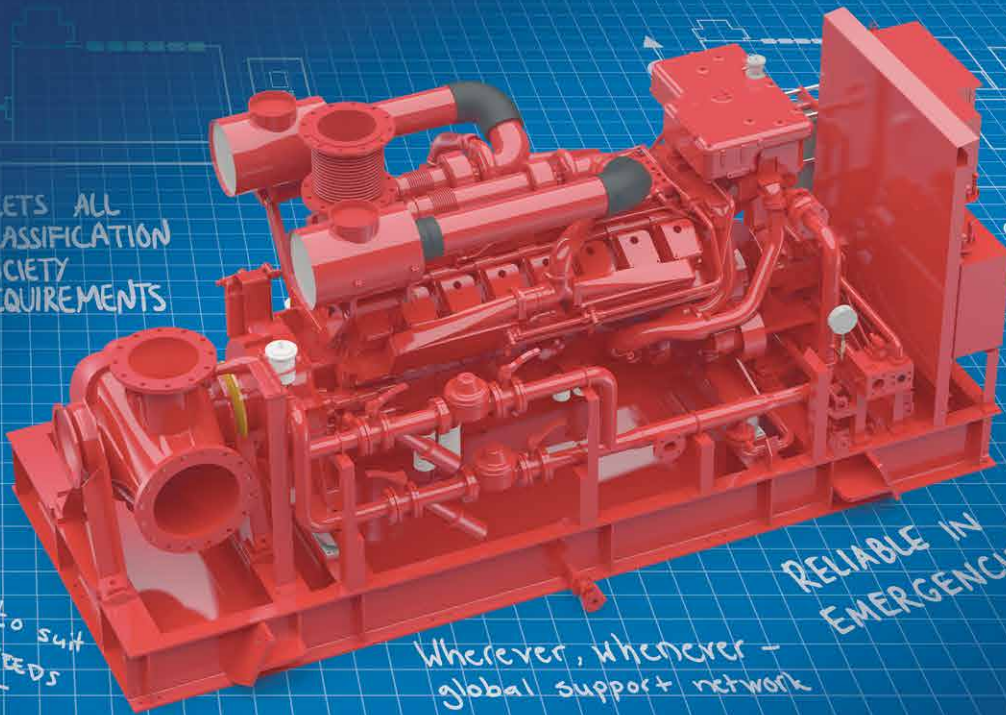


FIRE WATER PUMP PACKAGES

MEETS ALL
CLASSIFICATION
SOCIETY
REQUIREMENTS

Central system
ensures
NFPA 20 standards



Wide range of
configurations to suit
YOUR SPECIFIC NEEDS

Wherever, whenever -
global support network

RELIABLE IN
EMERGENCIES

BROAD SCOPE OF SYSTEM SOLUTIONS TO MEET REQUIREMENTS

Hamworthy Pumps has more than 100 years experience in the design and manufacture of pumps. Our development of system solutions to meet customer needs for fire water pump package installations is based on this extensive experience.

Fire Water Pump Packages (FWPP) are crucial for safety, and Hamworthy Pumps FWPPs meet the National Fire Protection Association's NFPA 20 standard and class requirements.

Hamworthy Pumps service team provides reliable operational support for its oil industry customers, especially during emergency operations.

CONFIGURATION

Hamworthy Pumps supplies various configurations of Fire Water Pump Packages (FWPP), including:

- Diesel/hydraulic driven system.
- Direct diesel driven system.
- Direct electric driven system, vertical or horizontal.

All systems can be delivered with either in-line centrifugal pumps or deep well submerged pumps. Hamworthy Pumps FWPPs are designed to be self-contained according to NFPA 20 regulations, while meeting the operational requirements of the marine, offshore, and onshore markets.

CAPACITY RANGE

Hamworthy Pumps is able to supply its FWPPs according to NFPA 20 with a range of capacities, as follows:

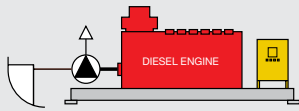
- For in-line pump configurations, our capacity range is from 300m³/h to 6500 m³/h.
- With a deepwell submerged pump configuration our capacity is up to 1800 m³/h.
- For all capacities the differential pressure availability is up to 18 Bar.

WHY A HAMWORTHY PUMPS FWPP

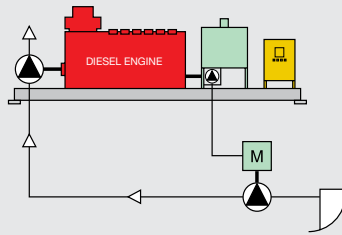
- We manufacture and assemble our FWPPs at our Singapore facilities, close to conversion and new building yards in South-East Asia, China and Korea.
- Full String Test capabilities at our assembly site.
- Wide range of FWPP configurations and capacities.
- Advice and consultations with the client during the pre-FEED, FEED and Detail Design stages.
- FWPPs for non-hazardous locations can be both containerized and open for fire compartment installation.
- One of the major reasons has been our ability to deliver much quicker than our competition.
- Worldwide service and spare parts network for support during installation and operation.
- Extensive reference list for both offshore and onshore FWPP installations.
- Classified by societies including ABS, BV, DNV GL, LR and able to comply with NORSOK.

FIRE WATER PUMP CONFIGURATIONS

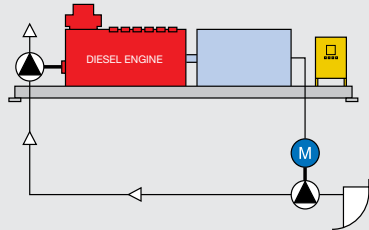
1. DIRECT DIESEL DRIVEN FIRE PUMP



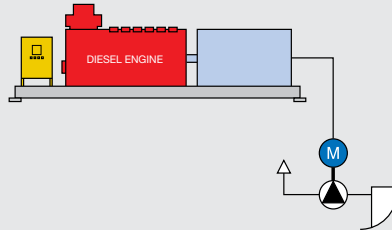
2. DIESEL DRIVEN FIRE BOOSTER WITH HYDRAULIC DRIVEN LIFT PUMP



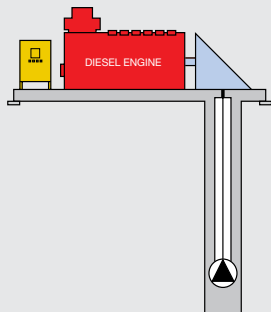
3. DIESEL DRIVEN FIRE BOOSTER WITH ELECTRIC DRIVEN LIFT PUMP



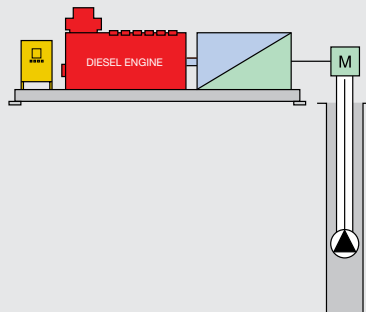
4. DIESEL/ELECTRIC DRIVEN FULL HEAD FIRE PUMP



5. DIESEL DRIVEN DEEPWELL FIRE PUMP VIA 90 GEAR



6. DIESEL/ELECTRIC OR HYDRAULIC DRIVEN DEEPWELL FIRE PUMP



DIRECT DIESEL DRIVEN SYSTEM (fig.1)

The direct diesel driven system is applicable for fire pump installations beneath the low water line. A typical FWPP system for such an installation consists of the following as a minimum:

- Diesel engine
- Diesel driven fire pump
- NFPA 20 controller

DIESEL/HYDRAULIC DRIVEN SYSTEM (fig.2)

The diesel/hydraulic driven system is applicable for FWPP installations above the low water line, typically in a compartment below deck in the fore peak of a FPSO. A typical FWPP system for such an installation consists of the following as a minimum:

- Diesel engine
- Diesel driven booster pump
- Hydraulic driven lift pump
- Diesel driven hydraulic system
- NFPA 20 controller

The hydraulic driven lift pump is installed dry. Suction is from a sea chest and water is pumped to the booster pump that is connected directly to the main diesel engine. To reduce the risk of water hammers, a non-return valve is installed after the dry installed in-line lift pump.

DIESEL/ELECTRIC DRIVEN SYSTEM (fig.3&4)

The diesel/electric driven system is applicable for FWPP installations above the low water line, typically in a compartment below deck in the fore peak of a FPSO. A typical FWPP system for such an installation consists of the following as a minimum:

- Diesel engine
- Diesel driven booster pump
- Electric driven lift pump
- Diesel driven generator system
- NFPA 20 controller

The electric driven lift pump is installed dry. Suction is from a sea chest and water is pumped to the booster pump that is connected directly to the main diesel engine. To reduce the risk of water hammers, a non-return valve is installed after the dry installed in-line lift pump (fig. 3). The boost and lift pump configuration can also be changed to a full lift pump concept where the electric driven lift pump takes the full required pressure (fig. 4).

DIRECT DIESEL DRIVEN DEEP WELL SYSTEM (fig.5&6)

For installation on deck or on a jetty, a deep well submerged pump, in a caisson with an angle gear between the diesel engine

PUMP FEATURES

Hamworthy Pumps in-line configurations for fire water pumps have the following features:

- Double suction impellers with low NPSHr enable the pump to operate at 150% capacity without cavitations.
- Ni-Al bronze used as the standard material. Other materials, such as Duplex and Super Duplex SS, are available as options.
- Double volute.
- Lightweight, compact and robust design.
- Mechanical shaft seal as standard, other seal arrangements are available on request.

The deepwell pumps used have the following features:

- Multi stage, single suction vertical deepwell pump.
- Material in 316L, Duplex or Super Duplex SS.
- Capacities up to 1800m³/h.
- Pump design in accordance with API 610.

and the pump, is a typical configuration consisting of (fig.5):

- Diesel engine
- Angle gear
- Direct driven deep well pump
- NFPA 20 controller

The deepwell pump can also be driven by either an electric motor together with a diesel generator set, or by an hydraulic motor together with a diesel hydraulic set (fig. 6).

ELECTRIC DRIVEN SYSTEM (fig. 7)

The electric driven system is suitable when the FWPP is installed beneath the low water line. The fire pump can be supplied in both vertical and horizontal configurations. Depending on the size and requirement of the el. motor, the motor may be cooled with water taken from the fire pump or by air. A typical FWPP system for such an installation consists of the following:

- Fire pump
- Electric motor
- NFPA 20 controller/starter.

The electric driven system can also be supplied with a diesel generator set as shown in fig. 4.

7.

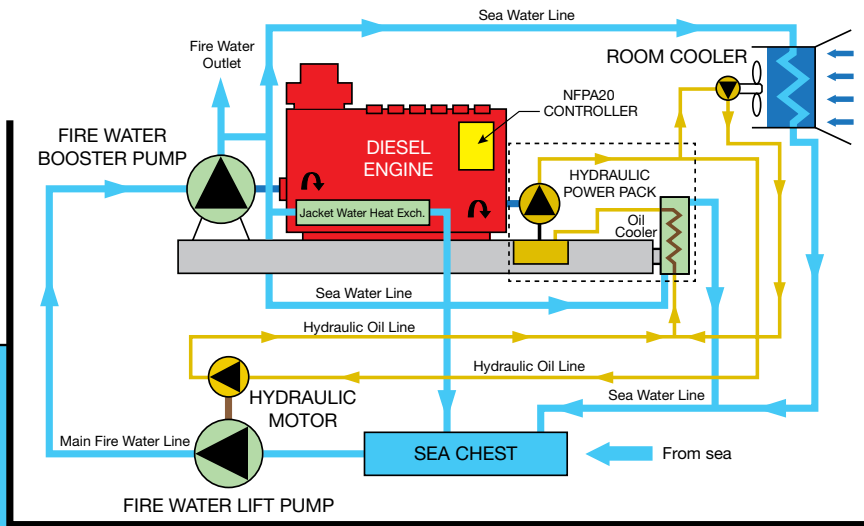


750m³/h - 13 bar electric motor driven fire pump



NFPA 20 controller

8. DIESEL HYDRAULIC FWPP SYSTEM



ON-SITE TESTING FACILITY

A full String Test is performed for the complete Fire Water Pump Package at our Singapore plant for all types of FWPP configuration. The String Test is performed in accordance with NFPA 20 requirements and includes a running test at 100 and

150% capacities. The comprehensive test program ensures that the NFPA 20 Controller is functioning correctly in all required modes and that it reacts correctly to all specified alarms.



NFPA 20 CONTROLLER

The NFPA 20 controller ensures that the pump operates according to the regulations given in NFPA 20. The FWPP system is supplied self-contained, and is in accordance with strict operational requirements such as when in fire mode, the controller will only start the fire pump when:

- The fire main pressure drops below the set value of the pressure switch
- Receiving a fire & gas signal
- Receiving a manual start signal, either locally or remote
- A wiring failure occurs (fail-safe design)
- Likewise in fire mode, the controller will only stop the engine when:
 - Engine overspeeds
 - Local stop button is pushed

ACCESSORIES

In addition to the main equipment, such as the diesel engine, pumps and NFPA 20 controller, Hamworthy Pumps can include the following accessories:

- Diesel tank complete with valves and instrumentation
- Jockey pumps and pressure vessel with pressure controllers
- Room coolers with hydraulic/electric driven fan
- Foam pump and tank
- Separate engine cooling system
- Fire Rated Enclosure for weather protection, non pressurized container
- Fire Rated Enclosure for hazardous installation, pressurized container

Figure 8 gives a typical schematic drawing of a Diesel Hydraulic FWPP system.

STARTING SYSTEMS

Two separate starting systems should be installed as per NFPA 20 requirements. The following three types are available:

- Electric starting with batteries
- Pneumatic starting with pressurized air
- Hydraulic starting with pressurized hydraulic oil

The starting system most frequently used for complying with the regulations is the double electric starter. This is the most cost effective solution. All starting methods can be used in combinations.

EXPERIENCE AND SUCCESSES



FPSO PAPA TERRA

Scope of supply:
2 x Diesel-hydraulic skids (lift & boost)

Q = 1700m³/h, H = 130m

Power: 1097kW @ 1500 rpm

Pumps: CAD350 & CB32

1x Direct diesel skid

Q = 1700m³/h, H = 130m

Power: 970kW @ 1800 rpm

Pumps: CB32

Shipowner.....BW Offshore, Norway

FPSO KNARR

Scope of supply:
2 x Diesel-hydraulic skids (lift & boost)

Q = 2450m³/h, H = 140m

Power: 900kW @ 1800 rpm

Pumps: CAD450 & CC500M

2x Direct diesel skids

Q = 2450m³/h, H = 140m

Power: 1900kW @ 1800 rpm

Pumps: CC500H

Shipowner.....Teekay Petrojarl, Norway

BULWER REFINERY

Scope of supply:
2 x Diesel-hydraulic skids (single lift)

Q=1358m³/h, H=97m

Power: 857kW @ 1800 rpm

Pumps: CL300, 3.8M length

“Short” CL300 pumps submerged in Brisbane river from jetty. Powered by remotely located diesel hydraulic skids

Customer.....BP, Australia

SERVICES

Hamworthy Pumps offer expertise, proximity and responsiveness for all our customers in the most environmentally sound way.

Our Services & Support solutions range from basic support, installation and commissioning, performance optimization, upgrades and conversions to service projects and agreements focusing on overall equipment performance and asset management.

We always provide first class technical, spares and services support to our customer wherever they are around the world. In addition, we are well supported by agent representatives in all major shipping locations.



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