



Fuel Conditioning Module

Fuel conditioning system for diesel engines



Fuel Conditioning Module.

Application

Fuel conditioning is the term given to a system that treats the heavy oil used as fuel in marine diesels and diesel power stations so that it meets the requirements for cleanliness, pressure, temperature, viscosity and flow rate specified by the engine manufacturer. If these requirements are not met, then this will result in inferior performance of the engine and can result in increased emissions due to poor combustion.

Various configurations of fuel conditioning systems have been used but experience has shown that the so-called two stage pressurized systems are to be preferred. Single stage systems can be difficult to control and tend to suffer from the cavitation and gasification problems associated with high fuel temperatures.

A major requirement of a fuel conditioning system is that it can easily be configured to meet the requirements of a specific engine or engine room layout.

The Alfa Laval Fuel Conditioning Module

Carefully engineered taking into consideration the lessons learnt from previous, and existing, fuel conditioning systems, the new Alfa Laval Fuel Conditioning Modules are very compact, simple to install and have what is possibly the best control system available on the market.

The complete FCM consists of carefully selected main components mounted on a frame, complete with piping, valves, and electrical cabling and other accessories. A centrally placed cabinet contains the starters for all motors and the advanced process controller with self-cure functions and manual backup possibilities.

Based on a standardized concept, the pressurized booster systems can easily be configured to meet the specific requirements of any engine and engine room layout. Maximum consideration has been given to good access to all components, and to the control system that provides truly "start and forget" operation.

System description

The Alfa Laval Fuel Conditioning Module is a two stage pressurized booster system that uses viscosity as the primary control parameter. Pressure in the low-pressure section is maintained at 4 bar whilst the pressure in the high-pressure section will be within the range 6 to 16 bar depending upon the requirements of the engine manufacturer.

Low pressure stage

The low pressure stage includes two supply pumps (one in operation, one on standby), an Alfa Laval automatic filter with a manual bypass filter as back up, and a flow transmitter to provide information on fuel consumption. The last part of the low-pressure section is the mixing tank where fresh fuel is mixed with hot fuel returning from the engine.

As engine speed changes so will fuel consumption so a special pressure control valve allows fuel to recycle within the low-pressure section so that the flow of fresh fuel entering via the three way valve exactly matches the fuel consumption of the engine. Should the supply pump in operation fail, then the system will automatically change over to the standby pump.

From the mixing tank the fuel enters the high-pressure section. The flow rate in this section is always set at a multiple of the actual fuel consumption rate in order to prevent fuel starvation at the injectors. The flow rate multiples and the pressure in the system are set by the engine manufacturer.

High pressure stage

The high-pressure stage includes the circulation pumps, fuel heaters and the viscosity transducer. The viscosity sensor measures the viscosity of the fuel and sends a signal to the controller where it is compared with the value for viscosity set by the engine manufacturer. Deviations from the set point are then corrected by adjusting the flow of heating medium to the heater.

Pressure in the system is maintained by a pressure relief valve after the injectors (normally part of the engine installation) and the excess fuel returns to the mixing tank.

Major advantages

- Compact modular design gives configuration flexibility and saves space.
- User friendly layout includes space for checking and maintenance work.
- Pre-installed components, connections and controls save time and installation man-hours when compared to buying loose components.
- Pre-tested system with approval for all functions gives faster, more secure commissioning.
- The use of pressure transmitters instead of switches greatly enhance control capability.
- User-friendly control and monitoring functions from one panel.
- Remote control is available in several options up to full remote operation from a control room.
- Maximum safety for the engine when changing over HFO-DO mode. Auto-



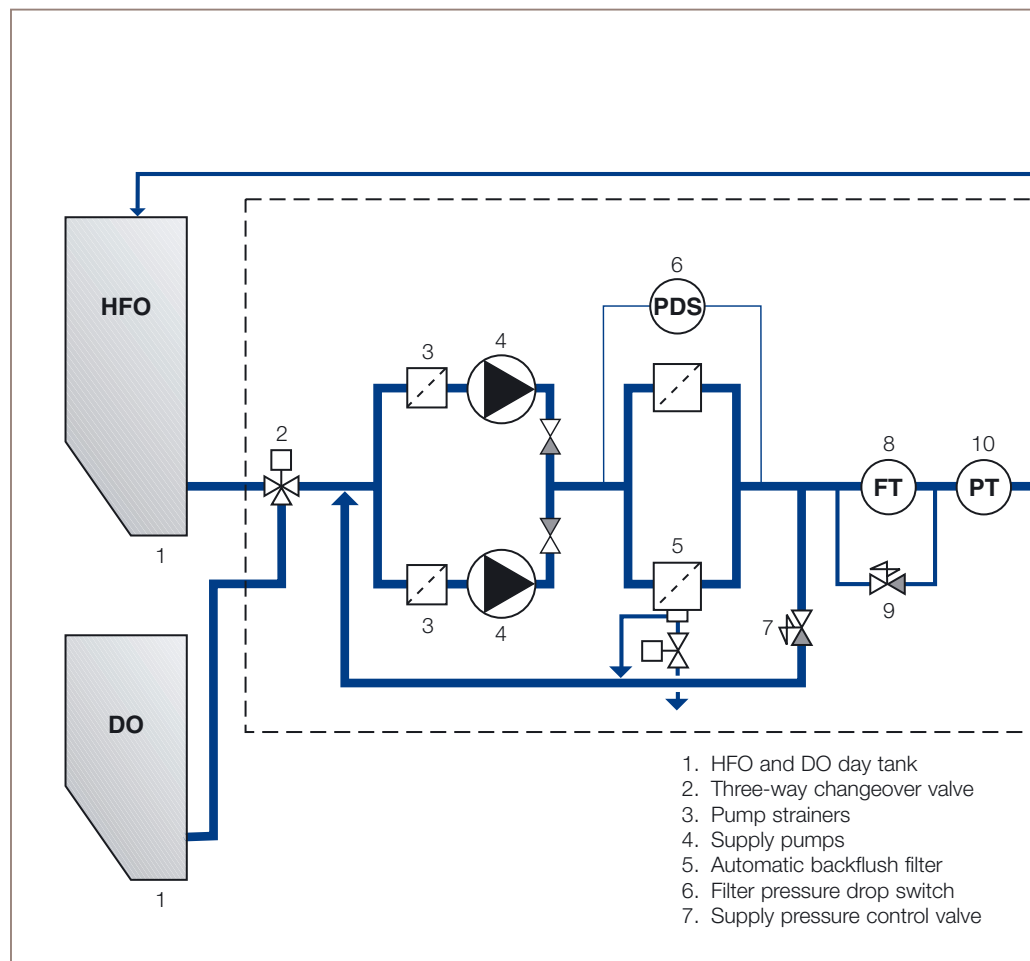
Fuel Conditioning Module with PHE of M6 type.

matic ramp function handles transition between two modes to prevent temperature shock to engine injection equipment.

Equipment

Low pressure supply pumps

Oil from the day tanks enters the system via the three way valve and into the suction of the low pressure supply pumps. Operation of this section under pressure eliminates the problems of gasification and cavitation that are associated with



high fuel temperatures (120–150°C). This will ensure an even fuel flow and prevent damage to the pumps.

Oil filters

An Alfa Laval automatic back flush main filter backed up by a manual by-pass filter removes any particles present in the fuel that could cause engine damage. Continuous automatic back flushing and robust disc type filter elements guarantee high efficiency and minimum maintenance requirement. As an alternative, the filtration stage can be moved over to the high-pressure stage but because of the higher flow rates this normally will require a larger filter for a given engine.

Flow transmitter

Installed on the pressure side of the supply pumps to monitor fuel consumption. As an alternative a mass flow transducer can be installed.

Mixing pipe with deaeration function

This is where fresh fuel is mixed with hot fuel returning from the injector circulation system. Gases that accumulate

in the mixing pipe are automatically vented back to the day tank and a permanent “air cushion” within the mixing pipe dampens out pressure fluctuations within the system.

High-pressure circulation pumps

Dimensioned to give the total flow required by the engine manufacturer, these pumps normally operate on “a one on-one standby” basis, but should the pressure fall then the system automatically activates the standby pump and triggers a “pump shift” alarm. An indicator lamp shows which pump is in operation.

Oil heaters

As standard, the FCM is equipped with the new M6 plate heat exchanger especially designed for operation at pressures of up to 16 bar and temperatures up to 170°C. This is accomplished by the use of special HeatSealF high temperature gaskets. The heating medium for the M6 heaters is steam but shell and tube heaters for either steam or thermal oil can be supplied as an alternative.



EPC 50B process controller.

Viscosity transducer

The viscosity transducer measures viscosity against a value set by the engine manufacturer and the controller adjusts the electrical valve actuator on the heating medium supply to the heaters in order to maintain the correct viscosity.

Control cabinet

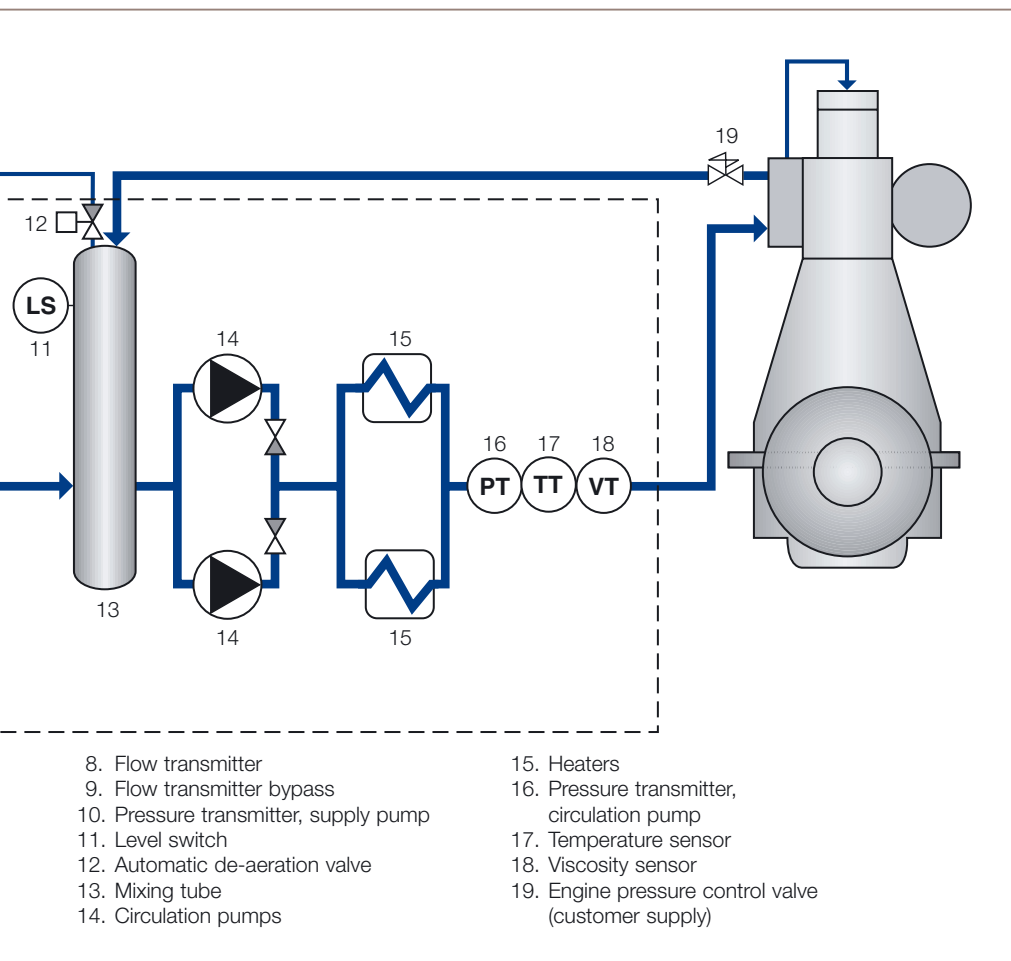
The control cabinet has two separate compartments, a lower one that contains all motor starters and an upper compartment that contains the EPC 50B controller.

EPC 50B process controller

The controller monitors and controls the functions of the system and displays process values, alarms etc in clear text. Standard modes include diesel oil mode for start-up and heavy fuel oil mode for normal running. The system can automatically handle the changeover from DO to HFO with a temperature ramp and a ramped three-way valve. Self-cure functions include pump changeover, changeover from viscosity to temperature control, or even the reverse, in the case of failure and even changeover to diesel oil should there be a heater failure. Standard process readings include viscosity, outlet temperature and instantaneous fuel consumption rate.

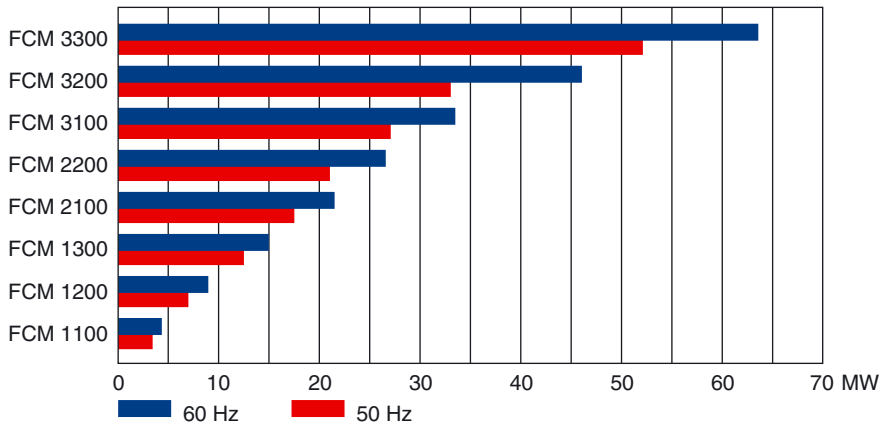
Options

Apart from the options of placing the filters on the high-pressure side, the use of a mass meter instead of a flow meter and shell and tube heaters instead of the M6 type, there are a number of other options available. These include a pneumatic or electrical emergency diesel oil supply pump in the case of main power failure and a system to pump away filter drain.



Capacities

The FCM range consists of modules in three standard dimensions but with a total of eight different capacities. This is because each standard module dimension can have a number of capacities depending upon the components selected. The largest module has an output capacity equivalent to a diesel engine installation of approximately 60 MW. All modules, if required, can be delivered as two units, a supply unit and a conditioning unit, in order to provide greater installation flexibility.



Engine power.
Based on engine consumption 200 g/kWh.
Filter after supply pumps and circulation factor 3.

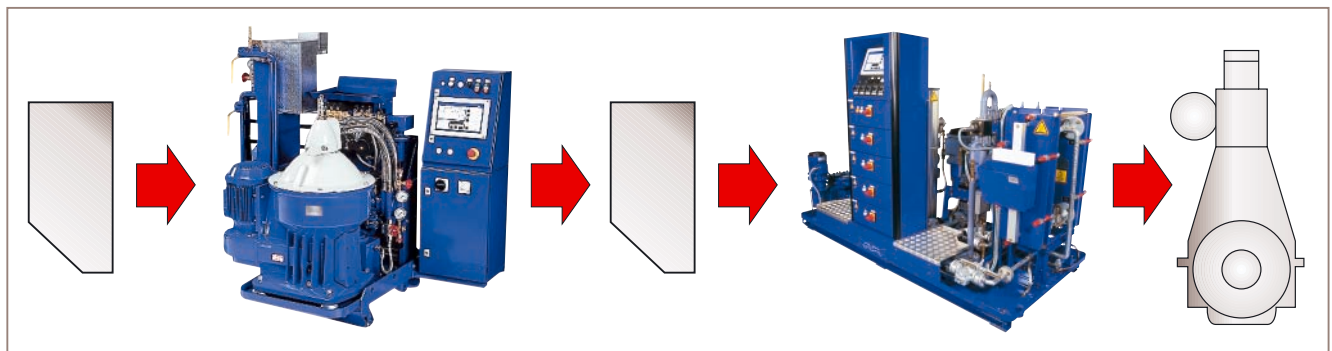
Operations

- System Manual includes detailed information in electronic format or paper copy for:
 - Operating instructions
 - Alarms and Fault finding
 - Installation instructions
 - Service and spare parts
- Service spares kits are available for the main components.
- Commissioning and technical service are available from Alfa Laval offices worldwide to start-up the system and advise about operation and maintenance.

Technical data

Fuel Conditioning Module	Size	Volume	Weight
FCM 1000 series	2500x1150x1900 mm	5.5 m ³	1650 kg
FCM 2000 series	3000x1150x1900 mm	6.5 m ³	1950 kg
FCM 3000 series	4500x1500x2200 mm	14.9 m ³	2700 kg

Main supply voltage	3-phase, 400/440/480 V up to 690 V
Control voltage	1-phase, 115/230 V
Frequency	50 or 60 Hz
Max oil pressure	16 bar
Max oil temperature	160°C



Completing the chain

The new range of Fuel Conditioning Modules provides the operators of large diesel engines, both on land and at

sea, with a purpose built, start and forget system that takes the guesswork out of fuel conditioning. When combined with Alfa Laval separation

modules it also completes the fuel treatment chain from bunker tanks to main engine with high quality reliable equipment from a single supplier.

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Alfa Laval reserves the right to change specifications without prior notification.

How to contact Alfa Laval

Contact details for all countries are continually updated on our web site. Please visit www.alfalaval.com to access the information direct.