YUKEN

Order number	Pub. EM-1358
Date	2004. 05. 30
Products Publicity Section	

Instruction Manual

ELDFHG Series High Response Type Proportional Electro-Hydraulic Directional and Flow Control Valves

Models :

ELDFHG-04-※-10

ELDFHG-06-※-10

———To use this product correctly and safely:———

- Before using the product, read this instruction manual carefully.
- Follow the safety precautions labeled "DANGER", "WARNING", or "CAUTION".
- Keep this instruction manual carefully in a safe and easy accessible place so that the future reference can be made immediately when necessary.
- This manual should be incorporated with the manuals for each hydraulic system using this product.

YUKEN KOGYO CO., LTD.

About This Manual

- Some drawings in this instruction manual, being abstracted, may not necessarily represent the actual products or component parts. In some cases, an abstract drawing is used to show the products or component parts.

- The contents of this manual are subject to change without notice.

- This instruction manual has been produced with our best knowledge and attention. However, if you have a question or find an error or omission, please contact your YUKEN KOGYO sales representative or our Sales Department.

- If the instruction manual in your hand has missing or out-of-order pages, contact your YUKEN KOGYO sales representative or our Sales Department for a replacement.

■SAFETY PRECAUTIONS

- This instruction manual assumes the reader and user has basic knowledge of hydraulics and electricity.
- The product must be handled directly by or under the guidance of persons having basic knowledge of hydraulics and electricity.
- The instructions and safety precautions (defined below) in this manual must be made known to the end users of the product.
- When you sell or transfer this product, please be sure to provide this instruction manual along with the product.

In this instruction manual, safety precautions are classified into three ranks: DANGER, WARNING, and CAUTION.

These words are defined as follows:

⚠ **DANGER:**	Indicates an imminent danger that is very likely to cause death or severe injury to a person when this precaution is ignored and the product is handled incorrectly.
⚠ **WARNING:**	Indicates a potential danger that may cause death or severe injury to a person when this precaution is ignored and the product is handled incorrectly.
⚠ **CAUTION:**	Indicates a potential danger that may cause injury to a person or that may result in property damage when this precaution is ignored and the product is handled incorrectly.

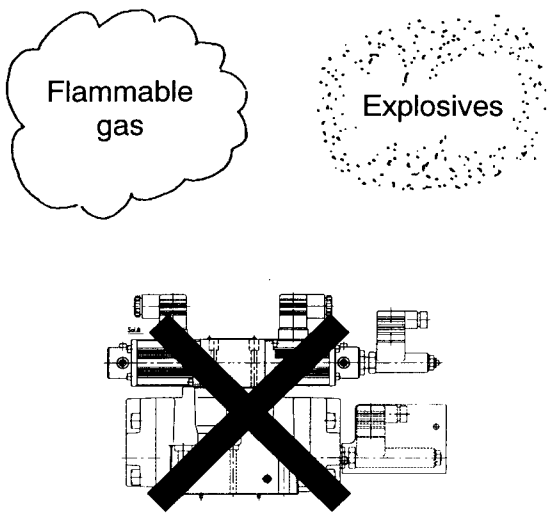
Note that even precautions labeled "CAUTION" may cause serious harm. Since all precautions are important regardless of their rank, be sure to follow all of them.

YUKEN KOGYO assumes no liability for any accident causing death, injury, or property damage caused by the unauthorized use or handling of the product or information contained herein.

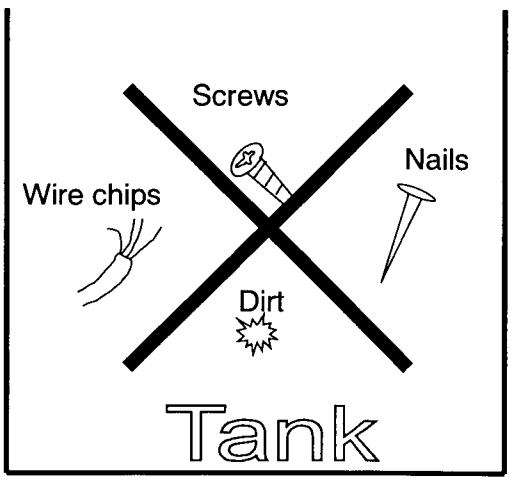
The following are specific important safety precautions that you must observe:

⚠ DANGER

Do not use the product in an EXPLOSIVE ATMOSPHERE, such as where flammable gas or powder is handled. Otherwise, a fire or explosion caused by combustion or ignition will result in death or severe injury.

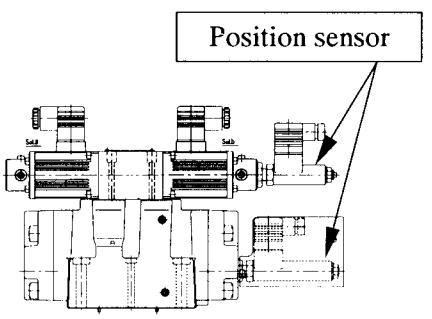


Foreign matters (debris) in the hydraulic fluid can cause the hydraulic system to malfunction. Always keep the hydraulic fluid clean (contamination level within class NAS 1638-10) and use 20-micrometer or less line type filters.



⚠ WARNING

When handling the valve, be careful to avoid loading the position sensor. Loading the position sensor may cause abnormal operation due to a sensor trouble.
Do not operate or adjust the position sensor as it is pre-adjusted to the zero point.



Avoid loading
the position sensor.

Perform wiring correctly between the valve and the dedicated amplifier. Miswiring may cause abnormal operation.
For the wiring diagram for connection, refer to the instruction manual for the ampifier.

Dedicated ampifier models:

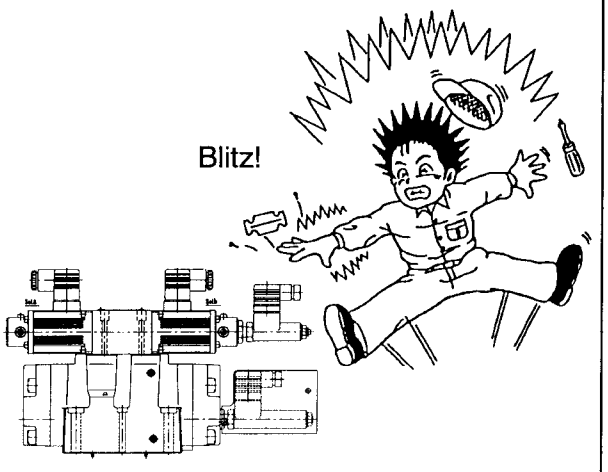
Model No.	Amplifier Model No.
ELDFHG-04-280-$^{3C2}_{3C40}$-XY-ET-10	AMB-EL-04-2-10
ELDFHG-04-280-3C2P-XY-ET-10	AMB-EL-04-2P-2-10
ELDFHG-06-350-$^{3C2}_{3C40}$-XY-ET-10	AMB-EL-06-3-10
ELDFHG-06-350-3C2P-XY-ET-10	AMB-EL-06-2P-3-10
ELDFHG-06-500-$^{3C2}_{3C40}$-XY-ET-10	AMB-EL-06-4-10
ELDFHG-06-500-3C2P-XY-ET-10	AMB-EL-06-2P-4-10

DO NOT
MISWIRE!

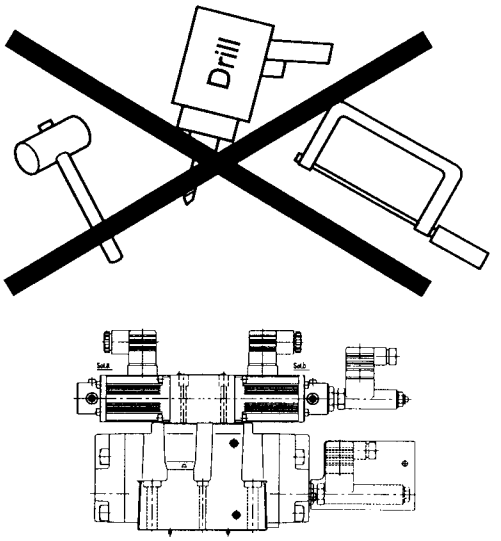
The following are specific important safety precautions that you must observe:

⚠ WARNING

Do not touch a connector or terminal with the power on. Doing so may result in electric shock, burns or death.

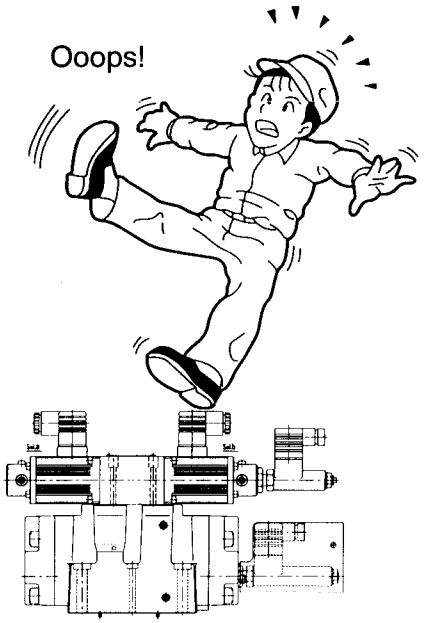


Do not modify the product. Doing so could create a hazardous situation, resulting in a malfunction or reduced performance.



⚠ CAUTION

Do not step or stand on the product or put any heavy object on it. Doing so may damage the product or hydraulic system and may result in an injury from falling.



Valve characteristics may vary with the load pressure or fluid temperature. Adjust the product so that the acceleration, deceleration and stop operation can be made safely within the pressure and fluid temperature to be used actually.

Contents

1. Introduction

1.1 Who Can Handle this Product?

This product must be handled either directly by or under the guidance of a person who has a basic knowledge of hydraulic systems and electricity.
Also be sure to read the instruction manual of the dedicated amplifier (AMB-EL-※-※-10).

1.2 Application

This product is a 2-stage type proportional electro-hydraulic directional and flow control valve used for driving the main spool by using a small-sized high-power solenoid and sensors for detecting the position of the spool, where a high response type proportional valve (ELDFG-01 type) is employed as the pilot stage of the closed loop system.

Since the main spool is positioned by an electrical feedback method using a differential transducer and a dedicated servo amplifier (AMB-EL), control can be achieved with high response and high accuracy.

As a servo valve designed for high speed and high accuracy control of various types of industrial machinery and test equipment, this product supports versatile applications such as positioning control, speed control, pressure control, etc.

1.3 Product Check

Be sure to check the following items when the product arrives.

In the event you have any questions regarding defects, etc., then contact the dealer where you purchased the product or your local YUKEN KOGYO sales representative.

- Is it the correct model?

  Check the model number stamped on the nameplate. (See Figure 1)

- Check the product for any damage or loosened screws.
- Check for absence of any accessory.

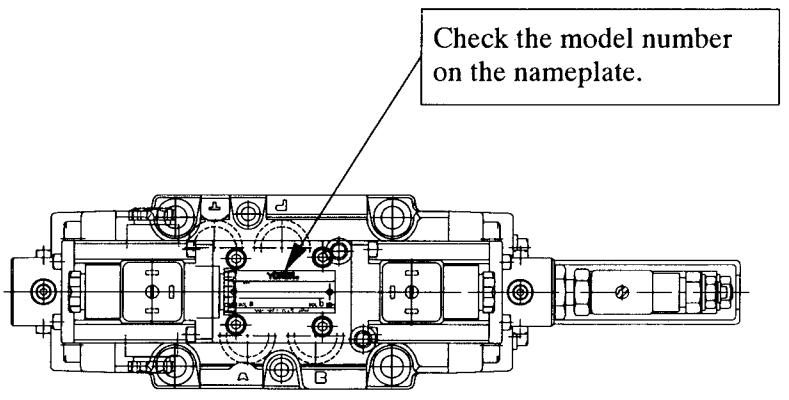


Figure 1 Checking the Product

2. About This Product

2.1 Models and Model Number Designation

ELDFHG	- 06	- 350	- 3C2P	-XY	- E	T	- 10
Series number	Valve size	Rated flow (Valve pres. def. at 1 MPa)	Spool type	Flow direction	Pilot type	Drain type	Design number
ELDFHG: High response type proportional electro-hydraulic directional and flow control valves (sub-plate mounting)	**04**	**280:** 280 L/min	**3C2:** Neutral overlap  **3C40:** Neutral A, B, T connection  **3C2P:** Neutral zero rap 	**XY:** Metered-in/ Metered-out	**None:** Internal pilot **E:** External pilot	**None:** External drain **T:** Internal drain	**10**
	06	**350:** 350 L/min **500:** 500 L/min					

2.2 Specifications

Description \ Model No.		ELDFHG-04-280	ELDFHG-06-350	ELDFHG-06-500
Rated flow (@. P=1 MPa)		280 L/min	350 L/min	500 L/min
Max. operating pressure		35 MPa	35 MPa	31.5 MPa
Proof pressure at return port	External drain	"T" Port: 31.5 MPa "Y" Port: 21 MPa	"T" Port: 35 MPa "Y" Port: 21 MPa	"T" Port: 25 MPa "Y" Port: 21 MPa
	Internal drain ★1	21 MPa		
Pilot pressure ★2		1.5～31.5 MPa		
Pilot flow ★3		Over 16 L/min	Over 16 L/min	Over 19 L/min
Null leakage (Ps=14 MPa, Pp=14 MPa) ★4		"3C2": 3 L/min or less, "3C40": 4 L/min or less, "3C2P": 10 or less L/min		
Step response (0⇔100%) (Pp=14 MPa) (Typical)		13 ms	15 ms	18 ms
Frequency response (±25% F.S. -90 DEG.) (Pp=14 MPa)		46 Hz	66 Hz	39 Hz
Water-proofness		IP64		
Operating temperature range		–15～+60°C		
Spool type		3C2:  3C2P:  (zero rap) 3C40:  ※Spool type is shown under the neutral position.		
Approxmate spool stroke to stops		±5 mm	±5 mm	±7 mm
Main spool end area		7.1 cm^2	8 cm^2	
Solenoid specifications	Current	MAX. 2.5 A		
	Coil resistance	3.9 . (at 20°C)		
Mass		10 kg	18 kg	19 kg
Dedicated amplifier	Spool type: 3C2, 3C40	AMB-EL-04-2-10	AMB-EL-06-3-10	AMB-EL-06-4-10
	Spool type: 3C2P	AMB-EL-04-2P-2-10	AMB-EL-06-2P-3-10	AMB-EL-06-2P-4-10

Note:
★1 Retun pressure should be less than the actual supply pressure.
★2 Supply pressure of pilot valve should be between 1.5 MPa and 31.5 MPa, and should exceed 60% of the actual supply pressure to main valve.
★3 Pilot flow is caculated with the above step response time at pilot pressure 14 MPa.
★4 Added up leakage of main and pilot spools are stated. "3C2", "3C40" or "3C2P" shown is the spool type.

The performance values listed in the above table are obtained when the valve is optimized in combination with the dedicated amplifier. Also refer to the instruction manual of the dedicated amplifier (AMB-EL-※-※-10).

2.3 External Dimensions

2.3.1 ELDFHG-04-280-※-※-※-10

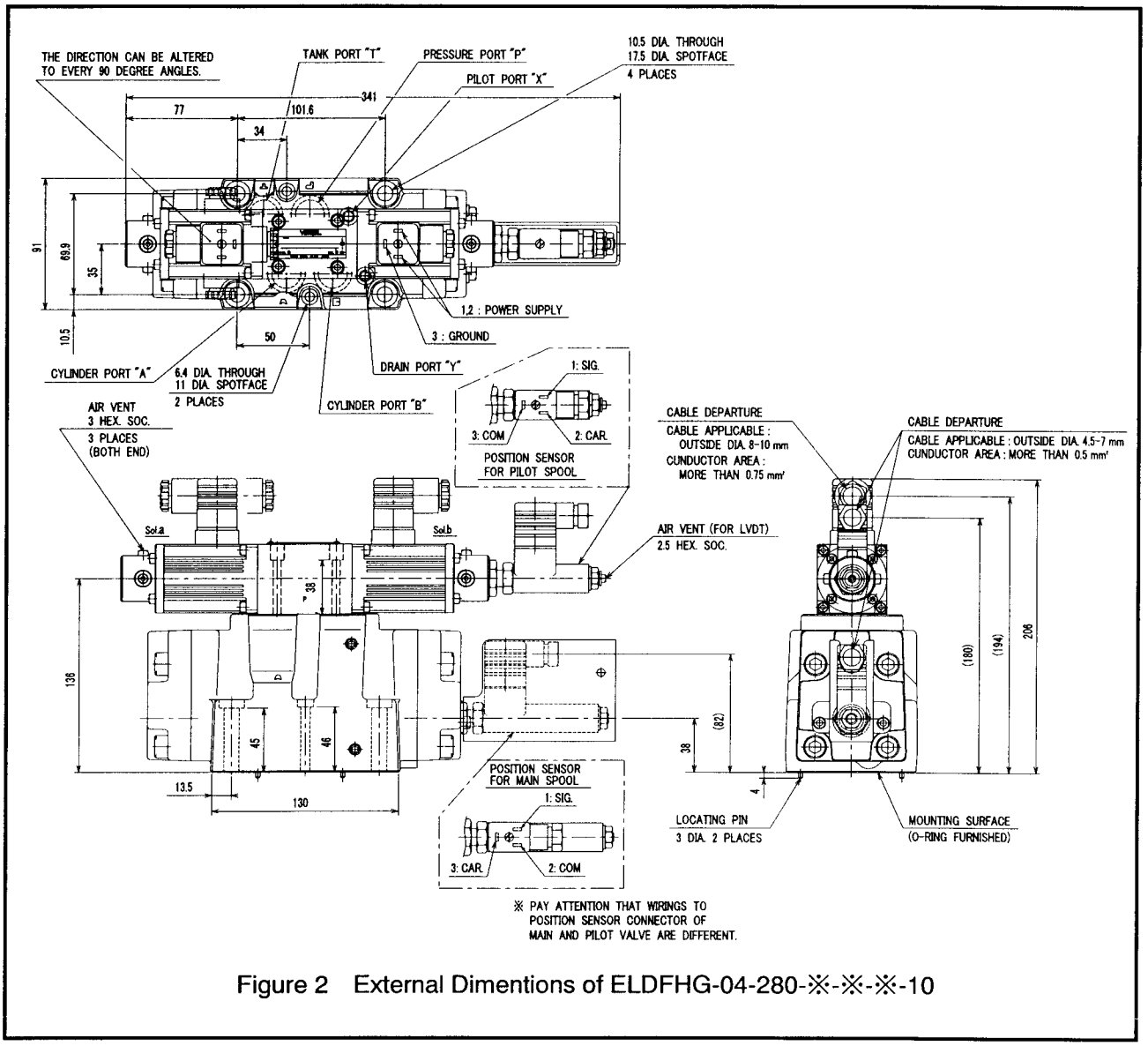


Figure 2 External Dimentions of ELDFHG-04-280-※-※-※-10

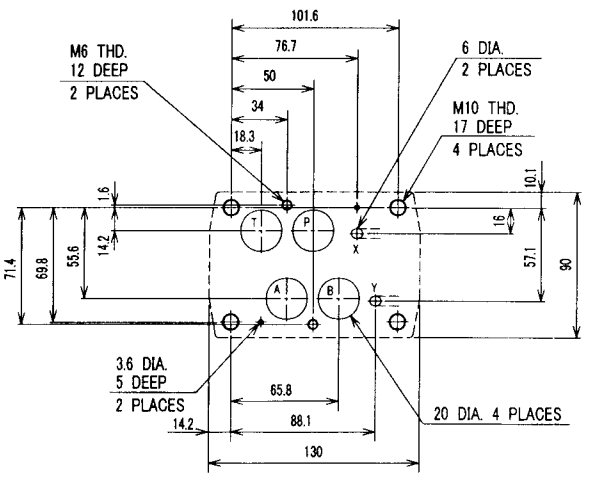


Figure 3 Dimensions of Valve Mounting Surface for ELDFHG-04-280-※-※-※-10

2.3.2 ELDFHG-06-350/500-※-※-※-10

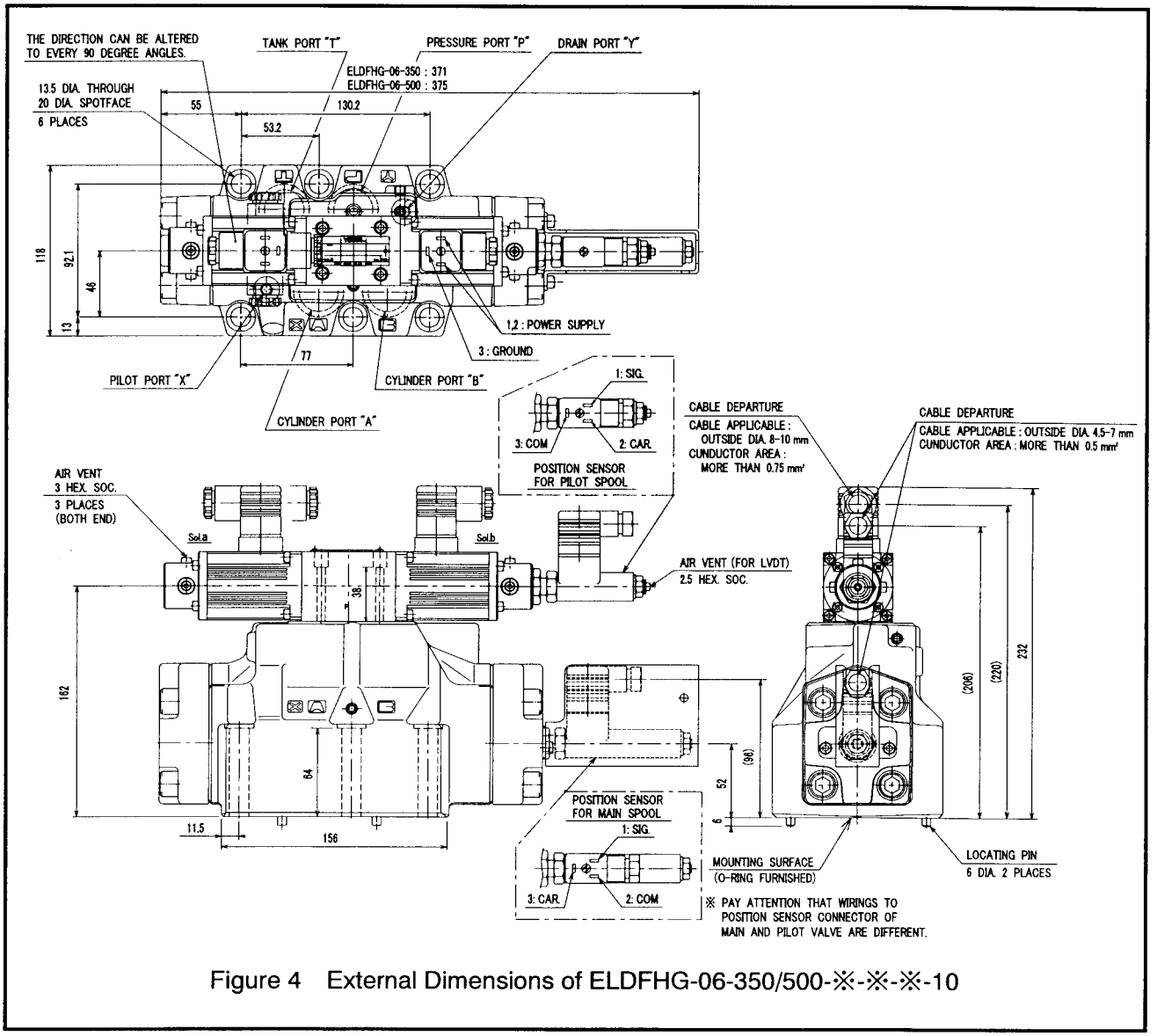


Figure 4 External Dimensions of ELDFHG-06-350/500-※-※-※-10

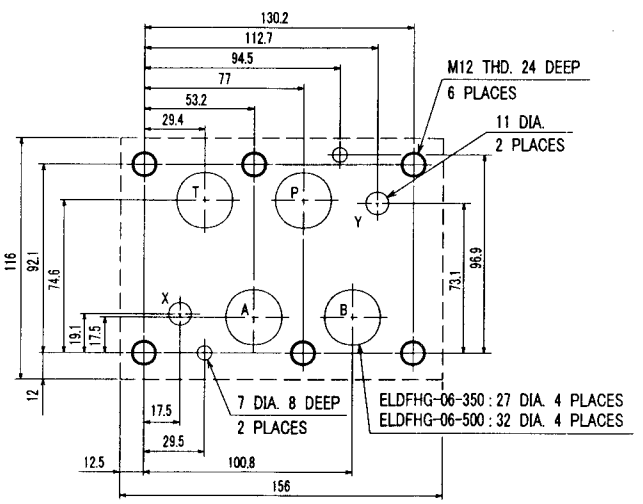


Figure 5 Dimensions of Valve Mountingf Surface for ELDFHG-06-350/500-※-※-※-10

3. Valve Installation

3.1 Valve Mounting Surface

The mounting surface of this valve conforms to the specifications shown in the table below. Refer to the Dimensions of Valve Mounting Surface in Section 2.3 and the External Drawing for detailed mounting dimensions. The mounting surface should be finished at a surface roughness level of about 6-S (0.4a).

Model number	Mounting surface
ELDFHG-04-280	Conforms to ISO 4401-AD-07-4-A (*Note)
ELDFHG-06-350/500	Conforms to ISO 4401-AE-08-4-A (*Note)

Note: This case may exhibit higher pressure drop and lead to insufficient rated flow. Use of the port diameter as indicated in Section 2.3 (Dimensions of Valve Mounting Surface) and the External Drawing is recommended.

3.2 Required Tools

Prepare the following tools.

Model number	Tool name	Application
ELDFHG-04-280	Hexagonal wrench (Width across flat 5 mm)	For valve mounting bolts (M6)
	Hexagonal wrench (Width across flat 8 mm)	For valve mounting bolts (M10)
ELDFHG-06-350/500	Hexagonal wrench (Width across flat 10 mm)	For valve mounting bolts (M12)
ELDFHG-※	Phillips screwdriver (for M3 screws)	For plug-in connector fastening screws

3.3 Checking the Valve Mounting Surface

⚠CAUTION

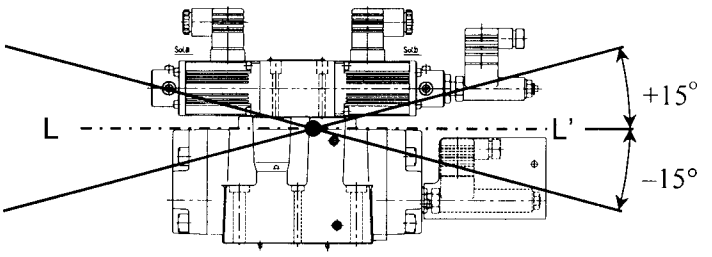
◆Any scratches on the valve mounting surface may result in oil leaks. Take particular care not to scratch the valve mounting surface.

◆The O rings may be damaged if not fitted correctly, resulting in oil spurting out. Make sure whether the O rings are correctly positioned in the O ring grooves.

3.4 Installation Posture

Install the valve such that axis line L-L' shown below is angled within approximately ±15 degrees from the horizontal plane.

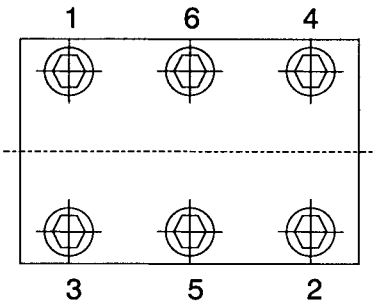
⚠CAUTION



3.6 Mounting

Before mounting the valve, check the port positions with the installation drawing. If the valve is forced to be mounted in a wrong direction, the equipment to be controlled by the valve will not work correctly.

To mount the valve, use the six hexagon socket head bolts supplied with the product. Tighten them two or three times evenly, in the 1 → 2 → 3 → 4 → 5→ 6 → 1 order as shown below. For the bolt tightening torque, see the recommended range shown below.



Tighten each bolt along the diagonal lines and in the order 1 → 2 → 3 → 4 → 5 → 6 → 1.

Figure 6 Bolt Tightening Order

Model number	Mounting bolt	Tightening torque
ELDFHG-04-280	M6	8.5～15.9 N·m
	M10	39.9～74.1 N·m
ELDFHG-06-350/500	M12	68.5～127.1 N·m

⚠WARNING

◆When installing the valve, be sure to use all of the six mounting bolts and tighten them within the specified torque range. Omitting any of the six bolts or applying an out-of-range tightening torque may break bolts or let hydraulic fluid spout, resulting in a serious accident.

⚠CAUTION

◆Do not mount the valve forcibly in a wrong direction, otherwise the equipment will not work correctly, resulting in a serious accident.
◆The valve is a precision device. Handle it with care.
◆Do not mount the valve with any foreign matter left between the valve and the mounting surface or with an O-ring off the groove. Doing so will damage the O-ring and let hydraulic fluid spout, resulting in injury or a fire.

4. Wiring the Valve

Wiring shown in Figure 7 is required to connect the valve and the dedicated amplifier (AMB-EL-※-※-10) before driving this valve.
The length of the wire should be 30 m at maximum.

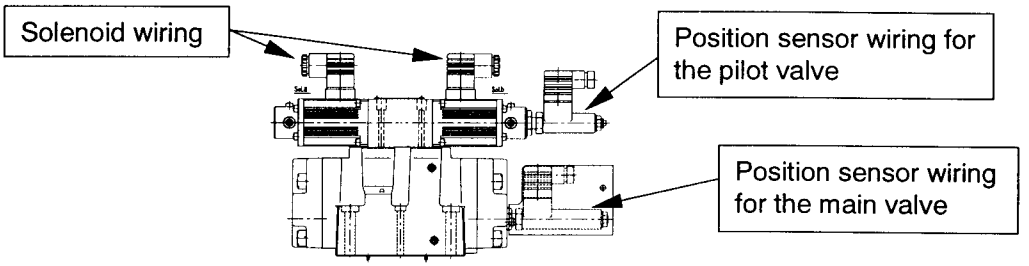


Figure 7 Wiring Position of the Valve

⚠CAUTION

◆Be careful not to miswire by taking the pilot valve position sensor for the main valve position sensor.
◆The wire connection with the position sensor connector for the main valve differs from that for the pilot valve. For more details, refer to Sections 4.2 and 4.3, and the instruction manual for the dedicated amplifier.

4.1 Wiring Solenoid

4.1.1 Cable for Wiring Solenoid

[Recommended cables]

Select from the cables equivalent to the following specifications, according to the operating environment.

JCS-271 microphone-oriented, vinyl-insulated, shielded cable (MVVS)
JIS C-3306 vinyl-insulated, shielded cable (VCTF)
JIS C-3401 control-oriented vinyl-insulated, shielded cable (CVVS)

- Number of cores: 2 (3-core cables are required when connecting to the ground terminal.)
- Finished outside diameter: 8 to 10 mm
- Nominal conductor sectional area: 0.75 mm^2 or above

⚠CAUTION

◆Be sure to use shielded cables as recommended above or equivalents for avoiding noise effects from the surroundings.
◆When shielded cables are used, connect them to Terminal b32 (FG) of the dedicated amplifier.

4.1.2 Disassembling (Refer to Figure 8)

(1) Loosen screw ① and pull the connector in the direction of screw ① to remove the connector from the coil.
(2) Remove screw ①. Store gasket ② not to lose it.
(3) Insert a small flathead screwdriver in the slot at the bottom of terminal block ③ and remove case ④ from terminal block ③ while prying the slot gently.
(4) Remove cable gland ⑤ and take out washer ⑥ and packing ⑦.

4.1.3 Wiring (Refer to Figure 8)

(1) Thread cable ⑧ into cable gland ⑤, washer ⑥ and packing ⑦ in this order and insert the cable into case ④ through the electrical conduit.

(2) Peel the sheath off about 30 mm from the end of cable ⑧ and terminate the core appropriately, for example, by attaching a crimp terminal.
The crimp terminal must fit the nominal sectional area of the wire to be used and be equivalent to a JIS C 2805 conforming product (nominal size of screws used: 3.5).

(3) Remove screw ⑨ with washer from terminal block ③, wire it as shown in Figure 8, then reapply and tighten screw ⑨ with washer.
Refer to Figure 9 for the position and name of the terminal block.

(4) Refer to Figure 10 for wiring of the terminal block and the amplifier terminal.

4.1.4 Assembling (Refer to Figure 8)

(1) Put wired terminal block ③ back in case ④ and push it until it clicks.
The connector direction can be changed freely depending on the way terminal block ③ is assembled at this step.

(2) Put packing ⑦ and washer ⑥ in to the cable inlet in this order and tighten cable gland ⑤ securely.

(3) Fit the connector onto the terminal of the coil with gasket ② inserted in between.

(4) Insert screw ① into the connector from above and tighten the screw.

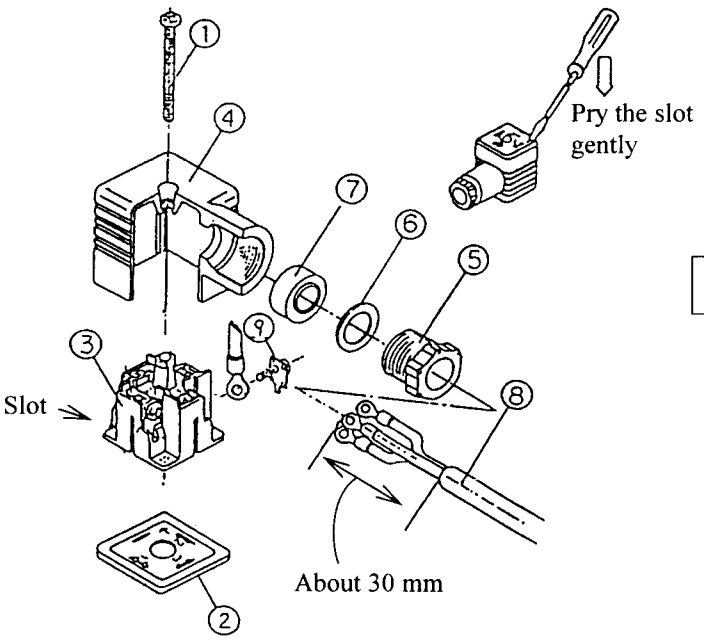


Figure 8 Plug-in Connector

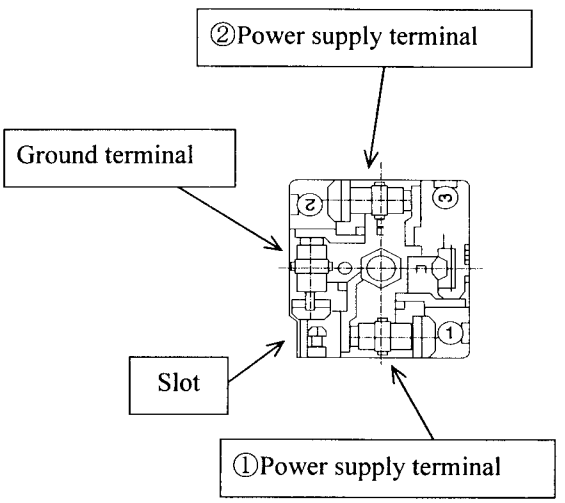


Figure 9 Terminal Block and Part Names

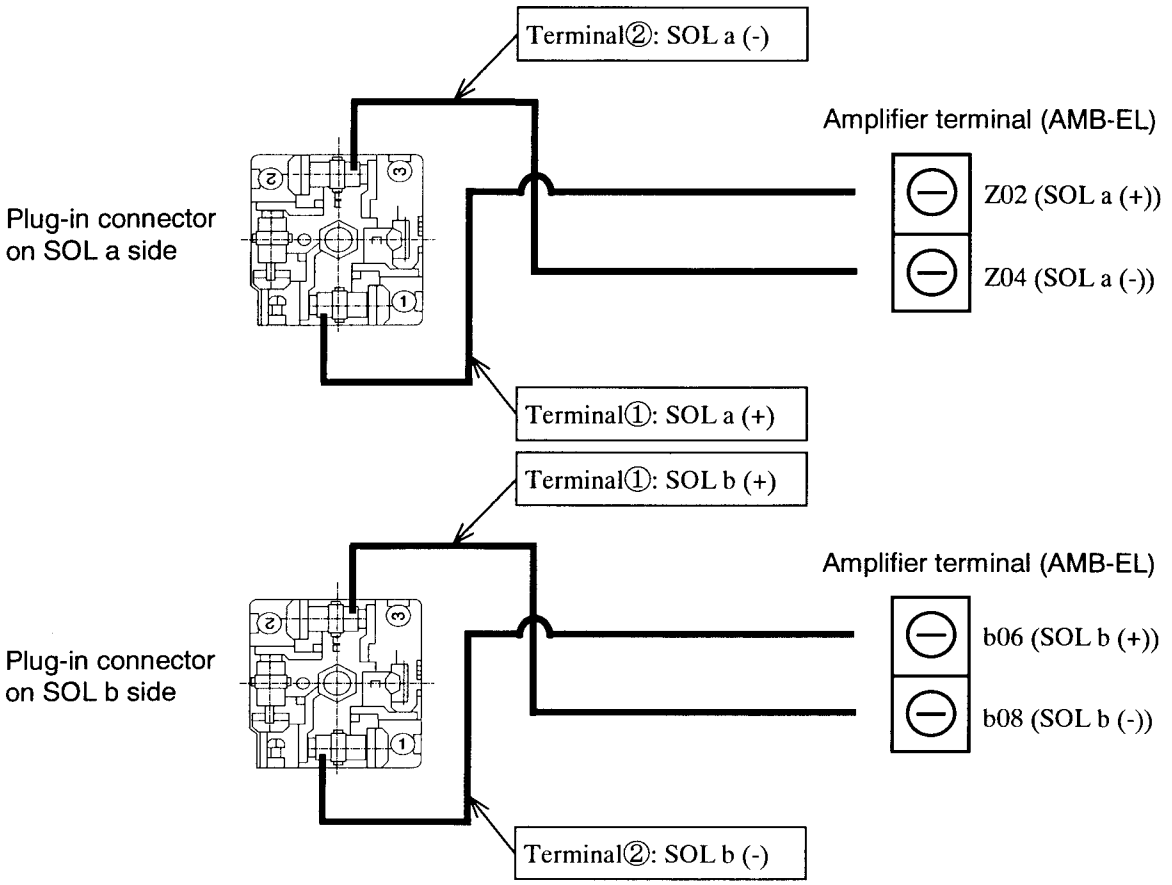


Figure 10 Terminal Block and Amplifier Terminal

4.2 Wiring the Pilot Valve Position Sensor

4.2.1 Cable for Wiring the Pilot Valve Position Sensor

[Recommended cables]

Select from the cables equivalent to the following specifications, according to the operating environment.

JCS-271 microphone-oriented, vinyl-insulated, shielded cable (MVVS)

JIS C-3306 vinyl-insulated, shielded cable (VCTF)

JIS C-3401 control-oriented, vinyl-insulated, shielded cable (CVVS)

- Number of cores: 3
- Finished outside diameter: 4.5 to 7 mm
- Nominal conductor sectional area: 0.5 mm^2 or above

⚠CAUTION

◆Be sure to use shielded cables as recommended above or equivalents for avoiding noise effects from the surroundings.

4.2.2 Wiring

Connect the pilot valve position sensor by using the plug-in connector attached to the product. Terminate the cores of the cables appropriately, and fasten them with screws attached to the plug-in connector. See Figure 11 for wiring between the plug-in connector and the amplifier terminals.

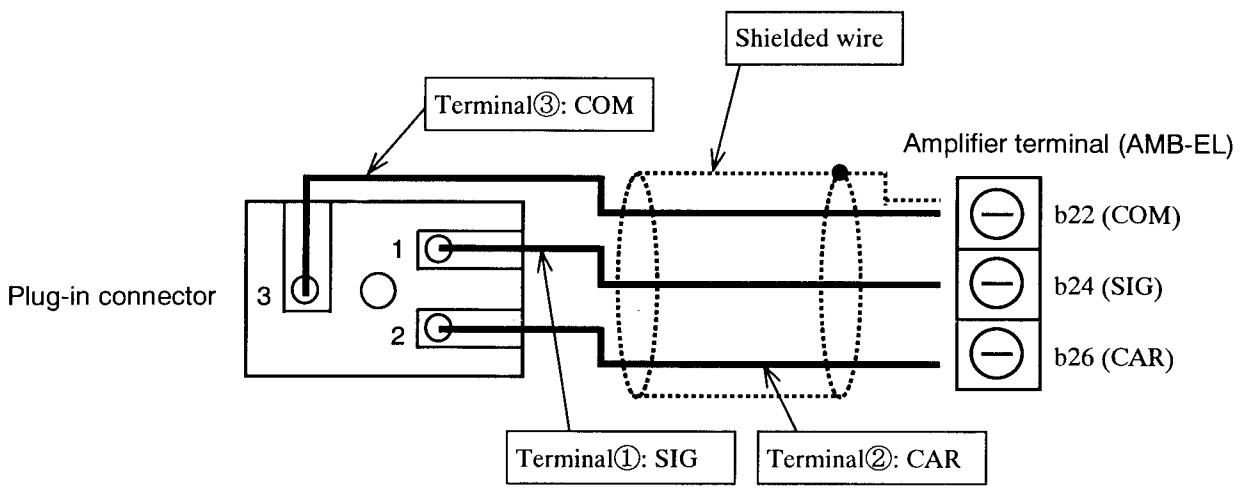


Figure 11 Wiring between the Pilot Valve Position Sensor and the Amplifier Terminal

4.3 Wiring the Main Valve Position Sensor

4.3.1 Cable for Wiring the Main Valve Position Sensor

[Recommended cables]

Select from the cables equivalent to the following specifications, according to the operating environment.

JCS-271 microphone-oriented, vinyl-insulated, shielded cable (MVVS)

JIS C-3306 vinyl-insulated, shielded cable (VCTF)

JIS C-3401 control-oriented, vinyl-insulated, shielded cable (CVVS)

- Number of cores: 3
- Finished outside diameter: 4.5 to 7 mm
- Nominal conductor sectional area: 0.5 mm^2 or above

⚠CAUTION

◆Be sure to use shielded cables as recommended above or equivalents for avoiding noise effects from the surroundings.

4.3.2 Wiring

Connect the main valve position sensor by using the plug-in connector attached to the product. Terminate the cores of the cables appropriately, and fasten them with screws attached to the plug-in connector. See Figure 12 for wiring between the plug-in connector and the amplifier terminals.

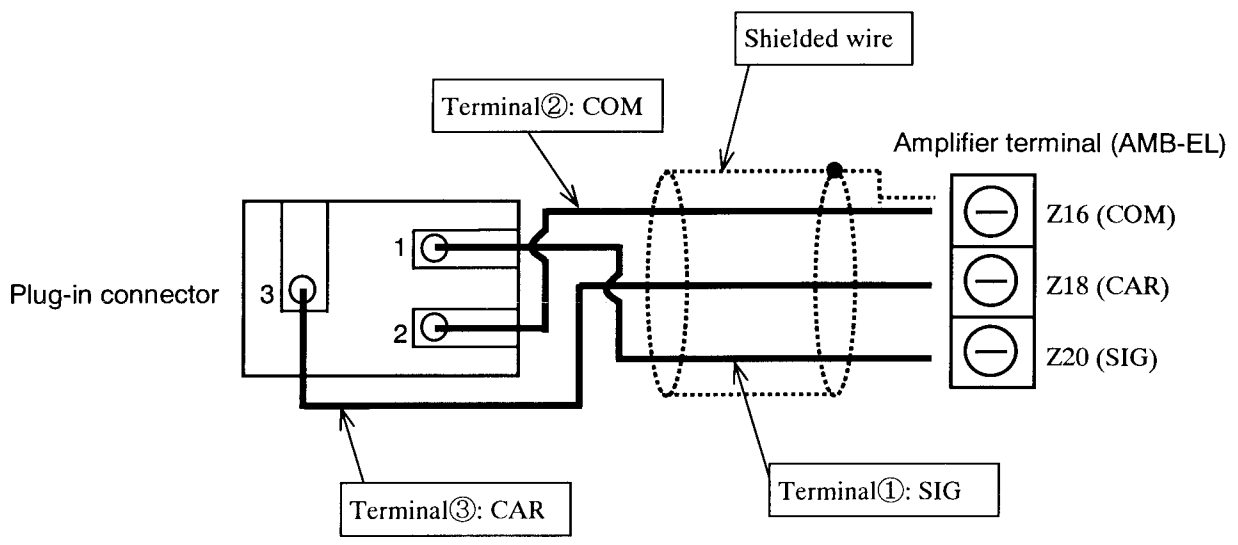


Figure 12 Wiring between the Main Valve Position Sensor and the Amplifier Terminal

⚠DANGER

◆Do not perform wiring with the power on. Doing so will result in electric shock, burns or death.

⚠WARNING

◆Be sure to ground the equipment to prevent an electric shock.

◆Do not connect an improper input power supply. Doing so may cause overheating which could result in a fire.

⚠CAUTION

◆Do not use any wiring material thinner than as specified. Otherwise, the wire may burn, causing a fire.

◆Do not apply an excessive force to wiring cables. Doing so may cause an unexpected accident such as disconnection of the wiring cables. Conduct wiring so that no excessive force is applied to the wiring cables.

⚠CAUTION

◆Applying an excessive force to the cable can cause an unexpected accident such as disconnection. Conduct wiring without applying an excessive force to the wiring cables.

◆Fix the cable conductors securely, for example, with crimp terminals to prevent an unexpected accident such as disconnection.

◆Connect the position sensor securely to the amplifier while checking the Installation Drawing of the amplifier. Failure to do so may cause the position sensor to malfunction.

5. Operation

5.1 Adjustment

The zero-point adjustment of the positioning sensor is completed already. So, never operate or adjust the positioning sensor.

Adjust null point for the actuator by setting the null volume of the dedicated amplifier (AMB-EL-※) to NULL.

5.2 Operating Environment

- This product is intended to be used to switch the connection of the hydraulic circuit in a hydraulic system and to control the flow rate and pressure of hydraulic fluid.
- To ensure stable operation of this product and the hydraulic circuits, bleed the air from the hydraulic circuits completely.
- For stable operation of this product, employing a configuration of external pilot and external drain is recommended.
- For stable operation of this product, loosen an air vent of the solenoid to bleed the air in it and to fill the solenoid case with oil. Perform air bleeding in unloaded state.
- Be sure to fill the Tank port always with the hydraulic fluid. When the external drain is employed, the pipe must be equipped with an approx. 0.04 MPa check valve to fill the pipe with the hydraulic fluid, which ensures stable backpressure.
- The total wiring length for the valve should be within 30 m and without suffering noise. If the wiring length exceeds the above limit due to long wiring between the valve and the dedicated amplifier (especially due to long sensor cables), the null adjustment with the amplifier cannot be performed within the specified range, where stable valve characteristics may not be ensured.
- Please contact YUKEN KOGYO in case of using the product with its wiring length over 30 m.
- In some operating environment, the noise generated by the solenoid in this product may affect peripheral electronic devices. To avoid this, use shielded cables for wiring.
- For ensuring safety, apply separate safety circuits to maintain or stop the hydraulic actuator at occurrence of momentary stop and restart of the hydraulic system.
- Do not use the product with the tank port left dry.
- Do not connect the tank port to any line in which surge pressure is generated. Doing so can cause a malfunction or fault.
- Environment conditions such as water resistance and vibration must be within their respective ranges specified in Section 5.3.
- The viscosity and oil temperature of hydraulic fluid must be within their respective ranges specified in Section 5.4. The ambient temperature must be –15 through 60°C, without condensation.
- Operating environment such as the ambient temperature must be within their respective ranges specified in this manual. If any of them falls outside the specified range, the product may not operate normally.

⚠CAUTION

◆For the structural reason, this product has an internal leak. The internal leak may cause the actuators of the equipment to move.
◆The solenoid of this valve may generate electrical noise which may affect peripheral electronic devices.
◆The valve may become hot during operation. Do not touch the valve (especially the coil) during or immediately after use to prevent you from getting burnt.

5.3 Water, Dust and Vibration Resistance

The product has capabilities conforming to the standards listed in the following table.
(The capabilities have been evaluated by YUKEN KOGYO.)

Item	Standard	Category	Description	
Water & Moisture	JIS F 8001 Waterproofing testing rules for electrical equipment intended for marine applications	Level 1 water spray	Equipment is waterproof against water droplets	
		Level 2 water spray	Equipment is splashproof	
	JIS D 0203 Moisture-proofing and waterproofing testing rules for automotive parts	Moisture test M1	Test operation of part with respect to moisture	
		Moisture test M2	Test operation of part with respect to high temperature and humidity	
		Water spray test R1	Test operation of part in presence of water droplets	
		Water spray test R2	Test operation of part subject to indirect wind, rain and splashing	
	JIS C 0920 Waterproofing testing rules for electrical equipment parts and wiring materials	Waterproof against water droplets	No adverse effect due to water droplets falling from within 15° of vertical.	
		Rain-proof	No adverse effect due to rain falling from within 60° of vertical.	
		Splashproof	No adverse effect due to water droplets from any direction.	
		Humidity-proof	Able to be used in environments with relative humidity of 90% or more.	
	International Electrotechnical Commission (I.E.C) PUBL. 529	Level 2 protection: Waterproof against water droplets (2)	No adverse effect due to water droplets falling from within 15° of vertical.	
		Level 3 protection: Rain-proof	No adverse effect due to rain falling from within 60° of vertical.	
		Level 4 protection: Splashproof	No adverse effect due to water droplets from any direction.	
Dust	International Electrotechnical Commission (I.E.C) PUBL. 529	Level 5 protection	Ingress of a small quantity of dust does not affect normal operation.	
		Level 6 protection	Fully protected from ingress of dust.	
Vibration	JIS C 0911 Vibration testing procedures for small electrical equipment	Resonance test (IC)	Vibration range: 7 to 59.5 Hz, Amplitude 0.1 mm	
		Fixed-frequency durability test (IIC)	Frequency: 20 Hz	Class 1: Amplitude 0.5 mm
				Class 2: Amplitude 1.2 mm
				Class 3: Amplitude 1.8 mm
				Class 4: Amplitude 2.4 mm
		Variable-frequency durability test (IIIC)	Frequency range: 7 to 59.5 Hz	Class 1: Amplitude 0.3 mm
				Class 2: Amplitude 0.5 mm
				Class 3: Amplitude 0.75 mm

Note: If the valve is used outdoors where it is directly exposed to water or rain, protect it, for example, by applying a cover.

5.4 Hydraulic Fluid

5.4.1 Type

Mineral based hydraulic fluid: ISO VG32 or 46 or equivalent.

5.4.2 Viscosity and Fluid Temperature

Use hydraulic fluid within the following operating ranges of viscosity and fluid temperature:

Viscosity: 15 to 400 mm^2/s

Fluid temperature: –15 to 60°C

Note that the recommended fluid temperature range is 40 to 50°C.

5.4.3 Preventing Foreign Matters

Foreign matters in the hydraulic fluid can often affect normal operation of the valve. Always keep the hydraulic fluid clean (contamination level within class NAS 10) and use 20-micrometer or less line type filters.

Note: Do not use hydraulic fluid contaminated foreign matters, or it causes a malfunction or fault.

⚠CAUTION

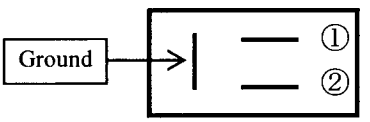
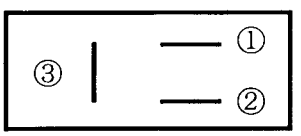
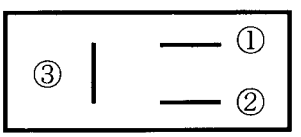
◆Do not use hydraulic fluid contaminated foreign matters, or it causes a malfunction or fault.

6. Maintenance and Troubleshooting

6.1 Maintenance

- This valve does not require periodic disassembling inspection as long as it is used normally.
- The lifespan of O-rings is about 2 to 3 years depending on the valve operating conditions. Keep spare O-rings for replacement in case of oil leak.
- Foreign matters in the hydraulic fluid often affect normal operation of the valve, resulting in a fault or shortened life.
- Always keep the hydraulic fluid clean (contamination level within class NAS 10), use 20-micrometer or less line type filters, and periodically inspect and clean the entire line.
- Letting water in petroleum based hydraulic fluid shortens the life of the valve. Take appropriate action such as periodically draining the tank.
- Letting air in the hydraulic circuit affects normal operation of the valve. Bleed air from the circuit sufficiently.

6.2 Troubleshooting

Problem	Cause	Action
The valve does not operate.	Source voltage is not supplied to the amplifier.	Supply power to the amplifier.
	Pilot pressure is not supplied.	Supply pilot pressure to the valve.
	Incorrect pilot type for the valve	Check the model number.
	Miswiring or disconnection of the position sensor cable and the solenoid cable	Wire them as shown in the amplifier wiring diagram.
	No input signal	Input the signal. (Prior to the delivery, this product has been adjusted to achieve rated strokes when ±10 V is input.)
	Is the resistance value of the solenoid (coil) normal?	Remove the plug-in connector, and measure the resistance of the coil. Normal resistance between ① and ②: Approx. 3.9Ω (20°C)  If the resistance of the coil is abnormal, contact our service desk for repair.
	Is the resistance value of the pilot valve position sensor normal?	Remove the plug-in connector, and measure the resistance of the pilot valve position sensor. Normal resistance between ① and ②: Approx. 31.5Ω (20°C) Normal resistance between ① and ③: Approx. 31.5Ω (20°C) Normal resistance between ② and ③: Approx. 45.5Ω (20°C)  If the resistance of the position sensor is abnormal, contact our service desk for repair.
	Is the resistance value of the main valve position sensor normal?	Remove the plug-in connector, and measure the resistance of the main valve position sensor. Normal resistance between ① and ②: Approx. 35Ω (20°C) Normal resistance between ① and ③: Approx. 35Ω (20°C) Normal resistance between ② and ③: Approx. 56Ω (20°C)  If the resistance of the position sensor is abnormal, contact our service desk for repair.

<table>
<tr><th>Problem</th><th>Cause</th><th>Action</th></tr>
<tr><td>The valve does not operate as ordered.</td><td>No signal is input.</td><td>Input the following signals and verify the main valve spool sensor monitoring voltage of the amplifier.<table><tr><td>Signal between Z10 (+) and Z12 (-)</td><td>Main Valve Spool Sensor Monitoring Voltage (Between Z30 and COM)</td></tr><tr><td>0 V</td><td>0 V (neutral position)</td></tr><tr><td>+10 V</td><td>+10 V (Flow in the direction of P→B→A→T)</td></tr><tr><td>-10 V</td><td>-10 V (Flow in the direction of P→A→B→T)</td></tr></table>※The amplifier has been adjusted as above before delivery.</td></tr>
<tr><td></td><td>Miswiring or disconnection of the position sensor cable and the solenoid cable.</td><td>Wire them as shown in the amplifier wiring diagram.</td></tr>
<tr><td></td><td>Incorrect combination of the valve and the amplifier.</td><td>Verify the external dimensions of the valve and the amplifier, and connect them properly.</td></tr>
<tr><td></td><td>Insufficient power source capacity.</td><td>Verify the output of the power source.
Recommended power source:
DC24V (3.1A at its peak), 75W or more</td></tr>
<tr><td>Abnormal noise comes out of the valve.
(Too much noise)</td><td>Miswiring or disconnection of the position sensor cable.</td><td>Wire them as shown in the amplifier wiring diagram.</td></tr>
<tr><td></td><td>The wiring between the valve and the amplifier is affected with noise.</td><td>(1) Refer to Section 4 for wiring of the valve. Use cables equivalent to those recommended in Section 4.
(2) Wire them as shown in the amplifier wiring diagram.
(3) Verify if wiring is close to equipment which generates noise.</td></tr>
<tr><td></td><td>The valve sensors and the amplifier are miswired by taking the main valve as the pilot valve.</td><td>Wire them as shown in the amplifier wiring diagram.</td></tr>
<tr><td>An alarm occurred.</td><td>Miswiring or disconnections of the position sensor cables and the solenoid cable</td><td>Wire them as shown in the amplifier wiring diagram.</td></tr>
<tr><td></td><td>Main valve or pilot valve spool is locked due to contamination or foreign matters in the hydraulic fluid.</td><td>(1) Refer to the actions for "The valve does not operate as ordered." Input signals and measure the main valve spool sensor monitoring voltage at the amplifier. If the monitoring voltage is abnormal, contact our service desk for repair.
(2) Verify the contamination level of the hydraulic fluid. Perform flushing or replace the current fluid with new one if the contamination level is high.</td></tr>
<tr><td>The actuator works in the reverse direction.</td><td>Signals from the amplifier are input to the port for negative signals, and vice versa.</td><td>Wire them as shown in the amplifier wiring diagram.</td></tr>
<tr><td></td><td>The hydraulic pipes are connected incorrectly by taking Port A as Port B.</td><td>Verify the connection of the hydraulic pipes. Take appropriate actions.</td></tr>
<tr><td>The actuator vibrates.</td><td>Air remains in the valve or in the hydraulic circuit.</td><td>Bleed the air from all the hydraulic circuits.</td></tr>
<tr><td></td><td>The solenoid case is not filled with the fluid sufficiently.</td><td>Loosen the air vent for the solenoid to bleed the air. Air bleeding must be performed in unloaded state.</td></tr>
<tr><td></td><td>The wiring between the valve and the amplifier is affected with noise.</td><td>(1) Refer to Section 4 for wiring of the valve. Use cables equivalent to those recommended in Section 4.
(2) Wire them as shown in the amplifier wiring diagram.
(3) Verify if wiring is close to equipment which generates noise.</td></tr>
<tr><td>Fluid leaking outside</td><td>Loose mounting bolt</td><td>Tighten up mounting bolts.</td></tr>
<tr><td></td><td>O-ring damaged or degraded</td><td>Replace the O-ring with a new one.</td></tr>
<tr><td></td><td>Others</td><td>Verify other bolts also if they are not loosened.</td></tr>
</table>

7. Storage

Unused valves as spares or replacements must be stored and managed appropriately in a dedicated location.

To prevent rusting and corroding, avoid the following locations:

- Places subject to high temperature, high humidity, and freeze
- Places to be exposed to the weather
- Places either near chemicals such as organic solvents, acids, and alkalis or subject to the fumes of gases.
- Places with large variations in temperature, possibly causing condensation

8. Disposal

When disposing of this valve, drain hydraulic fluid completely and treat it as a general industrial waste.

9. Service Information

If you have any enquires or servicing requests, please contact the agent from whom you purchased the valve, a YUKEN sales office, or the following office:

- **YUKEN KOGYO CO., LTD.**

  International Business Department (Tokyo office)

  Hamamatsucho Seiwa Bldg., 4-8, 1-chome, Shiba-Daimon
  Minatoku, Tokyo, 105-0012, Japan

  Tel: +81-3-3432-2110

  Fax: +81-3-3436-2344

  URL: http://www.yuken.co.jp

  E-mail: int.bd.@yuken.co.jp

- **Revision history**

  ELDFHG Series High Response Type Proportional Electro-Hydraulic Directional and Flow Control Valves: Instruction Manual

  May, 2004 First edition

- **Published by**

  Yuken Kogyo Co., Ltd.

  Products Publicity Section, Management Planning Office