

Conditions of use for models compatible with flame-resistant hydraulic oil (DE, DEV)

Hydraulic oil	Model No.		DE10-1 to 5			DE10-6, 7			DE20-6 to 9			DE20-11 to 13		
	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹		
	Maximum	Minimum		Maximum	Minimum		Maximum	Minimum		Maximum	Minimum			
Wear-resistant hydraulic fluid	17.2	0.7	600 to 1800	13.8 to 15.2	0.7	600 to 1800	17.2	0.7	600 to 1800	15.2 to 17.2	0.7	600 to 1800		
Water-glycol hydraulic fluid	12.2	0.7		12.2	0.7		12.2	0.7						
Water/oil emulsion type hydraulic fluid	10.1	0.7		10.7	0.7		10.7	0.7						
Phosphate ester hydraulic fluid	13.5	0.7		13.5	0.7		13.5	0.7						

Hydraulic oil	Model No.		DEV20			DEV25			DEV35			DEV45		
	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹	Operating pressure MPa		Permissible rotational speed min ⁻¹		
	Maximum	Minimum		Maximum	Minimum		Maximum	Minimum		Maximum	Minimum			
Wear-resistant hydraulic fluid	13.7 to 20.6	0.7	600 to 1800	17.2	0.7	600 to 1800	17.2	0.7	600 to 1800	17.2	0.7	600 to 1800		
Water-glycol hydraulic fluid	13.7 to 15.9	0.7	600 to 1500	15.7	0.7	600 to 1500	15.7	0.7	600 to 1500	15.7	0.7	600 to 1500		
Water/oil emulsion type hydraulic fluid	6.9	0.7	600 to 1200	6.9	0.7	600 to 1200	6.9	0.7	600 to 1200	6.9	0.7	600 to 1200		
Phosphate ester hydraulic fluid	13.7 to 20.6	0.7	600 to 1800	17.2	0.7	600 to 1800	17.2	0.7	600 to 1800	17.2	0.7	600 to 1800		

Handling (DE, DEV)

● Hydraulic oil

- A viscosity grade of ISO VG32 or ISO VG46 is recommended.
- Avoid using MIL-spec. High Water Base Fluid (HWBF), R&D type hydraulic fluid, or spindle oil.
- 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.
- Recommended contamination level of hydraulic fluid

Operating pressure MPa		Up to 13.7	13.7 to 20.6	Over 20.6
Recommended contamination level	ISO class	20/18/15	19/17/14	18/16/13
	NAS class	10	9	8

Use clean hydraulic fluid that satisfies the recommended contamination level for the operating pressure.

● 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.
- Restrict the clearance between the spigot joint of the flange and the hole to +0.01 to +0.05 mm in diameter.
- Restrict the clearance between the key shaft and the coupling hole to +0.003 to +0.025 mm in diameter.

● 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.
- For delivery pressures of 14 MPa {140 kgf/cm²} or greater, use a line filter with a filtration accuracy of 10 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.

● At start

- Fill inside the pump and the hydraulic system with the hydraulic fluid before starting operation.
- 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 before starting the pump.
- 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 maximum and increase the pressure when the fluid temperature has risen. (Note that the pressure must be 0.7 MPa minimum.)
- 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.
- The discharge pressure must always be larger than the suction pressure.

	Permissible suction pressure MPa	
	Hydraulic fluid (1)	Hydraulic fluid (2)
DE series	-0.017 to 0.068	-0.01 to 0.068
DEV series	-0.017 to 0.14	-0.01 to 0.14

(1) Wear-resistant hydraulic fluid (2) Water-glycol hydraulic fluid, water/oil emulsion type hydraulic fluid, phosphate ester hydraulic fluid

● Maximum pressure

- The rated pressure refers to the maximum pressure at which the product can be operated continuously.

Starting up procedure and points to note (DE, DEV)

- Supply fluid from either the pump's discharge port or suction port before starting the pump. Avoid piping where both of the ports are installed downward. As far as possible, try to arrange the oil tank and the pump such that the oil level in the tank is higher than the pump position. If the oil tank needs to be arranged such that the pump position is lower than the oil level, keep the piping length as short as possible and be sure to supply fluid into the pump casing from either the discharge port or suction port before starting the pump.
- The pump usually starts suctioning and discharging the fluid within two to three seconds after it is started. If no fluid is discharged, check for resistance at the suction side of the pump, aeration, and removal of air at the discharge side.
- Air has to be removed from the hydraulic system to enable suctioning by the pump when starting it for the first time. If it cannot be removed, implement the necessary measures, such as loosening the pipe joint at the discharge side or providing an air bleeding valve to enable removal of air. If the pump does not suction or discharge even after such measures, increasing the rotational speed of the pump may help. Follow the guideline below for the rotational speed of the pump when starting it for the first time.

Guideline for rotational speed of the pump when starting it for the first time

DE series	DEV series
1000 min ⁻¹ minimum	800 min ⁻¹ minimum
If the oil level is lower than the pump position and insufficient priming fluid is supplied at the start, it may be necessary to run the pump at 1500 min ⁻¹ or higher.	If the oil level is lower than the pump position and insufficient priming fluid is supplied at the start, it may be necessary to run the pump at 1000 min ⁻¹ or higher.

When starting the pump at a rotational speed lower than the guideline above, it is advisable to have the oil level in the oil tank higher than the pump position.

- Once the pump has started suctioning and discharging, securely fasten the connections at the discharge side that were loosened earlier. At the initial operation of the pump, run it for 5 to 10 minutes with no load to remove air in the hydraulic system. When the entire system has filled with fluid with the air fully removed, the pump can run under the regular operation conditions.

The operating conditions while the pump is running are as follows.

	DE series	DEV series
Minimum rotational speed	600 min ⁻¹	600 min ⁻¹
Recommended suction pressure	0 to 0.034 MPa	0 to 0.034 MPa
Permissible suction pressure	-0.017 to 0.068 MPa	-0.017 to 0.14 MPa
Recommended hydraulic fluid viscosity	13 to 54 cSt	13 to 54 cSt
Maximum viscosity at start	220 cSt	860 cSt

- When the pump is stopped for a long time, or when building a system where fluid inside the discharge/suction piping of the pump is drained when the pump is stopped, arrange the suction piping of the pump in the direction that prevents the fluid inside the pump casing draining out. By orienting the suction/discharge port upward or sideways, fluid is retained inside the pump on starting it after it has been stopped for a long time, and dry running of the pump can be avoided. When starting the pump after it has been stopped for a long time, follow the procedure and pay due attention to the points to note given above again.
- The condition of fluid inside piping in relation to the time that the pump has been stopped varies depending on the system configuration and conditions of use. However, it is necessary to check that the pump suction fluid and the pressure rises properly after the pump has been stopped for around a week to 10 days. If suctioning at the pump cannot be confirmed, stop the pump and restart it by following the procedure above.