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## Conditions of use for models accepting fire-resistant hydraulic oil (DS)

Hydraulic oil	Model No.	DS × × P		
		Operating pressure MPa {kgf/cm <sup>2</sup> }		Permissible rotational speed min <sup>-1</sup>
		Maximum	Rated	
General-purpose hydraulic fluid (R&O)				600 to 1800
Wear-resistant hydraulic fluid				600 to 1800
Water-glycol hydraulic fluid		7 {70}	7 {70}	600 to 1200
Phosphate ester hydraulic fluid				600 to 1800
Water/oil emulsion type hydraulic fluid				600 to 1200

## Handing (DS)

### ● Hydraulic oil

- Use a general-purpose hydraulic oil (R&O) or wear-resistant hydraulic oil that satisfies the viscosity grades given below.
- For fluids used with a vane pump, a viscosity in the range 20 to 90 mm<sup>2</sup>/s (at VG32, 19 to 52°C) is generally appropriate and operation in the range 10 to 220 mm<sup>2</sup>/s (at 5 to 74°C) is possible.
- Maintain the fluid temperature inside the tank in the range 10 to 45°C when using a water-glycol hydraulic fluid or water/oil emulsion type hydraulic fluid.
- Contamination of the hydraulic fluid causes pump trouble and reduces the service life, so pay due attention to controlling contamination and ensure that it goes no higher than NAS contamination class 9.

	DS series
Viscosity grade	ISO VG32, 46

### ● Installation and alignment

- Ensure that the eccentricity of the drive shaft and pump shaft is no greater than 0.05 mm (TIR), and run the pump with no force acting perpendicularly on the pump shaft.  
Misalignment between the shaft centers will cause damage to bearings and oil seals, generate noise and vibration, and lead to pump accidents.
- Avoid crosswise drive using a belt, chain or gears (it will cause noise generation or damage to the bearings).
- The pump shaft can be installed vertically.

### ● Filters

- Use a suction filter with 150 meshes per inch at the inlet side.
- In the return line to the tank at the discharge side, use a line filter with a filtration accuracy of 25 μm or better.

### ● Piping

- Ensure the suction port is airtight. Aeration will cause abnormal noise.
- When using steel pipes for piping, take care not to force the pump off center.  
Forcing the pump off center with pipes may cause abnormal noise.

## Handling (DS)

- **At start**
  - After checking that all hydraulic circuits and electrical circuits are ready for operation, set the hydraulic circuit at the load side in the no-load status or connect an unloading circuit before starting the pump.
  - Check that the pump rotates in the direction of the arrow showing the direction of rotation.
  - At the start of operation, rotate the motor at 950 min<sup>-1</sup> minimum. A higher rotational speed is required at the start of operation because no hydraulic pressure has been built up.
  - When the pump is driven for the first time, turn the power switch to the motor on and off a few times to let the air out of the piping and then run it continuously at full speed.
  - At a fluid temperature of 7°C or lower, warm up the pump by running it at a pressure of 2 MPa {20 kgf/cm<sup>2</sup>} maximum and increase the pressure when the fluid temperature has risen.
  - If there is a temperature difference of 20°C or greater between the pump and fluid, warm up the pump to reduce the temperature difference to within 20°C before running it.

- **Suction pressure**
  - Keep the suction pressure within the permissible suction pressure of the pump.
  - High suction pressures will generate cavitation and cause damage to the parts, noise, and vibration, resulting in a shorter pump service life.

	DS series	
	Hydraulic oil (1)	Hydraulic oil (2)
Suction pressure kPa {mmHg}	-26.7 {-200}	-13.3 {-100}

(1) General-purpose hydraulic fluid (R&O), wear-resistant hydraulic fluid  
 (2) Water-glycol hydraulic fluid, water/oil emulsion type hydraulic fluid, phosphate ester hydraulic fluid

- **Rated pressure**
  - The rated pressure refers to the maximum pressure at which the product can be operated continuously.
- **Maximum operating pressure**
  - The maximum operating pressure refers to the maximum pressure at which the product can be operated where the duration of operation is restricted.
  - Restrict the duration of operation at the maximum operating pressure to within 10% of the total operating time and within 6 seconds per minute.