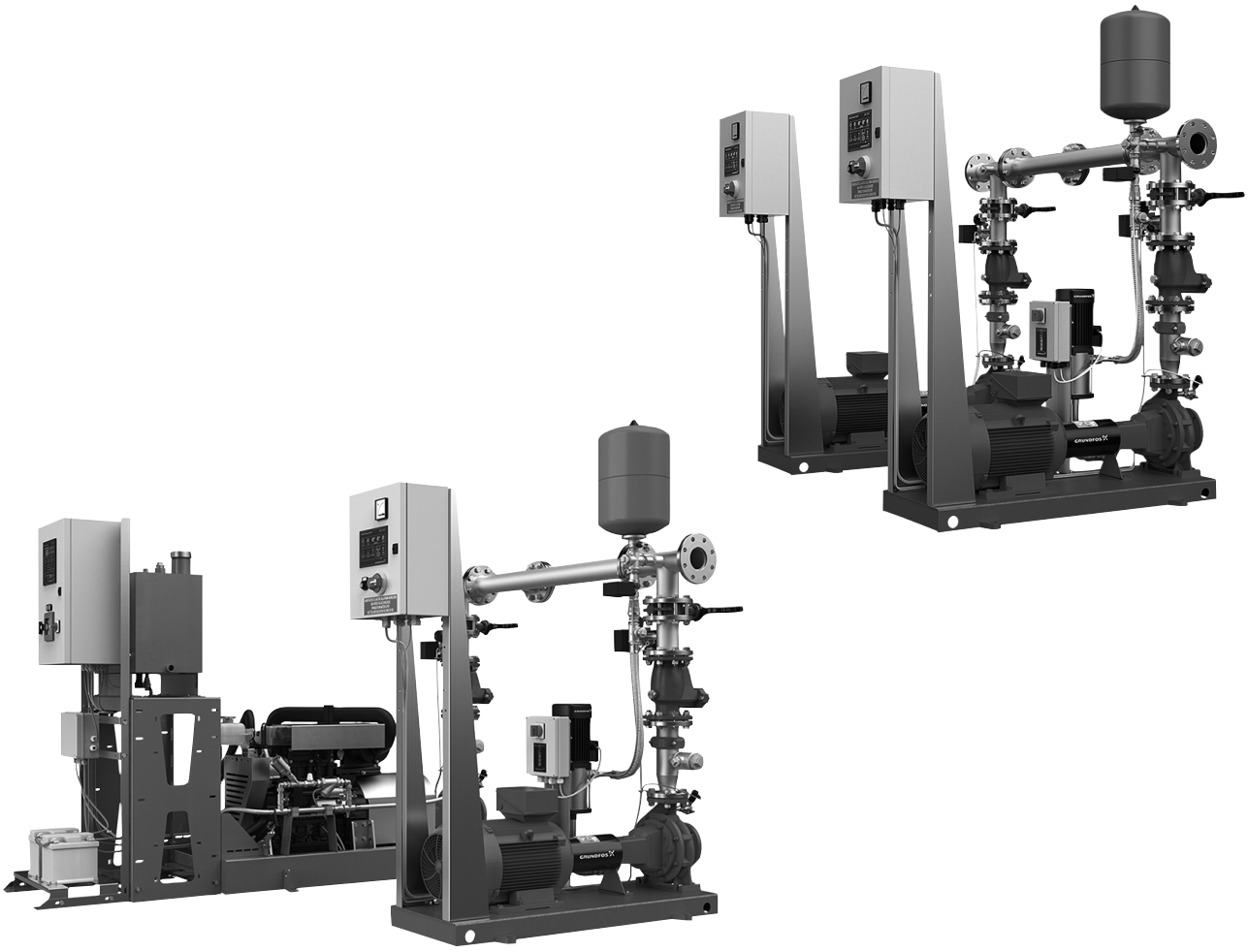
Hydro EN

Grundfos firefighting systems

Installation and operating instructions



Hydro EN
Installation and operating instructions
(all available languages)
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GRUNDFOS

Hydro EN

English (GB)
Installation and operating instructions 4

Original installation and operating instructions

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1. General information

Read this document before you install the system. Installation and operation must comply with local regulations and accepted codes of good practice.

1.1 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

Observe these instructions for explosion-proof products.

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

If these instructions are not observed, it may result in malfunction or damage to the equipment.

Tips and advice that make the work easier.

1.3 Target group

These installation and operating instructions are intended for professional installers and for the operators of the system.

We recommend that installation is carried out by skilled persons with technical qualifications required by the specific legislation in force.

1.4 General safety warnings

Before starting any operations, read carefully all the documentation and manuals delivered with the system.

The terminals and wires upstream the main switch of the control cabinet are live even if the switch is in OFF position.

DANGER
Electric shock
Death or serious personal injury

- Before any inspection, maintenance, service or repair of the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent inadvertent reconnection.

- There are more than one control cabinets. Make sure that you disconnect the correct one belonging to the section of the system that needs intervention.
- The design of the electric system and the electrical installation must be carried out by a qualified electrician, appointed by the client, in accordance with local regulations.
- Do not do maintenance work when the power supply is switched ON.

WARNING
Electric shock
Death or serious personal injury

- Before switching on the power supply, make sure that the electrical insulation and protection are appropriate to avoid unexpected contact with water.

WARNING
Crushing hazard
Death or serious personal injury

- Any kind of activity or intervention on the system must be performed by qualified and authorised persons.
- Incorrect use may cause serious damage to the system or even to the entire firefighting system network.

CAUTION
Toxic material
Minor or moderate personal injury

- Do not ingest oil, fuel or coolant. In case of accidental ingestion, refer to the safety sheet of the specific product.

CAUTION
Slipping hazard
Minor or moderate personal injury

- Do not spill liquids, such as oil, fuel or coolant on the floor, as it may get slippery.
- Use adequate filling tools.

2. System introduction

2.1 System description

The Hydro EN systems for automatic sprinkler systems are in compliance with the requirements of EN 12845 - Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance.

The Hydro EN systems are designed for automatic sprinkler systems such as single, superior single, duplicate or combined water supply sources.

The pumps are of the back pull-out design, enabling removal of the coupling, bearing bracket and impeller without moving the motor, pump housing or pipes.

The range consists of the following types:

- S version: One or two duty pumps operated by an electric motor.
- Y version: Two duty pumps. One pump is operated by an electric motor and the other pump is operated by a diesel engine.
- T version: One or two duty pumps operated by a diesel engine.

Duty pumps

Each duty pump, built on a robust baseplate, can deliver 100 % of the required flow rate.

In case of a two-pump system, the second pump is an active backup in case the first is not effective.

The system with three duty pumps is also available upon request, each delivering 50 % of the required flow rate (two pumps in operation simultaneously deliver the required performance).

In case of catching fire, the network pressure drops, the system starts automatically. The system continues to run until someone stops it manually. If necessary and permitted by local regulation, you can activate the "automatic stop function" (always included but factory-disabled) that automatically shut down the running duty pump through an adjustable timer.

The shape of the QH curve is stable.

Motors or engines are sized according to EN12845 prescriptions.

The diesel pump is cooled in one of the following solutions according to the power size:

- with direct air
- with water/water heat exchanger.

The heat exchanger cooling system has the following parts:

- a water/water heat exchanger with expansion tank
- a manometer with indication of the operational area at the inlet of the expansion tank
- a circuit consisting of a filter and a valve with hydraulic control and pressure regulator
- a bypass circuit with gate valve.

The fuel tank is sized to ensure at least 6 hours of continuous operation and is equipped with a containment basin and vent connection.

An industrial silencer is supplied as standard for diesel systems.

The systems are equipped with the necessary instrumentation to simplify the operations during tests and commissioning.

Jockey pump

A jockey electric pump (always included), operated by a dedicated control cabinet, automatically guarantees system pressurisation in case of small leaks, to prevent unjustified start-up of the duty pumps.

The jockey pump is equipped with a 24-litre tank.

Hydraulic components

The hydraulic components are selected and sized to minimise the pressure losses and the water speed in compliance with the requirements in the EN 12845 standard, at any flow rate value stated on the performance curve.

The components include the following:

- two pressure switches for each duty pump which are hydraulically connected to each other with a manifold of 15 mm in diameter
- a pressure switch on each duty pump to detect the actual pressure supplied
- connection for the priming circuit and connection for the recirculation circuit to prevent overheating of the pump when running against closed valves.

Control cabinet

An independent control cabinet is fitted for each duty pump with operating and control buttons.

Each pump installed in the system, regardless of jockey or duty pump either driven by electricity or diesel, is operated and controlled through a dedicated control cabinet.

The operating modes must be set individually on each control cabinet according to the specific needs.

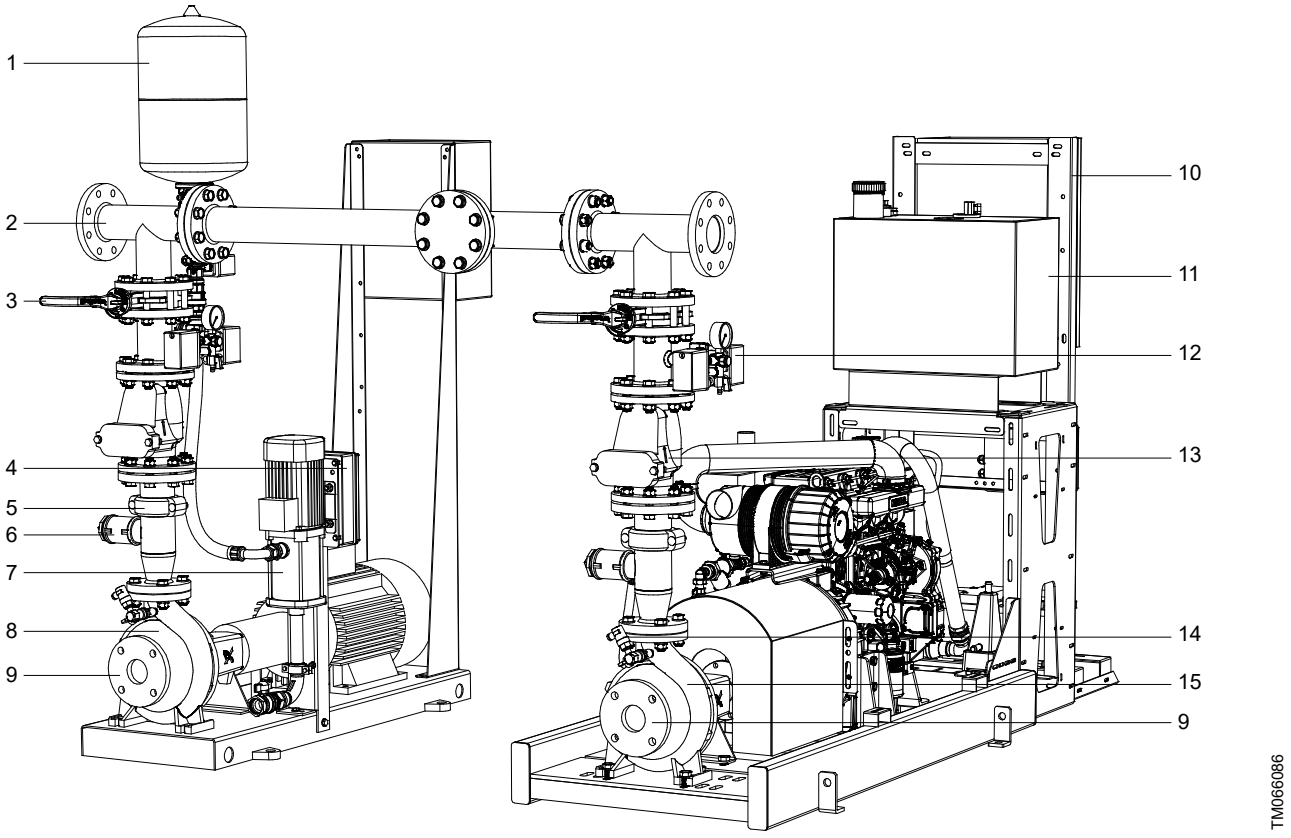
Refer to the dedicated sections to each control cabinet for the available functions and the relative activation procedures.

Accessories

The scope of supply can be completed with the following accessories:

- a suction kit dedicated for installation in suction-lift or in positive head conditions, including:
  - an eccentric divergent pipe with a controlled taper
  - a vacuum pressure gauge
  - an isolating valve (not included in the version for installation in suction-lift conditions).

  All accessories are sized according to the prescriptions of the standard.
- a testing kit including a flowmeter, valves and straight pipe sections to get the optimum flow rate reading.



System components

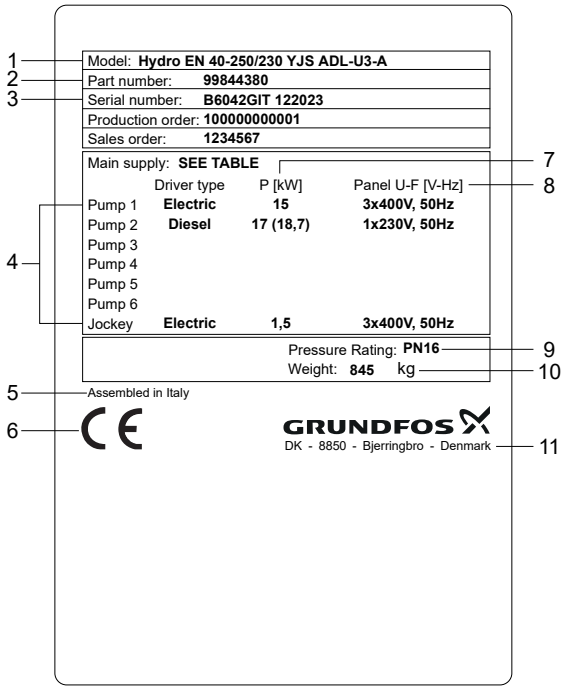
Pos.	Description
1	Diaphragm pressure tank, 24 litre (included)
2	Outlet manifold
3	Isolating valve
4	Control cabinet of the jockey pump
5	Grooved coupling
6	Connection to priming circuit
7	Jockey pump
8	Duty electric pump with spacer coupling
9	Independent inlet for pumps
10	Control cabinet of the standby diesel pump

Pos.	Description
11	Fuel tank sized to ensure at least 6 hours of continuous operation, complete with containment basin
12	Starting circuit complete with two pressure switches and a pressure gauge according to the EN12845 standard
13	Non-return valve
14	Pressure sensor to detect pump operation
15	Standby diesel pump with cardan shaft coupling

2.2 Identification

2.2.1 Nameplate

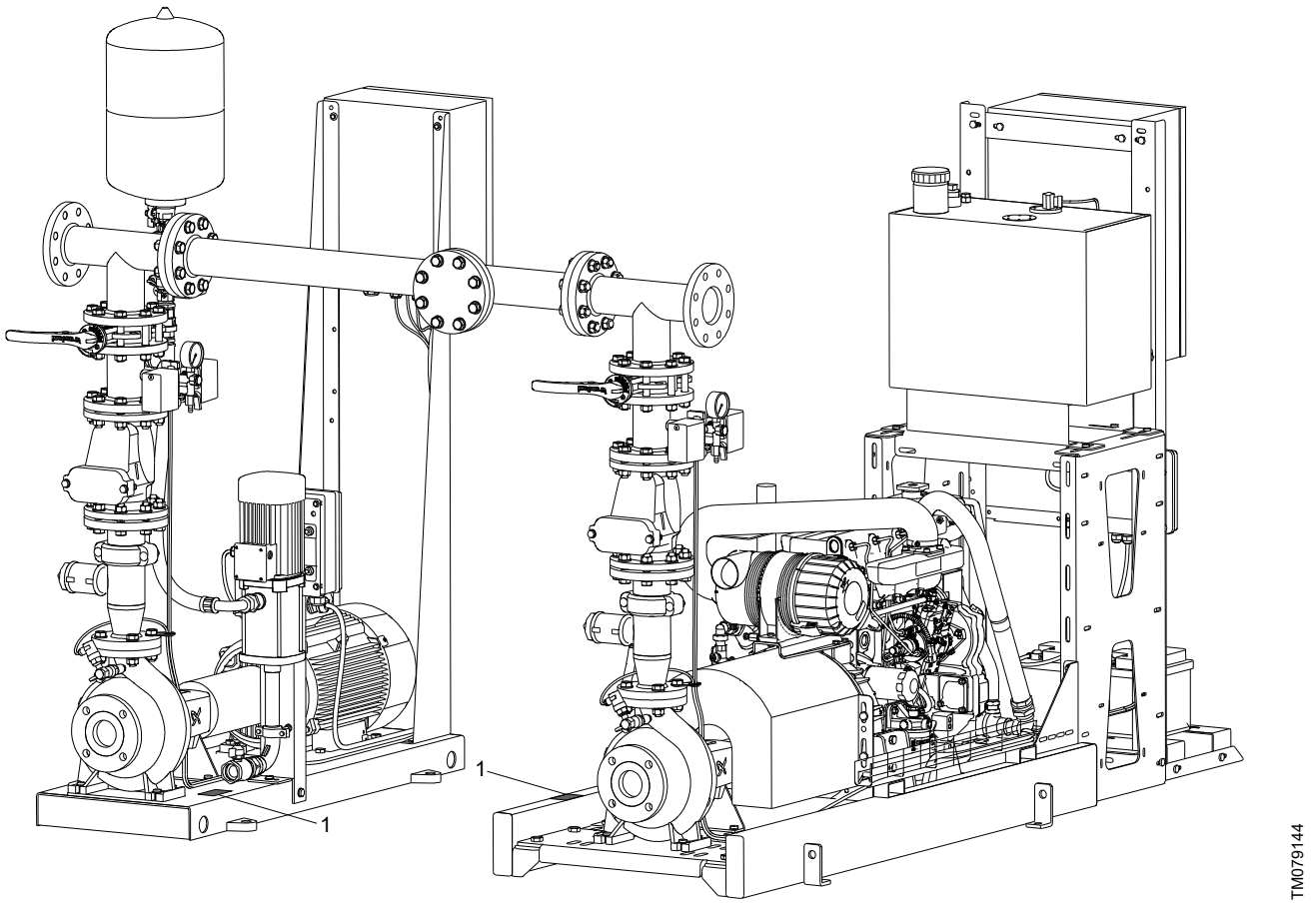
All relevant system data are shown on a nameplate on the base frame of the system.



Example of nameplate

Pos.	Description
1	Type designation
2	Product number
3	Serial number
4	List of pumps included in the system and the drive type of the pumps
5	Country of origin
6	CE mark
7	Power size of each pump
8	Mains supply voltage of each control cabinet
9	System pressure
10	Weight
11	Address of manufacturer

The following diagram shows the location of the nameplates.



Position of the nameplates

Pos.	Description
1	Nameplates

The following nameplates and labels can also be found:

- pump nameplate (one per pump placed on the bearings bracket)
- nameplate of each electric motor or diesel engine (placed on the motor or engine)
- control cabinet label (one per each control cabinet placed on the side of the cabinet or the inner side of the front door, depending on the model).

2.2.2 Type key

Example: Hydro EN 50-250/263-Y JS A SD-U3-B-X

Code	Explanation	Designation
Hydro EN		System type
50-250/263	Example: NKF 50-250 impeller ∅263	Pump type
-Y	S1: One duty electric pump (100 %) S2: One duty electric pump and one standby electric pump (100 % + 100 %) S3: Two duty electric pumps and one standby electric pump (50 % + 50 % + 50 %) T1: One duty diesel pump (100 %) T2: One duty diesel pump and one standby diesel pump (100 % + 100 %) T3: Two duty diesel pumps and one standby diesel pump (50 % + 50 % + 50 %) Y: One duty electric pump and one standby diesel pump (100 % + 100 %) Y1: Two duty electric pumps and one standby diesel pump (50 % + 50 % + 50 %) Y2: One duty electric pump, one duty diesel pump and one standby diesel pump (50 % + 50 % + 50 %)	Configuration
JS	JS: With a standard jockey pump JV: With a customised jockey pump (on request) NJ: Without a jockey pump (on request)	Jockey pump
A	A: Standard B: IP55 N: Without control cabinet X: Special execution control cabinet	Control cabinet
SD	DL: Direct-on-line SD: Star-delta	Starting method
-U3	U1: 3 × 400 V, 50 Hz duty electric pump (or standby pump) - 3 × 400 V, 50 Hz jockey electric pump U2: 1 × 220 V, 50 Hz duty diesel pump (or standby pump) - 3 × 400 V, 50 Hz jockey electric pump U3: 3 × 400 V, 50 Hz duty electric pump (or standby pump) - 1 × 220 V, 50 Hz duty diesel pump (or standby pump) - 3 × 400 V, 50 Hz jockey electric pump	Mains supply
-B	A: Direct air with fan B: Water/water heat exchanger	Diesel engine cooling, if present
-X	X: Other versions based on customer specifications (on request)	Other versions

3. Receiving the system

3.1 Transporting the system

The system has been prepared for shipment at the factory to minimise potential damage during handling and transport.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Make sure that the cage is firmly anchored on the truck before shipment.
- Transport must be carried out by qualified persons.

Do not stress the pump excessively during handling and transport.

During transport, take action to prevent the pump and system components from freezing in bad weather conditions.

3.2 Inspecting the system

Upon receipt of the system, do the following:

1. Make sure that the system and accessories correspond to the order and there are no missing parts.
2. Make sure that the packaging is intact.

3.3 Scope of delivery

All systems are supplied as factory-tested. The wooden cage contains:

- 1 Hydro EN system
- installation and operating instructions in digital format
  - for the system
  - for the duty electric pumps
  - for the jockey electric pump
  - for the pressure switches
- IOS manual with EC declaration of conformity (in paper copy)
- electrical diagrams of the control cabinets
- assembling and setting verification
- two copies of the nameplate of the system in addition to the one on the base frame of the system
- pump performance curves.

If available, the kit for measuring the flow rate is supplied with the installation and operating instructions of the flowmeter.

If a diesel pump is available, the following documents are also delivered:

- installation and operating instructions for the diesel engine
- safety data sheet for the batteries
- factory test report for the diesel pump as described in the EN 12845 standard.

If you need specific documents or any additional hard or digital copies of the documents listed above, request these during the bidding process.

3.4 Handling and lifting the system

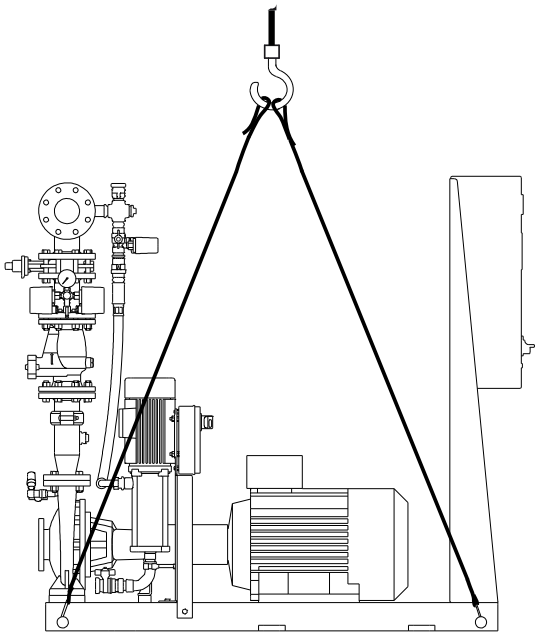
To facilitate handling, systems are shipped from the factory in pre-assembled blocks designed for transport by forklift or similar lifting equipment.

WARNING
Overhead load
Death or serious personal injury
- Make sure that the area below and around the lifted system is clear of people during operations.
- Do not allow anyone to stand on, under, or near the load.

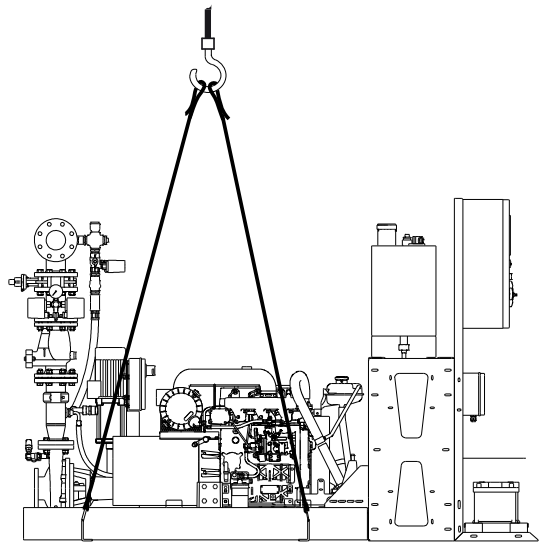
WARNING
Crushing hazard
Death or serious personal injury
- Before starting any handling operations with the package, make sure that all the bolts for anchoring the system to the package are in place.
- Before lifting, make sure that the load is balanced.
- Whenever possible, handle the system with a forklift.
- When using chains or belts, hook the system to the base in the correct lifting points.
- Never use the lifting eyes of the individual components to lift the system.
- Lock the cabinet door before moving the system.
- Only use the lifting equipment which is in proper condition and suitable for lifting the weight and the shape of the system.
- Handling operations must be carried out by qualified and authorised persons.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Make sure that the package is integral before handling operations.

CAUTION
Sharp element
Minor or moderate personal injury
- Use the dedicated DPI (gloves) to remove the packaging.



Lifting the electric system



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Lifting the diesel system

See also the installation and operating instructions for the diesel engine.

4. Installation requirements

Refer to the system design for the information of the room installation, specifically for the construction works, ventilation, air exchange, power supply system and the evacuation of the exhaust gases of the diesel engine. The installation must be carried out timely by specialists appointed by the client in compliance with relevant regulations and provisions.

The main criteria for installing firefighting systems are described in the EN 12845 standard. You also need to refer to the local regulations if applicable.

4.1 Location

DANGER
Crushing hazard
Death or serious personal injury

- The system must be installed in an access-controlled area. Make sure that only qualified and authorised persons have access to this area.
- If the site is left unattended before the installation is completed, all openings must be covered to prevent children or any other foreign objects, such as animals and stones, from entering.
- Use unbreakable covers that cannot be removed without tools.

WARNING
Crushing hazard
Death or serious personal injury

- Leave necessary space in the technical room during design for installing, using, maintaining and disassembling the system.
- The design of the technical room must be carried out by a qualified designer appointed by the client in accordance with local regulations.

Before installation, make sure the following items are fulfilled:

- The technical room dimensions are adequate for the system to be installed.
- The room has proper air circulation.

The system must be installed in a weatherproof room protected from freezing. The room must be well ventilated to ensure proper cooling of the electric motors and diesel engines.

Make sure that the operating conditions do not exceed those stated in section Operating conditions.

Pay attention to the correct evacuation of diesel engine exhaust gases. For this purpose, adequate ventilation ducts must be installed.

The technical room of the system must be properly sized according to existing regulations and good practices. You must take the following into account:

- the overall dimensions of the system
- easy access to the parts of the system for commissioning, routine checks and maintenance
- adequate air exchange in the room to ensure proper cooling of the machines.

When sizing room openings for effective air exchange, also consider the place of installation and the presence of other machines or heat sources in the same room.

The installation of motors and engines in closed environments always requires proper circulation of fresh air in the room to ensure elimination of heat generated during operation and adequate cooling of the machines.

Openings and ventilation ducts for hot air evacuation must be dimensioned based on analytic calculation.

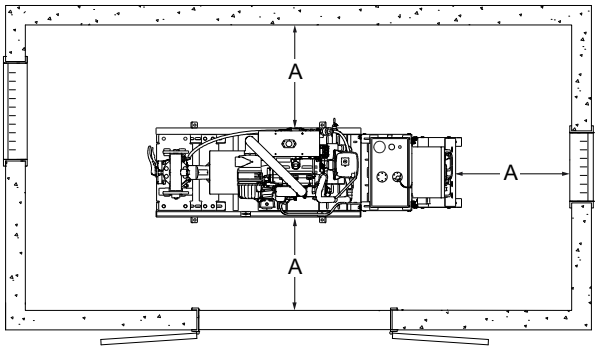
- Large openings must be protected to prevent people or animals from entering.
- Use unbreakable protection that cannot be removed without tools.

Related information

14.1 Operating conditions

4.1.1 Minimum space

The pictures below give an indication of the minimum free space to be left around the system.



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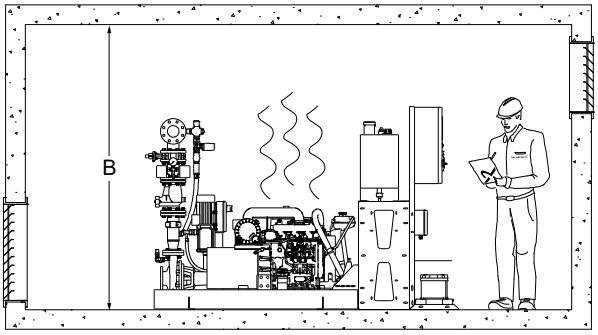
Top view of the technical room



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Side view of the technical room

Pos.	Description
A	Minimum 800 mm
B	Minimum 2400 mm

4.2 Diesel pumps with direct air cooling

A fan, driven by the engine itself, generates air flow that is conveyed to the engine and ensures cooling. The heat is then released into the environment and must be extracted from the room.

4.3 Diesel pumps with water/water heat exchanger

In the system, the cooling of liquid-cooled engines is provided by a water/water heat exchanger with an expansion tank.

When the engine is warm, a pressure, which will cause hot liquid to be discharged by extreme forces, is created in the cooling circuits. This results in a danger of burning. The cooling circuits may remain hot and pressurised even after the engine has been shut off.

CAUTION
Hot surface
Death or serious personal injury
- Open the coolant tank cap only when the engine is cold and only if strictly necessary.

The engine is cooled by the water of the firefighting system.

Do not let the engine run at a speed lower than the nominal speed. A low speed rotation may cause an insufficient cooling flow of water through the heat exchanger and a possible engine damage due to overheating.

Do not restrict or block the outlet of the heat exchanger. Avoid long and tortuous routes that can restrict the flow of passage water. Do not fit any component in the outlet pipe (gate valve or other) that can affect the proper circulation of cooling water.

Install the outlet pipe of the heat exchanger to visually inspect the effectiveness and correctness of water circulation.

The heat exchanger outlet must be installed close to the diesel pump.

Clean the filter regularly, and make sure that there is proper water circulation in the cooling system.

Make sure that the flow through the cooling system meets the minimum requirement as specified in the technical documentation for the specific model.

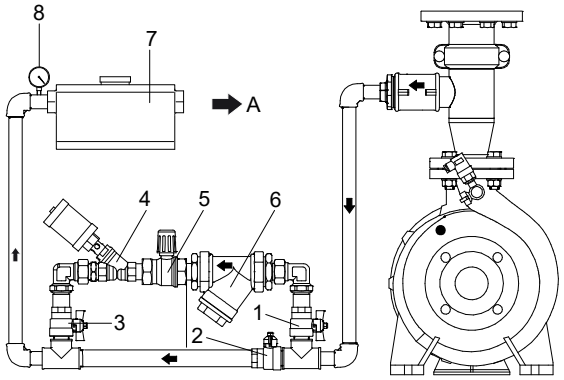
The outlet of the heat exchanger must be connected to the drain pipe with a flexible joint to avoid any mechanical stress on the heat exchanger.

The heat exchanger circuit is connected to the pump outlet just before the check valve with a pipe of appropriate size.

During pump operation, a part of the flow of the system circulates through the heat exchanger to provide cooling for the diesel engine.

This flow does not contribute to the supply of the firefighting system and must be considered in the hydraulic calculation and when choosing the system.

For values of minimum flow required to pass through the heat exchanger, refer to the performance curves of the system.



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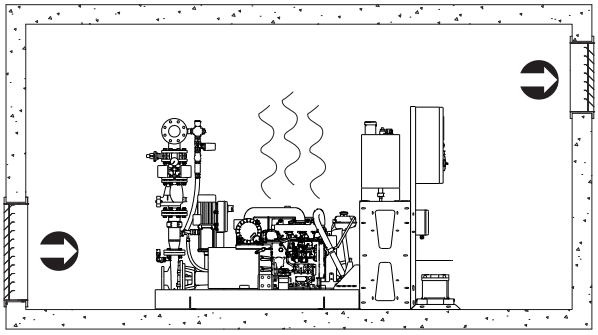
Heat exchanger

Pos.	Description
A	Outlet of the cooling flow
1	Isolating valve: Normally open
2	Bypass isolating valve: Normally closed The bypass line must only be used for service purposes.
3	Isolating valve: Normally open
4	Valve with hydraulic control: Normally closed It opens when the motor starts.
5	Flow regulator: To adjust the inlet flow to the exchanger
6	Filter
7	Heat exchanger with expansion tank
8	Pressure gauge with the optimum operational area indicated

Most of the heat is dissipated by the described cooling system. Despite this, the running engine emits a certain amount of energy in the form of heat into its environment. Therefore, it is necessary to ensure that the ventilation openings are sized to maintain the desired temperature in the room.

The following figure shows a possible solution:



Example of room ventilation

Related information

5.3 Connecting the recirculation circuits
11.2.2.5 Cleaning the circuit of the heat exchanger

4.4 Diesel tank with containment basin and vent connection

CAUTION
Toxic material
Minor or moderate personal injury

- The fuel vent pipe must be installed properly and make sure that all the parts are firmly supported, and all the connections are perfectly sealed to avoid concentration of fuel vapours in the technical room.
- Periodically check the integrity of the vent pipe.

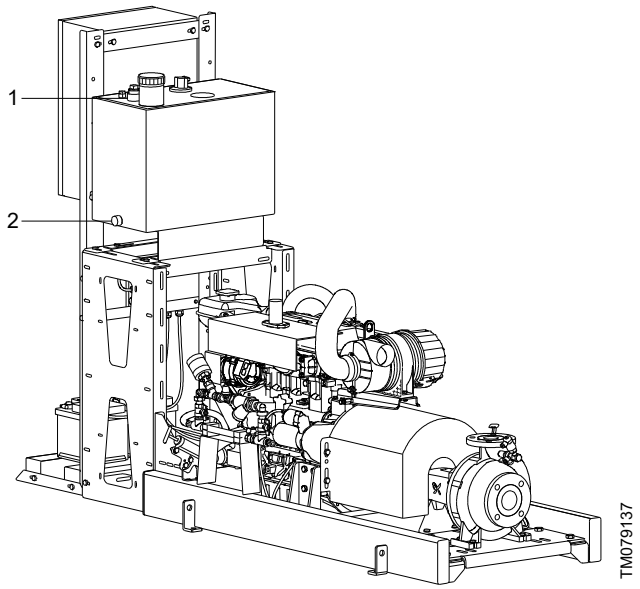
CAUTION
Harm to persons
Minor or moderate personal injury

- During refuelling, use adequate refuelling tools and avoid lifting excessive loads, which can cause falls or musculoskeletal problems.
- Use appropriate lifting techniques and do not bend the waist.
- Only use suitable fuel (refer to the engine manual). The unsuitable fuel can ignite flames and/or cause serious damage to the system or even to the entire firefighting system network.
- Smoking and live flames are prohibited when refuelling.

The diesel pump is equipped with a fuel tank equipped with a containment basin. The capacity of the containment basin equals to the capacity of the tank itself.

The basin prevents diesel from leaking if the tank breaks or leaks.

As seen in the figure below, there is a sight glass on the side of the basin for a visual check of the tank. The diesel tank is also supplied with a connection for the vent pipe.



Fuel tank

Pos.	Description
1	Connection for vent pipe
2	Sight glass

4.5 Exhaust gas outlet of the diesel pumps

WARNING
Toxic material
Death or serious personal injury

- The exhaust pipe and the muffler must be installed properly so that all the parts are firmly supported without an extra load on the engine.
- All connections must be perfectly sealed to avoid gas leakage inside the technical room.
- Check periodically the integrity of the exhaust pipe.
- The outlet of the exhaust pipe must be positioned far from passage areas or areas where people are stationed, in accordance with current regulations.
- The design and installation of the exhaust pipe must be carried out by a qualified designer, appointed by the client, in accordance with local regulations.
- Incorrect sizing of the exhaust pipe can cause the system to fail.

CAUTION
Hot surface
Death or serious personal injury

- The exhaust pipe and the muffler must be insulated and protected by materials suitable for high temperatures, to avoid contacting with extremely hot parts and to prevent heat from being released into the technical room.
- Check periodically the integrity of the insulation layer.
- Surfaces may remain hot after the system has been shut off. Do not touch the hot surface before it cools down. If it is not possible to wait, wear protective gloves.

The exhaust gas duct must be:

- arranged to allow the gas to exit outdoors directly or through a pipe, depending on the regulations in force at the place of installation
- protected from weather conditions
- positioned so that they do not disturb people or damage any equipment
- made of steel, sufficiently strong and perfectly sealed
- installed properly so that all the parts including the muffler are firmly supported without an extra load on the engine.

If the muffler is directly mounted on the engine, use a flexible joint to connect the exhaust outlet pipe to avoid any mechanical stress on the engine.

Due to thermal expansion of the exhaust gas ducts, we recommend using compensation joints suitable for the application.

A suitable condensation collection and a drain point is also required.

4.6 Exhaust back pressure

Wrong sizing of the exhaust pipe can affect correct operation of the system.

The exhaust gases must be discharged from the technical room avoiding long ducts. Long ducts create a high back pressure. This makes the discharge of the gases difficult and reduces the efficiency of the engine.

After having followed all the precautions for discharging the exhaust gases in an optimum manner, it is necessary to check the back pressure value at the exhaust by measuring it under the following conditions:

- with the exhaust gas system in its final configuration
- after warming up the engine
- at full load
- at the nominal speed of the engine defined for the specific model.

The resulting value cannot be greater than the maximum value recommended by the manufacturer of the engine.

5. Mechanical installation

WARNING
Crushing of hands
Death or serious personal injury

- All pipes must be supported.
- Supports for pipes and components must guarantee the stability over time and have mechanical characteristics such as withstanding static and dynamic loads, as well as vibrations of the system during its operation.
- Installations in territories with seismic characteristics must also be carefully evaluated.
- Incorrect or not lasting supports may cause serious damage to the system or even to the entire firefighting system network.
- The design and execution of the supports of the system must be properly carried out in accordance with the relevant standards and regulations by specialists commissioned by the client.

Do not step or walk on the components of the system.

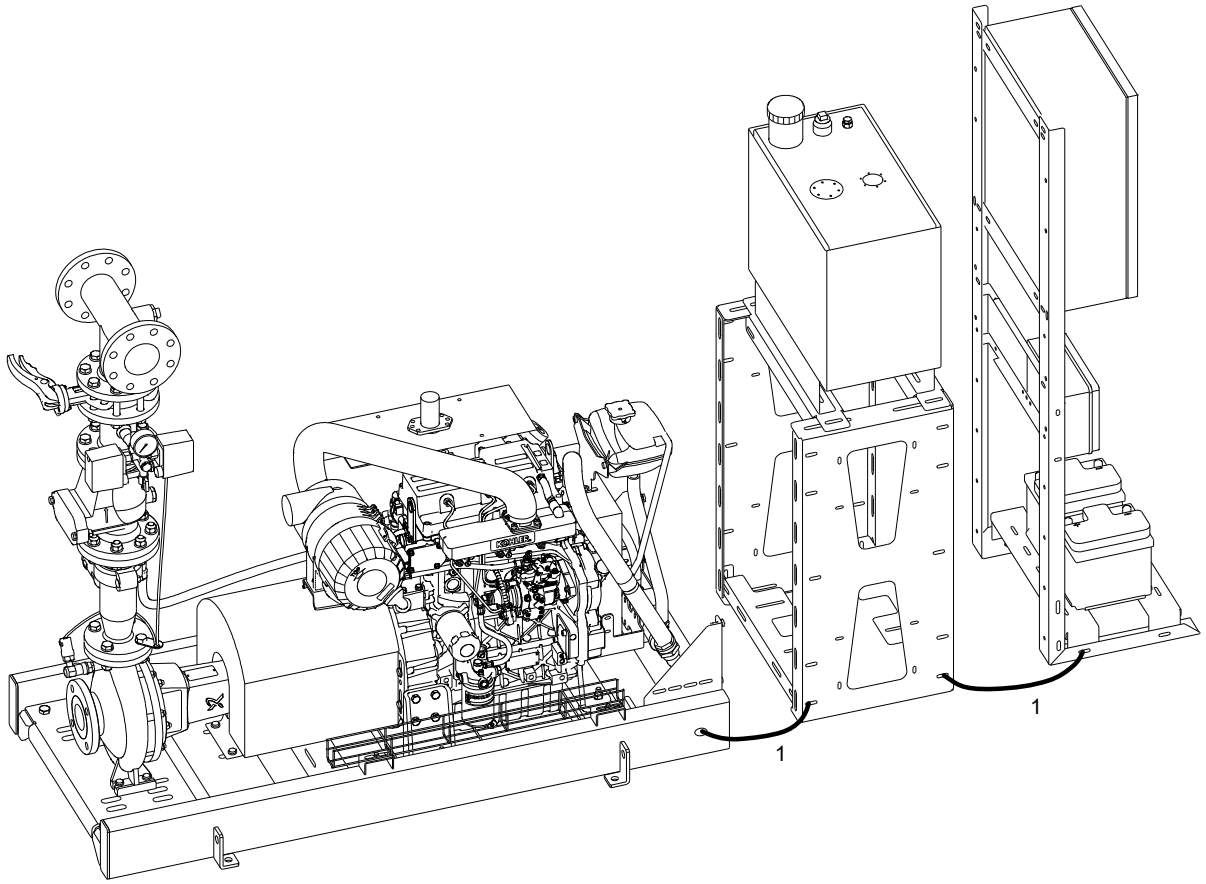
Do not place other parts or equipment on the system components.

The system is supplied in pre-assembled blocks which must be assembled before performing any operation.

The system must be placed on a flat and smooth surface, for example, on a solid floor or a concrete foundation.

The control cabinet of the diesel pump must be detached from the motor frame and fixed to the ground to avoid the propagation of vibrations to the electrical components.

A robust electrical earth connection between the engine frame and the control cabinet stand must be made with a cable with a large cross-section (equal to or larger than that of the delivered cable) or a metal braid.



Earth connection

Pos.	Description
1	Cable for earth connection

If necessary, the fuel tank can be removed from the motor frame. In this case, make sure that the tank is positioned on the same foundation as the engine, or at least at the same height, to ensure that the fuel feeds the injection pump by gravity.

The pipes connected to the system must be of adequate size and the inlet pipes must comply with the criteria listed in the EN 12845 standard regarding the water speed in the pipes (1.8 m/s for positive head installation and 1.5 m/s for suction-lift installation).

Special attention must be paid to choosing components and the path of the inlet pipes which must ensure that the available NPSH at the pump inlet port is at least 1 m greater than the required NPSH, at the maximum flow rate required.

Always prevent the inlet pipe from having a reverse gradient that results in a drain-trap effect.

If the inlet pipe fails to deliver the liquid to the pump in this condition, it can lead to noisy operation, swirling of liquid around the suspended pump, premature bearing failure and cavitation damage to the impeller and inlet of the casing.

Installation of pipe supports is always required on the outlet and inlet side of the system according to the requirements of the EN 12845 standard so that the weight of the pipes does not rest on the pumps.

5.1 Foundation and anchorage

WARNING
Crushing hazard
Death or serious personal injury

- The anchoring system must guarantee the stability and alignment of the system over time and have mechanical characteristics such as withstanding static and dynamic loads, as well as vibrations of the system during its operation.
- Installations in territories with seismic characteristics must also be carefully evaluated.
- Incorrect or not lasting anchorage may cause serious damage to the system or even to the entire firefighting system network.
- The design and execution of the anchoring system must be properly carried out in accordance with the relevant standards and regulations by designer appointed by the client.

If a seismic analysis is required, consult the governing bodies for grouting and foundation requirements.

To avoid critical situations, we recommend that you contact a civil engineering designer or an equivalent to check and approve the support structure and anchoring system.

The system must be placed on a flat surface such as a solid floor or a concrete foundation.

As a rule of thumb, the weight of the concrete foundation should be at least 1.5 times the weight of the system.

The width and length of the foundation must be larger than the size of the system it accommodates.

The fastening must ensure tightness over time and must withstand the vibration of the system during operation.

5.2 Connecting the priming circuit

In accordance with the requirements of the EN 12845 standard, the pumps are equipped with connections for priming as a mandatory requirement for suction-lift installation.

1. Connect the priming circuit by using the 2-inch connection on the system.
   - Hydraulic components are not included in the scope of delivery of the system.

5.3 Connecting the recirculation circuits

In accordance with the requirements of the EN 12845 standard, the pumps are equipped with connections for the recirculation circuit.

1. In the case of electric pumps or diesel pumps with direct air cooling, use the 1-inch plug available on the outlet side to connect the recirculation circuit to the inlet tank.
2. In the case of diesel pumps with water/water heat exchanger cooling system, the circulation is performed through the cooling system.
   - See the dedicated section for diesel pumps with water/water heat exchanger.
   - Use the functional diagram as reference.

Related information

4.3 Diesel pumps with water/water heat exchanger
7. Functional diagram

6. Electrical installation

WARNING
Electric shock
Death or serious personal injury

- The design of the electric system and the electrical installation must be carried out by a qualified electrician, appointed by the client, in accordance with local regulations.
- Before installing any connections, check the compatibility of the system supply voltage.

CAUTION
Harm to persons
Minor or moderate personal injury

- Before connecting to batteries, make sure that the cables are connected correctly according to the electrical diagram.
- Before charging the batteries, check that the charger is compatible with the voltage and capacity of the batteries.
- This operation must be carried out by qualified persons.
- Make sure that the neutralizing powder for battery acid is always available in the technical room.
- Do not weld near the batteries and make sure that there is a good ground connection to avoid current leakage that can damage the batteries.
- Do not place tools on or near the batteries. This could result in a short circuit.

Make sure that all connections, including the electrical connections, are correct and are carried out in accordance with all the applicable regulations and provisions in terms of security and fire prevention.

Make sure that the control cabinet and the duty and jockey pumps are suitable for the mains voltage to be used with.

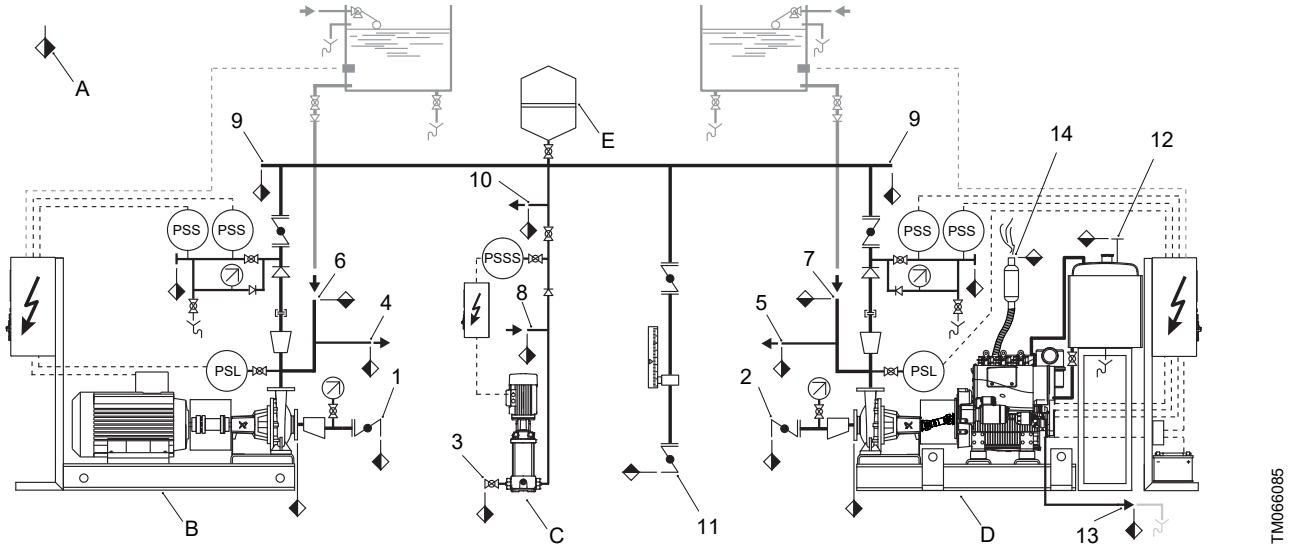
Make sure that the control cabinet is mechanically disconnected from the frame of the diesel engine and is fixed to the ground.

A robust earth connection between the engine frame and the control cabinet stand must be made with a cable of a large cross-section (equal to or larger than that of the delivered cable) or a metal braid.

Use connection cables of adequate cross-section for the current required by the pump and in compliance with the requirements of the EN 12845 standard.

Refer to the wiring diagrams supplied in the scope of delivery for the electrical connections of the control cabinet.

7. Functional diagram



Functional diagram

Pos.	Connection/description
1	Independent inlet connection for the duty electric pump
2	Independent inlet connection for the standby diesel pump
3	Inlet connection for the jockey pump
4	Recirculation circuit connection for the duty or standby electric pump
5	Recirculation circuit connection for the duty or standby diesel pump with direct air cooling
6	Priming circuit connection for the duty or standby electric pump
7	Priming circuit connection for the duty or standby diesel pump
8	Priming circuit connection for the jockey pump
9	System outlet connection
10	Connection for technical room sprinkler
11	Test circuit outlet
12	Diesel tank vent
13	Cooling circuit outlet with water/water heat exchanger, if present
14	Diesel engine exhaust gas outlet
A	Scope of supply limits
B	Duty electric pump
C	Jockey pump
D	Standby diesel pump
E	Diaphragm pressure tank

Symbol	Description
	Non-return valve
	Ball valve
	Butterfly valve

Symbol	Description
	Concentric divergent
	Eccentric divergent
[=]	Grooved coupling
	Flowmeter
	Pressure switch
	Pressure gauge
	Diaphragm pressure tank
	Control cabinet
	Drain connection
	Power and signal connections
	Main and auxiliary flow pipes

Related information

5.3 Connecting the recirculation circuits

8. Commissioning the system

CAUTION
Pressurised system
Minor or moderate personal injury

- Before filling and pressurising the pipes, make sure that all the hydraulic connections are properly tightened and there are no open circuit parts.
- Water is under pressure inside the pipes. Be careful and keep a safe distance from the pipes.

Before commissioning, recharge the batteries for at least 12 hours with an external battery charger before using them for the system.

Prime the pumps by filling the inlet pipes and the pumps with liquid, making sure that no air pockets are left in the system.

- Check the alignment of the couplings of the pumps after fixing all the hydraulic connections.
- Make sure that all the gate valves for the heat exchanger circuit are fitted in the operational configuration.
- Make sure that all connections, including the electrical connections, are correct and are carried out in accordance with all the applicable regulations and provisions in terms of security and fire prevention.
- Check the tightness and sealing of all hydraulic connections.
- Make sure that the positioning and tightening of the exhaust gas duct for the diesel pump is correct.
- Make sure that there is adequate ventilation in the room to ensure proper cooling of machines in order not to exceed the operating conditions.

9. Startup

WARNING
Automatic startup
Death or serious personal injury

- The system can start up automatically at any time. The operating noise level of the system is high and the system must be installed in an access-controlled area.
- Ear protection must be carried by, or available to, all persons authorised to enter the technical room.
- Observe the health and safety regulations and limit the exposure of persons to excessive noise.

The system can start up automatically but can only be stopped manually under automatic operation mode via a dedicated key removable from the control cabinet. Due to regulation of fire safety and protection of the system, it is required not to have any emergency stop.

WARNING
Harm to persons
Death or serious personal injury

- Clearly indicate where the key is stored in the technical room.
- Each time when people enter the technical room, or before any inspection, maintenance, service or repair of the system, make sure that the key is available on site.

WARNING
Pressurised system
Death or serious personal injury

- Keep a safe distance from the system when you are in the technical room.
- Check periodically the proper tightening of hydraulic connections and the integrity of all the components.

CAUTION
Hot surface
Minor or moderate personal injury

- Surfaces may remain hot after the system has been shut off. Do not touch the hot surface before it cools down. If it is not possible to wait, wear protective gloves.

For mode of operations and checks, refer to the dedicated section.

9.1 Alignment of the pumps

DANGER
Automatic startup
Death or serious personal injury

- The system can start up automatically at any time. If the system is not set as out of order, it is mandatory to keep a safe distance from any of its parts.
- Before any inspection, maintenance, service or repair of the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent inadvertent reconnection.

- In case of diesel pumps, isolate the fuel supply to the engine and disconnect the batteries by removing the negative terminal connector, before working on any part of the fuel supply or control system.
- Make sure that you wear suitable clothing on site. Do not let long hair down, wear loose or frayed clothing or jewelry to avoid being trapped into the equipment.
- Do not place fingers, hands, arms or tools into any openings.
- Under no circumstances should the system be operated, when the coupling guard is not in place and suitably secured.

Alignment of the duty electric pumps

WARNING
Crushing hazard
Death or serious personal injury
- Check regularly the alignment of the spacer coupling based on the operation time.

The coupling between the pump and electric motor is operated via spacer coupling. The alignment of this coupling is of fundamental importance for the proper functioning of the system and must be carried out by trained persons.

Although the motors and pumps are aligned with precision in the factory, after having them installed and connecting the system to the pipes, further alignment must be performed.

This is necessary due movement and tensions occurred during

- transport
- pipe connection.

It is also important to check the alignment after the first startup, when the machine has reached working temperature.

Follow the detailed procedure in the relevant installation and operating instructions of the pump.

Alignment of the duty diesel pumps

WARNING
Crushing hazard
Death or serious personal injury
- Check regularly that all screws are in place and correctly tightened.

The coupling between the pump and diesel engine is operated via cardan shaft. This kind of coupling do not require specific alignment.

9.2 Priming the pumps

Before starting the priming operations, read the installation and operating instructions.

CAUTION
Electric shock
Death or serious personal injury
- Make sure that all protections and cover of the electric parts are in place and secured.

CAUTION
Pressurised system
Minor or moderate personal injury
- Pay attention to the direction of the vent hole and make sure that no person can be hurt by the escaping liquid.

In the case of suction-lift installations, an automatic priming device (on request) is provided and installed for each duty pump.

During commissioning and when necessary (for example, in case of service), ensure correct priming of the pump. Refer also to the documentation for the pumps supplied with the system.

The following procedure must be repeated for each pump in the system.

1. Make sure that all the other pumps in the system are switched off.
2. Close all isolating valves on the outlet side of the pump and test circuit (if present).
3. Open the inlet isolating valve of the pump to prime.
4. Remove the priming cap and slowly pour water into the pump until it is completely filled.
5. Put the cap back on and carefully close it.
6. Set the operating mode selector switch of the pump to prime to manual position and start the pump.
7. Vent the pump.

In some cases, it may be necessary to repeat the procedure described above several times to completely purge the air from the pumps.

9.3 Adjustment of the diesel pump speed

Changing the speed of the diesel pump can compromise the proper functioning of the system and must only be performed by qualified persons.

A low rotation speed implies a lower flow of water to the heat exchanger and a possible engine damage due to overheating.

The rotation speed of the diesel pump is fixed at the factory during testing operations. It is possible to adjust the speed during the first start-up to better meet the demands of the plant, and for this purpose, fasteners are provided on accelerator which limit the adjustment possibilities.

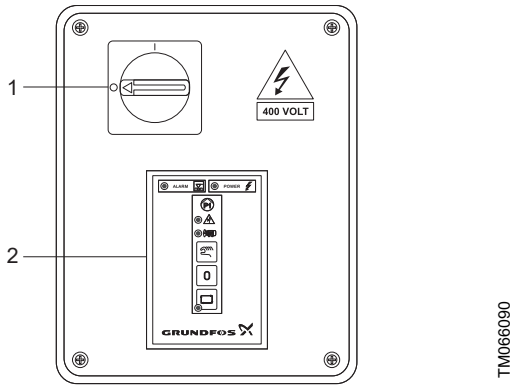
10. Control functions

10.1 Operating panel for the jockey pump

The jockey pump is controlled by a dedicated panel that automatically manages the operation of the pump based on the state in a low-voltage powered pressure switch, isolated from the network by a transformer.

The starting method of the electric motor is direct-on-line (DL).

A lockable general door-lock disconnector allows safe maintenance.



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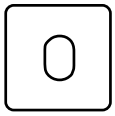
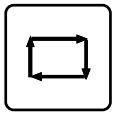
Operating panel for the jockey pump

The operating panel includes the following components and functions available in the door:

Pos.	Description
1	Door-lock disconnector (lockable)
2	Control interface

The control interface has the following luminous indications and actuation keys:

- LED - power supply present
- LED - pump running
- LED - automatic operating mode active
- LED - intervention of thermal protection
- LED - Intervention of protection against dry running.

	Manual **START** button (unstable condition)
	**STOP** button
	Button to enable automatic operation By pressing this button, the pump starts and stops according to the pressure switch setting.

10.1.1 Operating modes of jockey pump

Manual operating mode

Start the pump manually by pressing and holding the **START** button. The pump stops once the **START** button is released.

Automatic operating mode

Push the automatic mode button. The pump starts and stops according to the pressure switch setting.

The automatic mode can be disabled by pressing the **STOP** button.

Emergency operating mode (control board failure)

Use the emergency operating mode only when you are replacing the control board. In this operating mode, all the protections are not active.

If the control board is in failure, you can move a connector inside the cabinet to keep the jockey pump operating in emergency mode.

The wiring diagram shows how to enable this operating mode.

10.1.2 Motor thermal protection setting

You can set the motor protection current by setting the dip switch (SW1) to select one out of the eight values. The setting procedure is described in detail in the wiring diagram supplied with the system.

Each one of the above values, if needed, can be increased up to 130 % by setting on the trimmer AMP %.

If the motor current is above the set value, the pump stops and a dedicated LED is lit.

If the current value returns below the set threshold, the alarm resets automatically after one minute. After three unsuccessful attempts within five minutes, a manual reset is required.

10.1.3 Clicson motor protection

If the motor of the jockey pump is equipped with a Clicson, this can be used to identify the condition of overtemperature and to stop the pump.

The alarm condition must be reset manually.

This function is disabled at the factory and if necessary, can be activated by the user during commissioning by removing the bridge between the relevant terminals and connecting the Clicson.

Refer to the wiring diagram for the Clicson connection.

10.1.4 Jockey pump protection against dry-running

The jockey pump control cabinet is designed for dry-running protection.

This function is disabled at the factory. The factory setting is DRY % trimmer set on value zero and physical jumper on the terminal board.

If necessary, you can activate the dry-running protection during commissioning.

The dry-running condition can be detected in two ways (according to a specific setting):

- Through a threshold of current absorbed by the motor,
  by setting a value (% of the motor current) to DRY % with the trimmer. If the detected current is under this set value, the pump stops and dry-running alarm is activated.
- Through a level switch (not included in the scope of supply),
  by setting a value to DRY % (factory set to 0%) with the trimmer to enable a contact of a level switch that stops the pump and activates the alarm in case of water shortage.

The alarm automatically resets after one minute if the current value returns above the set threshold (or the level switch contact is closed). After three unsuccessful attempts within 60 minutes, a manual reset is required.

The setting procedure is described in detail in the wiring diagram supplied with the system.

10.1.5 Prolonged operation alarm

Prolonged operation alarm is given if the pump runs continuously for more than eight hours.

This function is disabled at the factory and if necessary, can be activated by the user during commissioning by following the procedures below:

1. Set the main switch to OFF position.
2. Press and hold the **STOP** button.
3. Set the main switch to ON position while keeping the **STOP** button pressed.
4. After a few flashes of all the LEDs, release the **STOP** button.
5. Now, by pressing the **START** button, the thermal alarm LED turns on and off:
   - With the LED on, the function is activated.
   - With LED off, the function is deactivated.
6. To confirm the desired selection, wait for five seconds without pressing any button.
7. Turn the main switch to OFF position.

The alarm condition must be reset manually.

The setting procedure is described in detail in the wiring diagram supplied with the system.

10.1.6 Jockey pump operating panel alarms

The LEDs on the operating panel, in addition to their main meaning already described, can signal different alarm conditions by means of flashing modes.

The table below shows the possible flashing modes.

Flashing mode	LED ON time [sec]	LED OFF time [sec]	Pause time [sec]
ON 50/50	0.5	0.5	0
ON 3/4	1.5	0.5	0
5 flashes	0.2	0.2	1
10 flashes	0.2	0.2	1

The alarms available are described below.

For more detailed information, refer to the wiring diagram.

LED (mode)	Alarm effect	Reset	Factory setting
Thermal overload			
Alarm condition: the motor current is higher than the set value (with trimmer AMP %).			
ON fix 	Pump stop, LED indication	Auto reset [1]	Active
Clicson			
Alarm condition: the Clicson contact on the motor is tripped.			
ON 50/50 	Pump stop, LED indication	Manual reset	Inactive
Unbalanced main supply phases			
Alarm condition: the difference in current between the monitored phases is greater than 30 %.			
ON 3/4 	Pump stop, LED indication	Manual reset	Active
Missing phase			
Alarm condition: in at least one of the monitored phases, the current is zero.			
ON 3/4 	Pump stop, LED indication	Manual reset	Active
Dry Run protection - analogic (set trimmer DRY % > 0)			
Alarm condition: the motor current is lower than the set value (with trimmer DRY %).			
ON fix 	Pump stop, LED indication	Auto reset [2]	Inactive
Dry Run protection - digital (set trimmer DRY % = 0)			
Alarm condition: the contact of the dry-running level switch (not included in the scope of supply) is open.			
ON fix 	Pump stop, LED indication	Auto reset [1]	Inactive

LED (mode)	Alarm effect	Reset	Factory setting
Prolonged operation			
Alarm condition: the pump runs continuously for more than 8 hours.			
ON 5 flashes			
	LED indication	Manual reset	Inactive
Excessive number of start-ups per hour			
Alarm condition: the pump starts up more than 60 times per hour.			
ON 10 flashes			
	LED indication	Manual reset	Active

1) Manual reset is required after 3 unsuccessful attempts within 5 minutes.

2) Manual reset is required after 3 unsuccessful attempts within 60 minutes.

In case more than one alarm is present simultaneously, only one alarm is displayed, according to the priority in the above list.

To manually reset the alarms, push **STOP** button for 5 seconds. All alarms are reset. In case an alarm is still present, the LED will light up again.

10.1.7 Signalling outputs (potential-free contacts) for jockey pump

For the supervision of the jockey pump, the outputs listed below are provided:

Signalling	Description
Pump in operation	Start of the jockey pump Closed contact indicates that the pump is running.
General alarm (cumulative)	Thermal protection tripping, protection against dry-running, power supply failure, non-automatic operating mode, an excessive number of close start-ups, prolonged operation. Closed contact indicates an alarm.

Contact type: AC1, potential-free relay contacts.

Maximum voltage: 115 V.

Maximum current: 2 A.

10.1.8 Modbus communication

The control cabinet is equipped with a communication interface for Modbus RTU networks; therefore, it can be integrated into a supervision system. Through an appropriate configuration, it is possible to remotely view all the information available in the cabinet, including the status of the LEDs and all the alarms.

Refer to the dedicated instructions (part of the scope of supply) for the Modbus configuration.

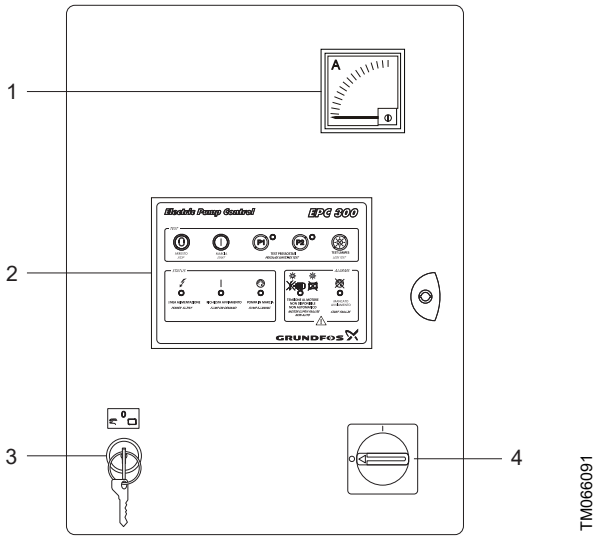
10.2 Operating panel for the duty electric pump

The duty electric pumps are controlled by an independent operating panel which provides easy reading of the measurement instruments and signals from a single observation point.

The starting of the electric motors is available as standard in the following configurations:

- direct-on-line, DL, for powers up to 30 kW
- star-delta, SD, for powers from 37 kW and higher.

To ensure greater safety for operators, the control pressure switch is powered by low voltage isolated from the mains by a transformer.



Operating panel for the electric pump

The panel includes the following components and functions available in the door:

Pos.	Description
1	Ammeter
2	EPC 300 control unit with buttons and warning lights
3	TEST-0-AUT operating mode selector with a removable key in AUT position
4	Main switch, pad lockable

The user interface of the EPC 300 control unit shows the following signal lights and operating buttons:

Manual **START** button

Manual **STOP** button

TEST LEDs button
When pressed, all the LEDs light up and a dedicated signalling output is activated.

P1 and **P2** buttons
For starting the test of the independent pressure switches

Additionally, the control unit also shows the following signals:

- power not available or wrong sequence phase connection, LED
- pump on demand, LED
- pump running, LED
- no voltage to the motor (permanently-on light), automatic operating mode disabled (flashing light), LED
- start failure, LED.

10.2.1 Manual operating mode of electric pump

1. Set the operating mode selector to **TEST**.
2. Start the motor by pressing the manual **START** button.
3. Perform the necessary tests.
4. Stop the motor by pressing the manual **STOP** button.

10.2.2 Automatic operating mode of electric pump

1. Set the operating mode selector to **AUT**.

If the pressure of the firefighting system decreases below the set threshold, the pressure switches provide the input for starting the pump. The pump can be stopped by positioning the operating mode selector to **TEST** and pressing the manual **STOP** button.

10.2.3 Testing the pressure switches for electric pump

Two pressure switches for each duty pump are required on the system, as specified in the EN 12845 standard.
The operation of every single pressure switch must be checked regularly, and for this reason the control cabinets are equipped with a device that allows the check of the proper operation for every single pressure switch.

1. Set the operating mode selector on **TEST**.
2. Press button **P1**.
3. Open the valve to make the system pressure drop down.
   - The panel will start the pump through P1 (pressure switch 1).
4. Close the water valve and wait for the system to reach the nominal pressure.
5. Switch off the pump by pressing the **STOP** button.
6. Press button **P2** and repeat the above procedures to verify the correct operation of pressure switch 2.

Related information

11.2.6 Checking the performance of the system

10.2.4 Testing the light signal

1. Press the LED **TEST** button.
   - All the warning lights will light up, showing their correct operation.

Related information

11.2.6 Checking the performance of the system

10.2.5 Automatic stop function for electric pump

In some countries and for specific applications, it is allowed for the duty pump to stop automatically.

When this function is enabled, the duty pump stops automatically when the pressure in the system exceeds the stop threshold of the starting pressure switches and remains there for a certain period which is set by an adjustable timer.

This function is disabled at the factory. If necessary and allowed by the local regulation, it can be activated by the user during commissioning by following the steps below.

1. Set the operating mode selector to **0**.
2. Power up the control cabinet by turning the main switch to ON position. The green LED is lit, and the pump is stopped.
3. Simultaneously press and hold the **STOP** button and the **TEST** button for more than five seconds. During this operation, all the LEDs are lit.
4. After five seconds, the LEDs **P1** and **P2** will flash.
5. Release the **STOP** button and the **TEST** button.
6. By pressing **START** button, the function can be activated, and the desired time can be set. Each press of **START** button lights up a different LED with the meaning given in the following table:

Power supply	Pump on demand	Pump running	Power to the motor	Start failure	Function status
⊗	⊗	⊗	⊗	⊗	Function disabled
☼	⊗	⊗	⊗	⊗	5 min. delay
⊗	☼	⊗	⊗	⊗	10 min. delay
⊗	⊗	☼	⊗	⊗	20 min. delay
⊗	⊗	⊗	☼	⊗	40 min. delay
⊗	⊗	⊗	⊗	☼	60 min. delay

7. After selecting the desired setting, wait about 10 seconds without pressing any button. The control cabinet saves the configuration.

To check the status of the automatic stop, repeat the first five steps. The LED lights will indicate the setting of the timer. After 10 seconds, the system exits the programming mode and reverts back to the standard operating mode.

10.2.6 Signalling outputs (potential-free contacts) for duty electric pump

The outputs listed below in accordance with the EN 12845 standard are provided for supervising the system from a control room:

Signalling	Description
Electric mains	Mains voltage is missing.
Motor voltage, or non-automatic operating mode	These outputs can indicate one of the following conditions: • There is no voltage to the motor when the pump is requested to start. • The operating mode selector is positioned on **TEST** or **0** (the group is not ready to start if requested).
Starting request	Request for starting the electric pump.
Pump in operation	The electric pump is in operation (two outputs are available, one used to start up the fan of the room ventilation system when the pump is in operation.)
Failure to start	The pump did not start on request.

Contact type: AC1, potential-free relay contacts.

Maximum voltage: 115 V.

Maximum current: 2 A.

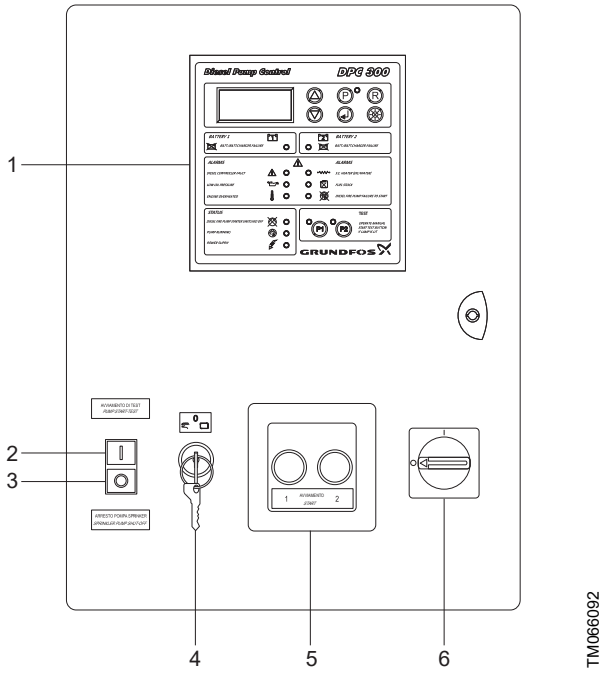
10.2.7 Modbus communication

The control cabinet is equipped with a communication interface for Modbus RTU networks; therefore, it can be integrated into a supervision system. Through an appropriate configuration, it is possible to remotely view all the information available in the cabinet, including the status of the LEDs and all the alarms.

Refer to the dedicated instructions (part of the scope of supply) for the Modbus configuration.

10.3 Operating panel for the duty diesel pump

The duty diesel pump is controlled by an independent operating panel which provides easy reading of the measurement instruments and signals from a single observation point.



Operating panel for the diesel pump

The panel includes the following components and functions available in the door:

Pos.	Description
1	DPC 300 control unit with buttons, warning lights and LCD multifunction display
2	Engine test start button
3	Manual engine stop button
4	TEST-0-AUT operating mode selector, with removable key in AUT position
5	Manual engine start button using battery 1 or 2, protected by breakable glass
6	Main switch, pad lockable

The control interface has a backlit LCD display, so you can read it even when the room lighting is poor. By means of the light signals, the system status is always under control.

The indications and their functions are divided as follows.

The LCD display has eight parameters in simultaneous reading:

- engine status or speed with the engine running
- status of the operating mode selector
- operation hour counter
- engine temperature
- oil pressure
- diesel fuel level
- battery 1 voltage
- battery 2 voltage.

In the case of an alarm, the description of the alarm is displayed instead of the battery voltage.

Programming area

- Parameter selection button
- programming button
- confirmation button
- reset button
- LED operation check button.

Battery 1:

- battery charger failure (flashing LED) or battery failure (LED is permanently on).

Battery 2:

- battery charger failure (flashing LED) or battery failure (LED is permanently on).

Alarm indication area

- Operating panel failure
- low oil pressure
- high engine temperature
- short circuit of oil or water pre-heating system
- diesel reserve
- engine start failure.

Status area

- Automatic start disabled
- pump in operation
- mains present.

Test area

- Button for pressure switch 1: test and operation check of the emergency starting circuit
- Button for pressure switch 2: test and operation check of the emergency starting circuit.

Two independent battery chargers and all the electromechanical components needed are housed inside the cabinet.

10.3.1 Functions of buttons on the LCD display

The following buttons can be found on the LCD multifunction display of the operating panel:

Buttons	Description
	**P** Used for accessing and exiting the programming mode
 	**UP and DOWN** In programming mode, they can be used for changing parameter values. Outside the programming mode, they can be used for adjusting the contrast of the LCD display.
	**ENTER** Enables access to the selected parameter and confirmation of its value With the motor running, this button displays the fuel level.
	**TEST LED** Used for testing the LEDs on the operating panel When pressed, all the LEDs are lit.
	**R** Used for resetting alarms and the operating hour counter
 	**P1 and P2** Used for testing the pressure switches and the emergency starting circuit

10.3.2 Manual operating mode of diesel pump

1. Set the operating mode selector to **TEST**.
2. Start the engine by pressing the engine **START** button.
3. Perform the necessary tests.
4. Stop the engine by pressing the engine **STOP** button.
   After pressing the engine **STOP** button, the display shows the message **STOP**.
5. Keep pushing the engine **STOP** button until the message **Engine OFF** appears on the display.

   After the engine stops, by setting the operating mode selector to **AUT**, once the pressure value in the network is under the start threshold of the pressure switch, the pump will start again immediately.

   When the display shows **Engine OFF**, after about eight seconds it is possible to reposition the selector to **AUT**.

10.3.3 Automatic operating mode of diesel pump

1. Set the operating mode selector to **AUT**.
   - If the pressure of the firefighting network decreases, one of the dedicated pressure switches provides the input for starting the pump.
   - The pump can be stopped by positioning the operating mode selector to **TEST** and pressing the engine **STOP** button. After pressing the engine **STOP** button, the display shows the message **STOP**.
2. Keep pushing the engine **STOP** button until the message **Engine OFF** appears on the display.

   After the engine stops, by setting the operating mode selector to **AUT**, once the pressure value in the network is under the start threshold of the pressure switch, the pump will start again immediately.

   - When the display shows **Engine OFF**, it is possible to reposition the selector to **AUT** after eight seconds.
   - In applications with hose reel systems, the stopping of the diesel pump can be controlled by an internal timer.
     This function must be activated by the user if needed and allowed by local legislations. See the dedicated section for the automatic stop function of the diesel pump.

Related information

10.3.8 Automatic stop function for diesel pump

10.3.4 Emergency operating mode of diesel pump

In the case of an emergency and when the engine has not started, it is always possible to start the engine directly with the batteries regardless of the control panel settings or the pressure switch command.

There are two **EMERGENCY START** buttons (one per battery) for enabling this function, and they are protected by a breakable glass.

10.3.5 Testing the pressure switches for diesel pump

Two pressure switches for each main pump are required on the firefighting main pump sets, as specified in the EN 12845 standard.

The operation of every single pressure switch must be checked regularly, and for this reason the control panels are equipped with a device that allows the check of the proper operation for every single pressure switch.

Before starting the following procedure, make sure that the LEDs of the buttons **P1** and **P2** are switched off.

If the LEDs are OFF, you can follow the procedure below to test the pressure switches.

If the LEDs are ON with a steady light, follow the procedures in the dedicated section for checking the emergency starting circuit.

1. Set the key selector on **TEST**.
2. Press button **P1**.
   - The corresponding LED light flashes.
3. Open the valve in order to make the system pressure drop down.
   - The panel will start the pump through P1 (pressure switch 1).
4. Close the water valve, and wait for the system to reach the nominal pressure.
5. Switch off the pump by pressing the **STOP** button.
6. Press button **P2**, and repeat the above procedures to verify the correct operation of pressure switch 2.

Related information

10.3.7 Checking the emergency starting circuit

11.2.6 Checking the performance of the system

10.3.6 Testing the light signal

1. Press the LED **TEST** button.
   - All the warning lights will light up, showing their correct operation.

Related information

11.2.6 Checking the performance of the system

10.3.7 Checking the emergency starting circuit

As specified in the EN 12845 standard, the operating panel of the diesel pump is equipped with two buttons, **P1** and **P2**, protected by a breakable glass for the emergency starting of the diesel engine. A periodic test must be carried out for checking the operation of these buttons without breaking the glass.

The buttons **P1** and **P2** are also used for testing the pressure switches as described in the dedicated section for testing the pressure switches.

For the emergency starting circuit, the buttons **P1** and **P2** automatically become active and the yellow LEDs of the buttons are permanently on (as required by the standard) only in the following two cases:

- after an automatic engine start followed by a stop
- after six unsuccessful attempts to start.

You can run the test when the LEDs of the buttons are permanently on.

1. Press the button **P1** until the engine starts.
2. Press the engine **STOP** button to stop the engine.
   The LED of the button **P1** is switched off.
3. Repeat the test with the second button **P2**.

The test is completed when the LEDs of both buttons are off.

Related information

10.3.5 Testing the pressure switches for diesel pump

11.2.6 Checking the performance of the system

10.3.8 Automatic stop function for diesel pump

In some countries and for specific applications, it is allowed for the duty pump to stop automatically.

When this function is enabled, the duty pump stops automatically when the pressure in the system exceeds the stop threshold of the starting pressure switches, and remains there for a certain period of time which is set by an adjustable timer.

This function is disabled in the factory and can be activated by the user following the procedure described in the dedicated section for setting the operating parameters.

Related information

10.3.3 Automatic operating mode of diesel pump

10.3.10 Setting the operating parameters

10.3.9 Adjusting the contrast of the LCD display

1. To optimise the readability of the LCD display, use the **UP** and **DOWN** buttons to increase and decrease the contrast of the display.

10.3.10 Setting the operating parameters

When the control cabinet is connected to the mains, it automatically sets the ON start time to 16 seconds and the OFF start time to 11 seconds for the commissioning test according to the EN 12845 standard. This condition is kept for 12 hours. After that, the time set by the user takes effect.

The DPC 300 control unit offers the possibility to customise the operating parameters.

The procedure to select and customise the various parameters is described below:

1. Set the key selector to position **0**.
   When pressing the **P** button, the green LED next to the button lights up.
2. Browse the menu to select the desired parameter using the **UP** and **DOWN** buttons.
   When the **ENTER** button is pressed, the green programming LED flashes.
3. Set the desired value of the selected parameter using the **UP** and **DOWN** buttons.
4. Press the **ENTER** button to confirm the value.
5. Press the **P** button to exit programming.
6. At the end of programming, switch off the control panel and then switch it back on using the general main switch.

The operating panel of the diesel pump is supplied calibrated and tested at the factory and does not need any calibration.

Modifying the calibration parameters of the operating panel may jeopardise proper operation of the pump set. Recalibration must be carried out only by qualified persons.

Recalibrating some parameters as described below may be useful only in the case of special requirements related to service operations.

Related information

10.3.8 Automatic stop function for diesel pump

10.3.11 Freely accessible parameters

Parameter	Description
Language	Italian, English, French, German, Spanish, Portuguese, Czech, Polish, Hungarian, Slovak, Swedish, Finnish, Danish, Norwegian, Dutch, Serbo, Romanian, Turkish
Stop time	Time interval for which the stop command is activated when the engine **STOP** button is pressed (modifiable from 5 to 25 seconds)
Start time ON	Time interval for which the starting relay is activated (modifiable from 5 to 10 seconds)
Start time OFF	Time interval between two start attempts (modifiable from 5 to 10 seconds)
Number of starts	Number of start attempts (value = 6, not modifiable)
Automatic stop	Enable or disable the automatic stop function
Automatic stop time	Time interval for which the pump keeps running after the outlet pressure is reset This parameter is available only if the automatic stop function is enabled.
Engine calibration ON	Enables the engine calibration function
Calibration speed	Maximum rated speed of the engine (modifiable from 1000 to 4000 rpm)
Password	Code for accessing the protected parameters

10.3.12 Password-protected parameters

The password-protected parameters are only available to authorised persons.

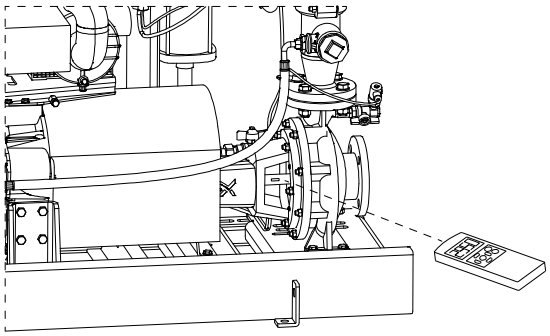
Parameter	Description
Battery voltage	For selecting the battery voltage (12 or 24 V)
External inputs	Not available
Serial port	Not available
Speed sensor	For selecting the type of the speed sensor: pick-up or alternator
Speed indicator constant	Parameter automatically calculated during calibration
Engine threshold ON	Engine rpm value ON - automatic calculation during calibration
Temperature sensor	Analog or digital temperature value and temperature selection for oil or water
Oil pressure sensor	Analog or digital oil-pressure value
Fuel level sensor	Analog or digital fuel-level value
Hour counter reset	For resetting the operating hour counter
Settings output AUX (Settings of AUX output)	The output can be set on one of the following: • fuel reserve • battery charger failure, over-voltage, or under-voltage • power failure • pre-heating system protection alarm.
Password change	For changing the password for accessing the protected parameters The password is disabled when value 0 is set.

10.3.13 Calibrating the engine speed

DANGER
Crushing hazard
Death or serious personal injury

- Under no circumstances should the system be operated, when the belt guard is not in place and suitably secured.
- To detect the exact speed of the engine, remove the protection in the area of the mechanical seal of the pump, and read the rotation value using an optical tachometer oriented towards the shaft.
- Do not place fingers, hands, tools, and so on into any shaft seal opening.
- Make sure to restore the protection in the area of the mechanical seal once the work is finished.
- This operation must be carried out by qualified persons.

1. Set the key selector to position **0**, and choose the value in the **SPEED CALIBR.** parameter.
2. Set the maximum engine speed.
   • Refer to the specific engine model.
3. Remove the pump shaft guard.
4. Check the effective speed of the engine with an optical tachometer.



Speed check (optical tachometer not included in the scope of supply)

5. Set the correct value on the operating panel.
6. Confirm by pressing the **ENTER** button.
7. Set the key selector to **TEST** position.
8. Start the engine at maximum speed, and wait for the calibration to complete.
   The display shows **?CAL?** until the calibration completes. After that, the speed set in the parameter appears.

The calibration process takes a few seconds.

10.3.14 Setting the Engine ON parameter

1. With the selector in **TEST** position, start the engine at minimum speed and wait until the engine speed stabilises.
2. Set the key selector to position **0**, and select the parameter **Engine ON calibration**.
3. Select **YES**, then press **ENTER**.
   The display shows **?CAL?** which flashes until the calibration is completed.

The self-learning process takes a few seconds.

10.3.15 Alarms

As required in the EN 12845 standard, the duty pump cannot be stopped by any alarm. The duty pump can only be stopped manually unless in applications with hose reel systems, where the duty pump can be stopped automatically by an internal timer.

The DPC 300 control unit displays the alarms described below.

The alarms can be grouped into two categories:

- **Memorised type** - these are constantly displayed even when the alarm is no longer present. The memorised alarm condition can be reset by pressing the button R (only if the cause is removed).

Alarm	Description
Battery 1	Battery 1 voltage is less than 9.6 V or greater than 16.2 V.
Battery 2	Battery 2 voltage is less than 9.6 V or greater than 16.2 V.
Low oil pressure	Low engine oil pressure. The control panel starts to check the oil pressure 60 seconds after the engine starts.
High engine temperature	High engine temperature. The control panel starts to check the engine temperature 10 seconds after the engine starts.
Start failure	The engine does not start after six unsuccessful starting attempts.
Pick-up	This occurs when the system does not detect any signal from the pick-up speed sensor while the engine is running. When this alarm occurs, the display shows **STOP**. If the alarm condition cannot be reset by pressing the button **R**, it is necessary to press **STOP** button.

- **Non-memorised type** - these are displayed only when the alarm is present. The alarm condition automatically resets once the cause of the alarm is removed.

Alarm	Description
Battery charger 1 failure	Battery charger 1 is inefficient.
Battery charger 2 failure	Battery charger 2 is inefficient.
Oil/water heater short circuit	The circuit breaker of the oil/ water heater has tripped.
Fuel reserve	The fuel is running low or the fuel level drops below 70 % of the tank volume.
Mains failure	Mains voltage is not present.

10.3.16 Alarm reset

The alarm signals can be reset by pressing the button **R** and setting the key selector to **AUT**.

Only the engine start failure alarm will reset after setting the key selector to **0**.

The low oil pressure and high motor temperature alarms will reset only after the engine is switched off.

10.3.17 Signalling outputs (potential-free contacts) for duty diesel pump

The operating panel of the diesel pump can be connected with remote devices such as, for example, the Grundfos remote acoustic-visual alarm.

The operating panel has the following relay outputs available on the terminal board. For detailed information, refer to the wiring diagram of the operating panel.

Relay outputs	Description
Pump in operation	The closing of the contact indicates the actual start of the diesel pump. Two outputs are available: one can be used to start the fan of the room ventilation system when the pump is in operation.
General alarm (cumulative)	The closing of the contact indicates the intervention of one of the following alarm conditions: battery charger failure, over- or under-voltage batteries, mains power failure, low oil pressure, high engine temperature, start failure, operating mode selector not in automatic position, fuel reserve, oil/water heater.
Failure to start	The closing of the contact indicates the engine start failure after six unsuccessful attempts.
Operating mode not in automatic	The closing of the contact indicates the alarm generated by the operating mode selector set in **0** or **TEST** position. The diesel pump is not ready to start in case of request.
Operating panel failure	The closing of the contact indicates that the DPC 300 control unit does not work properly.
AUX Programmable contact [3]	This output contact can be set to indicate one of the following three conditions (not cumulative): • fuel reserve • battery charger failure, over-voltage or under-voltage • power failure • pre-heating system protection alarm.

3) This contact is not available on the terminal board, but must be connected on the DPC 300. Refer to the wiring diagram for cabling.

Contact type: AC1, potential-free relay contacts.

Maximum voltage: 115 V.

Maximum current: 2 A.

10.3.18 Modbus communication

The control cabinet is equipped with a communication interface for Modbus RTU networks; therefore, it can be integrated into a supervision system. Through an appropriate configuration, it is possible to remotely view all the information available in the cabinet, including the status of the LEDs and all the alarms.

Refer to the dedicated instructions (part of the scope of supply) for the Modbus configuration.

11. Service

11.1 Maintenance

DANGER
Electric shock
Death or serious personal injury

- Before any inspection, maintenance, service or repair of the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent accidental reconnection.
- There are more than one control cabinets. Make sure that you disconnect the correct one belonging to the section of the system that needs intervention.
- The electrical installation must be carried out by a qualified electrician appointed by the client in accordance with local regulations.

DANGER
Automatic startup
Death or serious personal injury

- The system can start up automatically at any time. If the system is not set as out of order, it is mandatory to keep a safe distance from any of its parts.
- Before any inspection, maintenance, service or repair of the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent inadvertent reconnection.
- In case of diesel pumps, isolate the fuel supply to the engine and disconnect the batteries by removing the negative terminal connector, before working on any part of the fuel supply or control system.
- Make sure that you wear suitable clothing on site. Do not let long hair down, wear loose or frayed clothing or jewelry to avoid being trapped into the equipment.
- Do not place fingers, hands, arms or tools into any openings.
- Under no circumstances should the system be operated, when the coupling guard is not in place and suitably secured.

DANGER
Trapping hazard
Death or serious personal injury

- The system can start up automatically at any time. Keep a safe distance from the system when you are in the technical room.
- Do not do inspection, maintenance, service or repair of the system while the motor or the engine is in operation. If this is not possible, make sure that all protections against rotating or hot parts are in place and secured.
- Make sure that you wear suitable clothing on site. Do not let long hair down, wear loose or frayed clothing or jewelry to avoid being trapped into the equipment.
- Do not place fingers, hands, arms or tools into any openings.

WARNING
Automatic startup
Death or serious personal injury

- The system can start up automatically at any time. The operating noise level of the system is high and the system must be installed in an access-controlled area.
- Ear protection must be carried by, or available to, all persons authorised to enter the technical room.
- Observe the health and safety regulations and limit the exposure of persons to excessive noise.

WARNING
Crushing hazard
Death or serious personal injury

- Any kind of maintenance on the system must be performed by qualified and authorised persons.
- Maintenance performed by unqualified persons or incorrect use can cause serious damage to the system or even to the entire firefighting system network.

WARNING
Harm to persons
Death or serious personal injury

- Do not remove the protections during engine operation. Keep a safe distance from any of its parts.

CAUTION
Harm to persons
Minor or moderate personal injury

- Do not change the oil or refuel the fuel tank when the engine is hot.
- Let the engine cool down before you run any operations with oil or fuel.

CAUTION
Pressurised system
Minor or moderate personal injury

- Water is under pressure inside the pipes. Make sure to gradually decrease the pressure and empty the pipes before operation. This operation must be carried out by qualified persons.

11.2 Verification and checks

WARNING
Automatic startup
Death or serious personal injury

- The system can start up automatically at any time. Before any operation on the coupling, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent accidental reconnection.
- In case of diesel pumps, before working on any part of the fuel supply or control system, disconnect the batteries by removing the negative terminal connector.
- Check regularly the alignment of the spacer coupling based on the operation time.
- Check regularly that all screws are in place and correctly tightened.
- Before closing the coupling guard after the alignment (if required), make sure that all screws are correctly tightened.
- Under no circumstances should the system be operated, when the coupling guard is not in place and suitably secured.
- This operation must be carried out by qualified persons.

As required by the EN 12845 standard, the periodic verification of the system performance must be carried out by the installer of the system or by qualified persons. The activities performed must be documented in a dedicated register kept in the building.

11.2.1 Duty electric pump

WARNING
Crushing hazard
Death or serious personal injury

- Check regularly the alignment of the spacer coupling based on the operation time.

For electric pumps, checking and replacement of wear parts complies with generally accepted good workmanship practices.

For more information about the maintenance of electric pumps, refer to the specific documentation provided with the system.

11.2.2 Duty diesel pump

WARNING
Crushing hazard
Death or serious personal injury

- Check regularly if all the screws are in place and correctly tightened.

The diesel engine is coupled to the pump through a cardan shaft. This kind of coupling does not require specific alignment.

For more information about the maintenance of diesel engines, refer to the specific documentation provided with the system.

For diesel engines, as for all internal combustion engines, there are regularly scheduled service intervals depending on the hours of operation of the engine or the time passed since commissioning, for example, the periodic check of engine oil or cooling liquid.

11.2.2.1 Oil check and replacement

CAUTION
Harm to persons
Minor or moderate personal injury

- During oil replacement, use adequate tools to avoid lifting excessive loads that may result in falls or musculoskeletal problems.

Check the oil level periodically and refill if necessary.

For more information about the maintenance of diesel engines, refer to the specific documentation provided with the system.

11.2.2.2 Cooling circuit of the diesel engine

WARNING
Hot surface
Death or serious personal injury

- The cooling circuits may remain hot and pressurised even after the engine has been shut off. Open the coolant tank cap only when the engine is cold and if strictly necessary.

Check the cooling circuit periodically with a frequency depending on the hours of operation, time of being put into operation and the quality of water used for the secondary heat exchanger circuit, that is, water from the system.

11.2.2.3 Checking the coolant level

WARNING
Toxic material
Death or serious personal injury

- Do not ingest oil, fuel or coolant. In case of ingestion refer to safety sheet of the specific product.

1. Make sure that the engine is switched off.
2. Open the cap of the heat exchanger.
3. Check the level of coolant inside the water/water heat exchanger.
4. Refill the coolant, if necessary.
   Use a mixture of demineralised water and antioxidant or inhibited-ethylene-glycol-type antifreeze fluid appropriate for the purpose.

11.2.2.4 Checking the water flow in the heat exchanger

1. Make sure that during operation of the diesel pump, the pressure stays within the range indicated on the pressure gauge located upstream of the exchanger.
2. Excessive pressure indicates that there is an obstruction in the heat exchanger or in the output of the circuit. Make sure that the obstruction is cleared.
3. Verify visually that there is effective and correct water circulation in the heat exchanger.
4. Check that the flow through the cooling system meets the minimum requirement specified in the technical documentation for the specific model.

11.2.2.5 Cleaning the circuit of the heat exchanger

Regularly clean the filter located upstream of the heat exchanger. The frequency of cleaning depends on the quality of water used for the system.

1. Make sure that the engine is switched off.
2. Close the shut-off valves upstream and downstream of the filter.
3. Open the bypass circuit. See the dedicated section about diesel pumps with water/water heat exchanger.
4. Remove the filter and clean it.
5. After cleaning is completed, open the gate valve.

Related information

4.3 Diesel pumps with water/water heat exchanger

11.2.3 Pressure tank

The precharge of the tank must be periodically checked and adjusted to ensure proper operation of the system.

11.2.4 Flowmeter (optional)

The flowmeter requires no particular maintenance.

The presence of impurities in the pressure holes causes significant reading errors, so we recommend cleaning the measurement flange properly from time to time, and checking that the pressure holes are clean and free from impurities.

If there are deposits in the glass graduated tube, you can clean the duct inside the flowmeter. See the installation and operating instructions of the flowmeter.

11.2.5 Batteries (for diesel pump starting)

The batteries are sealed and ready for use. They are charged from the electronic battery chargers housed in the control cabinet.

The condition of the connections on the battery terminals must be periodically checked. If there is corrosion, clean the battery terminals.

11.2.6 Checking the performance of the system

At periodic checks, the flow rate is measured by a flowmeter with direct reading.

The Grundfos dedicated kit (optional) includes a shut-off valve, a flowmeter and a control valve. The configuration and measurement accuracy of the flowmeter correspond to the requirements of the EN 12845 standard.

Make sure that there are no air pockets in the flowmeter and there are no impurities in the measurement circuit as they considerably reduce measurement accuracy. If necessary, use the bleeder screw on the top of the instrument.

To check the performance of the system, perform the following steps:

1. Set the main switch of the jockey pump to **0** position.
2. Close the gate valves on the outlet connection to the system.
3. Set the operating mode of the duty pumps to **TEST**.
4. Open the gate valve of the flow rate test circuit.
5. Partially open the gate valve located downstream of the flowmeter on the test circuit to allow the measurement of the flow rate.
6. Check the outlet pressure on the manometer.
7. Check the pressure on the vacuum pressure gauge.

The difference between the outlet pressure and the inlet pressure is the total head of the pump.

Related information

10.2.3 Testing the pressure switches for electric pump
10.2.4 Testing the light signal
10.3.5 Testing the pressure switches for diesel pump
10.3.7 Checking the emergency starting circuit

11.2.7 Bolt and connection checks

CAUTION
Crushing hazard
Minor or moderate personal injury
- Periodically check the tightness of the bolts that may loosen due to vibrations generated by the operation of the system.

12. Storage

The system must be stored in a frost-free room protected from direct exposure to the environment.

Standard factory packaging is suitable for protection during shipment and during covered storage at the jobsite for a short period between installation and startup.

Prevent water, dust, dirty or small animals etc. from entering the pump. Always cover all openings until the pipes are connected.

See also the installation and operating instructions for the diesel engine.

13. Fault finding

DANGER
Electric shock
Death or serious personal injury

- Before any inspection, maintenance, service or repair of the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent accidental reconnection.

For failures relating to the diesel engine or pump, refer to the specific installation and operating instructions delivered with the system.

13.1 The electric pump does not start

Cause	Remedy
There is no mains supply.	• Connect the power supply.
The main switch is off.	• Turn on the main switch.
The fuse is defective.	• Replace the fuse.
The electrical circuit is interrupted or defective.	• Check and repair the electrical circuit.
The pump is blocked.	• The hydraulics are blocked. Dismantle and clean the pump. See the installation and operating instructions of the pump.
There is an electric motor failure.	• Repair or replace the electric motor. See the installation and operating instructions of the electric motor.

13.2 The diesel pump does not start

Cause	Remedy
There is no fuel.	• Fill the tank.
There is a battery failure.	• Check the battery and replace if necessary.
There is a diesel engine failure.	• Repair of replace the diesel engine. See the installation and operating instructions of the diesel engine.

13.3 The thermal relay trips (only for jockey pump)

Cause	Remedy
Too much energy consumption due to defective motor winding.	• Replace the motor. Contact Grundfos Service.
The pump is under strain.	• Dismantle and clean the pump.

13.4 The flow rate of the system is not as desired

Cause	Remedy
There are air pockets in the inlet pipe.	• Replace the inlet pipe or change its arrangement.
The inlet pressure is too low (cavitation).	• Restore the correct inlet condition.
The inlet pipe is too narrow.	• Check the correct sizing of the inlet pipe.
The pipe is clogged.	• Clean or replace the pipe.
The foot valve is clogged or blocked.	• Clean or replace the foot valve.
The direction of rotation is incorrect.	• Restore the correct direction of rotation.
The pump is clogged.	• Clean the pump. See the installation and operating instructions of the pump.
Incorrect flowmeter installation.	• Check and correct the installation.
There are air pockets in the flowmeter.	• Bleed air from the flowmeter.
The measurement flange of the flowmeter is clogged.	• Clean the measurement flange.

13.5 Water hammer in the system

Cause	Remedy
Water hammer when the outlet valves are closed.	• Install additional diaphragm tanks or a bigger diaphragm tank.
Water hammer when the system is stopped.	• The foot valve closes late. Replace the foot valve with a more appropriate model.

13.6 Leaks from the mechanical seal

Cause	Remedy
The mechanical seal is damaged.	• See the installation and operating instructions of the pump.

14. Technical data

14.1 Operating conditions

Installation	Indoors, waterproof room, protected against freezing
Installation level	Electric pumps: up to 1000 m above sea level Diesel pumps: up to 300 m above sea level
Performance	See the specific curve of the model. Performance according to ISO 9906.
Nominal pressure	Components and materials PN 16
Fluid pumped	Solid- and fibre-free clean water
Water temperature	0-40 °C
Ambient temperature	4-40 °C Minimum 10 °C for diesel pumps
Suction capacity	According to specific performance of the model chosen
Maximum inlet pressure	The maximum inlet pressure is linked to the maximum shut-off pressure delivered by the pump, which means that the sum of the inlet pressure with the shut-off pressure must be less than the nominal pressure of the pump. In case of water-cooled diesel pumps, the max inlet pressure is 2 bar.
Electric power	According to specific performance of the model chosen.
Starting method	Direct-on-line up to 30 kW Star-delta starting from 37 kW
Power supply	3 × 400 V, 50 Hz for electric pumps 1 × 230 V, 50 Hz. Imax = 4 A for diesel pumps

Related information

4.1 Location

15. Disposing

15.1 Precautions for disposal

WARNING
Electric shock
Death or serious personal injury

- Before dismantling the system, make sure that the main switch is in OFF position, locked and tagged. Attach suitable isolation warning signs to prevent inadvertent reconnection.
- Before loosening the bolts, make sure that the electrical connections are disconnected.
- Before loosening the bolts, drain the water from all the parts to be dismantled, and make sure that all protections and cover of the electric parts are in place and secured.

WARNING
Overhead load
Death or serious personal injury

- Make sure that the area below and around the lifted system is clear of people during operations.
- Do not allow anyone to stand on, under, or near the load.

WARNING
Crushing hazard
Death or serious personal injury

- Whenever possible, handle the system with a forklift.
- When using chains or belts, lift the system to the base by the correct lifting points.
- Never use the lifting eyes of the individual components to lift the system.
- Only use the lifting equipment which is in proper condition and is suitable to lift the weight and the shape of the system.
- Check the integrity of the lifting points before starting any handling operations. After lifecycle, the lifting points could be damaged.
- Pay attention to the centre of gravity of the parts to be removed.
- Lock the cabinet door before moving the system.
- Before loosening the bolts, make sure that the parts to be dismantled are correctly supported by a lifting tool suitable for the purpose.

CAUTION
Slipping hazard
Minor or moderate personal injury

- Remove all the liquids from the system before dismantling.
- Do not spill liquids, such as oil, fuel or coolant on the floor as it could get slippery.

15.2 Disposing of the system

This system or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

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