

FRAMO OIL AND GAS PUMPING SYSTEMS

Technical description



High-capacity systems for firefighting

Framo diesel-electric fire water pumps

The Framo advantage

At Framo, we're driven by the simple idea that pumps should never be isolated from the task they perform. It's a belief that revolutionized marine cargo handling. And today it's creating new possibilities for faster, safer and more profitable business in the oil and gas industry.

It's also an idea backed up by experience. Framo has proud roots that stretch back to 1938, and marine customers have put their trust in our unique pumping technology for over 50 years.

But even more important is the trust that customers place in us. That's why we see our designs through from start to finish at our own facilities in Norway, where we test each project in full scale before delivery.

Framo customers know they receive full support throughout the service life of their equipment. No matter the problem, our experts can be dispatched 24/7 to any location worldwide, and they stay until the issue is resolved.

With a global organization of 1200 dedicated employees, we are a partner you can rely on.



Think outside the pump room

Pumps are the heart of oil and gas processes. But traditional solutions with a central pump room mean wasted space, added risk and higher operational costs.

Framo pumps are different. Submerged in simple side-mounted caissons, they eliminate both hull penetrations and the need for a massive internal pump room and extensive piping.

Powered with the unique electric Framo cable-free concept, submersible pumps also ensure increased uptime. This is thanks to a short, stiff rotating shaft that avoids excessive wear and tear.

The total result is an oil and gas pumping solution that reduces risk while saving both space and money. That's what it means to think outside the pump room.

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The Framo diesel-electric fire water pump

Design philosophy of the fire water system

The fire water pump system shall be available, reliable and capable to function for a specified time when operating under specified conditions.

The unit should be inherently self-contained, with a “fail-safe start” philosophy and should be continuously available to meet the specified duty.

Framo diesel-electric fire water pump system

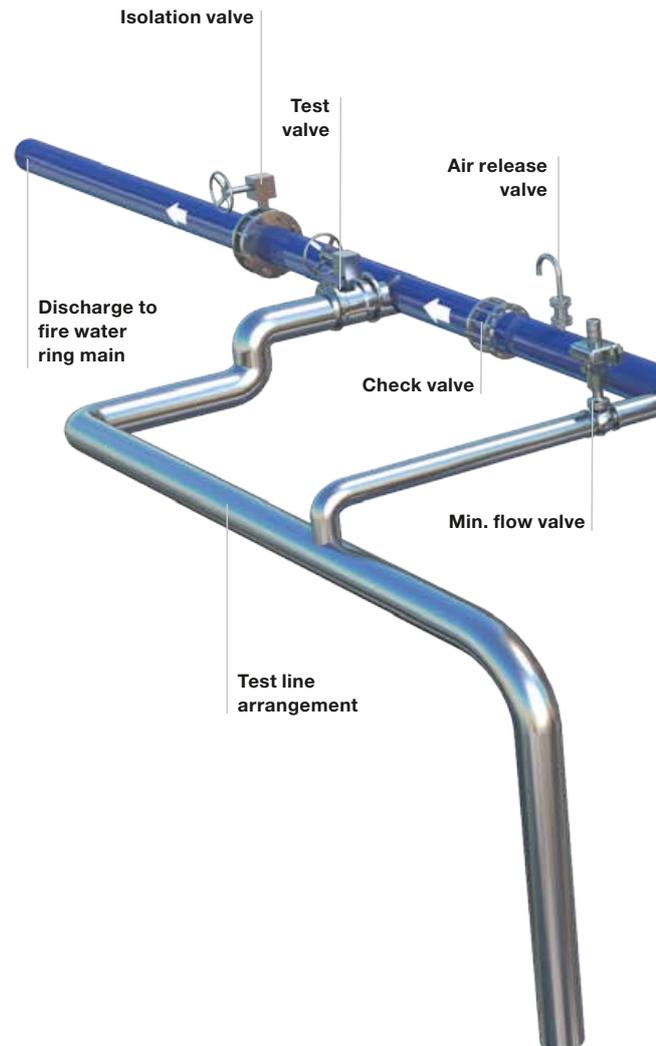
The Framo diesel-electric fire water pump system is a self-contained unit including all necessary auxiliary systems. The system is designed for a specified number of hours' continuous operation at rated capacity under specified conditions. The Framo diesel-electric fire water pump system is designed to meet the pump characteristics curve as required by NFPA 20.

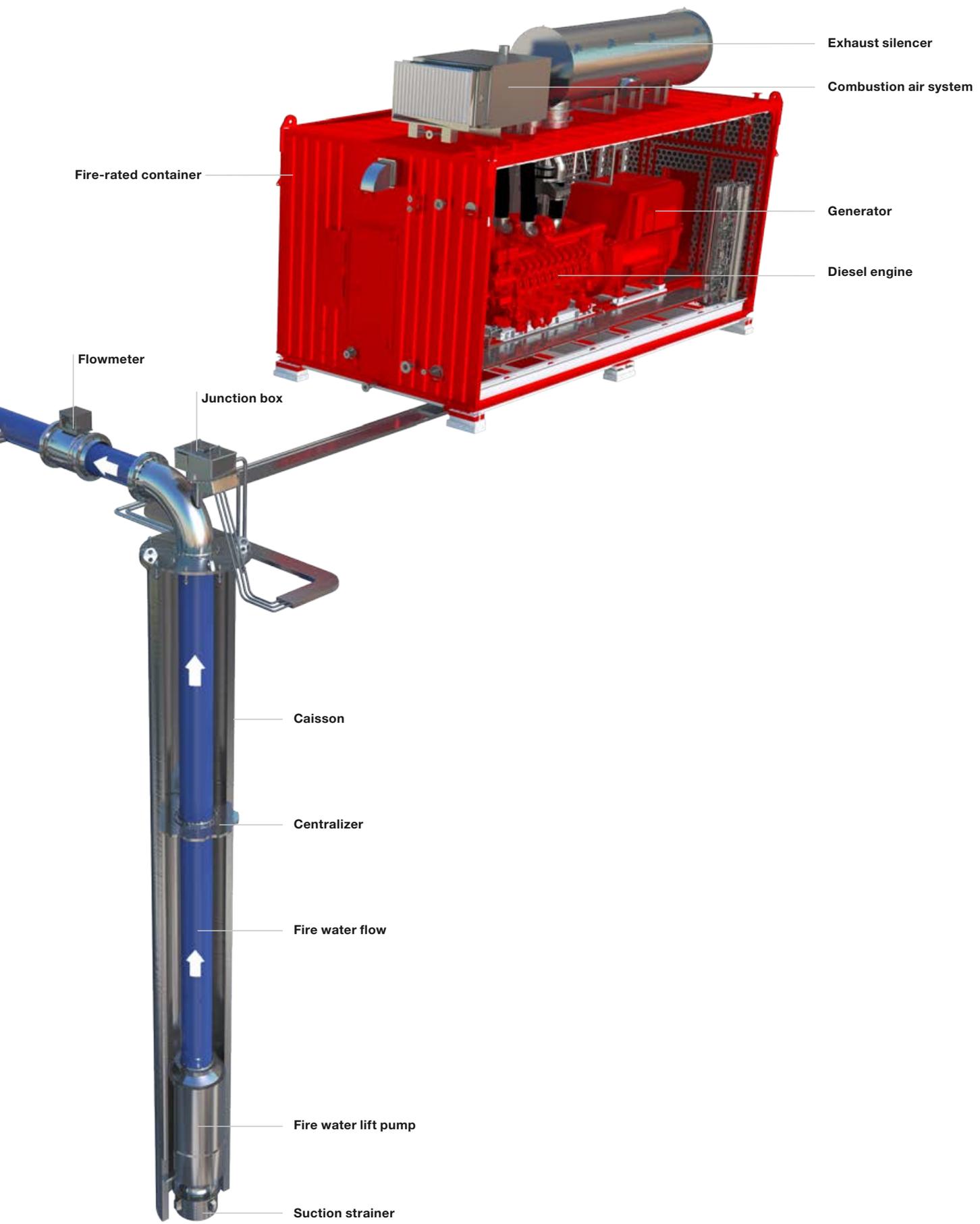
In the rated capacity we have also allowed for system cooling water. If specified the system can be designed and certified for hazardous area zone 2 operation.

The provision of fire water is ensured by the submerged electric fire water pump supplying water directly to the fire water main header.

The system consists of the following main components:

- Submerged electric fire water pump
- Surge damping tank and air evacuation system
- Fire water pump container with the following main components.
 - Diesel engine
 - Generator
 - Oil circulation unit
 - Seawater cooling system for engine and generator
 - Combustion air system
 - Exhaust system
 - Fuel oil tank
 - HVAC system
 - Air cooling unit
 - Unit control panel
 - Fire detection and extinguisher system





Submerged electric fire water pump

Framo submerged electric fire water pump is a close-coupled, end-suction centrifugal pump with one or two stages, driven by an integrated oil-filled induction motor.

To ensure maximum submergence under any operation conditions the pump has an end-suction design, and the pump is suspended from a riser pipe which contains the built-in electric power transmission system, eliminating the need for electric cables and submerged penetrations, while also providing mechanical protection. The pumped fire water is delivered up through the riser system. Seawater is prevented from entering the motor and conductors by internal overpressure, created by circulating lubrication/cooling oil from a small external oil circulation unit. The hydraulic oil also cools, insulates and lubricates the system.

Integral power transmission

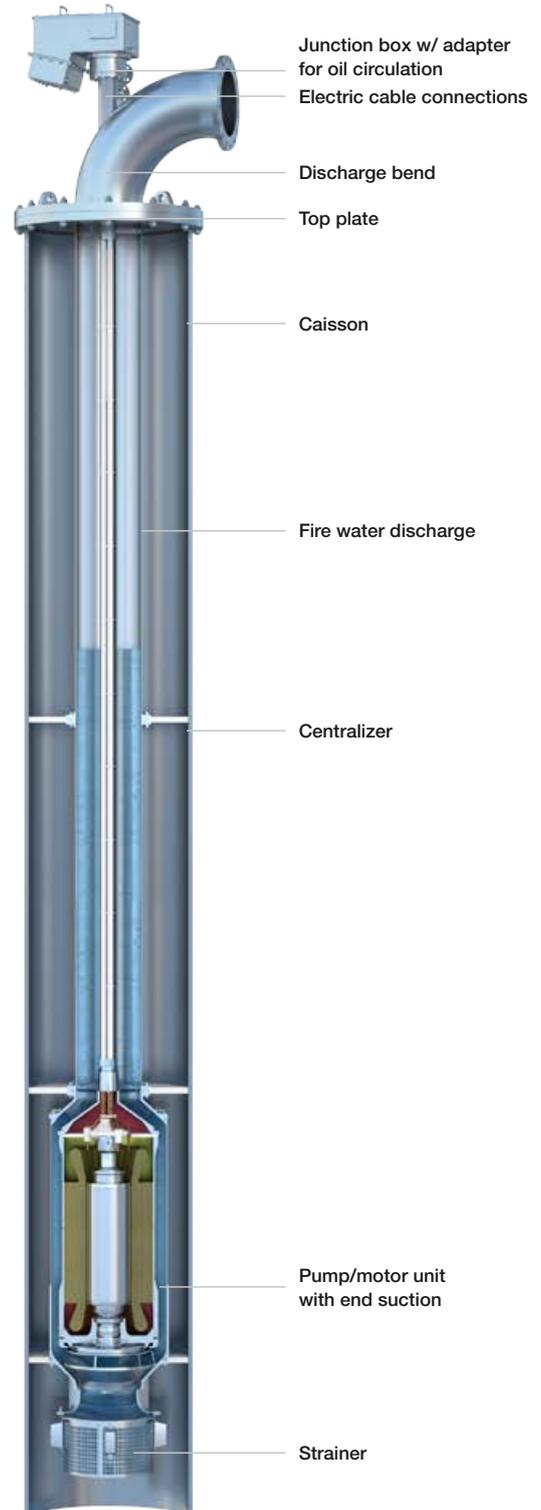
Each section of riser pipe is flanged and contains the power conductors and cooling system. This consists of a concentrically mounted oil-filled copper conductor pipe carrying power to the pump motor. The three conductor pipes are spaced at 120 degrees by means of insulation pieces. Spring-loaded sliding connectors on the conductors ensure a safe and reliable electrical connection. The oil pipe sections are fitted with stab-in connectors. The system is assembled by simply bolting the riser pipe flanges together. A top plate with discharge bend supports a junction box for termination of the power transmission system.

Circulation system

In addition to circulating oil in the system, the circulation unit also provides continuous condition monitoring of the submerged pump and motor unit. Temperature, pressure, cleanliness and seal leakage data are read by sensors and relay to the monitoring unit. Supply and return connections for the circulation unit are mounted on the discharge bend.

Compact, low-weight design

Circulating oil lubrication combined with the integrated pump and motor configuration makes the unit very compact, with a high power-to-weight ratio.



Submerged pump/motor unit

The electric motor is a low or high voltage, oil filled, induction motor.

The shaft with the rotor is supported at the top (non-drive end) by a roller bearing for radial support. The drive end is supported by combined radial and thrust bearings. They can be either double angular ball bearings or spherical axial roller bearings combined back-to-back with a conical roller bearing, pending ratings and motor speeds. The bearings are designed to take maximum axial forces and have a design life in compliance with API 610 latest edition.

Both drive end and non-drive end bearings are lubricated and cooled by the forced oil circulation, which gives optimal working conditions for the bearings.

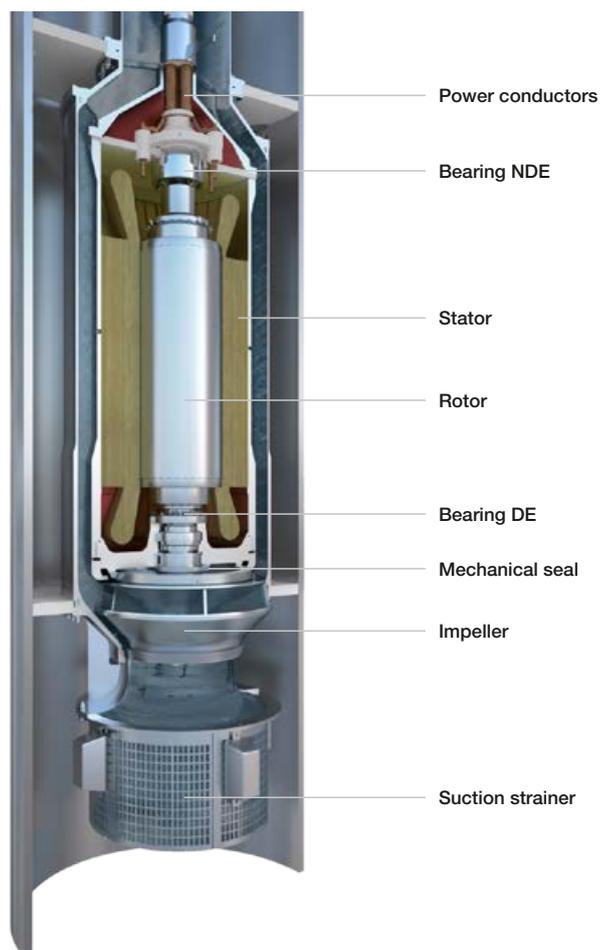
The axial thrust load is controlled by the impeller wear ring diameter and by draining the chamber above the impellers.

The seal arrangement consists of a balanced mechanical seal riding on a sleeve. The seal spring is inside the seal, protected by the lubrication oil. The arrangement is designed such that the seal is continuously lubricated and cooled by the forced oil circulation system.

The pump impellers discharge into the outer shell of the pump housing, concentric of the motor housing. The diffusor design is with guide vanes, ensuring good radial balance and minimum diameter. The suction is through a strainer, bolted to the end cover of the pump. The impellers are shrink-fitted to the motor shaft and locked with an impeller nut.

The oil circulation enters the motor via the outside of the conductor pipes (inside cofferdam pipes) and is directed to the lower part of the motor via a bore in the rotor shaft. A part flow is taken to the mechanical seal and through the bearings.

The oil returns through the rotor/stator gap before returning via the conductor system. The motor housing and bearing brackets are designed to give a good and even spread of the oil flow ensuring optimal cooling and lubrication for all rotating parts.



Fire water pump container



Diesel Engine

The diesel engine is fitted with auxiliary equipment to comply with the requirements of NFPA 20, main classification societies and national authorities. The start-up torque of the fire pump is low relative to the engine rating, as the booster pump is not engaged before water has been lifted to the deck level.

The diesel engine is normally supplied with the following:

- Generator drive arrangement
- Engine cooler(s)
- Engine auxiliary pre/post lubricating oil pump and jacket water pump with heater
- Engine start system. Alternative starting methods and combinations of same can be provided in accordance with NFPA-20 requirements:
 - Electric battery start with chargers
 - Pneumatic start system and charge unit
 - Hydraulic start system and charge unit

Generator

The generator is directly driven by the diesel engine and is block-coupled with the fire water pump. In addition to the fire water pump, the oil circulation unit, air cooling unit, generator cooling pump and control panel is supplied from the generator during package operation. In case of AFFF systems or similar, these suppliers can also be fed from the generator.

The generator is normally freshwater cooled (CACW) with a closed cooling water circuit.

Oil circulation unit

The submerged electric fire water pump oil circulation unit is installed inside the fire water pump container. The oil circulation unit serves the following purposes:

- Lubrication and cooling of pump bearings and mechanical seal
- Overpressure protection of electric motor and power transmission system against water ingress
- Cooling of submerged electric motor
- Submerged electric pump condition monitoring

Combustion air system

The combustion air inlet to the diesel engine is routed through the container roof or sidewall, and is equipped with a low velocity two-stage filter coalescer. To comply with noise requirements, or if otherwise required, a combustion air silencer can be installed downstream of the air filters.

Exhaust system

The exhaust system can be either a dry lagged or water cooled system with the silencer horizontally mounted on the roof. The water cooled system will ensure surface temperatures below temperature class T3. Arrangement for cooling of the exhaust gas to temperature class T3 by use of water injection downstream the exhaust silencer can be supplied.

Fuel oil tank

The fuel oil tank is designed with sufficient capacity to operate the system for the specified numbers of hours at rated conditions. The tank is fitted with a flame arrestor, overflow line, level gauge and transmitter, sampling valve, filling valve and emergency shut off valve remotely operated from outside of the container.

HVAC system

To ensure ventilation of the fire water pump container, it can be fitted with an independent HVAC system or connected to the platform/vessel HVAC system. In both cases, there will be an inlet fire damper and fire damper with an externally mounted louver on the outlet. The independent system will be complete with inlet louvre/coalescer/filter unit and fans. Heaters can be included for installations in cold environment. If required, a pressure control damper can be installed in the outlet to maintain an over-pressure inside the container.

Unit control panel

The unit control and distribution panel (UCP) takes care of both power distribution in the system and control and monitoring of the diesel-electric fire water system. The PLC is a Framo standard type, and interface is based on hardwired signals. Serial link interface is available if required.

At the front of the UCP, an operator panel (HMI) is installed for displaying all rising alarms and other relevant messages. All alarms are acknowledged on the VDU. In addition facilities for manual operation are provided in front of the UCP.

In stand-by mode, the UCP is fed from platform/vessel normal or emergency switchboard (UPS if applicable). During operation the package will be fully autonomic, and UCP power is provided from package internal instrument batteries. Battery charger(s) for instrument battery and electrical start batteries (if included) are integrated in the UCP.

The UCP is available in different configurations depending on the hazardous area requirements.

The following sub-systems are part of the instrumentation system and connected to the UCP:

- Diesel engine (diesel engine manufacturer's standard instrumentation)
- Diesel engine start system
- Generator monitoring system
- Oil circulation unit
- Fuel oil tank level control
- Battery charger
- El. heaters if applicable

Fire-rated container

All of the above deck-mounted equipment is installed in a fire rated container. Fire ratings from A-0 to J-120 are available. The container is sized for housing the fire pump system with all required auxiliary equipment. The container consists of a base-frame and an enclosure, both designed for the specified fire and blast conditions. The container is designed for maximum convenience of maintenance both by the general layout and by mechanical handling beams and pad eyes. A removable panel is installed in the sidewall for dismantling and removal of the diesel engine and generator.

Air cooling unit

A sea-water cooled air cooling unit with electric-driven fan is installed to remove heat radiation from the container's internal equipment during package operation. Thus the temperature inside the container will be kept to an acceptable level during operation, even if the inlet and outlet fire dampers are closed.

Fire detection and extinguisher system

A fire detection and extinguisher system is installed to detect and extinguish a potential fire inside the container. The type of extinguisher system can be water mist, inergen or CO₂. Supply of extinguisher medium can be from platform/vessel main system or from dedicated supply sources. The combination of detectors (flame/heat/smoke) and type of extinguisher system can be included as specified.



**Head office**

P.O. Box 23, NO-5329 Florvåg, Norway
Phone: + 47 55 99 90 00
Telefax: + 47 55 99 93 80
E-mail: oil&gas@framo.no

framo.com

FRAMO Nederland

Edisonweg 18
P.O. Box 305
NL-3200 AH Spijkenisse
The Netherlands
Phone: + 31 181 619311
fm.nederland@framo.no

FRAMO USA

3002 East 13th Street
La Porte, Texas 77571, USA
Phone: + 1 281 884 4800
fm.houston@framo.no

FRAMO Singapore

17 Tuas View Circuit
Singapore 637575
Republic of Singapore
Phone: + 65 6210 2400
fm.sin@framo.no

FRAMO Japan

Kotsu Building 5F, 15-5
Shinbashi, 5-chome
Minato-ku
Tokyo 105-0004, Japan
Phone: + 81 3 5776 2405
fmnippon@framo.co.jp

FRAMO Korea

Rm 608, Centum Sh Valley
35, Centum Dong – Ro
Haeundae – Gu, Busan
Korea, 612-020
Phone: + 82 51 743 6942/3
fmk@framosk.com

FRAMO Shanghai

Building No.5, 123
Lane 1165, Jin Du Road
Min Hang District, Shanghai
China 201108
Phone: + 86 21 6115 5000
fmcn@framo.com.cn

FRAMO Brasil

Av. Presidente Vargas, 463
/19° andar, Rio de Janeiro
CEP 20071-003, Brazil
Phone: + 55 21 2507 7898
framobr@framobr.com.br

FRAMO Services AS

P.O. Box 44
NO-5329 Florvåg, Norway
Phone: + 47 55 99 92 00
service@framo.no

FRAMO Fusa AS

Venjanaset
NO-5641 Fusa, Norway
Phone: + 47 55 99 96 00
marine@framo.no

FRAMO Holsnøy AS

Rosslandsvegen 933
NO-5918 Frekhaug, Norway
Phone: + 47 55 99 75 00
piping.marine@framo.no

FRAMO Flatøy AS

Flatøyvegen 24
NO-5918 Frekhaug, Norway
Phone: + 47 55 99 94 00
oil&gas@framo.no