

SERVO VALVES

Valve Type		Maximum Operating Pressure MPa	Rated Flow L/min (Valve Pressure Difference:7 MPa)																Page
			1	2	5	10	20	30	50	100	200	300	500	1000	2000	5000			
High-Speed Linear Servo Valves	Direct Type	35	LSVG-03 4; 10; 20; 40; 60																I-5
	Two Stage Type	35	LSVHG-04 750																I-10
		900 : 35 1300 : 31.5	LSVHG-06 900; 1300																
		35	LSVHG-10 3800																
OBE Type Linear Servo Valves (Std. Type)	Direct Type	35	LSVG-01EH 4; 10; 20																I-22
		35	LSVG-03EH 40; 60																
	Two Stage Type	31.5	LSVHG-03EH 210; 270																I-31
		35	LSVHG-04EH 580; 750																
		900 : 35 1300 : 31.5	LSVHG-06EH 820; 1300																
		35	LSVHG-10EH 3800																
OBE Type Linear Servo Valves (High Performance Type)	Two Stage Type	31.5	LSVHG-03EH-※-S 60; 100; 160																I-52
		35	LSVHG-04EH-※-S 100; 200; 280; 450																
		35	LSVHG-06EH-※-S 500; 900																

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Hydraulic Fluids

Type of Fluids

Any type of hydraulic fluid listed in the table below can be used.

Petroleum Base Oils	Use fluids equivalent to ISO VG32 or VG46.
Synthetic Fluids	Use phosphate ester or polyol ester type. When phosphate ester type fluid is used, prefix "F-" to the model number because a special seal (fluororubber) will be used.
Water Containing Fluids	Use water-glycol fluids. Water-glycol fluids cannot be used for valves "without Y port" (wet type: LSVG-*EH-* <u>W</u>) or "without DR port" (wet type pilot valve: LSVHG-*EH-* <u>W</u>).

Note: For use with hydraulic fluids other than those listed above, please consult your Yuken representatives in advance.

Recommended Viscosity and Temperature

Use hydraulic fluids which satisfy both recommended viscosity and oil temperatures given in the table below.

Viscosity	Temperature
15 - 400 mm ² /s	-15 - +60 °C

Control of Contamination

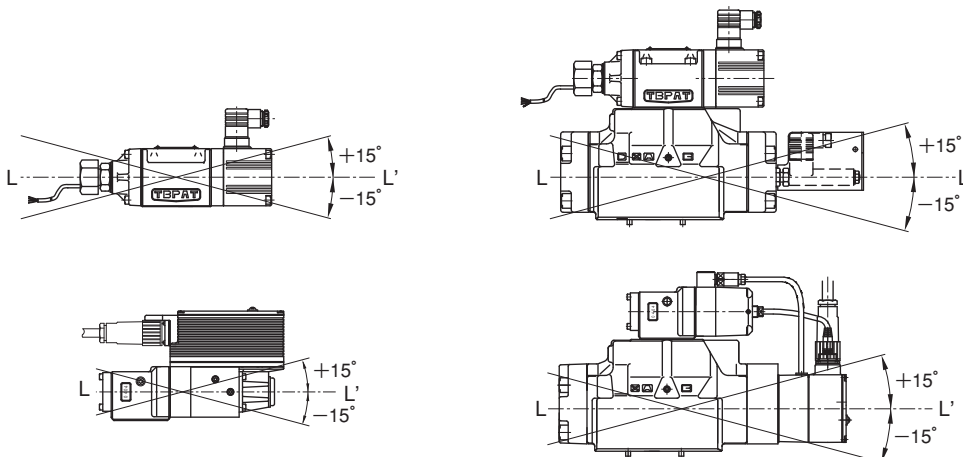
Keep the hydraulic fluid clean and provide a line filter so that contamination of the fluid will not obstruct proper valve operation. To assure long life of linear servo valves, it is recommended to improve fluid cleanliness before use.

Contamination Level	Line Filter
NAS1638 Class 10 ISO4406 21/19/15	Absolute 20 μm

Instructions

Mounting

Mount the valve with the angle of the axis line L-L' within about ±15° from the horizontal plane, as shown below. The valve must be mounted in such a way that the spool axis direction is not matched with the main vibration direction; otherwise, an external force may cause the spool to malfunction.



Installation Requirements

Avoid installing the valve in a strong magnetic field. Especially, the position sensor for detecting the spool position is affected by the magnetic field. Keep the valve away from devices that generate magnetic fields, such as solenoid operated directional valves. At the same time, a magnetic field generated by the valve may affect other devices; any device vulnerable to magnetic fields must not be installed near the valve.

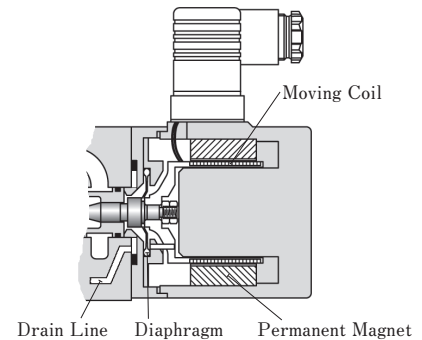
Drain Piping (LSVG: Y Port/LSVHG: DR Port)

LSVG/LSVHG series high speed linear servo valves have a diaphragm mechanism that keeps the inside of the linear motor dry in order to meet the requirements below.

- 1) Keeping response characteristics almost unchanged when fluid viscosity varies (the response characteristics of existing proportional/servo valves vary with changes in fluid viscosity).
- 2) Protecting moving coils from iron powder or moisture in hydraulic fluids.

A special drain port is provided to define the upper limit of pressure for the diaphragm, if any, so that the valve performance is maintained. For valve installation, provide a drain line by taking into account the following piping considerations.

- ① Back pressure at the drain port should be 0.05 MPa or less and not be a negative pressure.
 - ② The drain line should be open to the air (the line end must not contact the fluid).
- ★ There are two types of pilot valves available: a dry type good in response characteristics and a wet type that eliminates the Y or DR port to improve usability.



Structure of the Linear Motor

Cable Length for I/O Signals

- 1) High speed linear servo valves (amplifier-separated type)

Use a cable of up to 30 m in length.

Consult us for customized products (Model: LSVG-03/LSVHG-04, 06) that allow the use of a cable of up to 200 m in length.

- 2) OBE (on-board electronics) type linear servo valves

The maximum cable length depends on the I/O signal type. See the table below.

I/O Signal Type	Valve Model Number	Max. Cable Length
±10 V	LSV (H) G- * * EH- * * - * - * - A * / D * -10	50 m★
4 - 20 mA	LSV (H) G- * * EH- * * - * - * - B * / E * -10	300 m
±10 mA	LSV (H) G- * * EH- * * - * - * - C * / F * -10	

★ Consult us when the cable length exceeds 50 m.

For both valve types in 1) and 2), pay attention to ensure that the power cable resistance is within 1 Ω and is as low as possible.

Electrical Failure and Safety Measures for Startup

Provide a separate safety circuit (e.g. uninterruptible power supply), if required, to securely continue/stop the operation of the hydraulic actuator for safety in case of electrical failure (power failure, cable disconnection, etc.) or upon startup.

Supply Pressure

The servo valves are designed to operate at constant supply pressure; variations in supply pressure should be avoided as much as possible. Especially, for systems requiring high accuracy, the circuit must be designed to keep the supply pressure constant.

Ideally, an accumulator will be installed in the supply pressure line near the servo valve to avoid supply pressure fluctuations during pressure transients.

Pressure at the Return Port

The return port of the servo valve may be subject to a considerably high pressure depending on the circuit type. However, it should be used at atmospheric pressure or similar pressure as much as possible. The pressure at the return port should be equal to or below actual supply pressure.

Disassembly/Reassembly

Linear servo valves consist of high precision components. You are prohibited from disassembling or reassembling the valves; otherwise, the designed valve performance may be degraded.

Valve Pressure Difference/Load Pressure Difference

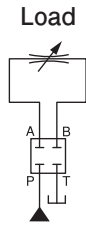
This catalog uses two terms related to pressure differences: “valve pressure difference” (used for the range of flow control and no-load flow characteristics) and “load pressure difference” (used for load flow characteristics). The terms are described below.

Valve Pressure Difference

Suppose that, in the circuit shown on the right, the fluid flows from P to A and from B to T. In this case, the sum of the pressure differences between P and A and between B and T is the pressure difference of this valve. For this four-way valve, the valve pressure difference “ ΔP ” is:

$$\text{Valve Pressure Difference} = [(\text{Pres. at P}) - (\text{Pres. at A})] + [(\text{Pres. at B}) - (\text{Pres. at T})].$$

In relation to the flow rate, an increase in the flow through the valve with a constant valve opening leads to an increase in the valve pressure difference due to increased flow resistance at the control part.



Load Pressure Difference

In the circuit above, the absolute pressure difference between A and B is the load pressure difference.

$$\text{Load Pressure Difference} = |(\text{Pres. at A}) - (\text{Pres. at B})|$$

If the resistance of piping, etc. is ignored, the difference between the supply pressure and the load pressure difference is the valve pressure difference of the linear servo valve. Therefore, a smaller load pressure difference means a larger valve pressure difference, allowing increasing the flow rate through the valve.

Flow Rate

In this catalog, the rated flow tolerance is $\pm 10\%$

The flow rate depends on the viscosity and specific gravity of each hydraulic fluid.

- Multiply each viscosity by the corresponding coefficient in the table below.

Viscosity mm ² /s	15	20	30	40	50	60	70	80	90	100
Coefficient	1.19	1.11	1.00	0.93	0.88	0.84	0.81	0.78	0.76	0.74

- Use the following formula to obtain the flow rate corresponding to a specific gravity. $Q' = Q\sqrt{(0.85/G')}$
- Use the following formula to obtain the relationship between the flow rate and the pressure for a servo valve.

$$Q_x = Q_{\text{rate}} \sqrt{\frac{\Delta P_x}{7}}$$

where Q_x : Flow rate to be determined;
 Q_{rate} : Rated flow rate (at $\Delta P = 7$ MPa); and
 ΔP_x : Valve pressure difference in the actual circuit.