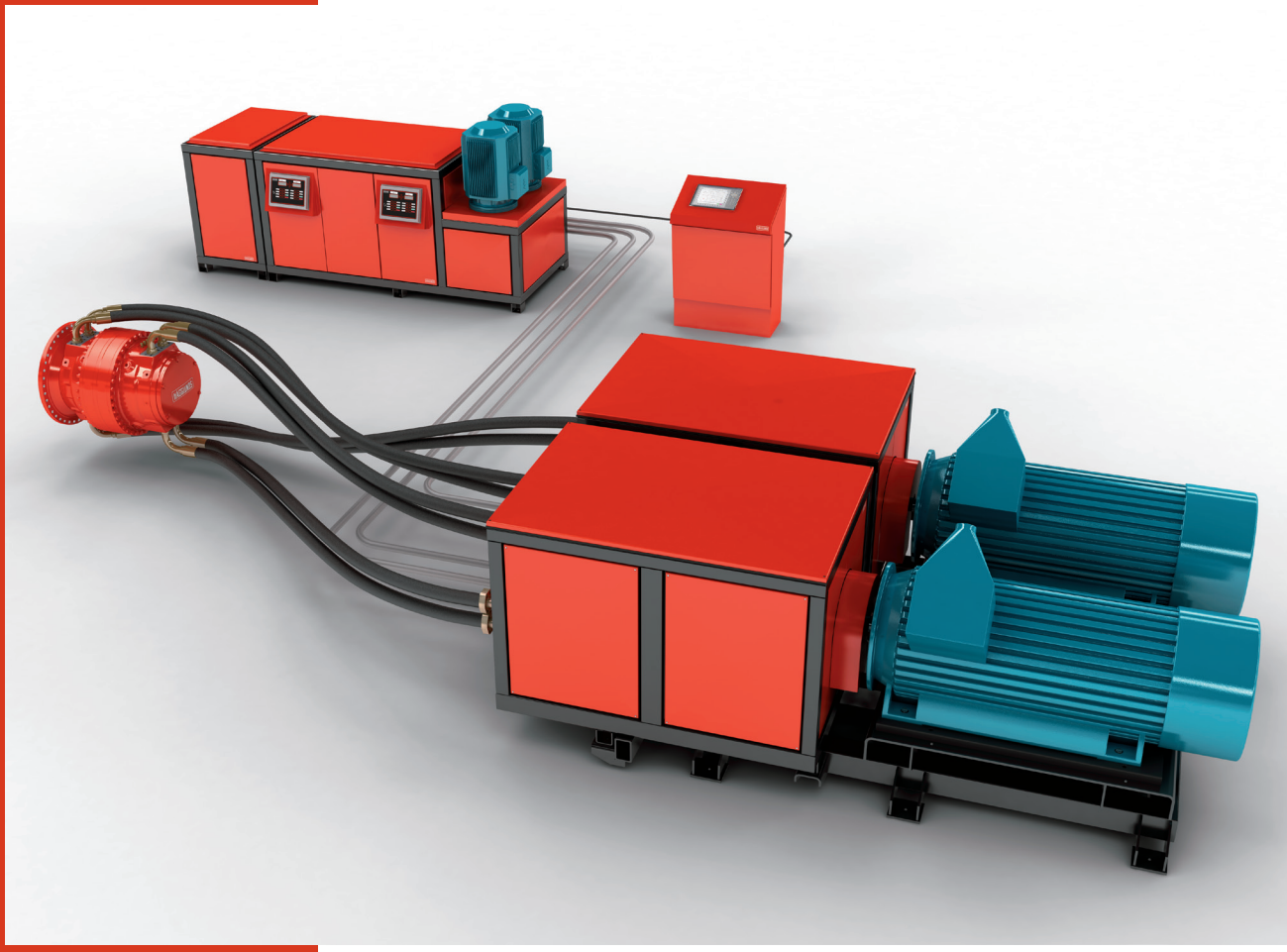
Installation and maintenance manual



Gemini system

HÄGGLUNDS

Installation and Maintenance Manual

Gemini

EN838-2h, 2010

Preface

Hägglunds Drives is one of the worlds leading manufacturers of large hydraulic Drive systems. A leading position, made possible by unbeatable service spirit and of continuing development of both products and markets all over the world. Our drives are to be found in most industrial and marine segments, where there are extremely high demands for efficiency and reliability. Our main office and production plant is in Mellansel, Sweden and we have our own sales- and representation offices in some 40 different countries.

This manual provides necessary information for installation and maintenance of the Gemini unit. In order to find particular information, just search for the wanted section as listed in the table of contents. However, changes in the equipment may occur. We therefore reserve the right to introduce amendments in the manual as we deem necessary without notice or obligations.

Before starting the installation/maintenance, the manual must be read and understood in all respects. All involved personnel shall be in agreement with the Safety precautions which is described in section 1.1.

Original EN838-1h, 2007

Contents

1. General

1.1 Safety precautions

It is of high importance that the Safety precautions are always followed, if you are unsure about something, please do not hesitate to contact your nearest Hägglunds Drives office for advice.

Special Gemini units

Standard Gemini units are not allowed to be used outside an ambient temperature according to table on page 21, or in areas with potentially explosive atmospheres. For lower ambient temperature than 0°C (32°F) and in areas with potentially explosive atmospheres, special Gemini units have to be used.

Gemini units intended for use in areas with potentially explosive atmospheres will be fitted with suitable components for use in such areas and manufactured in accordance with valid rules and standards complying with ATEX-directives or corresponding. Gemini units intended for use in such areas will be marked in a way that shows in which type of areas it can be used.

Warning signs

In this manual you will find the following signs which indicate a potential hazard, which can or will cause personal injury or substantial property damage. Depending on the probability of the hazard, and how serious the injury or property damage could be, there are three levels of classification.

DANGER is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

General

Ensure no admittance to the equipment by unauthorized persons. Only perform measures on the Gemini unit when you are completely familiar with the function of the Gemini unit (including the control system) as well as the complete drive.

Service and repair of the electrical, hydraulic and the mechanical functions, as well as controls and settings require professional service personnel knowledgeable of risks involved.

Safety equipment necessary for the prevention of accidents at the mounting and maintenance shall be provided in accordance with the regulations prevailing in the local country.

Before any measures

- Use the Order code and other attached technical documentation to identify the features of your unique Gemini unit and system.
- Read the attached technical documentation (this manual included) and make yourself familiar with the Gemini unit (control system included) as well as the complete drive.
- Use safety equipment like helmet, protective goggles, safety shoes and hearing protection. **Always** ensure that **no energy is accumulated** before any measures.
- Ensure that all electric power is cut and locked out.
- Ensure that there is no enclosed pressure in the hydraulic system (housing load).
- Ensure that no pressure will enter the hydraulic system in the Gemini unit via the hydraulic motor e.g. loads on the shaft or winch drum.
- If the hydraulic system is used for lift devices, these should be secured, or in the rest position (hanging load).
- Ensure that all accumulators are discharged.

Electricity supply

Safety equipment necessary for the prevention of accidents shall be provided in accordance with the regulations prevailing in the local country.

All electrical supply levels shall be within the limits that the equipment is designed for, see technical documentation and maximum rating plates.

Mounting

Carefully follow the instructions and be aware of the high weights and forces during lifting. Incorrect mounting and setting of electrical, hydraulic and the mechanical functions, as well as controls can cause personal injury or property damage.

Before starting up

Before starting up new, rebuilt or just worked on, applications. All accessories and safety arrangement functions should be controlled/tested.

Maintenance and service

Notice the special maintenance intervals for your specific Gemini unit or the maximum intervals on the maintenance chart (section 5.2) and keep a maintenance log. Regular and correct maintenance and service are necessary conditions for reliable and safe operation.

Use only spare parts recommended and supplied by Hägglunds Drives.

Hydraulic fluid

Notice that most hydraulic fluids can cause personal injury and major damage on the environment. Check the caution sign on the container or consult the supplier. Used hydraulic fluid can contain noxious contaminations. We recommend using the service of professional oil companies for supply and disposal of fluids used. Never dump hydraulic fluid into drainages or water courses.

Bell housing

Note that there are rotating parts inside the bell housing during operation. Be careful during inspection through the inspection hole. Put back the cover.

Hot surfaces

Hot surfaces locally. Temperatures above 70°C (158°F) can be experienced.

Emergency situations

Emergency shutdown: It must be possible to cut the electric power at emergency situations. Fire-extinguisher: Use only fire-extinguisher adapted for use both to oil products and electric equipment.

1.2 System description

Description of Gemini drive system.

The Gemini hydraulic drive system consists in the substantial out of:

- CBP motor mounted to the machine shaft either via torque arm or flange mounted in a bracket.
- Hydraulic pump units with main electrical motor and hydraulic pump placed as close as possible to the hydraulic motor.
- Oil tank unit with hydraulic fluid and charge pump circuit.
- Filter units placed in a convenient area for maintenance.
- Cooler unit

Hydraulic motor CBP

The hydraulic motor is fitted via splines to the customer shaft. A torque arm or bracket is used to accomplish the counter-torque. A speed encoder is mounted on to the motor for speed measurements. A temperature transmitter is monitoring the motor case temperature and a magnetic plug can give information if particles are coming out of the motor case. The motor case is flushed for cooling.

Hydraulic pump unit

The main hydraulic pump supplies fluid to the hydraulic motor in a closed loop system. The main hydraulic pump is a variable displacement axial piston pump of swash plate type. The hydraulic pump displacement, and thereby the flow of hydraulic fluid, is changed by controlling the solenoids on the stroker proportional valve. These solenoids are activated by Hägglunds Drives Spider control system. The main pump is pressure compensated, that means it will swash down to zero displacement if the maximum allowed high pressure setting is reached. A pressure switch shuts the main pump electric motor off if the charge pressure is below minimum. A temperature transmitter is monitoring the pump case temperature and a magnetic plug can give information if particles are coming out of the pump case. The pump cases are flushed for cooling.

Tank unit

The tank unit holds the system fluid in the oil tank and is equipped with replenishment pumps. The replenishment pumps supply the main hydraulic system with charge pressure and replenishment flow. The replenishment pumps shall be started before main electrical motors. The main pump electrical motors cannot be started until the charge pressure switch indicates that charge pressure is above minimum set value of the drive system.

The replenishment pumps are also used for flushing the hydraulic motor case and the hydraulic pump case with oil from the tank. Tank temperature is measured by a temperature transmitter. Low and minimum oil tank level are monitored by a level switch. The fluid in the tank is prevented from atmosphere by use of an air filter.

Filter unit

The filter units maintains a sufficient cleanliness level in the drive system. Return flow from the closed loop and drain flow from motor and pump cases are directed to the filter unit. Return flow passes the return filters and continues to the coolers and further to the tank. Drain flow passes the drain filters and continues directly to the tank.

Cooler unit

The cooler unit includes a water/oil cooler of bolted plate type.
The cooler unit, GCM1, comprises of one common open frame for different cooler sizes, oil flow by pass valve and water valve.

Driving the system

The hydraulic motor speed is controlled by the flow from the main pumps. Increasing the swash angle of the pumps implies more flow and hence, more speed on the hydraulic motor.

The control system is controlling and monitoring the status of the drive system. Parameters monitored are e.g. temperature, pressure and speed. Switches for warning and alarm situations are picked up by the Spider control system. All drive system parameters are preset from Hägglunds Drives in accordance with the customers technical specification.

1.3 Operating principle

1.3.1 Hydraulic pump units

Function

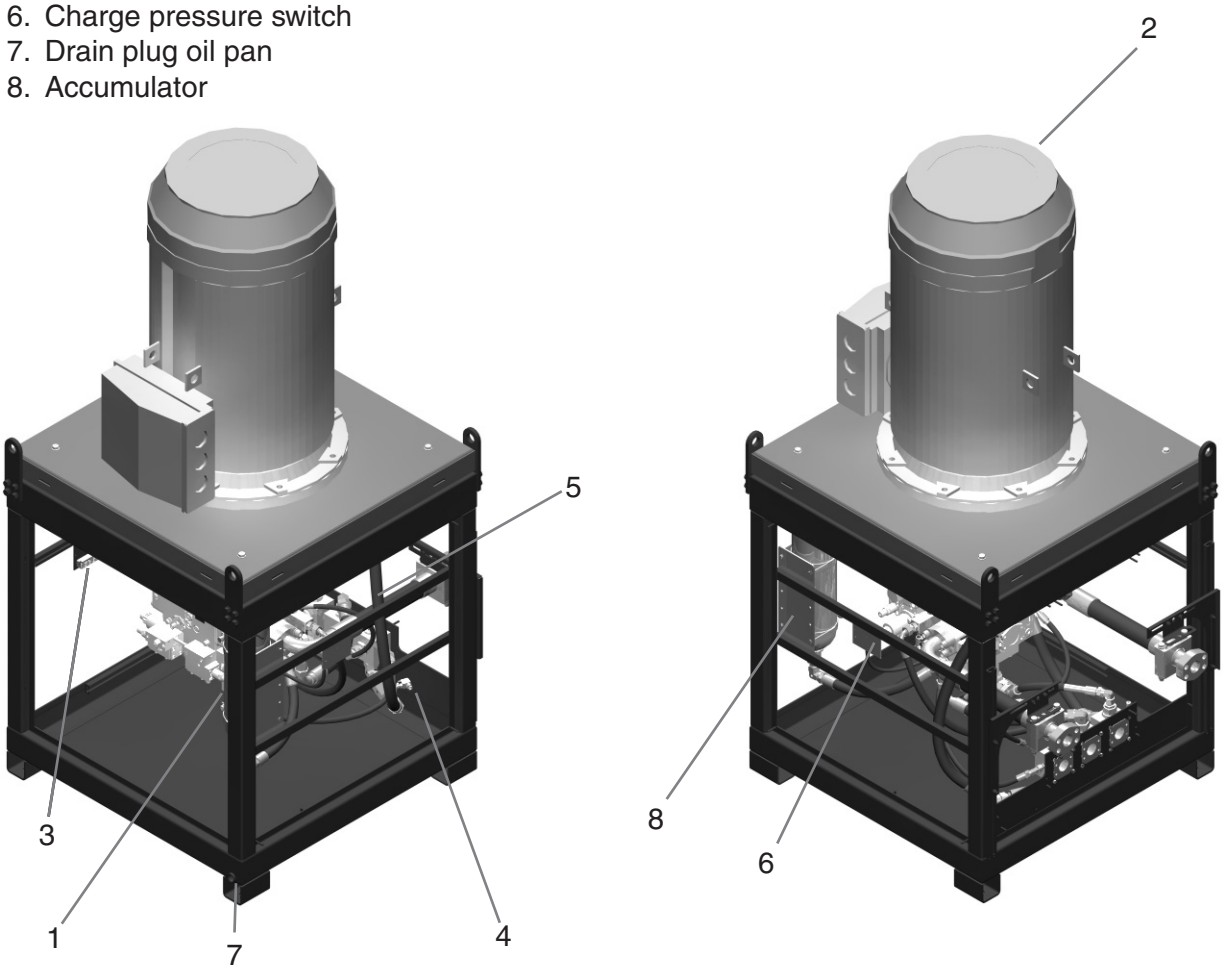
The intention of the pump units is to provide the hydraulic motor(s) with required flow of hydraulic fluid and pressure. The system is splitted so that the pump units can be positioned free standing from oil tank and filtration units.

The hydraulic pump units are available in three different designs:

- Single vertical pump unit,
- Tandem vertical pump unit
- Tandem horizontal pump unit

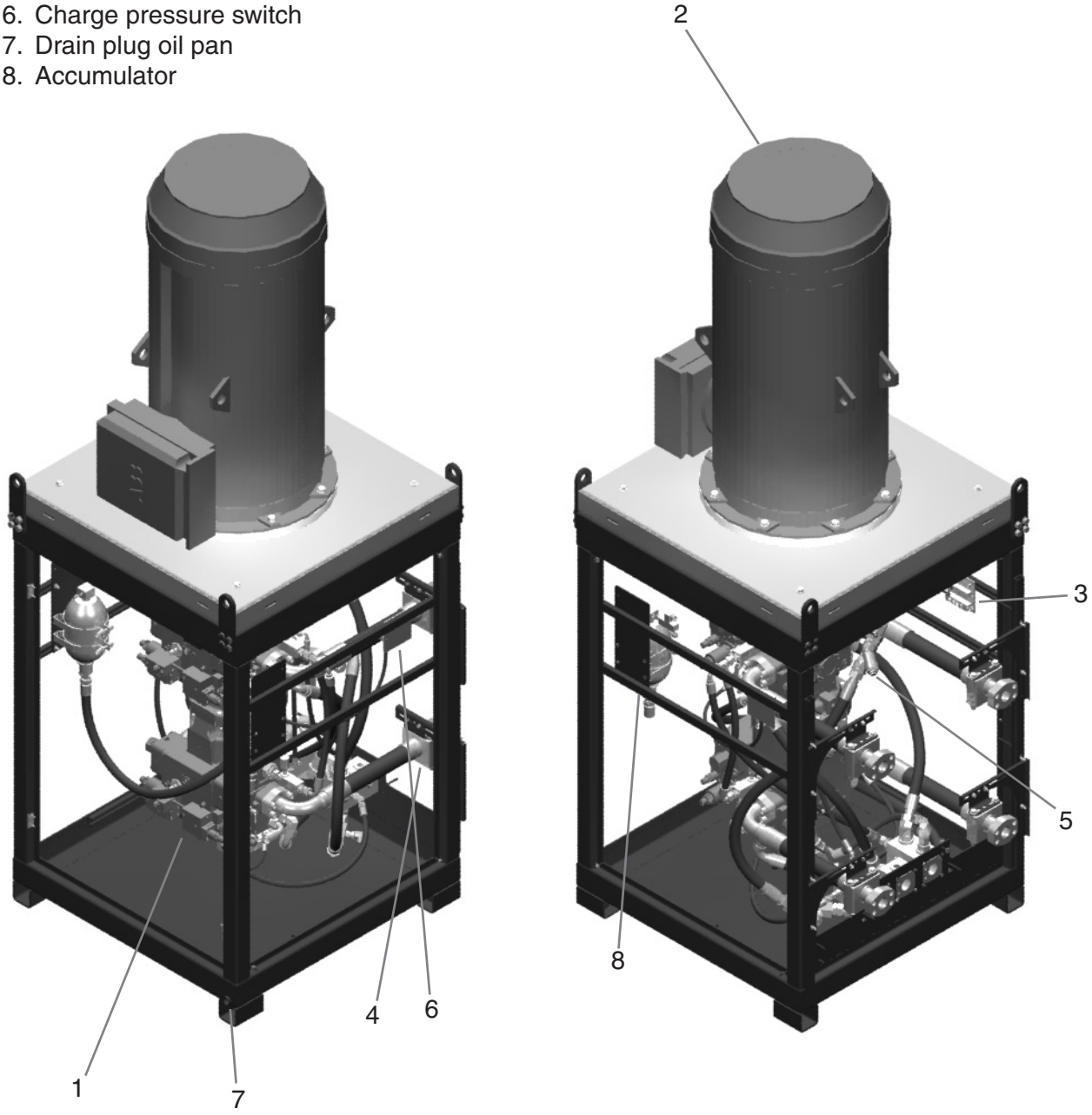
Main components, Single vertical pump unit

1. Hydraulic pump
2. Electric motor
3. I/O box
4. Temperature transmitter
5. Magnetic drain plug
6. Charge pressure switch
7. Drain plug oil pan
8. Accumulator



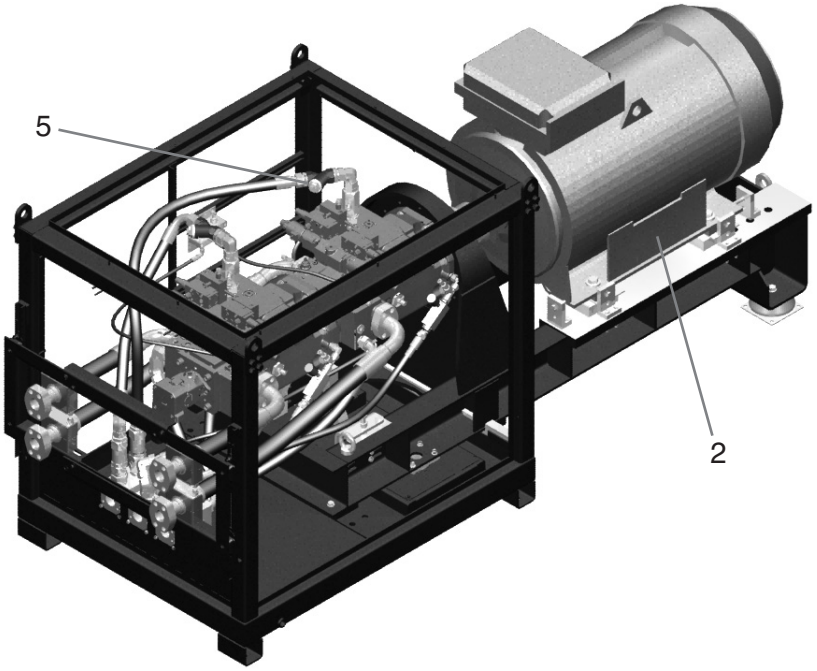
Main components, Tandem vertical pump unit

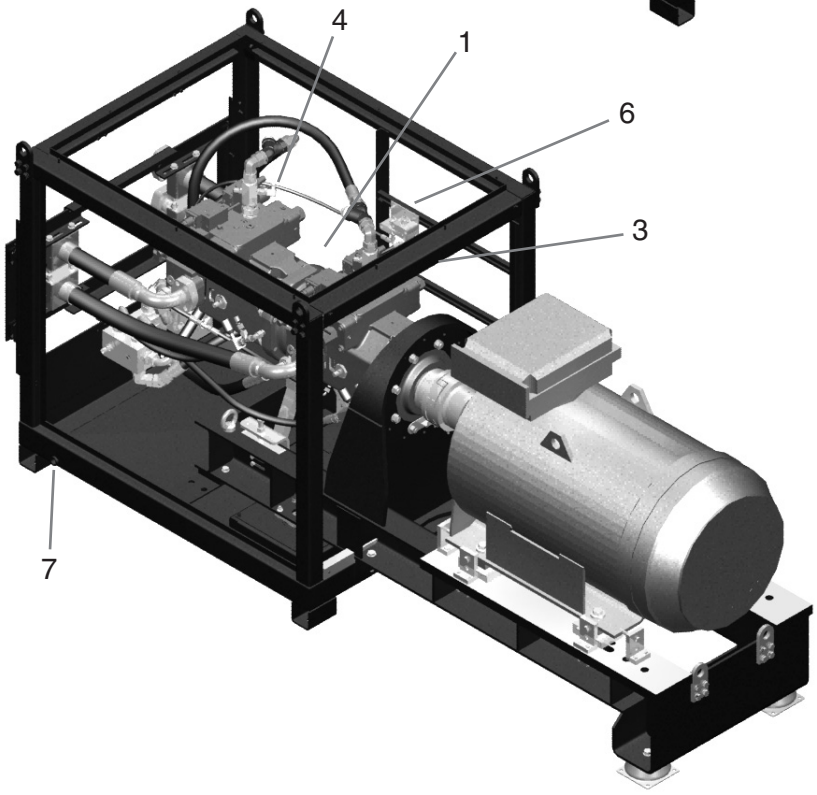
1. Hydraulic pump
2. Electric motor
3. I/O box
4. Temperature transmitter
5. Magnetic drain plug
6. Charge pressure switch
7. Drain plug oil pan
8. Accumulator



Tandem horizontal pump unit - main components

1. Hydraulic pump
2. Electric motor
3. I/O box
4. Temperature transmitter
5. Magnetic drain plug
6. Charge pressure switch
7. Drain plug oil pan





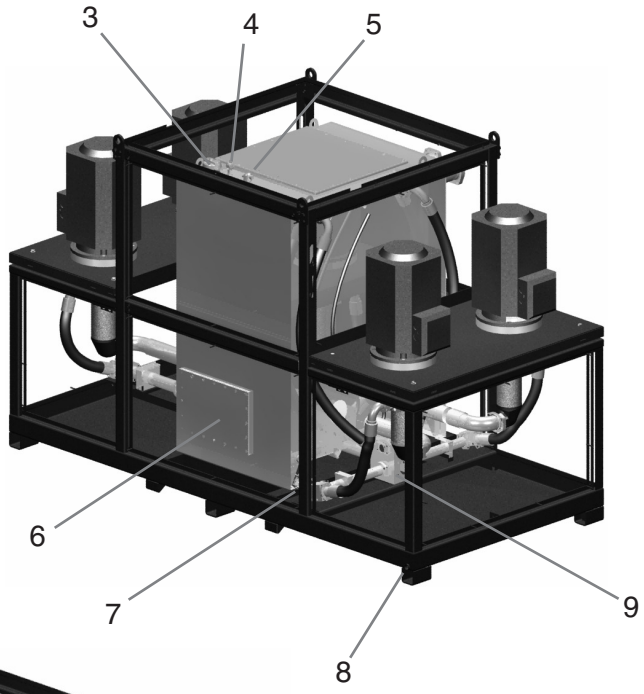
1.3.2 Tank unit

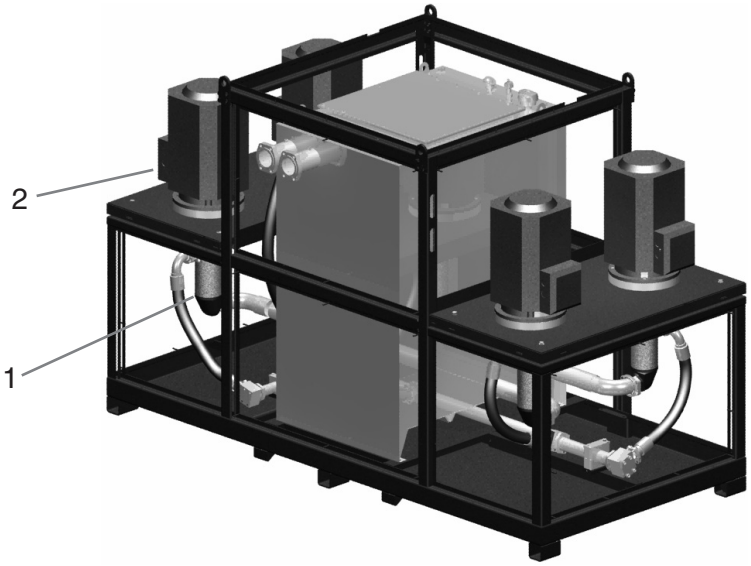
Function

The intention of the oil tank unit is to contain the hydraulic fluid necessary for the drive system. The replenishment pumps for boosting the main circuit are installed in the tank unit cabinet.

Main components

1. Hydraulic pump
2. Electric motor
3. Air filter
4. Level transmitter
5. Temperature gauge
6. Oil heater
7. Drain plug oil tank
8. Drain plug oil pan
9. Pressure relief valve





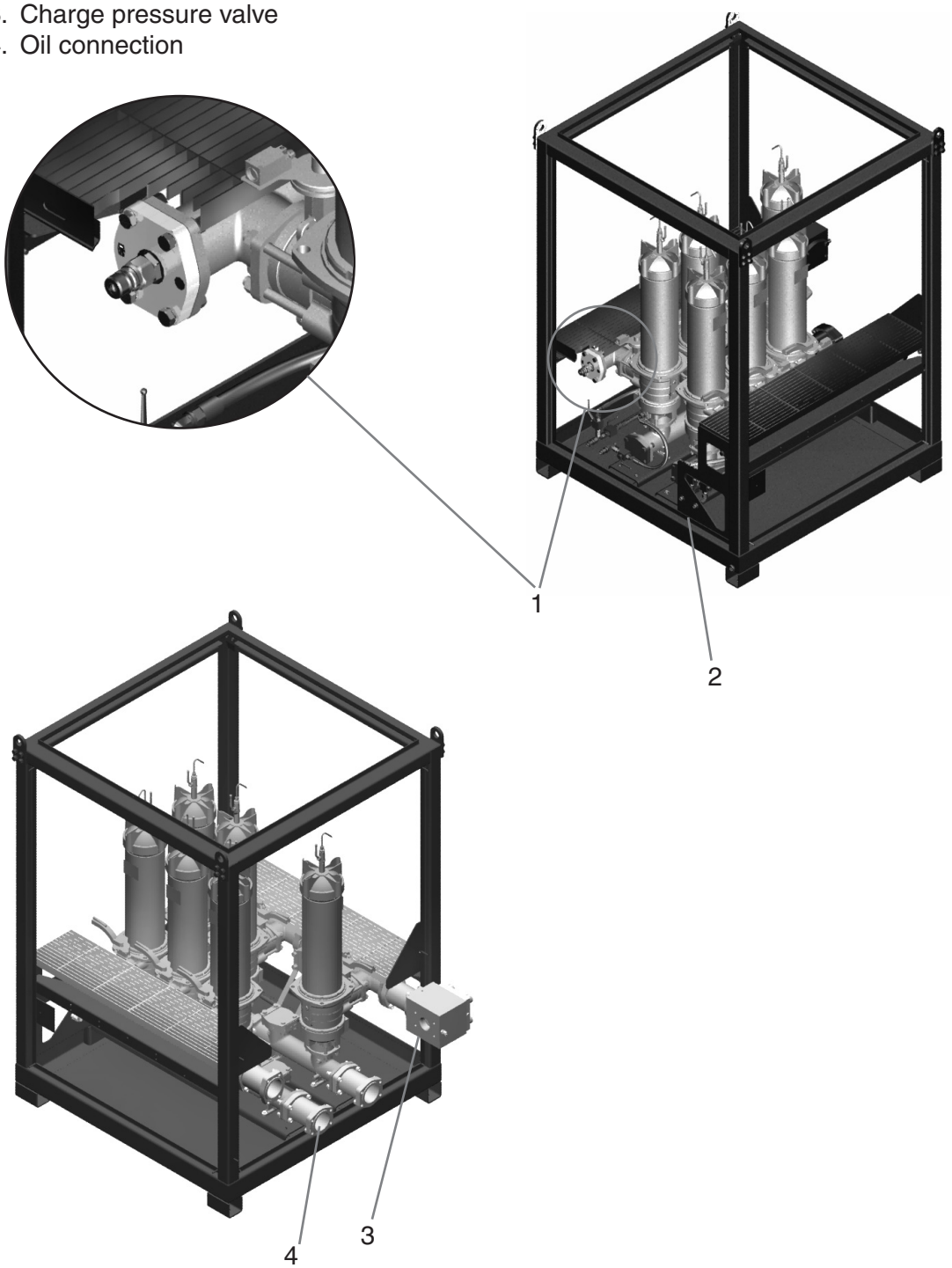
1.3.3 Filter unit

Function

The intention of the filter unit(s) is to filter the hydraulic fluid to an acceptable cleanliness level in the drive system. The filters are dimensioned to handle both return flow from the closed loop and the external drain flow from components within the drive system.

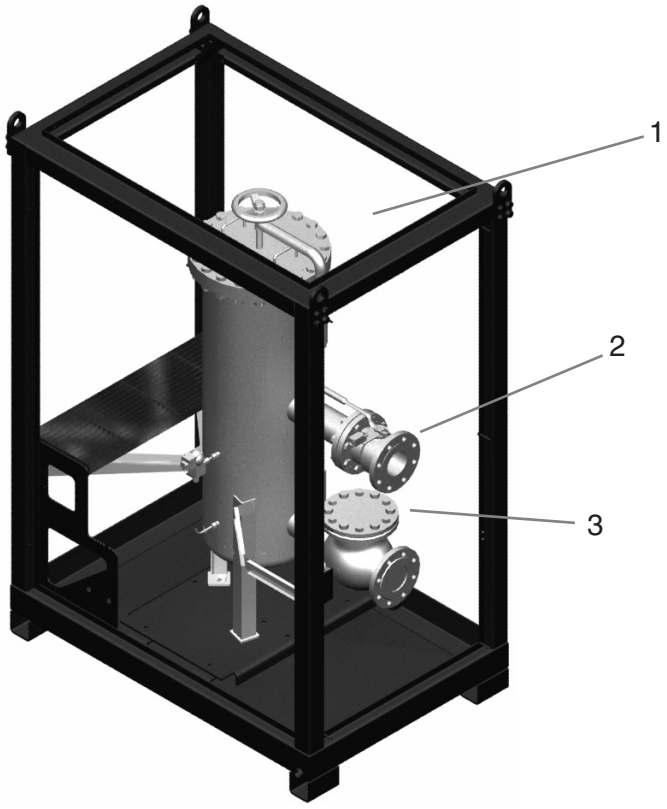
Main components

1. Oil filter connection
2. Oil filter drain
3. Charge pressure valve
4. Oil connection



Replenishment filter - main components

1. Replenishment filter
2. Shut off valve
3. Check valve



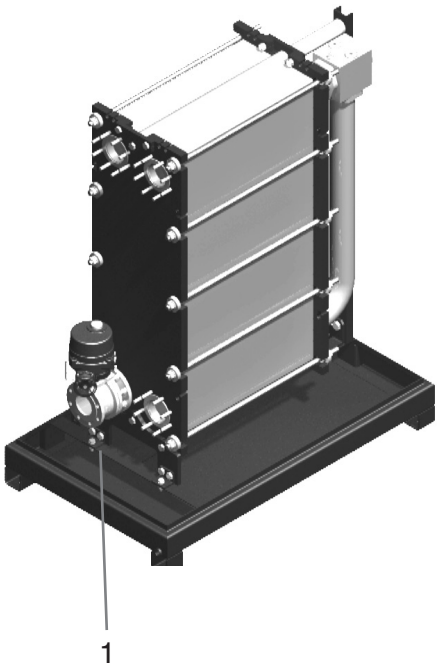
1.3.4 Cooler unit

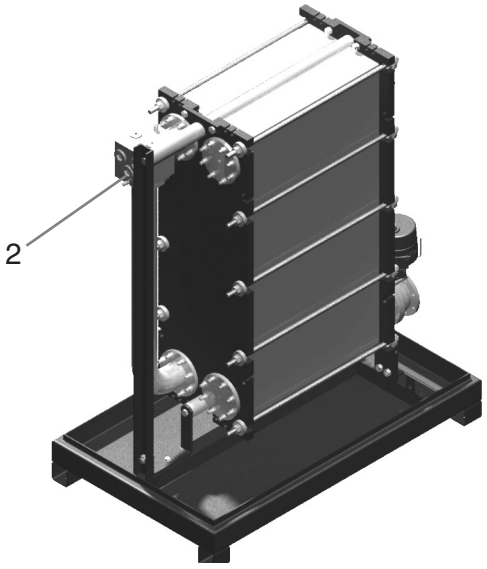
Function

The intention of the cooler unit(s) is to cool the hydraulic fluid to an acceptable temperature level in the drive system. The coolers are dimensioned to cool away the losses in the drive system.

Main components

1. Shut off valve
2. Bypass





1.4 Functional description

Start up of system drive

There are two main starts up modes for the drive system, normal start up and start up during high viscosity conditions.

Normal start of the drive system

Normal start of the drive system can be performed at an oil viscosity ≤ 700 cSt, corresponding to a tank temperature ≥ Tt_{low2}. (Tables below)

$Tt \geq Tt_{low2}$

The system will be started by start of the change pump electric motors. The charge pump are always started towards an unloaded charge pump pressure relief valve, i.e. the solenoid on the charge pump valve is energized and the pressure level is low, 8 bar. At this low pressure level the main electric motors are interlocked.

The charge pumps electric motor will be started in sequence and it will take at least 60 seconds after start of all charge pump electric motors before it will be possible to reach next level. At the next level when the charge pumps system possible can shift to a higher pressure level, provided that the drain temperature is enough. The time delay of at least 60 seconds will be needed for allowing the hydraulic motor piston to be pressed out towards the cam ring.

$Td \geq Td_{start}$

At an oil viscosity ≤ 500 cSt, corresponding to a drain temperature of ≥Td_{start} the charge pump system will shift to the higher charge pressure level, 30 bar. At the same temperature level it will be possible to start the main electric motors provided that the charge pressure level is high enough, i.e. no low charge pressure alarm is activated.

The start of the main electric motors will be delayed 10 seconds from that the charge pressure is enough.

The main electric motors will be started in sequence one by one with a delay of 5-10 seconds (default 5 seconds). When all main electric motors are running, the drive start signal can be enabled after a delay of 10 seconds. When drive start signal is enabled it is possible to stroke the hydraulic pumps.

Parameter table

Parameter name	Measurement point
Tt	Current tank temperature
Tt_{low1}	Tank temperature limit for start of one charge pump. Below this level the charge pump electric motors are interlocked and only the tank heaters are allowed to be started.
Tt_{low2}	Tank temperature limit for start of all other charge pumps.
$Tt_{h\ off}$	Tank temperature when the electric heaters will be disabled.
$Tt_{h\ on}$	Tank temperature when the electric heaters will be enabled.
Td	Current temperature in the hydraulic motors and pumps case drain
Td_{start}	Drain (all motors and pumps). Temperature limit for drive start. Below this level the main electric motor are interlocked.
Td_{on}	Drain (all motors and pumps). Temperature limit for start of heat holding mode.
Td_{off}	Drain (all motors and pumps). Temperature limit for stop of heat holding mode.

Oil viscosity versus oil temperature for different oil types. (Mineral oils)

Viscosity (cSt)	Oil type ISO VG 68	Oil type ISO VG 100	Oil type ISO VG 150	Temperature
300	15°C	21.5°C	28.5°C	Td_{off}, $Tt_{h\ off}$
500	8°C	14°C	21°C	Td_{on}, Td_{start}, $Tt_{h\ on}$
700	4°C	10°C	16.5°C	Tt_{low2}
2000	-7.5°C	-2°C	4°C	Tt_{low1}

Start of drive system during high viscosity conditions

Start of drive during high viscosity conditions means start at oil viscosity ≥ 2000 cSt corresponding to a tank temperature ≤ Tt_{low1}.

$Tt < Tt_{low1}$

When the tank temperature $Tt < Tt_{low1}$ the charge pump electric motors are interlocked, i.e. it is not possible to start the charge pumps. Electric oil heaters in the tank are used to increase and hold the tank temperature above this limit to allow the charge pumps to be started.

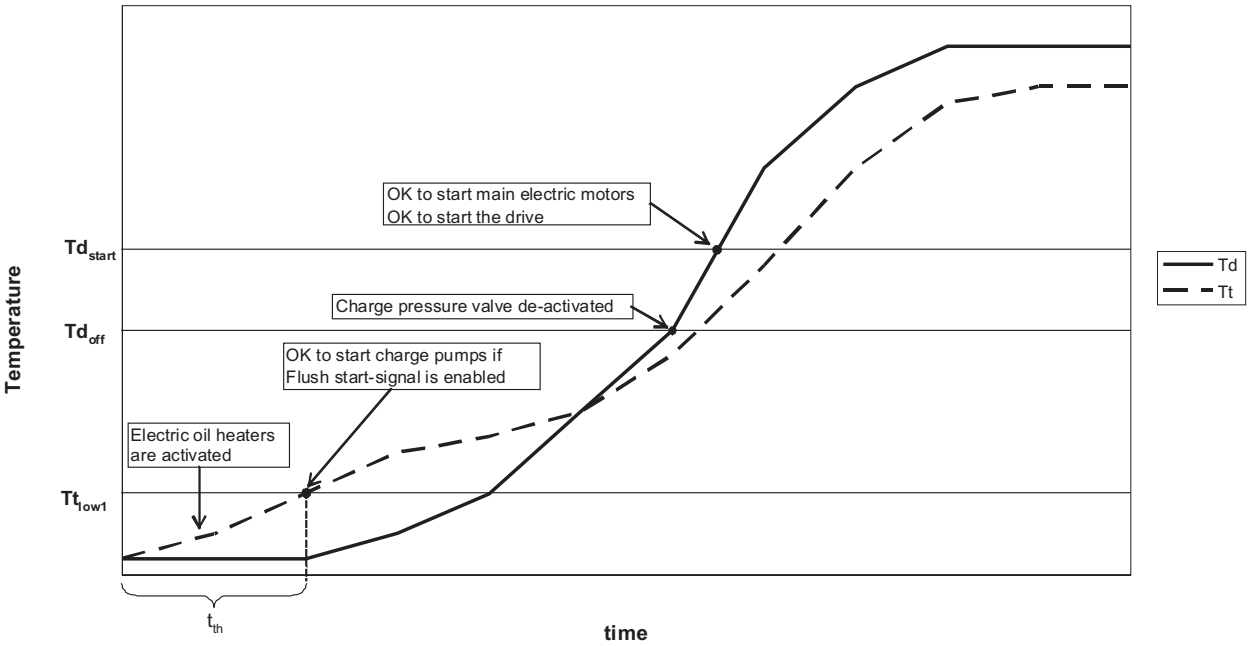
$Tt \geq Tt_{low1}$, $Td < Td_{off}$

Above the tank temperature Tt_{low1} the one charge pump can be started towards an unloaded charge pump pressure valve, i.e. the solenoid on the charge pump pressure valve will be energized and the pressure level is low, 8 bar. As long as $Td < Td_{off}$ the charge pump valve will be unloaded and the oil in the tank and the hydraulic pumps and motors is flushed and heated.

$Tt \geq Tt_{low2}$

Above the tank temperature Tt_{low2} all other charge pumps can be started towards an unloaded charge pump pressure relief valve, i.e. the solenoid on the charge pump valve is energized and the pressure level is low, 8 bar. (See “Normal start of the drive system”)

Further levels according to “Normal start of the drive system” above.



Start of the drive system during high viscosity condition.

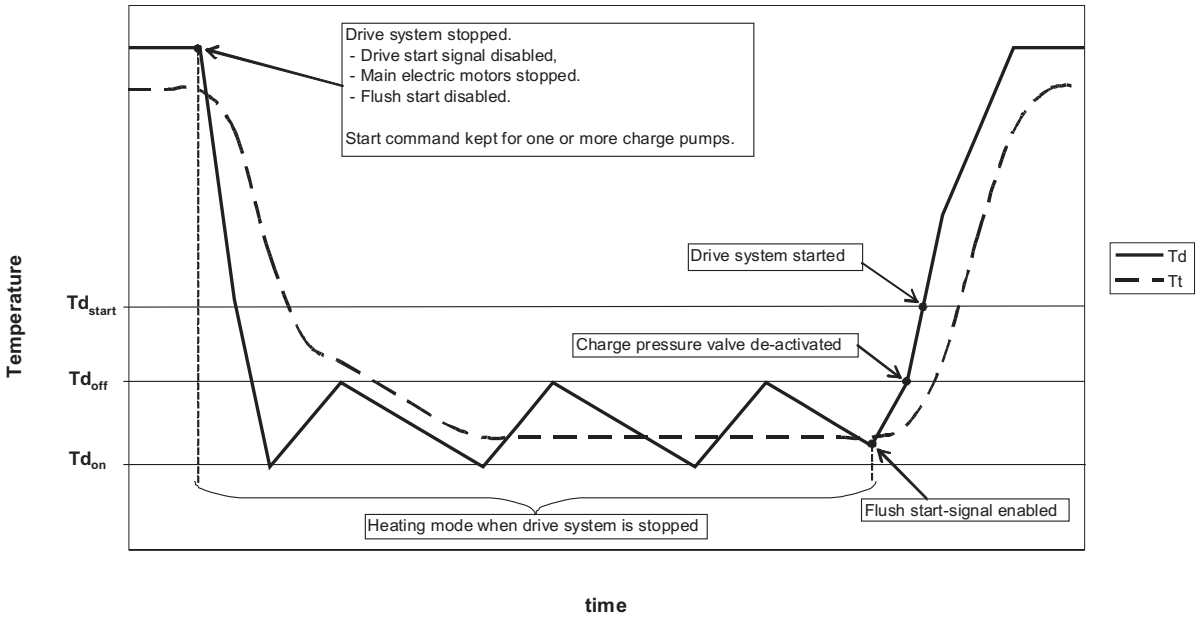
Heat holding mode when drive system is stopped

To maintain a sufficient high temperature in the hydraulic system during stand-still and thereby avoid too high oil viscosity, a heating mode is available in the Gemini system.

When the system is stopped (no electric motor is running and the flush signal is disabled), a start command for one of the charge pumps can be kept. When the drain temperature decrease below Td_{on} ($Td < Td_{on}$) corresponding to an oil viscosity ≥ 500 cSt the charge pump valve will open (low charge pressure level) and the charge pump will start.

When the drain temperature increases above Td_{off} ($Td \geq Td_{off}$) corresponding to an oil viscosity < 300 cSt the charge pump will stop, the charge pump valve closes and the heating cycle is completed.

When the system is in “heat holding mode” and the system shall be started in operating position the starting sequence will be performed according to the “Normal start of the drive system mode”.



Stop and start of the drive system when using heating mode.

Electric heater in the oil tank

The electric heater in the oil tank will be disconnected at an oil temperature in the tank $Tt > Tt_h$ off corresponding to an oil viscosity ≤ 300 cSt. Below a tank temperature $Tt < Tt_h$ on corresponding a viscosity > 500 cSt the heater will be connected.

Shutting off valves in the hydraulic system

For a standard Gemini system the main ports A and B on the pumps are fitted with stop cocks.

The reason for the stop valves in the main ports is to be able to shutting off one or more electric motor/power unit for service.

At shutting off some of the pump units the number of charge pumps has to be reduced.

Possible combinations of number of started main pumps and number of charge pumps according to below tables. The combination is based on possible minimum and maximum charge flow for each main pump.

	Replenishment flow 550 lpm		**Replenishment flow 700 lpm**		**Replenishment flow 850 lpm**		**Replenishment flow 1100 lpm**		**Replenishment flow 1350 lpm, 50Hz**		
	Number of started charge pumps		**Number of started charge pumps**		**Number of started charge pumps**		**Number of started charge pumps**		**Number of started charge pumps**		
Number of started main pumps	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**
12	No	No	No	No	No	No	No	No	OK	OK	No
11	No	No	No	No	No	No	No	No	OK	OK	No
10	No	No	No	No	No	No	OK	No	OK	OK	No
9	No	No	No	No	No	No	OK	No	OK	OK	No
8	No	No	No	No	OK	No	OK	No	OK	OK	No
7	No	No	No	No	OK	No	OK	OK	OK	OK	No
6	No	No	OK	No	OK	OK	OK	OK	No	OK	No
5	OK	No	OK	No	OK	OK	No	OK	No	OK	OK
4	OK	OK	OK	OK	No	OK	No	OK	No	No	OK
3	OK	OK	No	OK	No	OK	No	OK	No	No	OK
2	No	OK	No	OK	No	No	No	No	No	No	No
1	No	No	No	No	No	No	No	No	No	No	No

	Replenish-ment flow 550 lpm		**Replenishment flow 700 lpm**			**Replenishment flow 850 lpm**				**Replenishment flow 1100 lpm**			**Replenishment flow 1350 lpm, 50Hz**			
	Number of started charge pumps		**Number of started charge pumps**			**Number of started charge pumps**				**Number of started charge pumps**			**Number of started charge pumps**			
Number of started main pumps	**2**	**1**	**3**	**2**	**1**	**4**	**3**	**2**	**1**	**3**	**2**	**1**	**4**	**3**	**2**	**1**
12	OK	No	OK	OK	No	OK	OK	OK	No	OK	OK	No	OK	OK	OK	No
11	OK	No	OK	OK	No	OK	OK	OK	No	OK	OK	No	OK	OK	OK	No
10	OK	No	OK	OK	No	OK	OK	OK	No	OK	OK	No	No	OK	OK	No
9	OK	OK	OK	OK	No	OK	OK	OK	No	No	OK	No	No	OK	OK	No
8	OK	OK	No	OK	No	No	OK	OK	No	No	OK	OK	No	OK	OK	No
7	OK	OK	No	OK	OK	No	OK	OK	No	No	OK	OK	No	No	OK	No
6	No	OK	No	OK	OK	No	No	OK	No	No	No	OK	No	No	OK	OK
5	No	OK	No	No	OK	No	No	OK	OK	No	No	OK	No	No	OK	OK
4	No	OK	No	No	OK	No	No	No	OK	No	No	OK	No	No	No	OK
3	No	No	No	No	OK	No	No	No	OK	No	No	No	No	No	No	OK
2	No	No	No	No	No	No	No	No	OK	No	No	No	No	No	No	No
1	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Sequence at low charge pressure in the hydraulic system and high temperature in the main electric motors.

At low charge pressure (≤ 8 bar) or high temperature in the main electric motor the pumps will stroke down immediately and the electric motor will stop after a delay of 0.5-1.0 seconds.

Sequence at low oil level, filter guard and high system pressure.

At low oil level, indication of return and drain filter and high system pressure a warning signal will occur.

Sequence at high oil temperature in the drain lines.

At high oil temperature 1) corresponding to a viscosity of 30 cSt in any of the drain lines the pumps stroking will be limited to 25-75 % of the maximum value.

Sequence at max oil temperature in the drain lines.

At maximum oil temperature 1) corresponding to a viscosity of 24 cSt in any of the drain lines the pumps will stroke down immediately and the electric motor will stop after a delay of 0.5-1.0 seconds.

Oil temperature versus current viscosity for different oil types. (Mineral oils)

Viscosity (cSt)	Oil type ISO VG 68	Oil type ISO VG 100	Oil type ISO VG 150
30	59°C (138°F)	68°C (154°F)	77°C (171°F)
24	65°C (149°F)	74°C (165°F)	84°C (183°F)

2. Technical data

2.1 Choice of hydraulic fluid

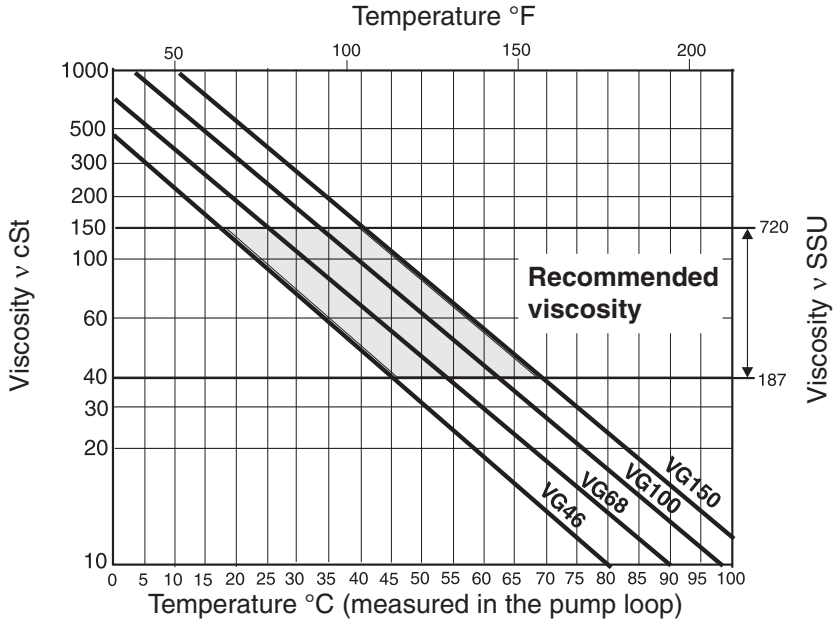
The Gemini drive system is designed to operate on conventional petroleum based hydraulic fluids. The hydraulic fluid can be chosen in consultation with an oil supplier.

The hydraulic fluid has to fulfil the following requirements:
- Fulfil FZG 90 test stage 11 described in IP 334 (DIN 51354).
- Contain inhibitors to prevent oxidation, corrosion and foaming.
- Have a viscosity within the prescribed interval for both Gemini unit (see below) and Hydraulic motor at operating temp (measured in the motor case). Hydraulic fluid with ISO-class minimum ISO VG 100 is recommended.
- Have a water content of <0.1% and in industrial applications with high demands for service life, <0.05%.

For other hydraulic fluids please contact your Hägglunds Drives representative as:
- You may need other seals within the pump and other components.
- The service life, max. pressure and max speed for the pumps may be reduced.
- Some fluids are not possible to use.

Viscosity (cSt)	Oil type ISO VG 68	Oil type ISO VG 100	Oil type ISO VG 150
40	52°C (126°F)	60°C (140°F)	69°C (156°F)
150	25.5°C (78°F)	32.5°C (90.5°F)	40°C (104°F)
2000	-7.5°C (18.5°F)	-2°C (28°F)	4°C (39°F)

RECOMMENDED VISCOSITY at operating temperature
40-150 cSt (187-720 SSU)
At cold start the maximum permissible viscosity is 2000 cSt (9250 SSU) run with low pressure and low flow.



WARNING

- **Check caution sign on container or consult the supplier.**
- **Avoid contact of long duration with the skin.**
- **Use services of a professional oil supplier for disposal of used fluids and filter elements.**
- **Never dump hydraulic fluid into drainages or water courses.**
- **Avoid contamination of hydraulic fluids on floors, it involves a great risk to slip and fall.**

2.2 Requirements for hydraulic fluid cleanliness

The Gemini units are equipped with filters on the drain- and return line(s). In order to obtain stated service life it is important to follow recommendations concerning cleanliness levels and maintenance.

Cleanliness level recommendations

- The system must be flushed before start up, see section 4.10 “Flushing before start up".
- When filling the tank with hydraulic fluid it is important to fill through the special oil filling connection, see section 4.11.2 ” Filling up the system with hydraulic fluid “
- For industrial applications the contamination level should not exceed ISO 4406:1999 18/16/13 (NAS 1638, class 7).
- Always use filter elements recommended and supplied by Hägglunds Drives.
- The hydraulic fluid should be analysed according to the special maintenance intervals for your specific Gemini unit or the maximum intervals on the maintenance chart (section 5.2 "Maintenance chart"). Be particularly vigilant when removing equipment for repairs or maintenance, dirt must not be allowed to enter the system, clean components prior to opening.

Do not re-use hydraulic fluid which has leaked out.

2.3 Cooling water

The cooling system is primarily designed to operate on clean fresh water.

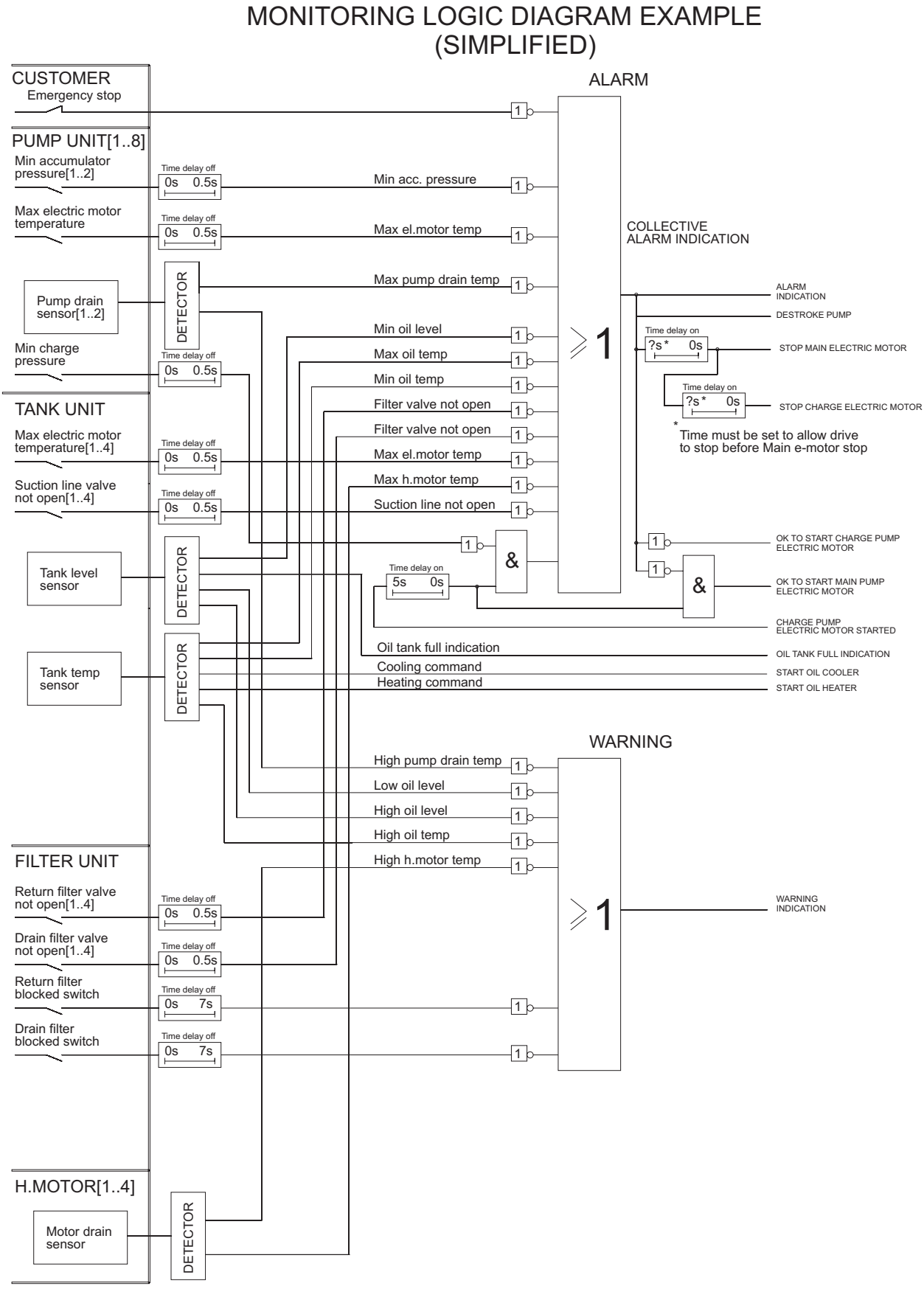
When there are particles in the water, larger than 0.5 mm (0.02 in), a water filter has to be used.

It is important to:

- Maintain the water filter (if any) in a correct way, this is to get the required flow of water through the water oil cooler.
- Have the required flow, pressure and temperature of the cooling water (see attached technical documentation).
- Check the temperature in the hydraulic system, according to the special maintenance intervals for your specific Gemini unit or the maximum intervals on the maintenance chart.
- Clean the cooling system if the temperature in the hydraulic system is above the specified limits on account of too low cooling capacity.
- Clean and empty the cooling system (water side) before periods of rest (especially if the cooling water is not totally clean).

If cooling capacity is too low, the service life of Hydraulic pump, motor and the hydraulic fluid will be reduced.

2.4 Monitoring logic Diagram

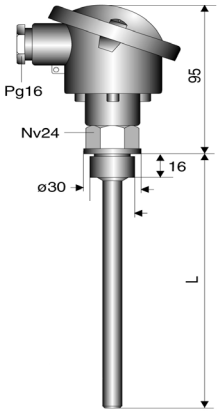


For further information, see Spider users manual

2.5 Miscellaneous components

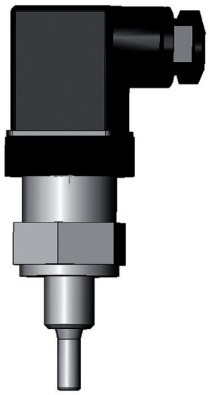
2.5.1 Temperature transmitter in tank

Temperature levels to be set in the control system. Setting levels according to documentation.



2.5.2 Temperature transmitter in hydraulic pump and motor case

Temperature levels to be set in the control system. Setting levels according to documentation.



2.5.3 Magnetic plug

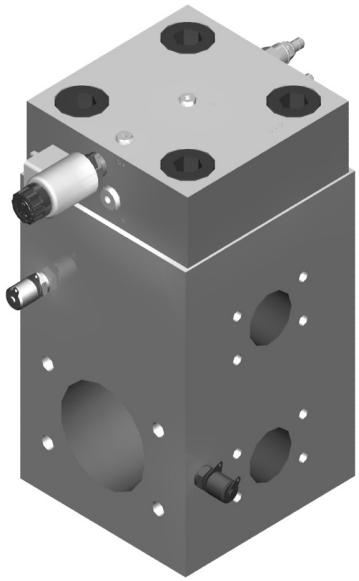
The magnetic plug is mounted onto the drain port of each component in a Gemini system. The magnetic plug can give information if solid metal particles are coming out of the case of the component to which it is attached. The plug has to be manually inspected.

2.5.4 Inspection cover on tank

Replace the gasket when opening the inspection cover.

2.5.5 Valves for high viscosity start

The Gemini system is equipped with pressure relief valves mounted onto the charge pumps. The function of these valves is twofold. Under normal operation they act as safety valves to prevent the replenishment pumps from overloading. At high viscosity condition, the valve is unloaded and hence, the pressure level is limited during warm-up.



3. Handling of the packed gemini unit

3.1 Storage of the packed Gemini unit

At delivery, the hydraulic components are protected internally by an oil film (containing rust preventing additives). This provides sufficient protection for indoor storage in air conditioned premises for about 12 months.

The Gemini unit and belonging parts should be stored indoors, in dry, vibration free and dust free conditions. It should not be stored for more than three months in non-air conditioned premises. (the text above includes parts belonging to the Gemini unit delivered separately).

If storage time exceed limits, the Gemini unit must be operated so that the hydraulic system is lubricated with new fluid.
(see section 5.8 "Gemini unit out of service")

The Gemini unit must be placed where not exposed to strong sunlight or severe cooling to avoid condensation.

3.2 Lifting the packed Gemini unit

The packed Gemini unit is among other things branded with centre of gravity and weight. Normally the Gemini unit package is designed for forklift truck handling. For the pump units the label reflects the centre of gravity without electric motors.

Centre of gravity label

- **Centre of gravity can be high, see label on the goods.**
- **Avoid rapid acceleration, deceleration and turns while moving the goods.**
- **Position the forks according to the instructions below.**

Lifting with fork lift

The lifting of Gemini Power Unit modules can be done both from long side and short side of the different modules but preferably from the long side. The minimum distance between the forks is 700 mm (27.6 in) - 1100 mm (43.3 in) depending of the Power Unit module size. Position forks about the centre of gravity at lifting from long side. At lifting from short side the lifting shall be done from the side next to the centre of gravity.

Lifting with fork lift of module Pump Unit GPVM 1 & 2, Filter unit GFRM 2 & 3, GFPM 1 & 2 and Cooler unit GCM 1.

- The absolute minimum required fork length is 1700 mm (66.9 in).

Lifting with fork lift of module Pump Unit GPHM and tank Unit GTM 1 & 2

- The absolute minimum required fork length is 2500 mm (98.4 in).

Parts that are delivered separately

The package is always marked with the weight.

- Packages on loading stools are only designed for forklift truck handling.
- Other packages may be lifted with a lifting crane, always check the label on the package.

- **Do not stand under hanging load.**
- **Use only lifting equipment adapted to the weight stated on the label of the package.**

4. Installation

4.1 Installation directions

If the Gemini unit is to work properly it must be installed in accordance with these instructions. The conditions the unit will operate in must be taken into consideration.

Improper installation, not following the instructions in this manual and in the attached technical documentation, may affect the function and/or the service life of the Gemini unit. It is important that the safety precautions in this manual are always followed.

Never place the Gemini unit directly against a wall or similar obstruction. Satisfactory air circulation will then be impossible. Contact your Hägglunds Drives representative.

4.2 Positioning the Gemini unit

- On a firm level foundation (to avoid vibrations).
- Protected from weather, airborne sprays, heavy contaminations and radiated heat.
- To ensure free ventilation of cooling purposes for the electric motor and the air-oil cooler.
- To minimize pipe runs.

Clamp each pipe in the pipe run separately and attach it to a firm foundation to avoid vibration. The main connections from the Gemini unit must always be fitted to the piping with hoses. If Air-oil cooler is mounted at a location other than on the Gemini unit, it must be considered that the cooler will start without notice and has sharp edges.

A minimum space of 700 mm (28 in) must be left around the Gemini unit, to ensure free ventilation and provide sufficient working space for easier maintenance. Heavier maintenance e.g. change of motor/pump will demand more working space.

It is important that all pipes (both for water and hydraulics) are mounted to give sufficient working space for maintenance.

At installation of Gemini units in outdoor environment with heavy wind, at inclined surfaces or in areas with risk for earthquakes, special measures have to be taken. At such conditions its risk for unstable movement or turning over of the Gemini unit.

The Gemini unit has to be fixed to the ground by means of fixing screws or similar.

4.3 Lifting methods and weights

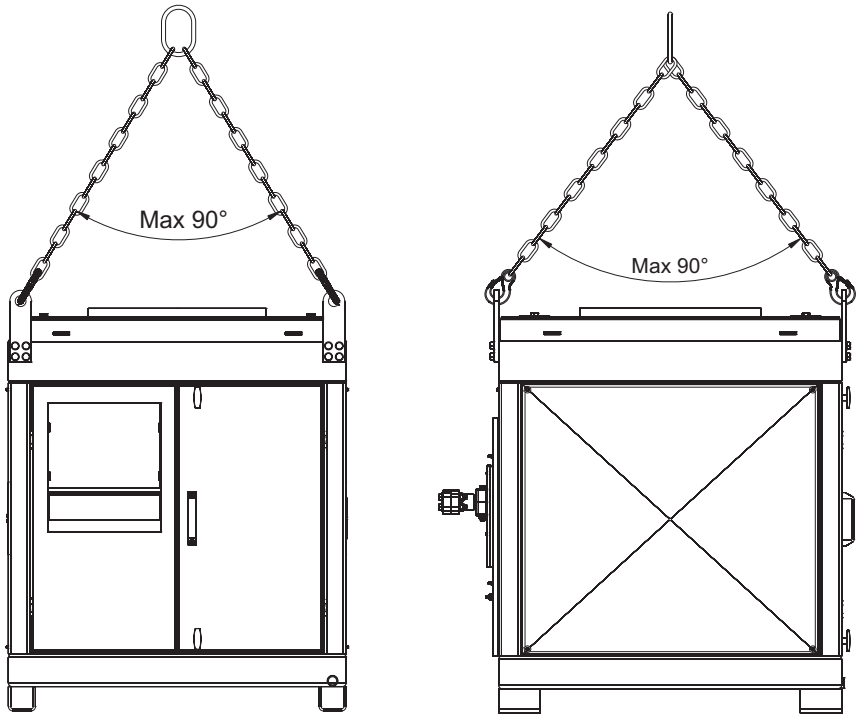
Lifting with ropes/chains

Lift the Gemini unit with maximum lifting angle 90°.

Lifting with fork lift

- The absolute minimum required fork length is 700 mm (27.6 in) - 1100 mm (43.3 in).
- For Pump Unit GPVM 1 & 2, Filter unit GFRM 2 & 3, GFPM 1 & 2 and Cooler unit GCM 1, the absolute minimum required fork length is 1700 mm (66.9 in).
- For Pump Unit GPHM and tank Unit GTM 1 & 2, the absolute minimum required fork length is 2500 mm (98.4 in).
- Position forks at the centre of gravity.

Do not lift with electric motor mounted.

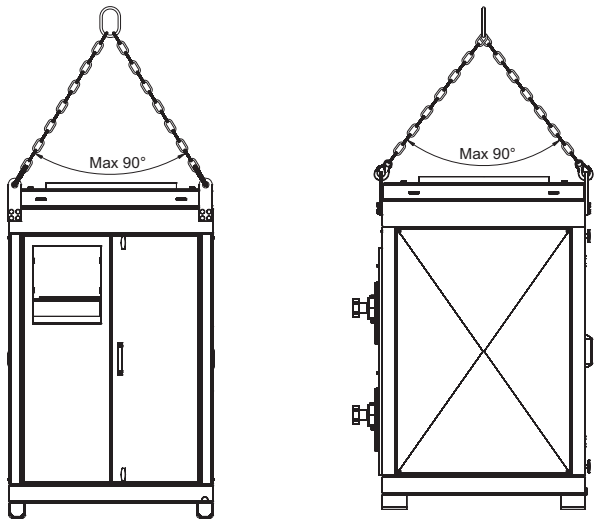


Lifting of single vertical pump unit

Total weight, Single vertical pump unit (without electric motor)

Pump type	kg	lb
without pump	980	2160
SP355	1220	2690
SP500/P24/P30	1330	2935

Frame weight	kg	lb
Tandem vertical	980	2160



Lifting of tandem vertical pump unit

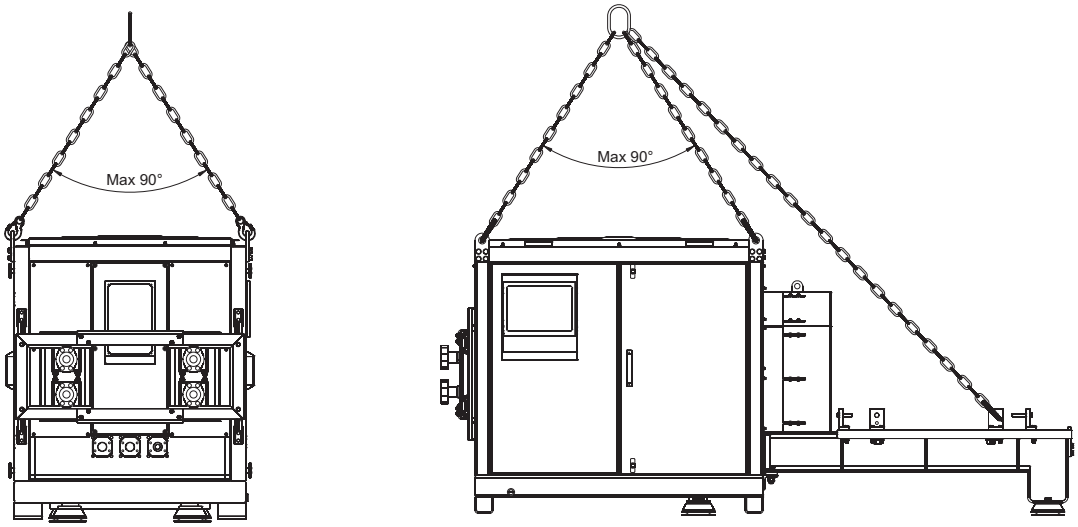
Total weight (without electric motor)

Pump type	kg	lb
HD24+HD24	1980	4360
HD30+HD24	2000	4400
HD30+HD30	2015	4435
SP355+SP355	1835	4040
SP500+SP355	1955	4305
SP500+SP500	2070	4560

= frame weight + pump1 +pump2

Frame weight	kg	lb
Tandem vertical	1270	2795

Note: No electric motors



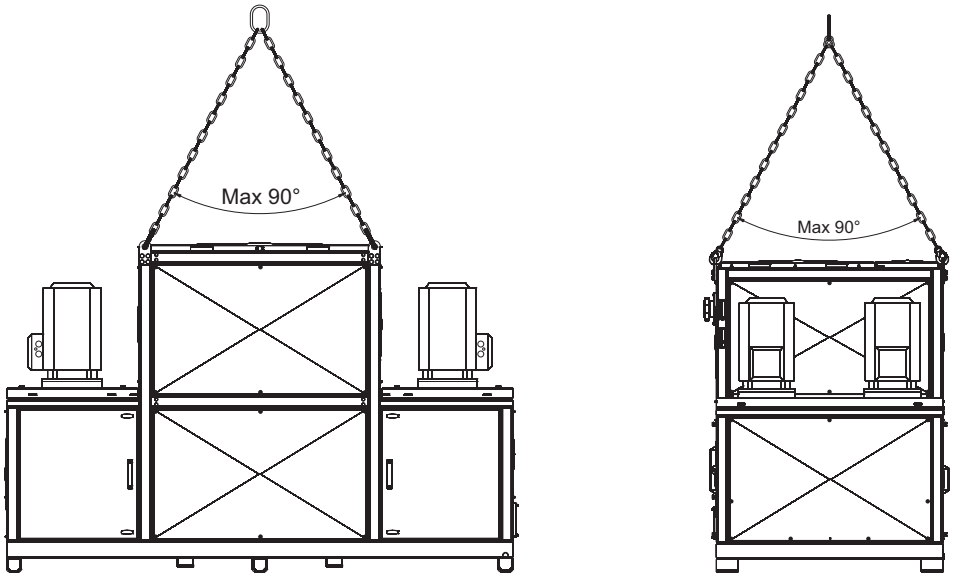
Lifting of horizontal pump unit

Total weight (without electric motor)

Pump type	kg	lb
HD24+HD24	1645	3625
HD30+HD24	2355	5185
HD30+HD30	2375	5230
SP355+SP355	2210	4870
SP500+SP355	2330	5135
SP500+SP500	2445	5390

= Frame weight + pump1 +pump2

Frame weight	kg	lb
Tandem horizontal	1645	3625

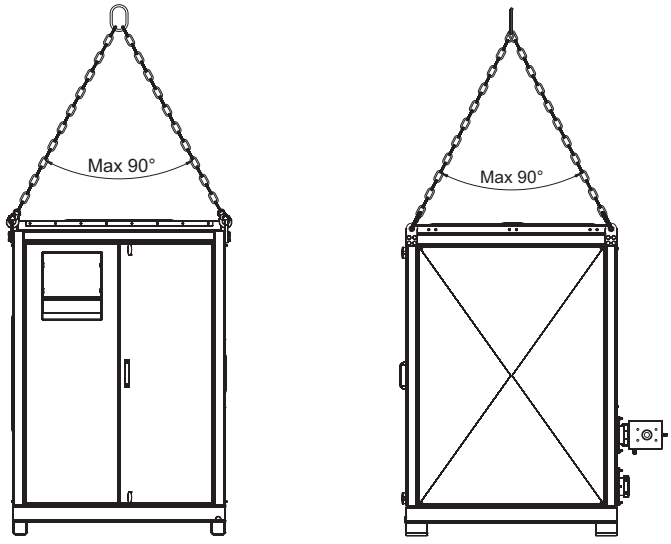


Lifting of tank unit

Weight (without electric motors, pumps and oil)

Frame size	kg	lb
1200L	1850	4080
1800L	2030	4480
2400L	2750	6070
3600L	2860	6310

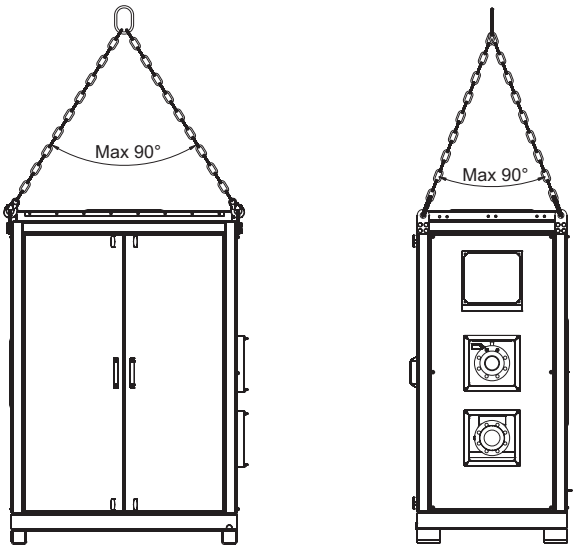
Note: No oil in the tank.



Lifting of drain/return filter unit

Weight (including filters)

Filter unit	kg	lb
GFRM2	950	2095
GFRM3	1360	3000



Lifting of replenishment filter unit

Weight (including filters)

	kg	lb
Weight	880	1940

If fitted, always use all four lifting points when lifting the Gemini unit.

- **Do not stand under hanging load.**
- **Use only lifting equipment adapted to the weight of the Gemini unit.**
- **Centre of gravity can be high, see label on cabinet.**
- **Do not lift the Gemini tank unit with hydraulic fluid in the tank.**
- **Hydraulic pump units must not be lifted with electric motor mounted.**

4.4 Mounting of main electric motor

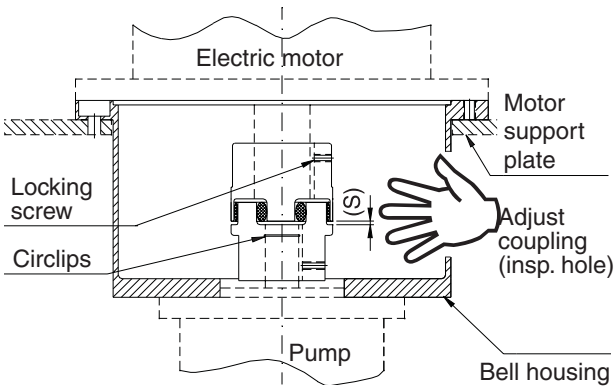
In certain cases the main electric motor(s) are delivered separately. The following instructions are applicable for these cases only.

4.4.1 Vertical pump unit

1. **Unpack the electric motor(s)**
   Unpack the electric motor. Check the electric motor for external damage and that all rating plate data are the same as in the attached technical documentation.
2. **Check the shaft coupling(s)**
   Check that the axial shaft coupling clearance is in conformance with the table and picture beside and that the locking screw is tightened. If possible, attach the cabinet and the pump-motor frame in the foundation.
3. **Lift the electric motor**
   Use the two side mounted lifting ears and lift to position the electric motor horizontal
4. **Mount the electric motor onto the Gemini unit**
   Lift the electric motor onto the horizontal unit foundation. Direct the motor shaft end perpendicular towards the pump mounting flange and parallel with the pump shaft. Move the electric motor horizontal to the pump and fit the motor shaft coupling half into the nylon star coupling on the pump without causing any damage on it. Remove the two transportation support.
5. **Tighten bolts to the bell housing**
   Correct alignment is essential to avoid bearing, vibration and possible shaft failures. Mount the motor on the foundation using the appropriate screws and existing adjustment device.
   Place shim plates between the foundation and the feet if necessary.
   Place greased screws in the holes, tighten by hand.
   Align the motor using special appropriated alignment tool.
   Check that there is an axial clearance (table above) between the two shaft coupling half's.
   Tightening the mounting screws for the electric motor after alignment.
   For connection of the electric motor, see section 4.8 "Electric connections"

Coupling type	Axial clearance S mm (in)
R 90	5.5 (0.22)
R100	6 (0.24)
R110	6.5 (0.26)

R = Rotex
A = Spidex



- **Do not stand under hanging load.**
- **Use all lifting ears when the electric motor is hanging free.**
- **Use only lifting equipment adapted to the weight on the rating plate.**
- **No hands between electric motor and bell housing during assembly.**

4.4.2 Horizontal pump unit

1. **Unpack the electric motor(s)**
   Unpack the electric motor. Check the electric motor for external damage and that all rating plate data are the same as in the attached technical documentation.
2. **Check the shaft coupling(s)**
   Check that the axial shaft coupling clearance is in conformance with the table and picture beside and that the locking screw is tightened. If possible, attach the cabinet and the pump-motor frame in the foundation.
3. **Lift the electric motor**
   Use the two side mounted lifting ears and lift to position the electric motor horizontal
4. **Mount the electric motor onto the Gemini unit**
   Lift the electric motor onto the horizontal unit foundation. Direct the motor shaft end perpendicular towards the pump mounting flange and parallel with the pump shaft. Move the electric motor horizontal to the pump and fit the motor shaft coupling half into the nylon star coupling on the pump without causing any damage on it.
   Remove the two transportation support.
5. **Tighten bolts to the bell housing**
   Correct alignment is essential to avoid bearing, vibration and possible shaft failures. Mount the motor on the foundation using the appropriate screws and existing adjustment device.
   Place shim plates between the foundation and the feet if necessary.
   Place greased screws in the holes, tighten by hand.
   Align the motor using special appropriated alignment tool.
   Check that there is an axial clearance (table above) between the two shaft coupling half's.
   Tightening the mounting screws for the electric motor after alignment.
   For connection of the electric motor, see section 4.8 "Electric connections"

4.5 Water valve

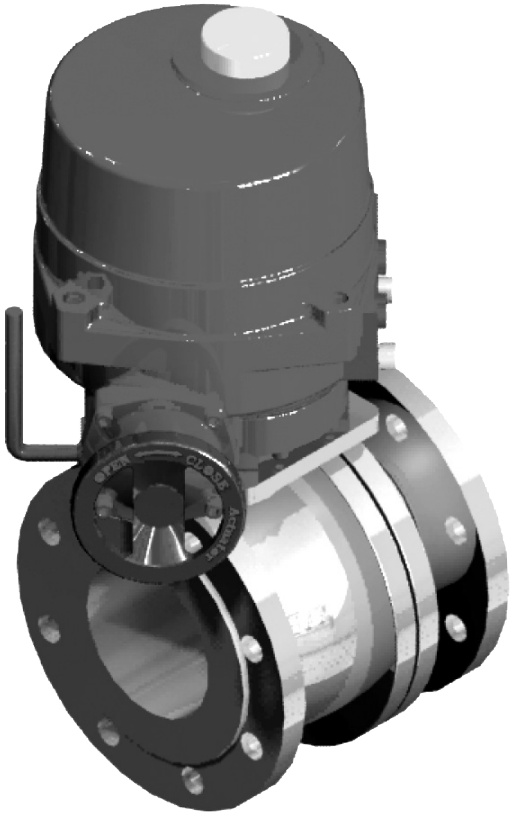
- High alloy steel gear trains provide self-locking function to avoid valve back drive.
- Gear trains have already been lubricated sufficiently with anti-high temperature lubricant at the factory.
- The water valve has a visual position indicator on the top of the actuator.
- The electric actuator is made of dry powder coating aluminium alloy.
- The actuator is also equipped with a manual hand-wheel override.

Pressure rating
PN 16

Weight
24 kg (53 lb)

Dimensions in accordance to DIN EN 1092-1

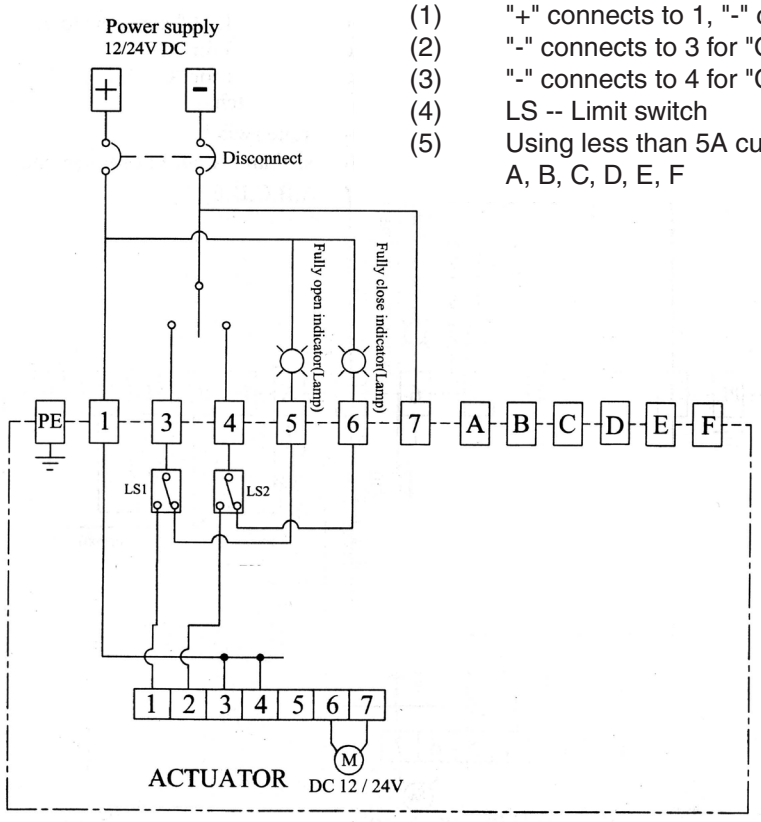
DN	D	n	HCD	d	L
100	220	8	180	18	190



Technical data

Power	70 W
Torque	150 Nm
Speed	22 sec for 90 degree
Mounting flange	ISO 5211 F07
Enclosure	IP67, Nema 4 and 6
Power Supply	24 VDC
Current consumption max. (A)	3.0 A
Ambient Temp	-30°C ... +65°C (-22 ... 149°F)
Limit Switches	Open/Close, 2+2 pcs
Position Indicator	Continuous visual position indicator
Thermal Protection	Built in +135°C (275°F)
Worm Gear	Permanently lubricated and self locking
Manual Override	Auto declutching mechanism
Conduit Entries	Two M20x1.5 mm

Note:
(1) "+" connects to 1, "-" connects to 7
(2) "-" connects to 3 for "OPEN"
(3) "-" connects to 4 for "CLOSE"
(4) LS -- Limit switch
(5) Using less than 5A current for switches A, B, C, D, E, F



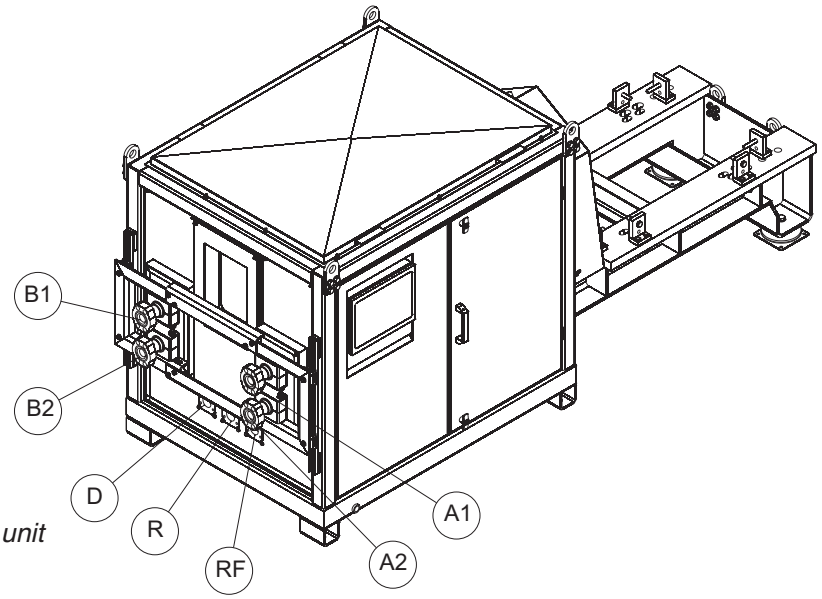
Wiring diagram OM-3 12/24 VDC

4.6 Hydraulic connections

The Gemini units have hydraulic connection interfaces according to pictures below.

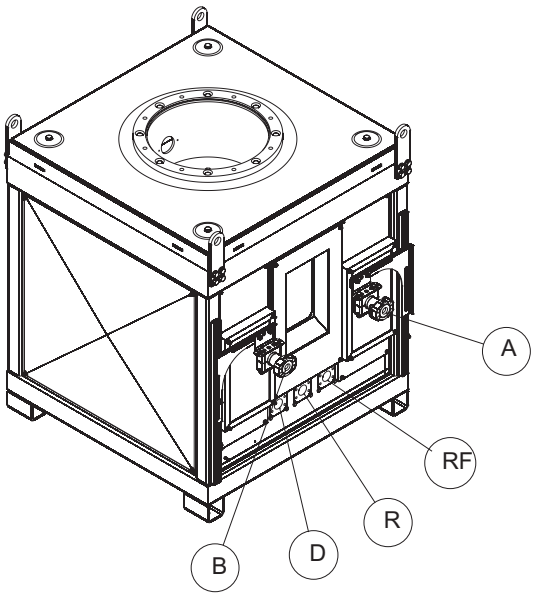
During mounting of the hydraulic connections following points must be kept in mind :

- The coupling protections must be kept on until final assembly.
- It is important that all pipes are mounted to give sufficient working space for maintenance of the Gemini unit.
- Always use hoses to connect pump interface with piping.



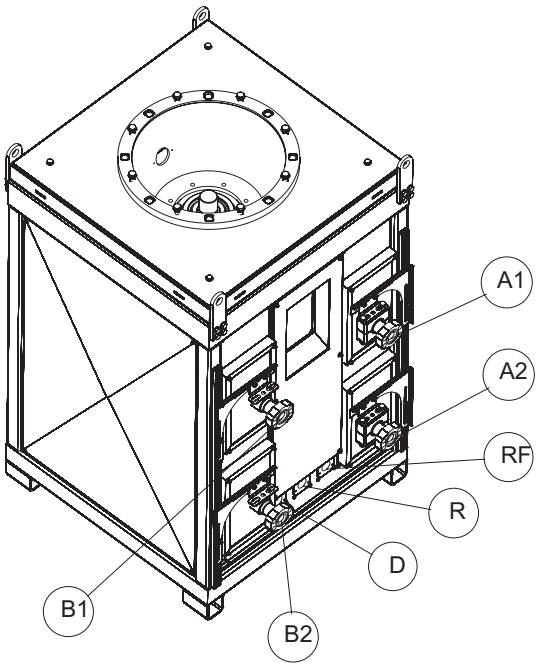
Horizontal pump unit

Connection	Description	Port connection	Class
A1, A2	Main connection (No o-ring)	SAE 2"	6000 psi
B1, B2	Main connection (No o-ring)	SAE 2"	6000 psi
R	Return connection	SAE 2"	3000 psi
D	Drain connection	SAE 2"	3000 psi
RF	Replenishment connection	SAE 2"	3000 psi



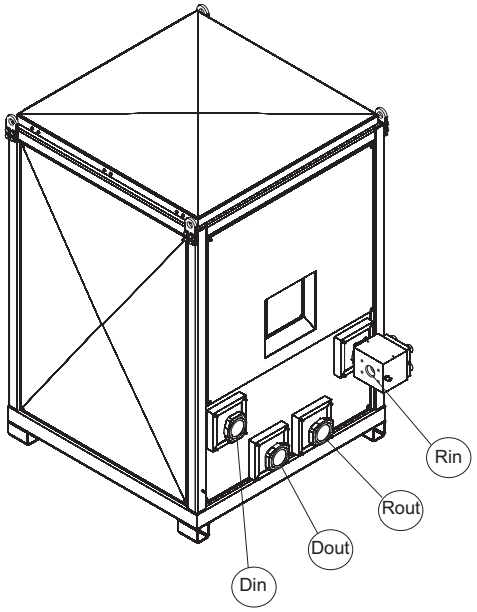
Single vertical pump unit

Connection	Description	Port connection	Class
A	Main connection (No o-ring)	SAE 2"	6000 psi
B	Main connection	SAE 2"	6000 psi
R	Return connection	SAE 2"	3000 psi
D	Drain connection	SAE 2"	3000 psi
RF	Replenishment connection	SAE 2"	3000 psi



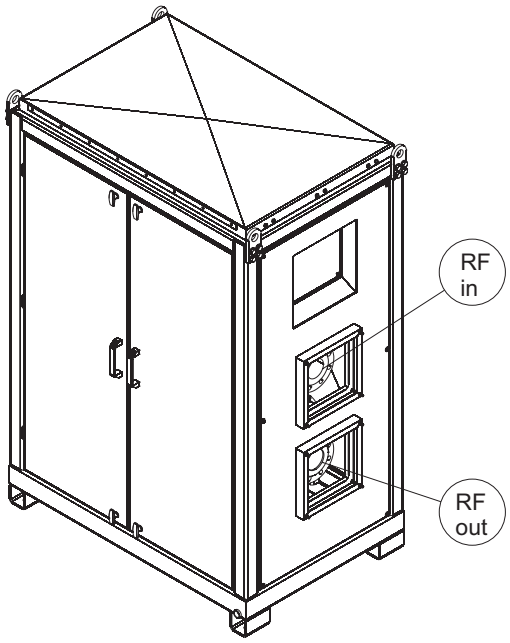
Tandem vertical pump unit

Connection	Description	Port connection	Class
A1, A2	Main connection (No o-ring)	SAE 2"	6000 psi
B1, B2	Main connection	SAE 2"	6000 psi
R	Return connection	SAE 2"	3000 psi
D	Drain connection	SAE 2"	3000 psi
RF	Replenishment connection	SAE 2"	3000 psi



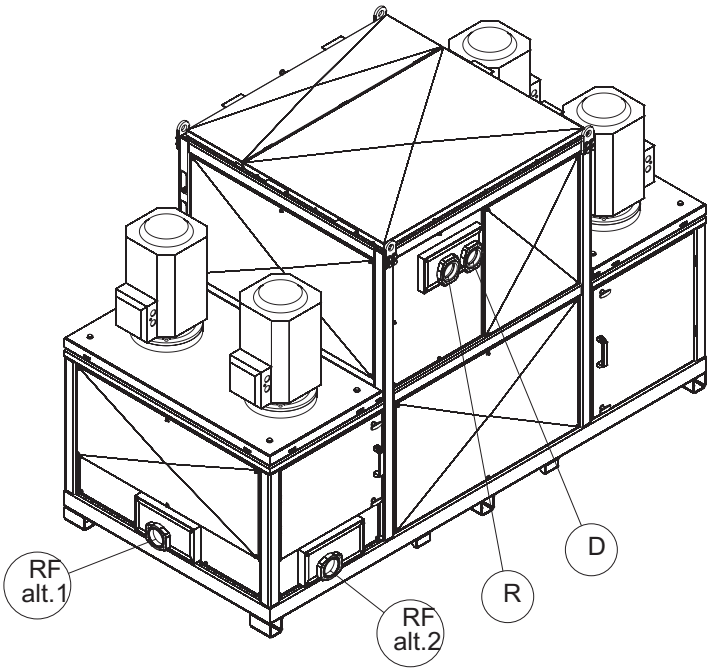
Filter unit

Connection	Description	Port connection	Class
Rin	Return in connection	SAE 4"	50 bar
Rout	Return out connection	SAE 4"	50 bar
Din	Drain in connection	SAE 4"	50 bar
Dout	Drain out connection	SAE 4"	50 bar



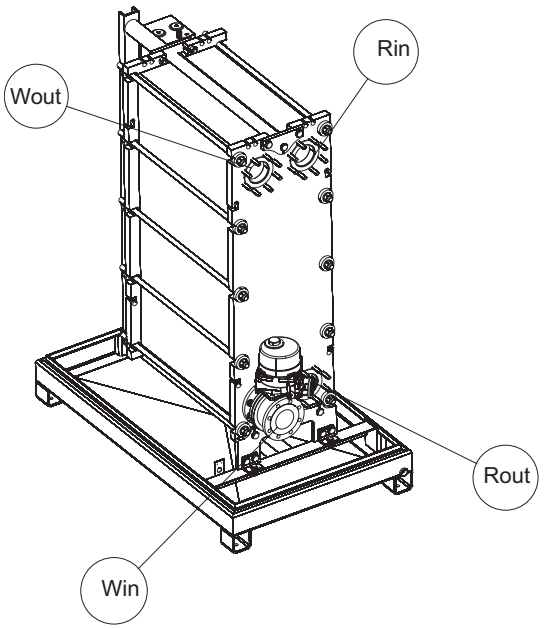
Replenishment filter

Connection	Description	Port connection	Class
Rfin	Replenishment connection in	DN 100	PN 64
Rfout	Replenishment connection out	DN 100	PN 64



Tank unit

Connection	Description	Port connection	Class
RF	Replenishment connection	SAE 4"	50 bar
R	Return connection	SAE 4"	50 bar
D	Drain connection	SAE 4"	50 bar



Cooling unit

Connection	Description	Port connection	Class
Win	Water in connection	DN 100	PN 16
Wout	Water out connection	DN 100	PN 16
Rin	Return in connection	DN 100	PN 16
Rout	Return out connection	DN 100	PN 16

4.8 Electric connections

Safety precautions

- All electric equipment is intended to be installed and used by qualified personnel who are familiar with relevant safety requirements.
- Safety equipment necessary for the prevention of accidents at the mounting and operating site shall be provided in accordance with the regulations prevailing in the local country.
- Earthing shall be carried out according to local regulations before the electric equipment is connected to the main voltage.
- All electrical supply levels must be within the limits that the equipment is constructed for, see technical documentation and maximum rating plate.

Installation of electrical equipment must in most countries be installed by licensed electricians (ref. to domestic laws).

Control system power

Connect control system power to the junction box on each of the main pump units, to the junction box in the filter unit and also to the control desk according to the electrical drawing in the technical documentation.

Internal control system signals

- Connect the control system cables with M23 contacts between the filter unit and the tank unit, between the filter unit and the cooler unit and between the filter unit and the replenishing filter unit.
- Connect the emergency stop cables between the junction boxes of each pump unit, to the junction box in the filter unit and finally to the control desk according to the electrical drawing.
- Connect the profibus cable with M12 contacts between the units according to the electrical drawing.
- Connect the hydraulic motor sensors to the pump units according to the electrical drawing.
- Connect the hydraulic motor speed encoder signal to the pump units according to the electrical drawing.
- Connect the electric motor thermistor in each pump unit to the junction box according to the pump unit internal electrical drawing.

If used, connect the position switches from the shut-off valves in the main hydraulic lines to the control desk according to the electrical drawing.

External control system signals

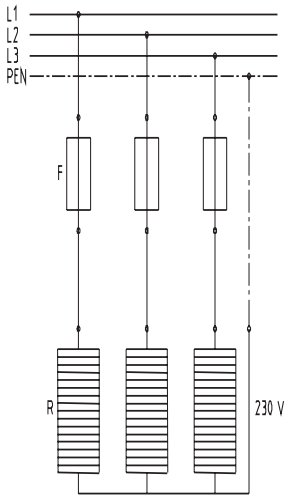
- Connect the emergency stop signal to the control desk according to the electrical drawing
- Connect the main electric motor monitoring and control signals from the starter unit to each pump unit according to the electrical drawing.
- Connect the electric motor monitoring and control signals from the starter unit to the filter unit according to the electrical drawing.
- Connect the tank heater control signal from the starter to the filter unit according to the electrical drawing.

Oil heater

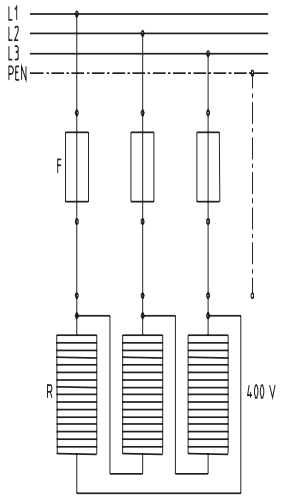
Connect the cables to the screw terminals inside the terminal box as shown on pictures below.

For power and voltage see attached technical documentation and rating on the oil heater.

230/254



400/440



Electric motor

Major voltage connection according to stamping on the rating plate.

4.9 Pipe work

General

The hydraulic pump unit should be placed as close to the hydraulic motor as possible, taking other circumstances (such as space, environmental conditions etc) into consideration.

The main connections of the hydraulic pump and the hydraulic motor must always be fitted to the piping with hoses. We recommend to install shut off valves on the main lines A & B. The protective covers on delivered parts shall be kept on until final assembly.

Do not work on the pipe work if the hydraulic system is pressurized. Use necessary safety equipment during installation of the pipe work. Safety requirements for each measure must be followed.

Storage of included components

The included components shall be stored according to section 3.1 “Storage of the packed Gemini unit“. Notice that the packing must not be removed during storage.

Handling of fittings

General:

Inspect the sealing surfaces on the couplings visually before mounting. It must be free from any damages such as scores and cracks. Handle the couplings with care. If you drop the coupling or it has nicks on it, inspect it visually. Check that the sealing is in its right position, free from cracks and that it is saturated with oil.

The protections and packing on the fittings must be kept on until final assembly.

Flange fittings:

The screws must be tightened crosswise.

Moment of tightening; by hand +1/4 - 1/2 turn. Do not overtighten the fittings.

Use correct size tools, fittings can be damaged and difficult to remove.

Notice that all fittings may expand because of heat and vibrations and must be retightened.

Welded fittings:

Contact your Hägglunds Drives representative.

Mounting of hoses

Ensure that hoses are not stressed or twisted on installation, so as to prevent premature failure. Bend radius should conform to manufacturers recommendations.

Clamps

The normal distance between clamps:
D ≤ 25 mm (1 in) 1500 - 2000 mm (59 - 79 in).
D ≥ 25 mm (1 in) 2000 - 2500 mm (79 - 98 in).

The pipes must be clamped immediately before and after a bend and immediately before transition to a hose.

Cleaning

The pipes and hoses should be pre-cleaned, inspected and sealed by the supplier. If the pipes are field bent and installed the overall system must be oil flushed to reach the required cleanliness level.

Pressure tests

Pressure tests should always take place before flushing in order to release contaminations by stresses introduced by the pressure. The main lines must be pressure and leakage tested to a static pressure of 1,5 x max. expected system pressure (not above bursting pressure). The hydraulic motor and Gemini unit must be disconnected or protected by closed valves during the pressure tests. The tests on the main lines are appropriately carried out by using a hydraulic hand pump.

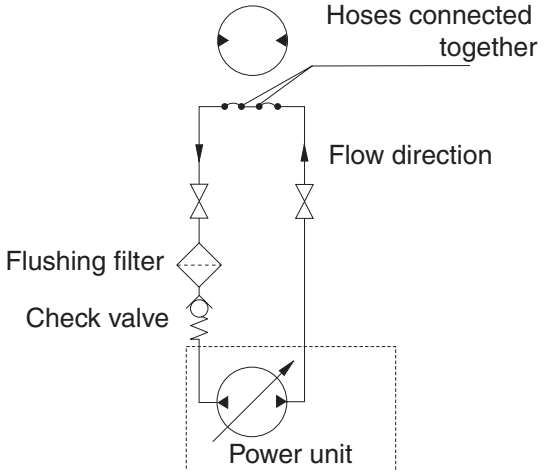
4.10 Flushing before start up

A pressure filter and check valve has to be connected to the main line at the Gemini unit. This filter is connected on the return side of the drive pump.

Recommended filtration degree **ß10 = 75** or better.

The size of the flushing filter should be matched to that of the pump concerned, so that the pressure drop across the filter is not excessive and that the maximum pressure/flow ratings for the filter is not exceeded. Use high pressure filters.

The main lines should be connected together at the motor enabling the entire system to be flushed, see figure beside.



The flushing line to the hydraulic motor shall be connected to the drain line of the motor during flushing to enable cleaning of the drain line.

The maximum flow from the Gemini unit should be flushed through the main circuit for at least 2 hours on small installations and considerably longer on large ones.

Use extreme caution to ensure pump is stroked in sync with free flow direction of check valve.

Use a check valve sized for the oil flow. When using the main pump the maximum pressure should be reduced.

Use a check valve sized for the oil flow.

When using the main pump the maximum pressure shall be reduced.

After cleaning flushing of the system the cleanliness has to be verified with oil sample test, inline cleanliness measurement or corresponding.

4.11 Commissioning

4.11.1 Before commissioning

General

- Read and understand this complete manual and the other attached technical documentation.
- Visually check the whole system for: signs of damage, incorrect circuitry, security of foundations, the degree of filtration for the filter according to the data in the technical documentation.
- Check that the degree of filtration for the filters are according to the data in the technical documentation.
- Check that the coupling between the electric motor and pump is properly mounted.

Cleanliness

- The hydraulic system must be flushed and thoroughly cleaned on the inside.
- If the slightest doubts are entertained, the cleanliness should be checked before filling with oil.

Pipe work

- Are the couplings properly tightened?
- Is the pipe work properly cleaned?
- Is the pipe work mounted free of stress?
- Are the lines in accordance with installation drawing/piping plan?

Electrical components and control system

- Check that electric motor(s), control system and other electrical components are connected to the voltages specified on the component and in the electrical drawings.
- Check the function of all actuators, switches, transmitters and other sensors in the system which can be checked without running the pumps, eg suction line switches, temperature transmitters. Make sure the corresponding alarm or warning is indicated in the control system. Actuators which cannot be tested must be checked for correct wiring and actuated manually if possible. Tank oil level transmitter must be tested when the tank is filled the first time.
- Measure the resistance of the PTC thermistors in the electric motors. The resistance may vary depending on the number of PTC elements connected in series. The resistance should be between 500 Ω and 1200 Ω in a cold electric motor. Make sure the thermistor alarm is active in the control system when the PTC sensor is disconnected.

4.11.2 Filling up the system with hydraulic fluid

Before filling

- Check that the correct type and quality of hydraulic fluid is used. Do not mix different types of hydraulic fluid without first checking with manufacturers.
- Check that the barrel with hydraulic fluid and tank/hoses are not contaminated with water or other substances.
- For handling of couplings and hoses see section 4.9 “Pipe work“
- Close the ball valve on filter unit where filter has oil filling connection to prevent non filtered fluid being flushed into the system, when filling the tank for the first time.

Filling

Use a fluid filling pump unit which has a filter with a filter rating of 10 microns or better.

New fluid is normally not filtered and will introduce dirt into the system, the fluid must therefore always be filled through a filter. Never pour hydraulic fluid into the tank through the air breather filter.

Always pump the fluid in through the special quick connection. The quick connection is a quick release coupling inside the filter unit. The fluid filled into the system will be filtered through the drain filter.

Check the function of the level transmitter while filling up the tank. There is an indication lamp mounted inside the return and drain filtering unit on the right hand side which will indicate when the correct fill level has been reached. The indication lamp can be tested by a separate test button mounted beside the lamp.

Oil tank size Litres (US gallon)	Overfilling oil level signal Litres (US gallon)	Full oil level signal Litres (US gallon)	Low oil level signal Litres (US gallon)	Minimum oil level signal Litres (US gallon)
1200 (317)	1250 (333)	1200 (317)	1100 (291)	1000 (264)
1800 (476)	1850 (489)	1800 (476)	1700 (449)	1600 (423)
2400 (634)	2450 (647)	2400 (634)	2250 (594)	2150 (568)
3600 (951)	3650 (964)	3600 (951)	3450 (951)	3350 (885)

- **Check the caution sign on the hydraulic fluid container and the warnings in section 2.1“Choice of hydraulic fluid”.**
- **Avoid long skin contact with the hydraulic fluid.**
- **Remove any spilled oil from the floor due to great risk to slip and fall.**

4.12 Initial start up procedure

- Make sure the driven system and driven machine is ready to run, warn all personnel in the area that start up is imminent.
- Follow "Safety precautions" section 1.1.
- Follow instructions in sections 4.10 and 4.11.
- Never operate the Gemini unit with defective instruments or control elements.
- Keep inflammable materials away from the Gemini unit.
- During start-up period, the hydraulic system will be cleaned from built-in dirt particles, therefore keep an eye on the filter indicator during the entire start up procedure.

On high viscosity start up, the filters may indicate bypass. If the indicators will not reset after system has reached operation temperature, filter element must be changed.

Fill oil through filter unit.

STEP 1 Immediately before starting

- Check safety equipment.
- Check that the prescribed steps in section 4.11 “Before commissioning“ have been carried out.
- Make sure that all valves on the suction, pressure and inlet side of the pump, as well as any valves on drain lines, are open.

For adjustments and settings on the control system see special instruction in attached technical documentation.

STEP 2 Start charge pump and check charge pressure.

- Check that sufficient charge pressure is present in the system.
- Let the charge pumps run until system is properly filled up with fluid.
- If necessary, add of more fluid according to section 4.11.2 "Filling up the system with hydraulic fluid".

STEP 3 Start with unloaded main pump at short intervals

Starting of the hydraulic pump unit shall be carried out with a completely unloaded pump in short intervals.

Read oil level in Spider control system

Make sure immediately that the pump has the correct direction of rotation, otherwise the pump will be damaged. The correct direction of rotation is evident from a sign placed under the electric motor.

- When the hydraulic fluid is cold some restarts may be needed to raise the charge pressure.
- Check the charge pressure, confirm with data and settings on attached technical documentation.
- If OK, the pump may be allowed to come on stroke and introduce flow into the unloaded hydraulic system. Check that the charge pressure is still OK.

STEP 4 Unloaded main pump at longer intervals

Run for a period at no load condition until system is stable and control is established.

Additional topping up may be needed due to parts of the system having been filled with fluid.

- Check the function of all actuators, switches, transmitters and other sensors in the system which was not tested before initial start up, eg pressure transmitters.
- Check for unusual noises or vibrations.
- Check that the specified pressure levels for charge pressure at the Gemini unit are maintained in accordance with the values stated on the hydraulic diagram in the attached technical documentation. These pressure levels are preset at the factory but may have to be corrected due to site conditions.
- Check for leakage points.
- Correct any faults discovered on the points above.
- Check all connections, screws etc. and tighten if it is necessary.
- Restart when finished.

STEP 5 Loaded hydraulic system

The hydraulic system can be loaded when the hydraulic system functions runs satisfactorily in unloaded condition.

- Gradually increase load pressure until satisfactory operation is obtained.
- It may be necessary at this point to make adjustments to flow, ramp rates, etc.
- Cycle the system until normal operating temperature is reached.

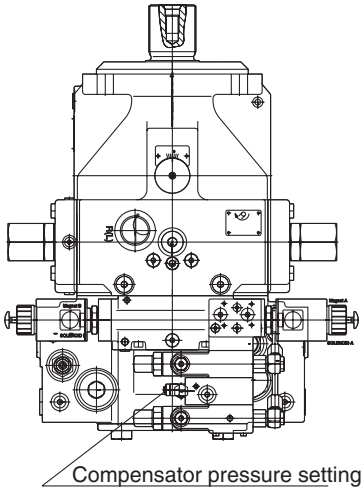
STEP 6 Checking

- Check for unusual noises or vibrations.
- Check the function of the safety equipment.
- Check temp in tank and closed loop. Check also that the cooler control is stable. If not, investigate water supply, controls, air blast cooler, etc.
- Check for leakage points.
- Check that the pump compensator pressure control and pressure switches (optional) are set at levels appropriate to the drive. Upon delivery, these pressure levels are set at the levels specified by the customer and normally no readjustment will be necessary. The values are stated in the technical documentation, data and settings. Pressure can easily be checked by closing a ball valve in the high pressure line (if there is one) and stroking the pump until the pressure can be read on a portable gauge or in the Spider control system.
- The working pressure must be checked to ensure that they correspond to the contracted values.

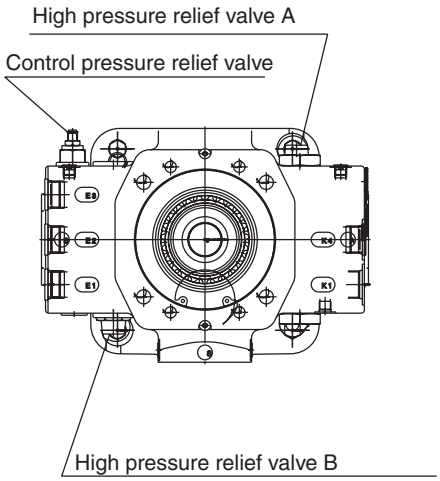
STEP 7 Stop the main electric motor

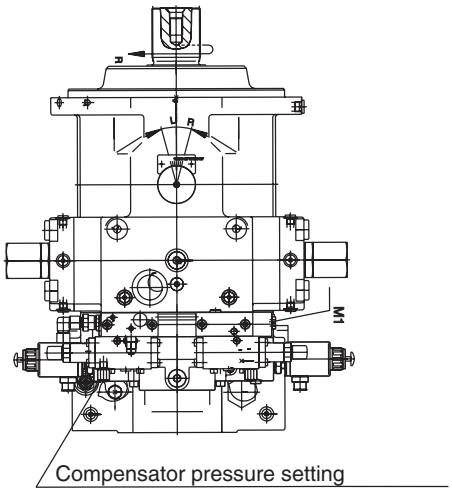
- Correct any faults discovered at the points above.
- Check the filter indicator. It is not unusual to change elements on commissioning as the system is cleaning the dirt particles out. When changing filter elements carefully follow the instructions in section 5.3 “Filter change“ to prevent introduction of dirt into the system. If there is still dirt in the system, additional flushing is necessary in order to prevent premature failure of system components.
- Check all connections, screws etc. and tighten if it is necessary.
- Tidy up inside and around the Gemini units. Remove waste fluid, pieces of cable among other things. Keep the inside of the Gemini units neat and clean.

4.13 Pump settings and adjustments, SP-pump

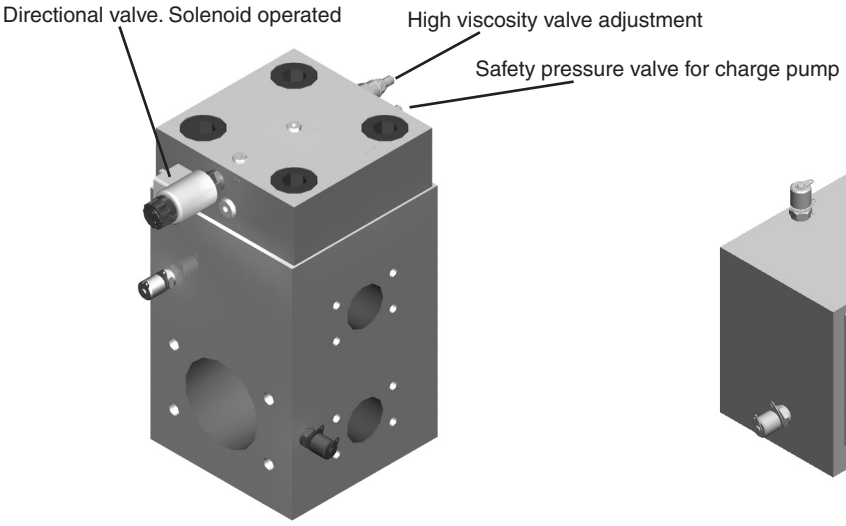


SP355

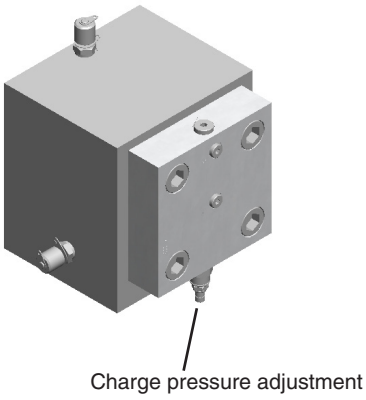




SP500-SP750



Valve for safety of charge pump and for high viscosity start.
Valve is placed in the tank unit, GTM.



Valve for charge pressure level adjustment. Valve is placed in the filter unit, GFRM.

Charge pressure level, control pressure level, high pressure relief valves, pressure compensator, safety pressure valve for charge pump and valve for high viscosity start are set before the delivery of Gemini Units from the factory and there is normally no need for readjustment. Check always the pressure levels in the documentation. Setting of pressures on the pump(s) and in the Gemini systems must be performed by skilled service personnel familiar with functions and risks involved with the pump. The pressures shall be set during operation and with system at operating temperature.

Note that pressures will change with different viscosities.

In the Gemini system control pressure level, high pressure relief valves and the pressure compensator are set on the pump(s) in the pump unit GPVM/GPHM. The charge pressure level are set in the common filter unit GFRM and the safety pressure valve for charge pump and valve for high viscosity start are set in the tank unit GTM.

1. Pressure level for valve for high viscosity start: Plug the outlet from the charge pump valve block in the tank unit GTM. Unscrew the high viscosity valve adjustment to a minimum. Energies the solenoid on directional valve to move it in open position. Start the charge pump(s) and adjust the pressure level for high viscosity start to 8 bar. The pressure to be measured at the valve block.
2. Safety pressure valve for charge pump: With plugged outlet from the charge pump valve block in the tank unit GTM. Unscrew the safety valve for the charge pump to a minimum. De-energies to the solenoid on directional valve to move it in closed position. Start the charge pump(s) and adjust the safety pressure valve level to 33 bar.

   The pressure to be measured at the valve block. Take away the plug on the outlet on the valve block.
3. Charge pressure adjustment: The charge pressure level shall be adjusted on the valve in the return filter unit GFRM. Start the complete system in operating mode and let the main pumps run in idling mode with zero stroke/neutral position.

   Adjust the charge pressure level by turning the adjustment screw. The charge pressure shall be set at 15 bar/220 psi as standard. Pressure to be measured at port MK4 at one of the main pumps in the pump unit GPVM/GPHM. After adjustment tighten the setting screw by means of the luck nut.
4. Control pressure adjustment: The control pressure to be measured at port E2 on every main pump in the pump unit. The control pressure shall be adjusted to 30 bar/436 psi + (pn - ps) with the pump in neutral (zero stroke position).

   Release the luck nut width size 19 and adjust the control pressure to the necessary level by turning the setting screw (internal hexagon size 6).

   To get the value p_n measure the pressure in ME3-port with the pump in neutral position.
   To get the value p_s measure the pressure in ME3-port with the pump swiveled out to >50 % stroke (Secure that the flushing valve has moved).
   (p_n - p_s) = should be about 5-12 bar, depending on the pump size.
   After adjustment tighten the setting screw by means of the luck nut size 19.
5. High pressure relief valves setting A and B side for each pump: To adjust the high pressure relief valve the pump has to be loaded (blocked or partly blocked main port or actuator).

   Set the compensator pressure (See item 6.) to a value corresponding to the high pressure relief valve setting. The reason for that is to be able to reach enough high pressure at the pressure relief valve setting. Release the luck nut (width size 24) and adjust the setting screw (internal hexagon size 6).

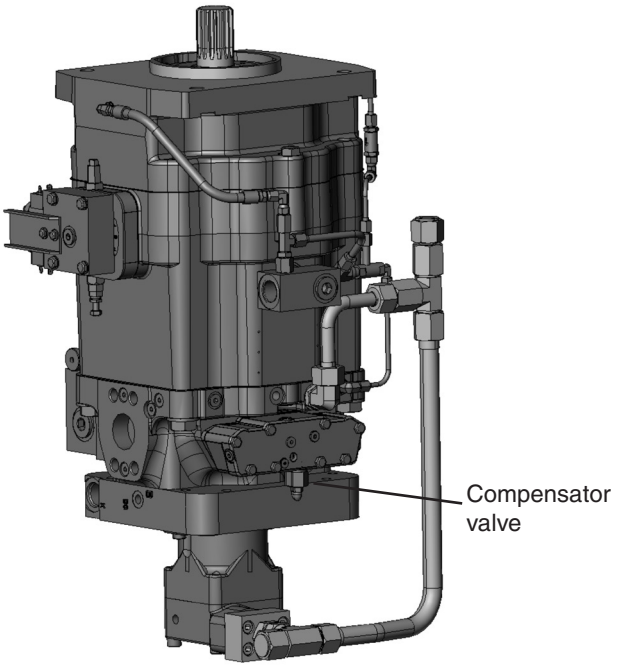
   First adjust the high pressure relief valve to the maximum value. Then adjust the compensator pressure down to the minimum level. Swivel the pump to about 50 % stroke in A/B side and adjust the compensator pressure up to the requested high pressure level (high pressure relief valve setting). Adjust the high pressure relief valve A/B to the same value as the recently set compensator level.

   Setting value according to documentation, maximum 390 bar (5660 psi). With completely blocked port the swivel angle shall be below 3°. Measure the pressure at port M_A respectively M_B or at MAB-port. The setting value shall be 40 bar (580 psi) above the compensator pressure setting.

Note: The high pressure relief valves must be adjusted before the compensator pressure adjustment.

6. Pressure compensator setting: Release the luck nut (width size 17) and adjust the setting screw (internal hexagon size 5). The pressure compensator shall be adjusted with blocked main-port or blocked actuator. Set the compensator pressure to a value according to the documentation, maximum 350 bar (5080 psi).
   Measure the pressure at port M_A resp. M_B or at MAB–port.

4.14 Pump settings and adjustments, HD pump



HD24S & HD30S

Charge pressure and Pump compensator pressure level are set before the Gemini units leave the factory and consequently there is normally no need for readjustment. Check always the pressure levels in technical documentation. **Setting of pressures on the pump(s) must be performed by professional service personnel familiar with the functions and risks involved with the pump.** The pressures shall be set during operation and with the system at operating temperature. Note that pressures can change with different viscosities.

1. *Charge pressure adjustment*: Charge pressure level is set on the pressure relief valve mounted on the filter unit. Ref. section 4.13. Charge pressure level can not be set on the pump.
2. *If the main pressure levels are to be increased:* **Make sure that the piping and machine structure can take higher pressure/higher torque delivered from the hydraulic motor.**
3. *Compensator pressure adjustment:* Activate or move the input signal to the control so that pressure increases in the high pressure closed circuit to the pressure limiter setting. The pressure limiter setting is reached when the pressure stops increasing and remains steady at a given pressure level. (as shown on the gauges)

The pressure limiter setting for both A- and B-side is set on the compensator valve.

Remove acorn nut, loosen lock nut and adjust pressures with an Allen key, size 5/32", until the desired pressure level is established. Clockwise rotation of the adjustment screw will increase the pressure.

4. *When main pressures are set:* Tighten lock nut and return acorn nut. Note the new pressure level in logbook or technical documentation.

Working in high pressure areas could be dangerous in case of unforeseen failures.

5. Preventive maintenance

5.1 Maintenance log

We recommend that a maintenance log is kept to record service/maintenance/repair, addition and alteration of the equipment. Each note, observation or comment should be dated.

5.2 Maintenance chart

Common

The maintenance of hydraulic systems is designed to prevent failure of the system and to keep the system running efficiently to specification. The specific procedures will depend on the nature of the equipment, the environment it is working in and the duty cycle, bearing in mind the consequences of a breakdown. To optimise the maintenance intervals economically a Life Cycle Cost (LCC) analysis is recommended. Follow the section 1.1 "Safety precautions" during the check-ups.

Daily checks, first week after commissioning

- Fluid leaks
- Fluid level in the tank
- Operating temperature
- System pressure
- System performance and general condition
- Unusual noises

Pre-start checks (even daily)

- Fluid leaks
- Fluid level in the tank
- Is the suction valve open?

Frequent checks

- Unusual vibrations
- Unusual noises
- Fluid leaks
- Fluid level in the tank
- Is the unit relatively clean? Air flow paths unrestricted?
- Pressure levels normal - stable?
- Operating temperature
- Is the drive running smoothly?

Scheduled maintenance

Planned maintenance at specific time intervals, including the following checks and actions:

- All points under frequent checks
- Check all pressure levels
- Check for stable temperature levels around the system
- Drain water and sludge from the tank at the drain tap
- Check the electric motor
- Check the function of monitoring equipment/switches, etc
- Clean areas where dirt is building up.

Note: Never use a high pressure washing system to clean inside the Gemini unit

- Check the cables
- Check drain line flows and drain line oil condition
- Check the hoses, couplings and pump(s), with respect to cracks, leakages and condition
- Check the shaft coupling through the inspection hole.

Warning, rotating parts inside the inspection hole

- Check the flow of cooling water
- Check that the insulation inside the cabinet is fixed
- Check that the doors and cover of the Gemini unit are not damaged
- Check the visual contamination indicator on all the oil filters when the pump electric motors are started and the hydraulic oil is warmer than 25°C. If the contamination indicator is visible but there is no filter warning indicated the control system, check the electrical wires and replace the filter.
- Check all hand actuated valves. Make sure that both the valve and the monitoring switch are clean, not damaged and operating smoothly.
- Check the vapor corrosion inhibitor(s) mounted on the inside of the door in all spider control units, junction boxes and the control desk. Check the marking on the inhibitor and replace it if the week for replacement has passed.

Absolute max. intervals for major inspection and replacement					
	Oil filters	Air breather on tank	Hydraulic fluid	Accumulator	Air inlet
After the first 100 working hours	R*				
After 3 months or 500 working hours	R*				
Once every 3 months				I**	
Once every 6 months	R*		I	I	I
Once every 12 months		R			

* If the contamination indicator is tripped out, the filter must be changed immediately, and the oil examined.

I = Inspection
R = Replacement

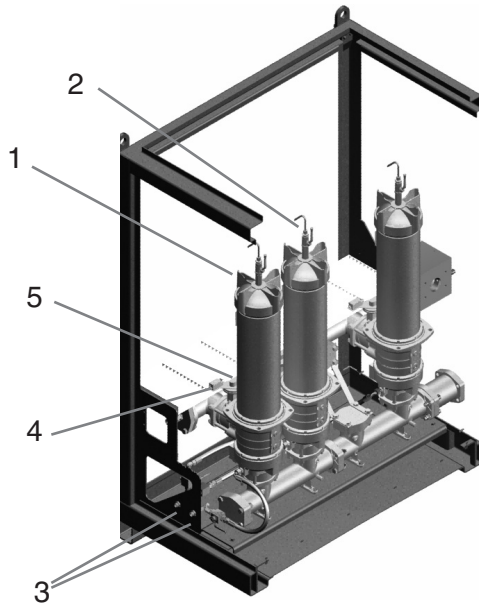
** For shock load applications, shredders, crushers i.e.

5.3 Filter change

Return/drain filter

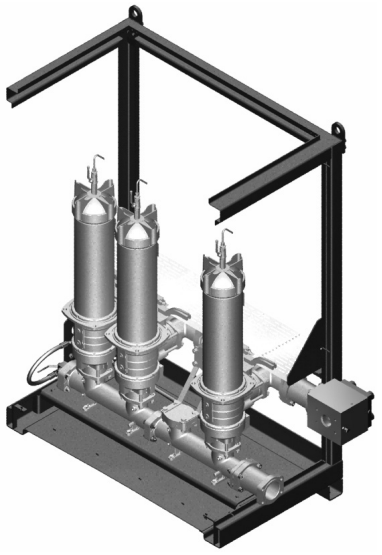
Removing the filter element

1. Stop the main pump(s) and the replenishment pumps.
2. Close the ball valve to isolate the filter hydraulically. A limit switch (4) will be activated and an alarm signal will interlock the system when the ball valve handle is removed from its position.
3. Drain the fluid from the filter housing by connecting a hose to the drain connection (3) and at the same time open the air vent screw (2) on the cover plate of the filter.
4. Unscrew the cover plate (1) on top of the filter housing and remove the used filter element upwards. Examine the surface of the filter element for contamination residue and large-sized particles. This may be an indication of damage of components in the system.
5. Make sure that no foreign material enters the filter housing and clean the cover plate, if necessary.
6. Check the filter housing for mechanical damage/wear, paying special attention to the sealing surfaces. Check the O-rings and change them, if necessary.



Installing the filter element

1. Wet the sealing surfaces on the filter housing and the cover plate including the seals with clean hydraulic medium.
2. Check that the designation of the new filter element corresponds to that of the old one.
3. Carefully mount the filter element on the element spigot in the housing. It is very important during the mounting not to expose the filter element to any dirt, i.e. keep it in the plastic cover as long as possible
4. Screw on the cover plate (hand-tight).
5. Remove the hose from the drain connection and open the ball valve. Place the ball valve handle in open position and de-activate the limit switch.
6. Close the air vent screw.
7. Switch on the hydraulic system, check the filter for leakage.

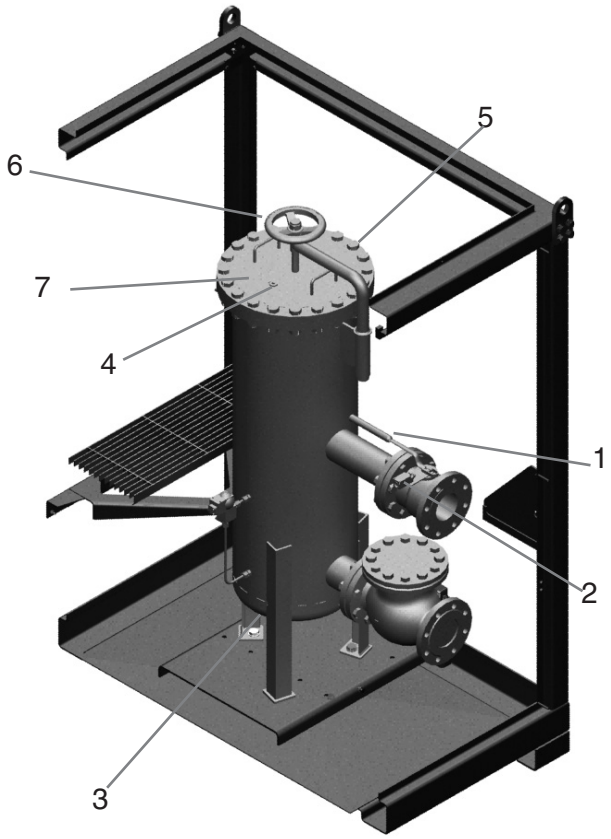


Note: When removing a filter element take some time to inspect and look for unusual contamination within the pleats. Contact your Hägglunds Drives representative for advice.

Replenishment filter

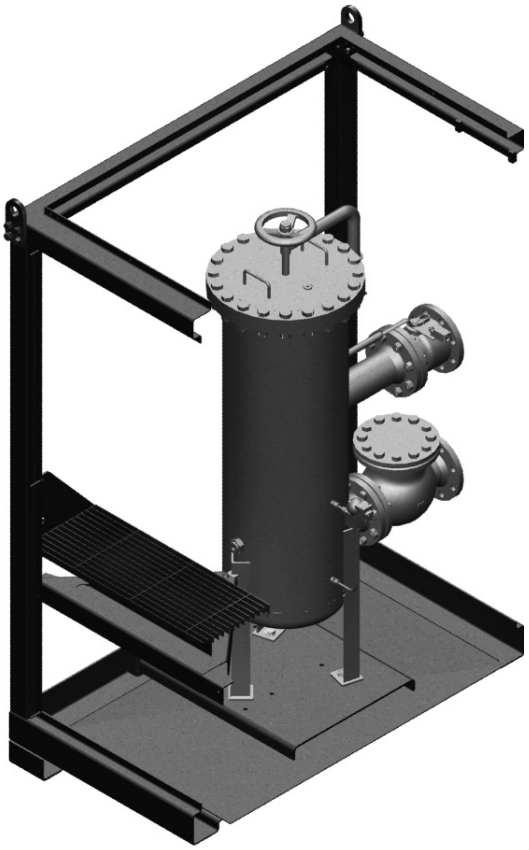
Removing the filter element

1. Stop the main pump(s) and the replenishment pumps.
2. Close the ball valve (1). A limit switch (2) will be activated and an alarm signal will interlock the system when the ball valve handle is removed from its position.
3. Drain the fluid from the filter housing by connecting a hose to the drain connection (3) and at the same time open the air vent screw (4) on the cover plate of the filter.
4. Unscrew the screws(5)
5. Lift cover (7) by screwing the handle (6).
6. Turn the cover to the side and remove filter element upwards. Examine the surface of the filter element for contamination residue and large-sized particles. This may be an indication of damage of components in the system.
7. Make sure that no foreign material enters the filter housing and clean the cover plate, if necessary.
8. Check the filter housing for mechanical damage/wear, paying special attention to the sealing surfaces. Check the O-rings and change them, if necessary.



Installing the filter element

1. Wet the sealing surfaces on the filter housing and the cover plate including the seals with clean hydraulic medium.
2. Check that the designation of the new filter element corresponds to that of the old one.
3. Carefully mount the filter element on the element spigot in the housing. It is very important during the mounting not to expose the filter element to any dirt, i.e. keep it in the plastic cover as long as possible
4. Turn back cover and lower it by screwing the handle.
5. Screw bolts on the cover plate with tightening torque 520 Nm.
6. Remove the hose from the drain connection and open the ball valve. Place the ball valve handle in open position and de-activate the limit switch.
7. Close the air vent screw.
8. Switch on the hydraulic system, check the filter for leakage.



5.4 Inspection of hydraulic fluid

We recommend that the hydraulic fluid is analysed once every 6 months. The analysis should cover viscosity, oxidation, water content, additives and fouling. In the vast majority of cases, your oil supplier will undertake to perform an analyses that will reveal the condition of the hydraulic fluid and can recommend suitable actions. If the analysis reveals that the properties of the hydraulic fluid is not fulfilling the requirements in section 2.2 “Requirements for hydraulic fluid cleanliness“ it should no longer be used, but be changed or cleaned immediately. Refill fluid according to section 4.11.2 “Filling up the system with hydraulic fluid“.

- **Dangers associated to hydraulic fluid.**
- **Store up used hydraulic fluid and contamined filter elements for destruction.**
- **The fluid may be hot if the cooling is insufficient.**

Different hydraulic fluids are affected differently - consult the manufacturer.

5.5 Lubrication of electric motor

Lubricate electrical motors.

1. Clean the grease nipples.
2. Grease the electrical motor, use a grease gun.
3. For details see operating instructions of electrical motors.

Air inlet for electrical motor

Check that the air inlets on the electric motor are not clogged by dirt and that air can easily pass.

5.6 Tank breather filter change

1. Clean around the area where the air filter is located.
2. Unscrew the cap and change the filter.
3. Mount the cap and make sure that no foreign material has entered the oil tank.

5.7 Cleaning of cooler

If the plate pack is to be cleaned while closed, the necessary plant prerequisites must be created, e.g. the installation of appropriate pipe connections, valves, collecting containers, etc. for the preparation, storage and transport of the detergent.

The detergent used must not contain any components which attack the plate material and the gaskets used. When using ready-made, proprietary cleaning chemicals the manufacturer’s instructions must also be observed, e.g.

- Concentration of detergent
- Specifications for the temperature regime according to the application
- Sequence of use of different chemicals (basic, acidic)
- Flushing and passivation specifications (especially when shutting down after cleaning).

In CIP cleaning (Cleaning in place) the deposits are released from the plates by pumping around a suitable detergent and then flushed out of the apparatus. To achieve a satisfactory result, the flow rate of detergent should be greater than the rate during normal operation (at least 1.5 times more).

Following the actual cleaning sequence the detergent is removed from the apparatus after flushing with clean, chemically neutral water. If concentrated detergents are used subsequent passivation should be carried out using an oxidising acid (e.g. 2 % nitric acid solution). The apparatus must then be rinsed again thoroughly with plenty of water.

The changes in temperature which occur in the plate heat exchanger during CIP cleaning (Cleaning in place) due to the process are inoffensive with regard to the guidelines in the order documentation.

The maximum permissible operating temperature, indicated on the nameplate, may in no case be exceeded. This applies also to any steaming procedure (only saturated steam to be used!) and hot rinsing.

Before the heat exchanger may be loaded with hot rinsing solution or hot water for CIP cleaning of the side of the service medium of evaporators, it is essential to suck the refrigerant completely off the apparatus. Otherwise the plate heat exchanger can be seriously damaged when the refrigerant evaporates explosively and therewith provokes a pressure increase on the refrigerant side.

Follow the safety precautions on the container of the cleaning agent used. Disconnect the Power Unit before disconnecting the water-oil cooler. Make sure that electric power is cut off before cleaning! Cleaning agent and waste water from rinsing should not be disposed in nature.

5.8 Gemini unit out of service

Periods out of commissioning

If the Gemini unit is to be out of service for more than three months, the hydraulic system must be protected internally against rust. This can be done in the following manner:

Use hydraulic fluid with rust preventing additives according to ASTM D665 class A or hydraulic fluid similar to Shell corr. hydraul, 2% VSI-improver. This additive gives protection against rust for up to about a year. After this, the equipment should be run at intervals so as to maintain a protective film on the internal surfaces of components and oil lines, thus providing protection against corrosion.

If any parts of the system are disconnected, note that open fittings must be protected by plugs or covers to prevent ingress of any dirt particles.

Re-commissioning

Before the plant is re-started after a long idle period, a check should be made as to whether the instructions supplied for the original commissioning still apply. Moreover, the following measures should be observed.

-Remove preservative solution and any signs of contamination.
-Follow the procedure in section “Initial start up procedure“

6. Corrective maintenance

6.1 Common

Before removing any hydraulic/electric components, disconnect the Gemini units. Ensure that no energy is accumulated in the system and that the electric motors are currentless. Please consider section 1.1 "Safety precautions".

Before disassembly:

- Trouble-shoot the Gemini unit(s) and perform appropriate tests.
- Clean all assemblies and components, take all precautions necessary to prevent dirt entering the system.
- Disassembly shall only be done by professional service personnel.

Disassembly:

- Label all parts, and protect precision or machined surfaces.
- Inspect all parts during disassembly for wear or damage.
- If hydraulic fluid is to be drained and reused, make sure that drain containers are clean and covered when not in use.
- Clean all metal parts using a suitable solvent prior to reassembly, set aside on a clean and lint free cloth to drain.

Reassembly:

- Lubricate with system hydraulic fluid
- Replace all seals, gaskets and O-rings with new items of the correct size.
- Ensure complete sealing at pipe connections
- Refill hydraulic fluid according to section 4.11.2 “Filling up the system with hydraulic fluid“.

6.2 Change of electric motor/pump unit

In vertical assembly of pump units the electric motor and pump are assembled into a unit and mounted on the motor support plate attached to the frame via anti vibration elements.

1. Dismount the electric motor from the pump unit.
2. Release the motor support plate from the frame
3. Dismount the hydraulic pump, can be lifted out together with the motor support plate.

In horizontal assembly the hydraulic pumps and the electric motors can be dismounted free from each other.

- **Always use all four lifting points when lifting the electric motor/pump unit.**
- **Never use the lifting ears on the electric motor to lift the complete electric motor/ pump unit.**
- **Use only lifting equipment adapted to the weight (for weights see section 4.3 “Lifting methods and weights“)**
- **Do not stand under hanging load**
- **Take centre of gravity into consideration during lifting**

6.3 Fault finding

Fault	Probable cause	Action
Gemini unit does not start	Main voltage to electric motors lacking.	Look for the cause in the electric power network.
	Control voltage lacking.	Look for the cause in the electric power supply network. Examine the control system in the Gemini unit. If the control system has tripped, determine the reason.
Gemini unit fails to deliver oil flow.	No servo pressure. No control current to electro hydraulic stroker control.	Examine the control function or electronic control card and servo pump.
	Coupling pump/electric motor defect.	Check through the inspection hole in the bell housing.
	Wrong direction of rotation hydraulic pump.	Check direction of rotation.
	Load is too big.	Check that load pressure is not too high so that pressure override reduces pump delivery.
Unwanted noise	Suction line not open.	Open suction line valve.
	Charge pressure too low or non-existent.	Check that charge pressure is correct.
	Air leaks. Pump cavitating.	Examine the suction line to the charge pump for air leaks. Test by pouring oil over pipe joints while listening to changes in noise in the pump.
	Air filter in tank clogged.	Change filter.
	Worn elastomer element in the shaft coupling.	Change elastomer element.
	Wrong direction of rotation.	Reverse direction of rotation.

Fault	Probable cause	Action
No pressure in system	Gemini unit fails to deliver oil.	Perform previously described actions.
	High pressure pilot control is not closed.	Clean and repair high pressure pilot control.
	Additional valves on the pump.	Check additional valves on the pump.
Excessive wear.	Viscosity too low.	Compare with our oil recommendations. Check the oil temperature, and the cooling circuit.
	Abrasive material circulation through pump with the hydraulic fluid.	Change filters and change if necessary. Check that changing is performed at prescribed intervals.
	Air in the hydraulic system. Pump cavitating.	Locate and redemy the air system leak Purge air from system.
	Content of water in hydraulic fluid too high.	Inspection of hydraulic fluid, change oil.
High oil temperature.	Poor cooling capacity. Internal leakage in pump.	Check flow of cooling water, cooler, water valve and water filter or air cooler (option). Change or repair pump.
	Too small amount of replacement oil in hydraulic system.	Check that charge pump delivers sufficient flushing oil.
High oil temp. in closed circuit.	No oil exchange out of closed loop.	Check charge pressure + shuttle valve setting.

7. Disposing

When the system or a single component is worn out, it should be handled in an environmentally friendly way. In general waste should at first hand be reused or recycled followed by safe disposal.

Careless disposal of the system, its components and the oil can lead to pollution of the environment. Please therefore observe the following points:

- Dispose the product/components in accordance with the national regulations in your country and/or your company-internal specifications.
- Dispose the oil according to the current applicable material safety data sheet.

- Check that the Gemini unit is completely disconnected.
- The components may contain accumulated energy.
- Take the fire hazard into consideration during dismantling.
- The accumulator must be empty.

8. Declaration of incorporation

The Declaration of Incorporation, is available on request for deliveries from Hägglunds Drives AB.

HÄGGLUNDS

Declaration of Incorporation of partly completed machinery
As defined by the EC Machinery Directive 2006/42/EC, Appendix II B

The manufacturer

Hägglunds Drives AB

hereby declares that the partly completed machinery

Name: Gemini
Function: Hydraulic system
Modules: Pump unit, Tank unit, Filter unit, Cooler unit, Control system
Type: Gemini
Trade name: Gemini

satisfies the following essential requirements of Machinery Directive 2006/42/EC in accordance with the chapter numbers in Appendix I:

General principle no. 1.									
1.1.3	1.1.5	1.2.1	1.2.2	1.2.3	1.2.5	1.2.6	1.2.8	1.3.2	1.3.3
1.3.4	1.5.4	1.5.5	1.5.7	1.5.8	1.5.9	1.5.15	1.6.3	1.7.0	1.7.2
1.7.3	1.7.4								

The requirements are fulfilled provided that the data in the product documentation (fitting instructions, operating instructions, project management and configuration documents) are implemented by the product user. The requirements of Appendix I to Machinery Directive 2006/42/EC not mentioned here are not applied and have no relevance for the product.

It is also declared that the special technical documents for this partly completed machinery have been compiled in accordance with Appendix VII, Part B. These are transferred on request to the market surveillance body in paper-based/electronic format.

Conformity with the provisions of further EU Directives, Standards or Specifications:

SS-EN 982
SS-EN ISO 12100-1
SS-EN ISO 12100-2
SS_EN 60204-1
EC Council Low Voltage Directive 2006/95/EEC
EC Council EMC Directive 2004/108/EEC

The partly completed machinery may only be put into operation when it has been established that the machine into which the partly completed machinery is to be incorporated conforms to the provisions of EC Machinery Directive 2006/42/EC, where relevant according to this directive.

The individual below is authorized to compile the relevant technical files:

Name: Björn Leidelöf
Address: Hägglunds Drives AB, S-890 42 Mellansel

Björn Leidelöf Mellansel, 2009-12-29

We reserve the right to make changes to the content of the Declaration of Incorporation. Current issue on request.

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