

For safety reasons, winch devices are not permissible with beginning control at q_{min}.

Solenoid Specifications

Code	B1	B2
Voltage	DC24V	DC12V
Resistance (20℃)	41.5 Ω	9.5 Ω
Rated power consumption (20℃)	≦ 17 W	
Connector type	Tyco Electronics Japan DT04-2P	

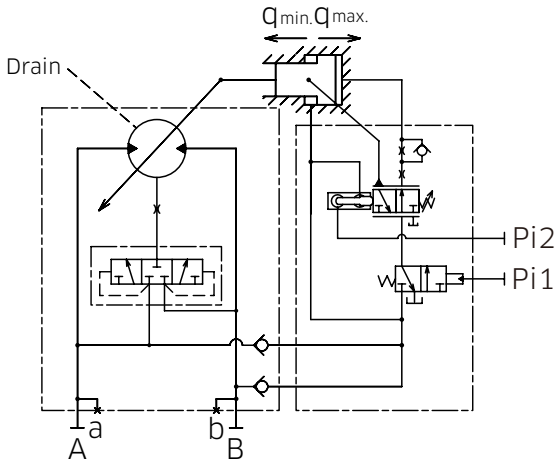
The above data are independent of the motor size.

3-3 Pressure Related Control – With Pressure Increase and Hydraulic Remote Control, and Hydraulic Two Position Control Valve

Ordering Code [10] [11] : H3C1, H3C2

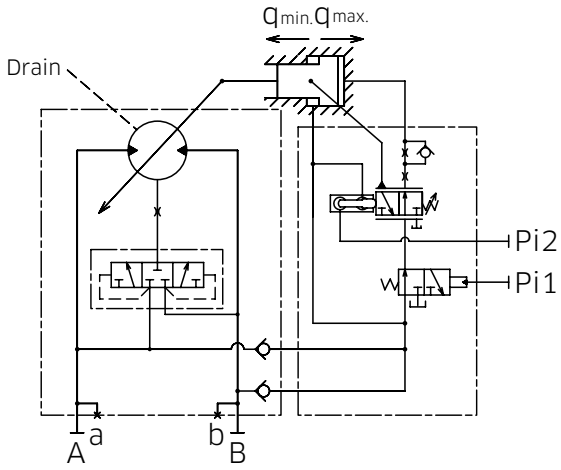
Hydraulic Circuit

Pressure Control with Negative Two Position Control



H3C1

Pressure Control with Positive Two Position Control



H3C2

Pressure related control (pressure control with pressure increase and hydraulic remote control) can be combined with hydraulic two position displacement control by using an hydraulic two position control valve. If the motor has both pressure related control and hydraulic two position displacement control, pressure related control overrides hydraulic two position displacement control.
For safety reasons, winch devices are not permissible with beginning control at q_{min}.

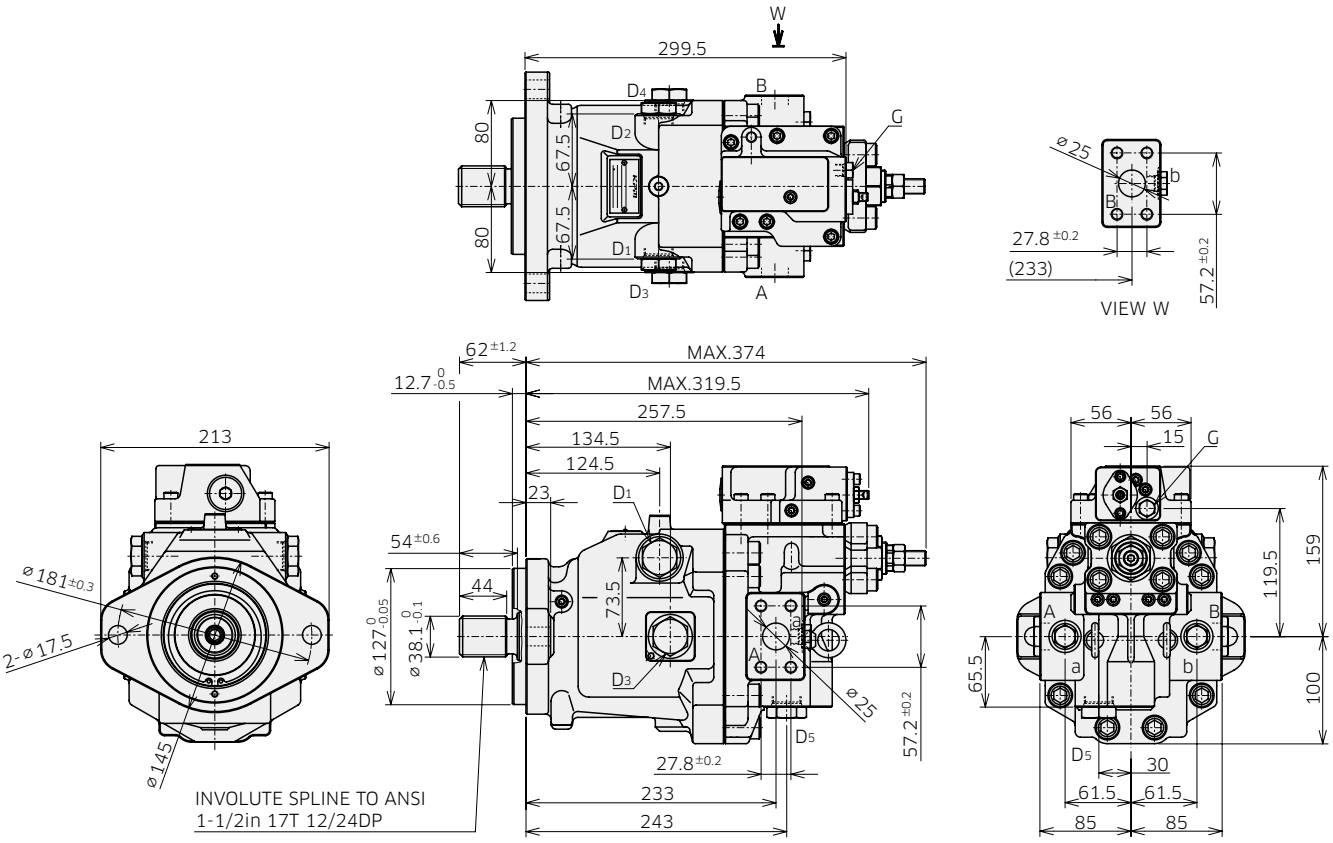
4 Dimensions

4-1 Installation Dimensions

*Dimensions in mm.

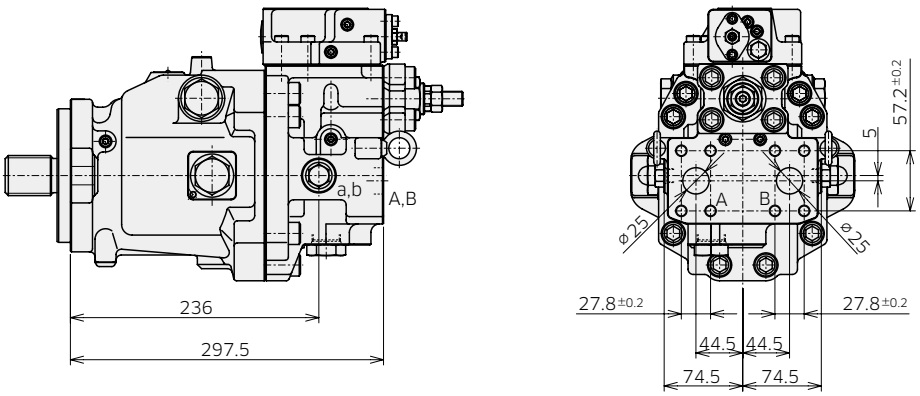
◆ M7V85 SAE 2bolt Mounting, Flange Ports at Side

Model Code : M7V 85 A B 1 1 – * * 1 H1 X X X N – * *



◆ M7V85 SAE 2bolt Rear Port

Model Code : M7V 85 A A 1 1 – * * 1 H1 X X X N – * *

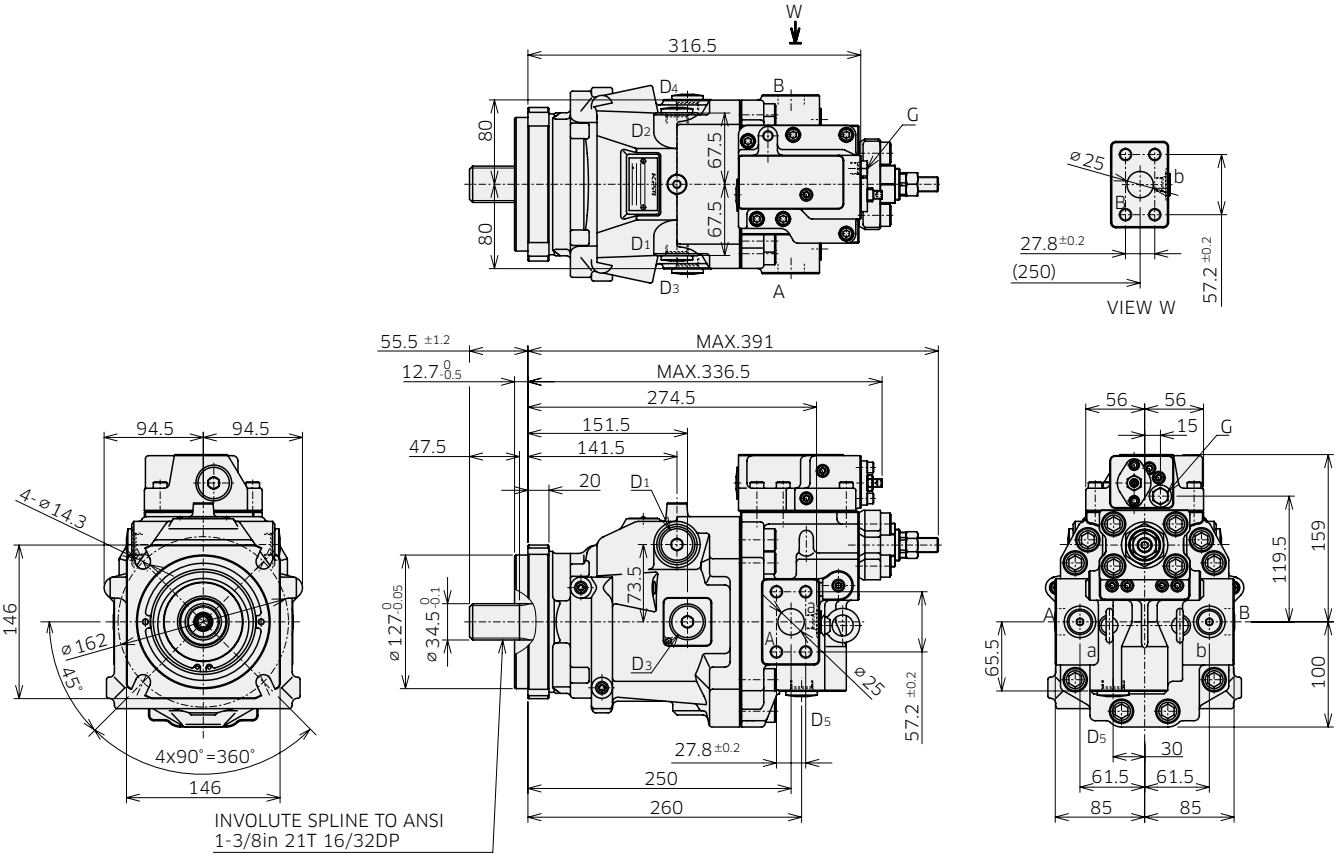


Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions

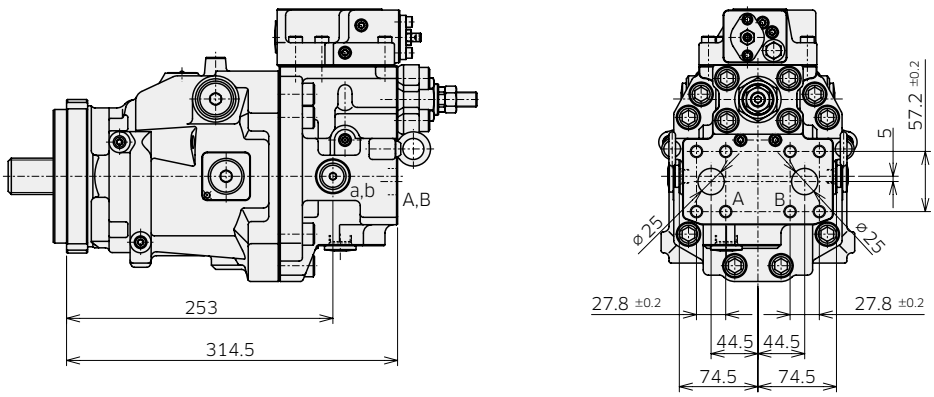
M7V85 SAE 4bolt Mounting, Flange ports at Side

Model Code : M7V 85 A F 1 4 – ＊ ＊ 1 H1 X X X N – ＊＊



M7V85 SAE 4bolt Rear Port

Model Code : M7V 85 A E 1 4 – ＊ ＊ 1 H1 X X X N – ＊＊



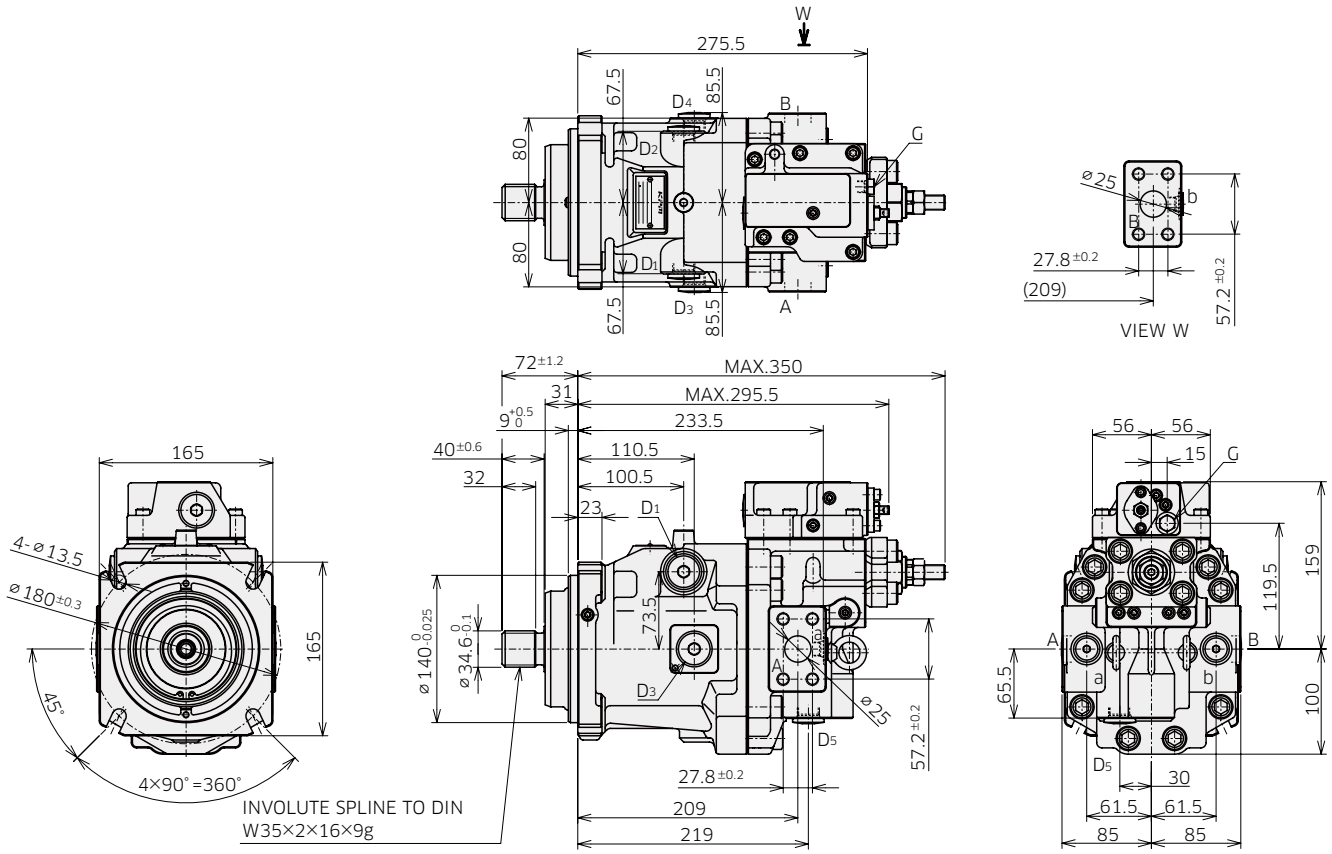
Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions

*Dimensions in mm.

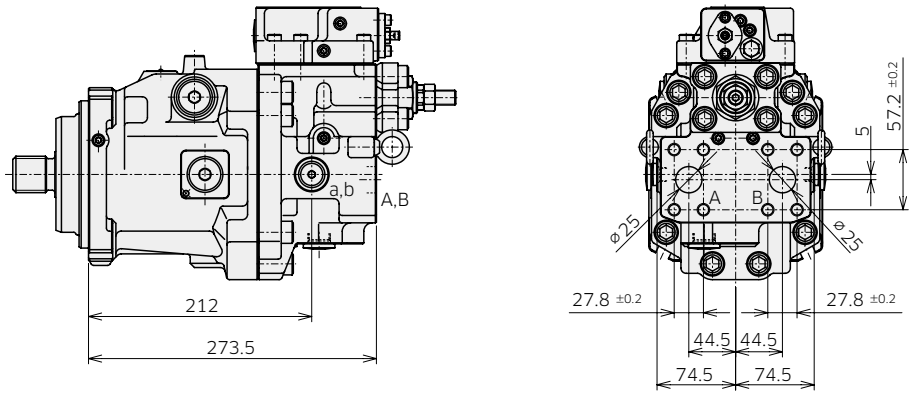
M7V85 ISO Mounting, Flange ports at Side

Model Code : M7V 85 A D 1 5 – * * 1 H1 X X X N – * *



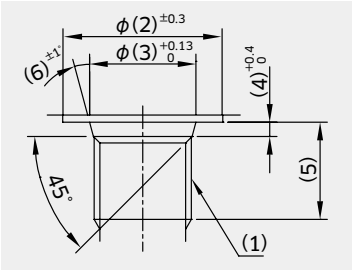
M7V85 ISO Rear Port

Model Code : M7V 85 A C 1 5 – * * 1 H1 X X X N – * *



Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions



*Dimensions in mm.

◆ M7V85 Port and Flange Fixing Thread (Ordering Code: [5])

Thread Port

ANSI thread type (Code : 1)

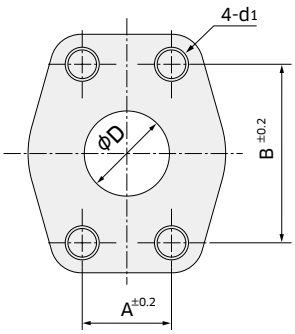
	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	9/16-18UNF-2B	24	15.6	2.5	12.7	12	59
Gauge port	G	7/16-20UNF-2B	21	12.4	2.4	11	12	12
Pilot port	Pi	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Drain port	D1 to D5	1-1/16-12UN-2B	41	29.2	3.3	12.7	15	170

Parallel piping thread type (Code : 4)

	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	G 1/4	24	15.6	2.5	15	15	36
Pilot port	Pi	G 1/4	24	15.6	2.5	14	15	36
Drain port	D1 to D5	G 1/2	34	22.6	2.5	12.7	15	108

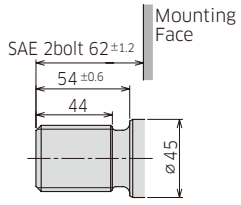
Flange port

Port thread type code	d1	A	B	D
1	7/16-14UNC-2B	27.8	57.2	25
4	M12	27.8	57.2	25



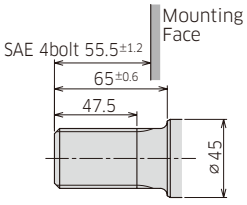
◆ Shaft End (Ordering Code [6])

ANSI B92.1a
(1-1/2in 17T 12/24DP)



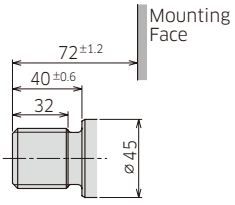
Code : 1

ANSI B92.1a
(1-3/8in 21T 16/32DP)



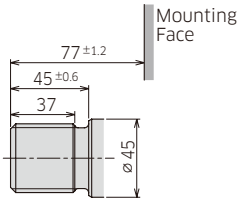
Code : 4

DIN 5480
(W35x2x16x9g)



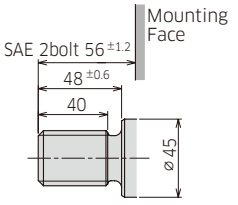
Code : 5

DIN 5480
(W40x2x18x9g)



Code : 6

ANSI B92.1a
(1-1/4in 14T 12/24DP)



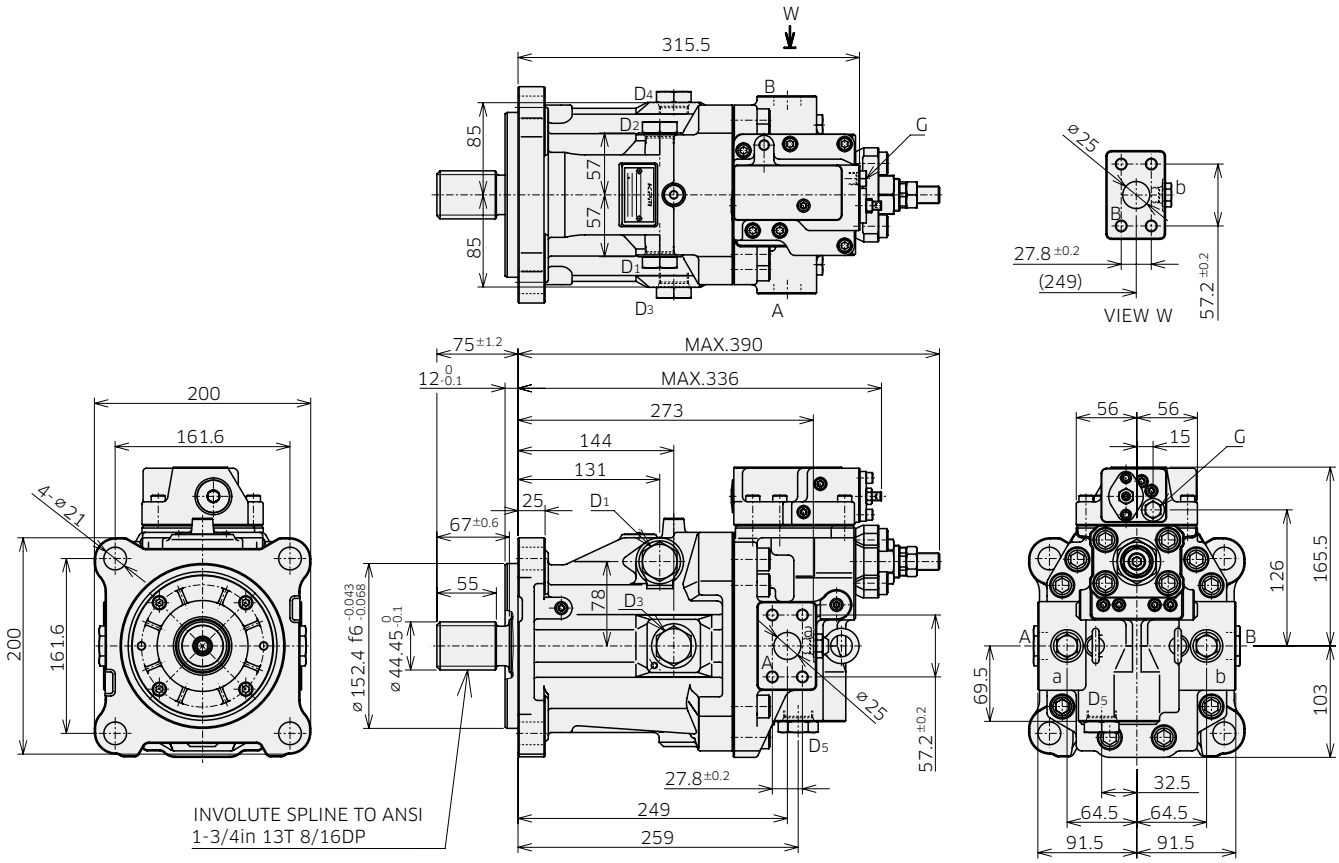
Code : 9

4-1 Installation Dimensions

*Dimensions in mm.

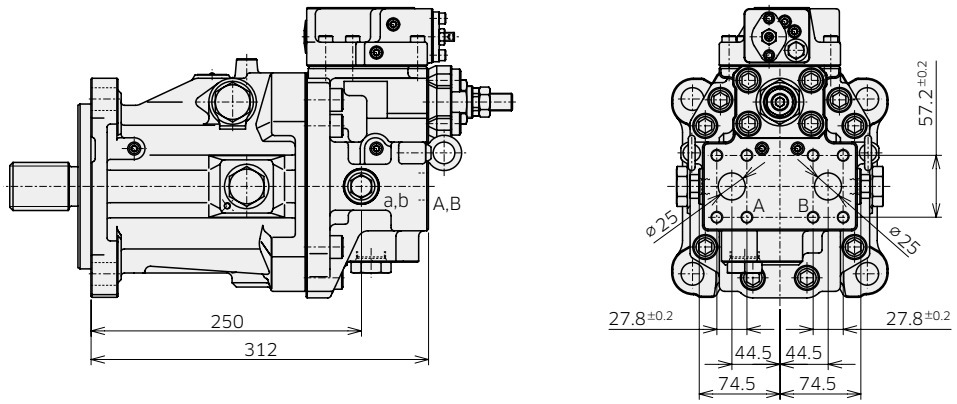
M7V112 SAE Mounting, Flange Ports at Side

Model Code : M7V 112 A B 1 2 – * * 1 H1 X X X N – * *



M7V112 SAE Rear Port

Model Code : M7V 112 A A 1 2 – * * 1 H1 X X X N – * *



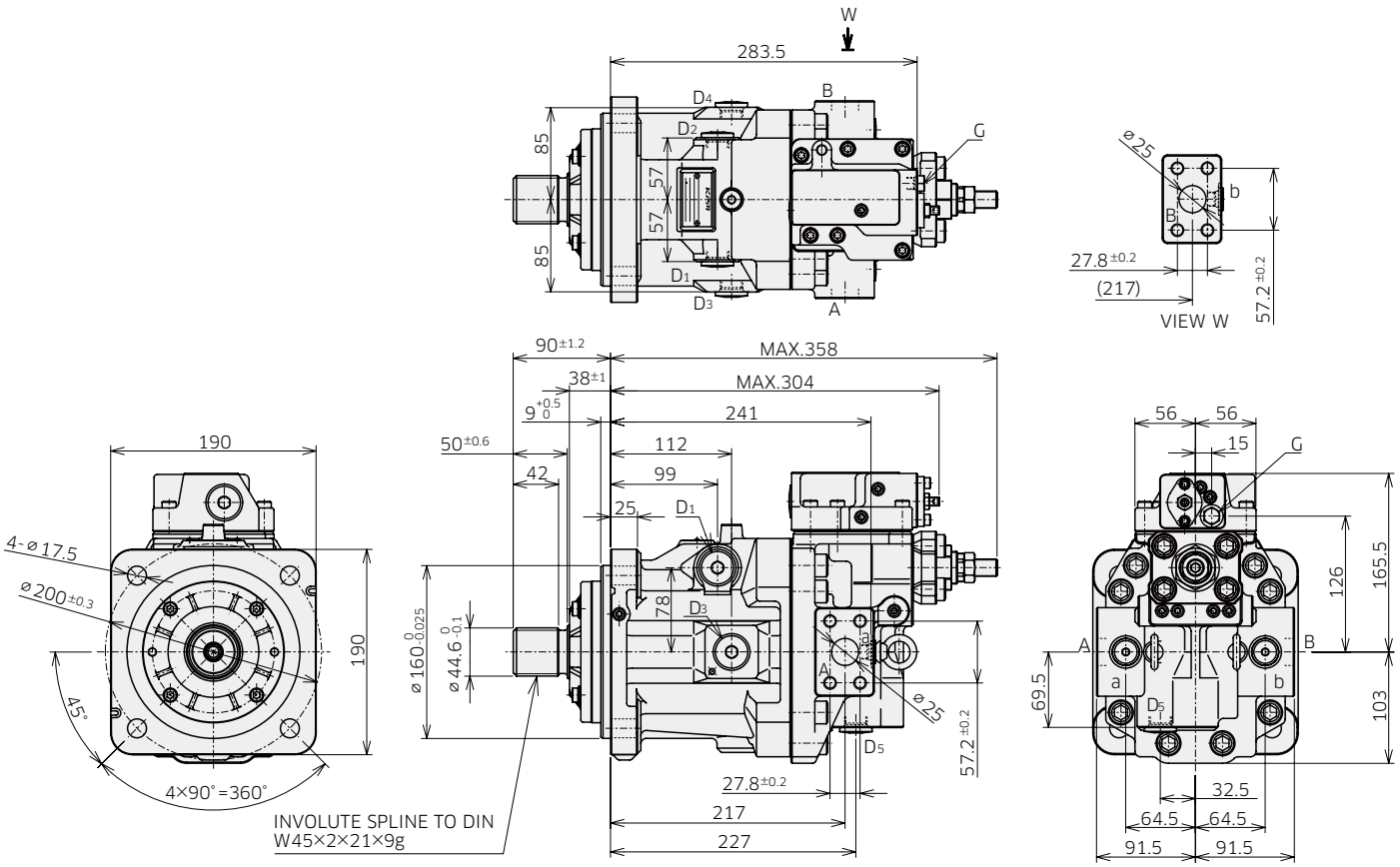
Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions

*Dimensions in mm.

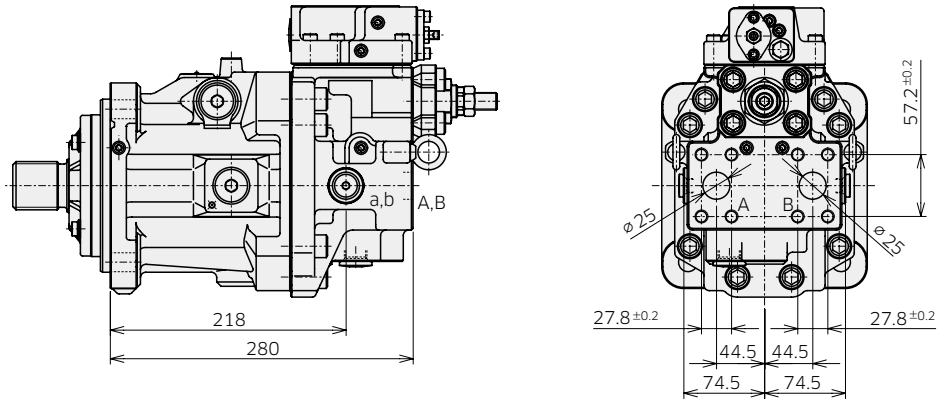
M7V112 ISO Mounting, Flange Ports at Side

Model Code : M7V 112 A D 4 7 – * * 1 H1 X X X N – **



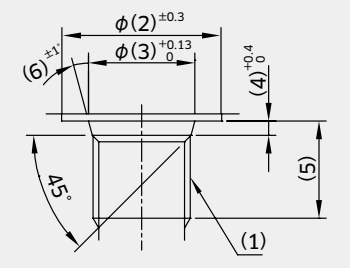
M7V112 ISO Rear Port

Model Code : M7V 112 A C 4 7 – * * 1 H1 X X X N – **



Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions



*Dimensions in mm.

◆ M7V112 Port and Flange Fixing Thread (Ordering code: [5])

Thread Port

ANSI thread type (Code : 1)

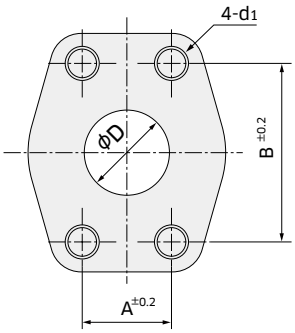
	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Gauge port	G	7/16-20UNF-2B	21	12.4	2.4	11	12	12
Pilot port	Pi	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Drain port	D1 to D5	1-1/16-12UN-2B	41	29.2	3.3	12.7	15	170

Parallel piping thread type (Code : 4)

	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	G 1/4	25	15.6	2.5	15	15	36
Pilot port	Pi	G 1/4	24	15.6	2.5	14	15	36
Drain port	D1 to D5	G 1/2	34	22.6	2.5	12.7	15	108

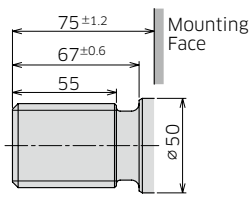
Flange port

Port thread type code	d1	A	B	D
1	7/16-14UNC-2B	27.8	57.2	25
4	M12	27.8	57.2	25



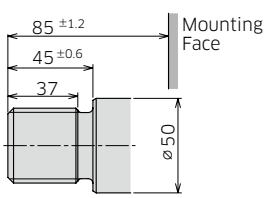
◆ Shaft End (Ordering Code [6])

ANSI B92.1a
(1-3/4in 13T 8/16DP)



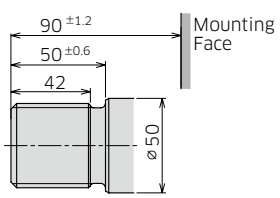
Code : 2

DIN 5480
(W40x2x18x9g)



Code : 6

DIN 5480
(W45x2x21x9g)

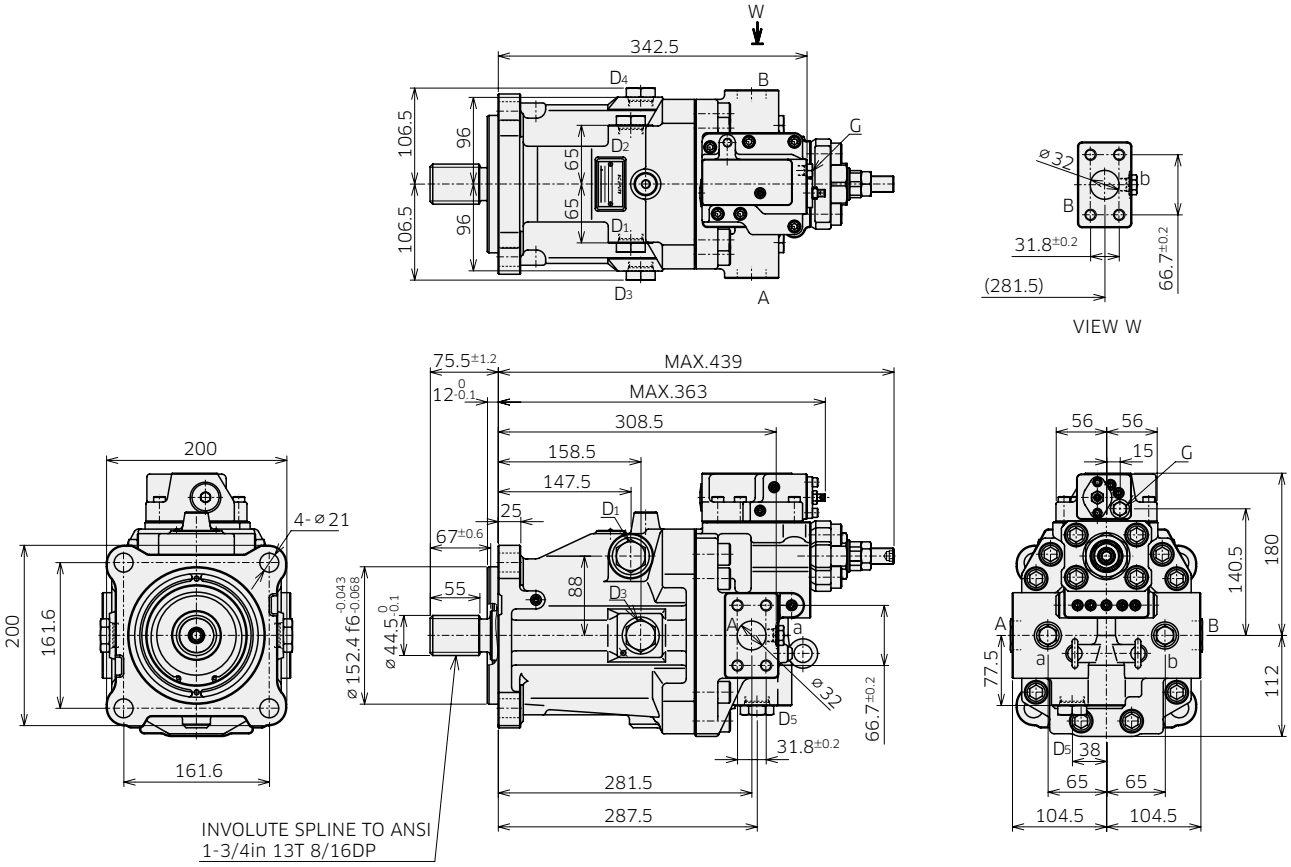


Code : 7

4-1 Installation Dimensions

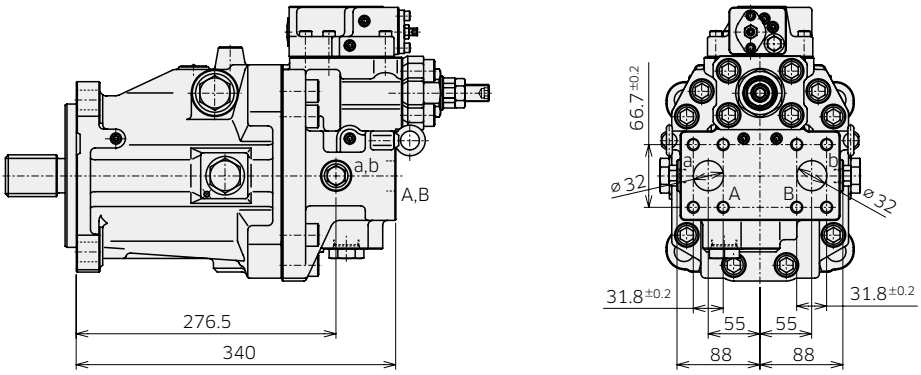
M7V160 SAE Mounting, Flange Ports at Side

Model Code : M7V 160 A B 1 2 – * * 1 H1 X X X N – * *



M7V160 SAE Rear Port

Model Code : M7V 160 A A 1 2 – * * 1 H1 X X X N – * *



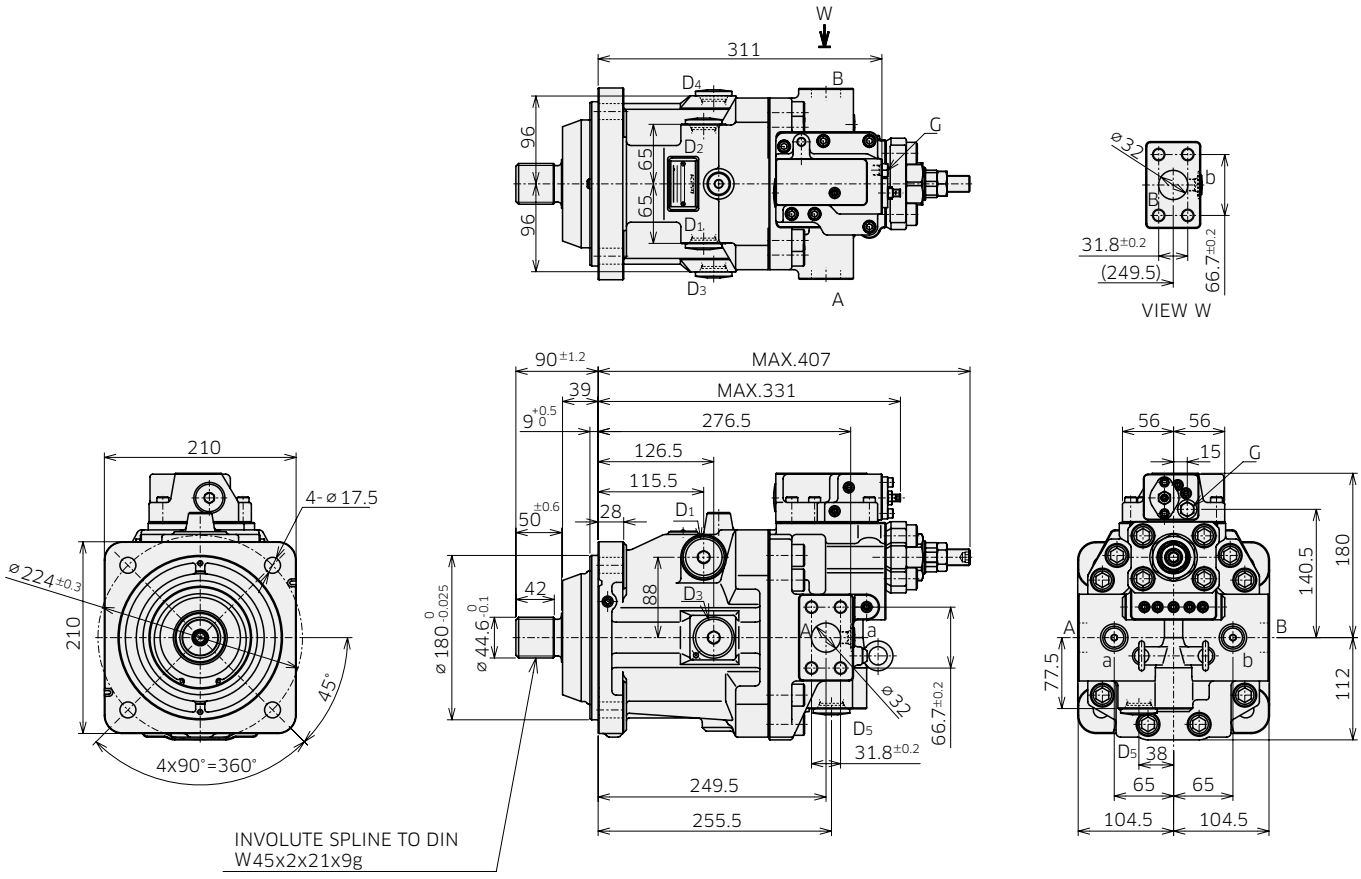
Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions

∗Dimensions in mm.

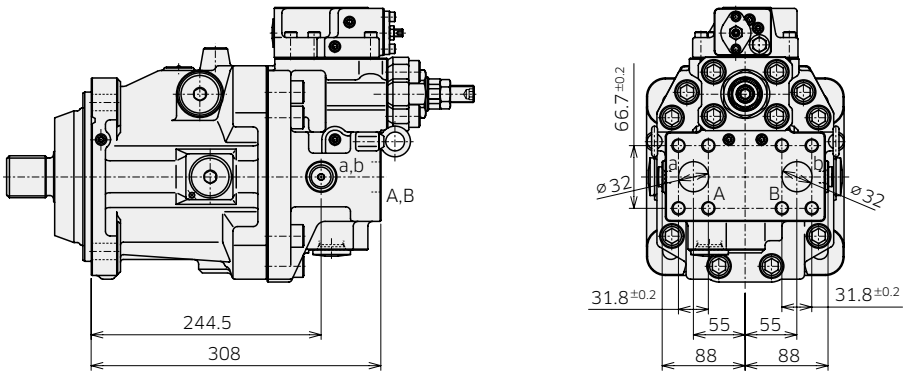
M7V160 ISO Mounting, Flange Ports at Side

Model Code : M7V 160 A D 4 7 – ∗ ∗ 1 H1 X X X N – ∗∗



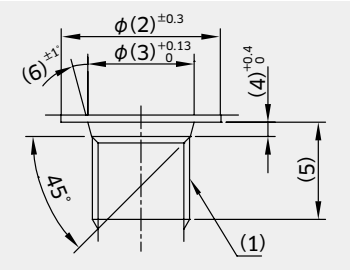
M7V160 ISO Rear Port

Model Code : M7V 160 A C 4 7 – ∗ ∗ 1 H1 X X X N – ∗∗



Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions



*Dimensions in mm.

◆ M7V160 Port and Flange Fixing Thread (Ordering code: [5])

Thread Port

ANSI thread type (Code : 1)

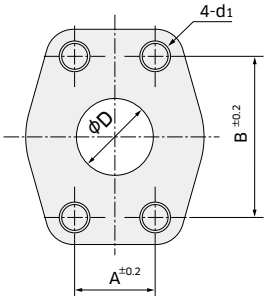
	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Gauge port	G	7/16-20UNF-2B	21	12.4	2.4	11	12	12
Pilot port	Pi	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Drain port	D1 to D5	1-1/16-12UN-2B	41	29.2	3.3	16.7	15	170

Parallel piping thread type (Code : 4)

	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	G 1/4	25	15.6	2.5	15	15	36
Pilot port	Pi	G 1/4	24	15.6	2.5	14	15	36
Drain port	D1 to D5	G 3/4	45	30.8	3.5	16.7	15	170

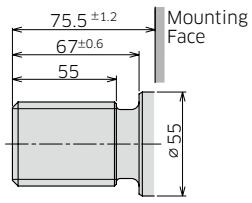
Flange Port

Port thread type code	d1	A	B	D
1	1/2-13UNC-2B	31.8	66.7	32
4	M14	31.8	66.7	32



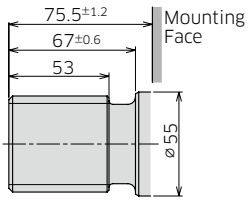
◆ Shaft End (Ordering Code [6])

ANSI B92.1a
(1-3/4in 13T 8/16DP)



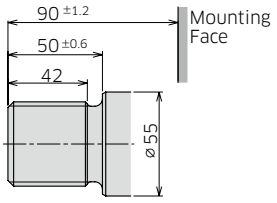
Code : 2

ANSI B92.1a
(2in 15T 8/16DP)



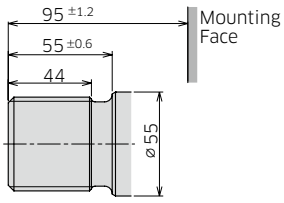
Code : 3

DIN 5480
(W45x2x21x9g)



Code : 7

DIN 5480
(W50x2x24x9g)



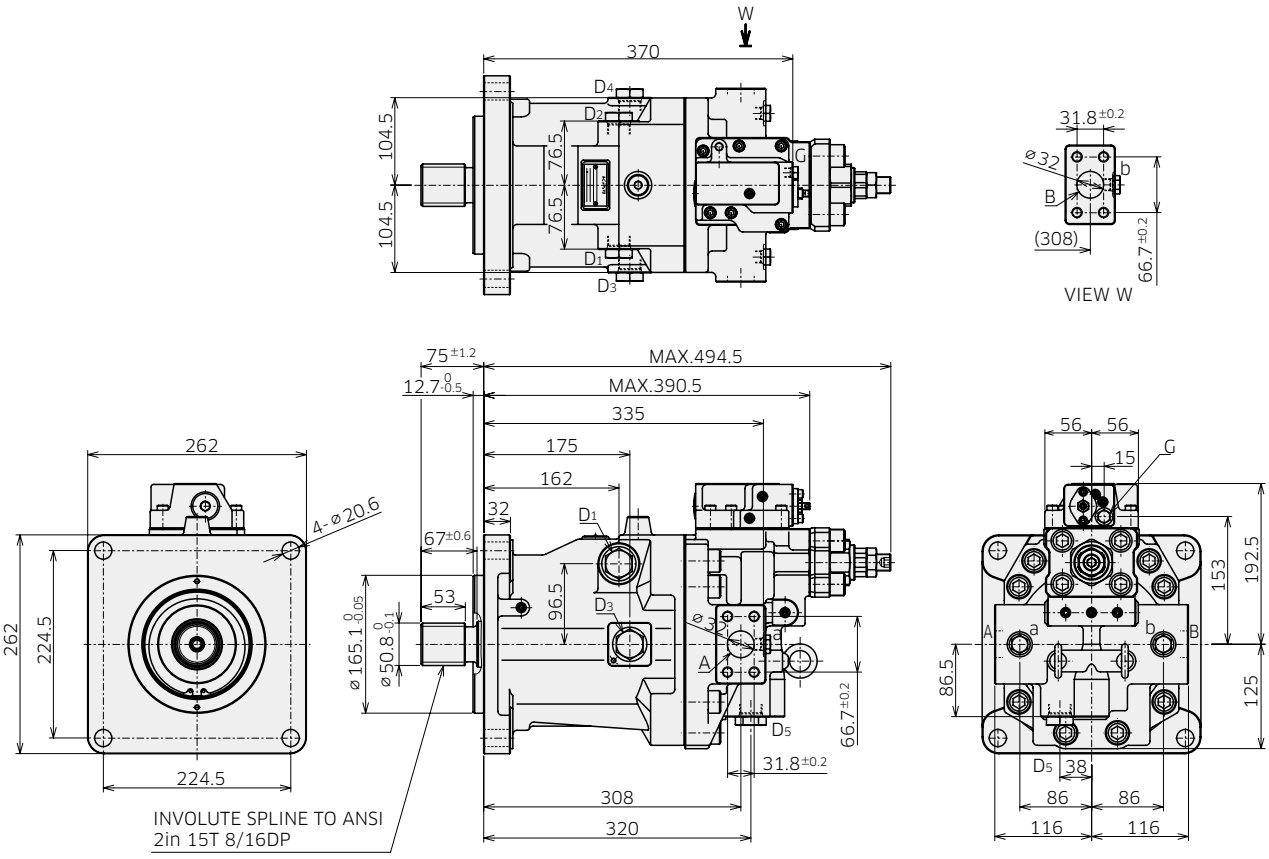
Code : 8

4-1 Installation Dimensions

*Dimensions in mm.

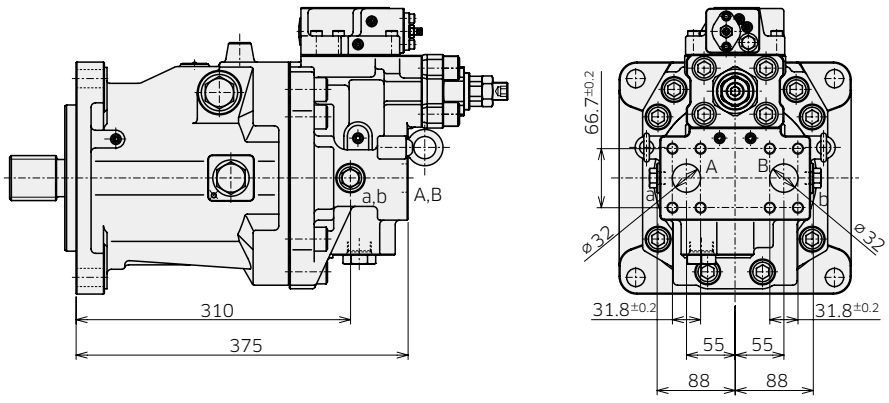
M7V212 SAE Mounting, Flange Ports at Side

Model Code : M7V 212 A B 1 3 – * * 1 H1 X X X N – * *



M7V212 SAE Rear Port

Model Code : M7V 212 A A 1 3– * * 1 H1 X X X N – * *



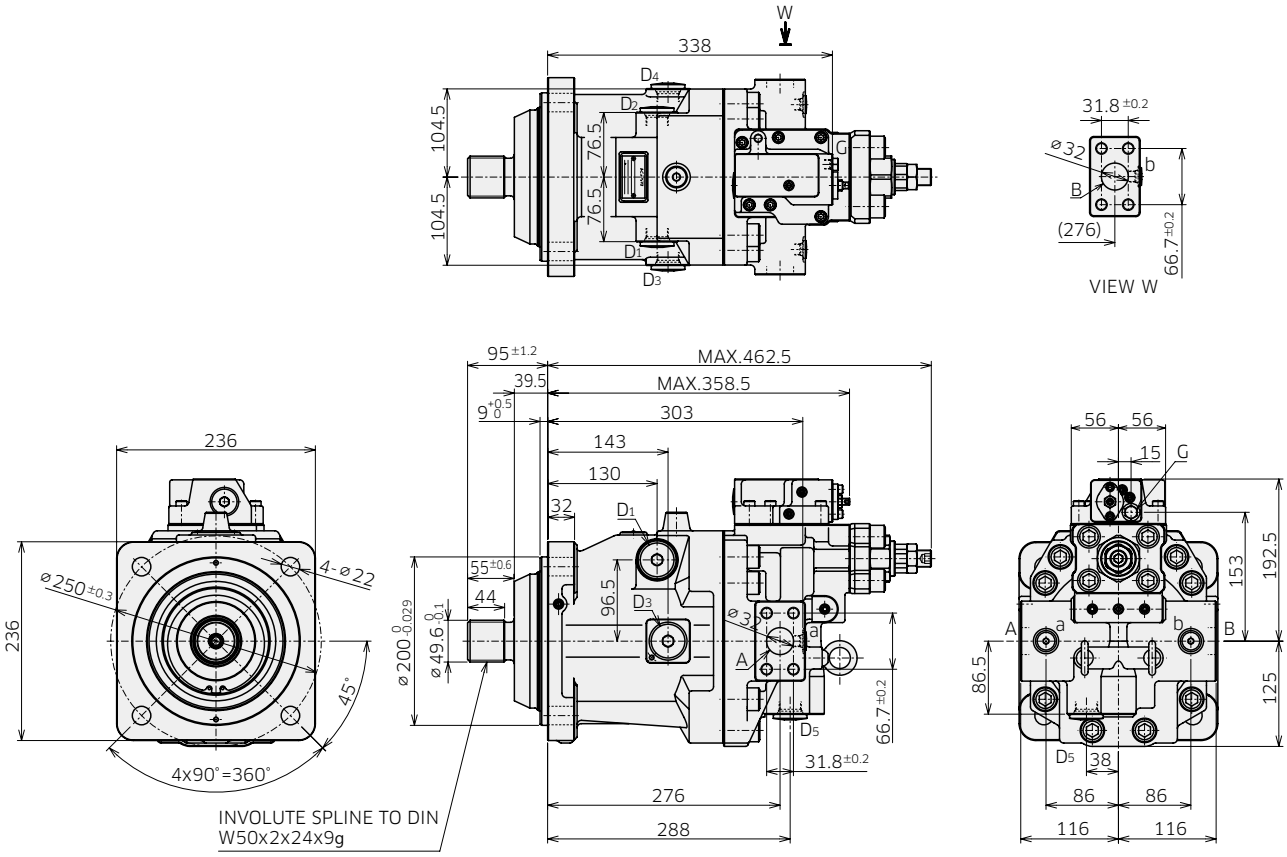
Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions

∗Dimensions in mm.

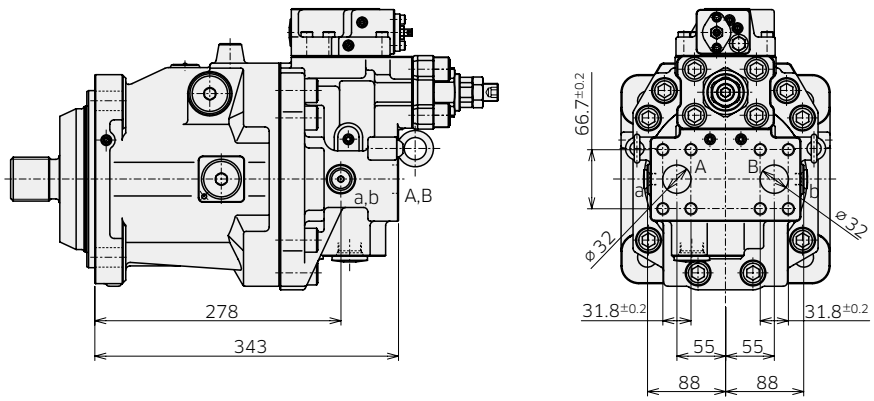
◆ M7V212 ISO Mounting, Flange Ports at Side

Model Code : M7V 212 A D 4 8 – ∗ ∗ 1 H1 X X X N – ∗∗



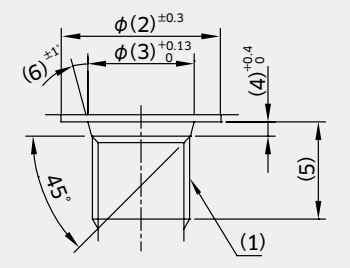
◆ M7V212 ISO Rear Port

Model Code : M7V 212 A C 4 8 – ∗ ∗ 1 H1 X X X N – ∗∗



Refer to the page 52 and 53 for dimensions with other regulator options.

4-1 Installation Dimensions



*Dimensions in mm.

M7V212 Port and Flange Fixing Thread (Ordering code: [5])

Thread Port

ANSI thread type (Code : 1)

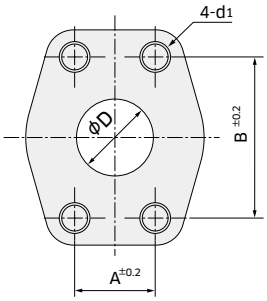
	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Gauge port	G	7/16-20UNF-2B	21	12.4	2.4	11	12	12
Pilot port	Pi	9/16-18UNF-2B	25	15.6	2.5	12.7	12	59
Drain port	D1 to D5	1-1/16-12UN-2B	41	29.2	3.3	19	15	170

Parallel piping thread type (Code : 4)

	Symbol	(1)	(2)	(3)	(4)	(5)	(6)	Tightening torque (Nm)
Gauge port	a, b	G 1/4	25	15.6	2.5	15	15	36
Pilot port	Pi	G 1/4	24	15.6	2.5	14	15	36
Drain port	D1 to D5	G 3/4	45	30.8	3.5	20	15	170

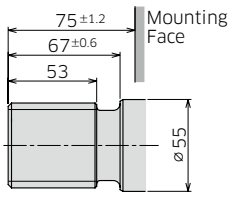
Flange port

Port thread type code	d1	A	B	D
1	1/2-13UNC-2B	31.8	66.7	32
4	M14	31.8	66.7	32



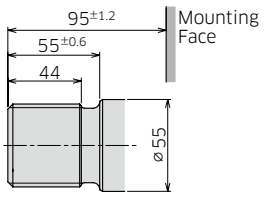
Shaft End (Ordering Code [6])

ANSI B92.1a
(2in 15T 8/16DP)



Code : 3*

DIN 5480
(W50x2x24x9g)



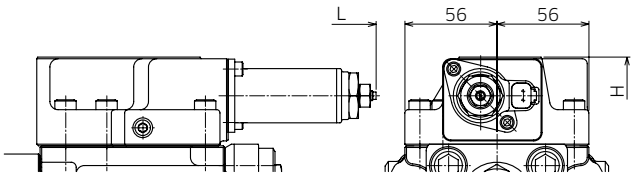
Code : 8

*Code 3 is under development.

4-2 Regulators Installation Dimensions

*Dimensions in mm.

Electric Two Position Displacement Control
Regulator Code: T1, T2

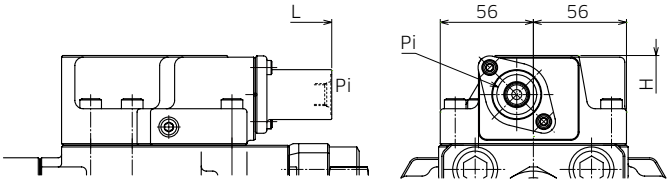


Dimension L : Length from mounting face.
Dimension H : Height from shaft center.

Dimension L, H (mm)

Motor size	Mounting type	Dimension	
		L	H
85	SAE 2bolt	390	159
	SAE 4bolt	407	
	ISO	366	
112	SAE	406	164
	ISO	374	
160	SAE	433	180
	ISO	401	
212	SAE	461	193
	ISO	429	

Hydraulic Two Position Displacement Control
Regulator Code: Y1, Y2



Dimension L : Length from mounting face.
Dimension H : Height from shaft center.

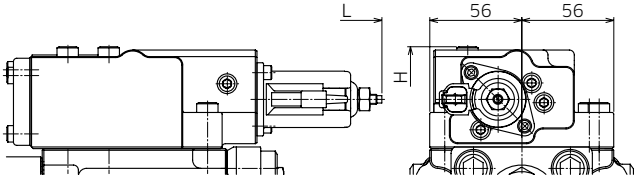
Dimension L, H (mm)

Motor size	Mounting type	Dimension		
		L	H	H1
85	SAE 2bolt	345	159	135.5
	SAE 4bolt	362		
	ISO	321		
112	SAE	361	165.5	142
	ISO	329		
160	SAE	388	180	156.5
	ISO	356		
212	SAE	416	192.5	169
	ISO	384		

4-2 Regulators Installation Dimensions

*Dimensions in mm.

Electric Proportional Control
Regulator Code: E1, E2, E3 and E4

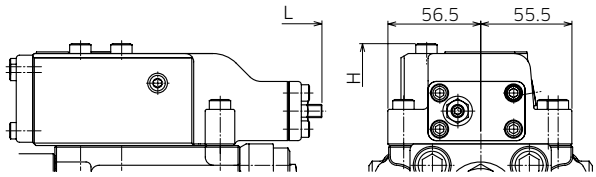


Dimension L : Length from mounting face.
Dimension H : Height from shaft center.

Dimension L, H (mm)

Motor size	Mounting type	Dimension	
		L	H
85	SAE 2bolt	392	167
	SAE 4bolt	409	
	ISO	368	
112	SAE	408	172
	ISO	376	
160	SAE	435	188
	ISO	403	
212	SAE	463	201
	ISO	431	

Pressure Related Control
(with Pressure Increase)
Regulator Code: H2



Dimension L : Length from mounting face.
Dimension H : Height from shaft center.

Dimension L, H (mm)

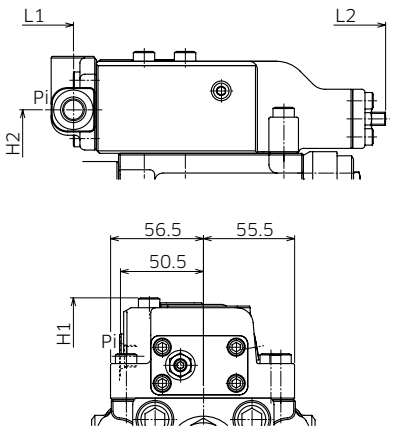
Motor size	Mounting type	Dimension	
		L	H
85	SAE 2bolt	348	167
	SAE 4bolt	365	
	ISO	324	
112	SAE	364	172
	ISO	332	
160	SAE	391	188
	ISO	359	
212	SAE	419	201
	ISO	387	

Pressure Related Control
(with Pressure Increase Hydraulic Remote Control)
Regulator Code: H3

Hydraulic Proportional Control
Regulator Code: P1, P2, P3 and P4

Dimension L, H (mm)

Motor size	Mounting type	Dimension			
		L1	L2	H1	H2
85	SAE 2bolt	158	348	167	132
	SAE 4bolt	175	365		
	ISO	134	324		
112	SAE	174	364	172	137
	ISO	142	332		
160	SAE	201	391	188	153
	ISO	169	359		
212	SAE	229	419	201	165
	ISO	197	387		



Dimension L : Length from mounting face.
Dimension H : Height from shaft center.