

# Hydraulic Drive Improves Fire Pump Availability

**JOÃO ALBERTO MENIN**  
**ELISEO IGUMA**  
**SULZER PUMPS**

Safety is a critical consideration for all offshore oil production facilities, and an integral part of the safety systems are the firewater pumps, associated drives, and automatic controls. After long standby periods, fire pumps must be ready to immediately start and run up to full load as soon as an alarm is triggered. They must maintain continuous operation under the most difficult conditions. The latest fire pump sets supplied to Petrobras by the Sulzer Pumps facility in Brazil offer both improved availability and reliability and thereby contribute significantly to the safety of the vessel.

1 The ZE8 400-500 booster pump is used for high hydraulic efficiency and reliable mechanical performance. It is a centerline-mounted single-stage overhung pump that is in full compliance with Petrobras standards.



► Fire pumps deliver seawater under pressure to the platform fire sprinkler and hose systems. The pumps must be able to lift water from sea level up to the floating production storage and offloading vessel (FPSO) or platform main deck (min. height 30 m). These pumps are either directly driven by submersible electric motors using an independently generated power supply or by diesel engines. Diesel-driven pumps have long vertical drive shafts running in the center of the rising pipe and connecting the pump to the engine via a 90° gearbox located in the pump header. Fire pumps are test-run on a regular basis to prove system integrity and to avoid problems caused by the extended stationary, or stand-

2 The vertical pipe stack section, which is nearly 30 m long, is arranged with built-in concentric power piping; the seawater pipe stack surrounds and protects the hydraulic lines from contamination.



by, periods. Because of these conditions and necessary precautions, fire pumps can often be highly maintenance-intensive. Maintenance can result in long non-availability periods and high costs for the operators.

### Benefits of Alternative Approach

Petrobras, for their P-50 FPSO, decided to take a different approach to the traditional solutions. Three oil-hydraulically driven units were specified in order to correct a number of weaknesses associated with traditional solutions, namely:

- In submerged-motor designs: elimination of the dedicated generator, power cables to the motor, and the motor itself. This change removes the risk of a fire disrupting the electrical power supply and eliminates the electric motor, which can be difficult to maintain and tends to suffer from insulation breakdown and bearing problems over time.
- In diesel-driven units: removal of the long drive shaft, associated connections, and support bearings, as well as the 90° gearbox. Although more reliable in a fire, the complexity of the drive train makes these designs time-consuming and complex to maintain.

The hydraulic drive solution thus simultaneously addresses problems in both types of units: being mechanically based, it avoids the cabling and electric motor issues of the submerged design; it also removes the complex mechanical elements of traditional shaft-driven pumps. This change simplifies the design and increases ease of maintenance. There are, in addition, a

number of advantages unique to the hydraulic drive option: It has the ability to continuously run the lift pump at “tick-over” speed (about 60 rpm); this prevents fouling within the pump and maintains the drive unit at operating temperature. Sulzer proposed that the primary diesel power unit and all auxiliary systems be built into a self-contained power module. This increased the integrity of the fire system in an emergency and made its integration on the hull much simpler for the customer. Finally, the complete power module, control system, and pump can be full-load-tested before installation on the production vessel. The power module can be shipped “as tested,” vastly reducing commissioning and start-up time on the FPSO.

### String Testing—the Ultimate Test

Once the fire pumps and module were assembled, the complete system was subjected to rigorous witness testing at Sulzer Pumps facility in São Paulo, Brazil. Testing consisted of a full-load 48-hour run during which the usual hydraulic and mechanical performance measurements were taken for the lift and booster pump. Further, the module was run in both “open” and “closed” configurations to check the effectiveness of the ventilation systems and prove the modules’ internal systems were able to cope with full-load closed running. Following successful testing to the complete satisfaction of the customer and engineering contractor, the three modules were shipped to Singapore for installation on the P-50 hull at Jurong Shipyard. ◀

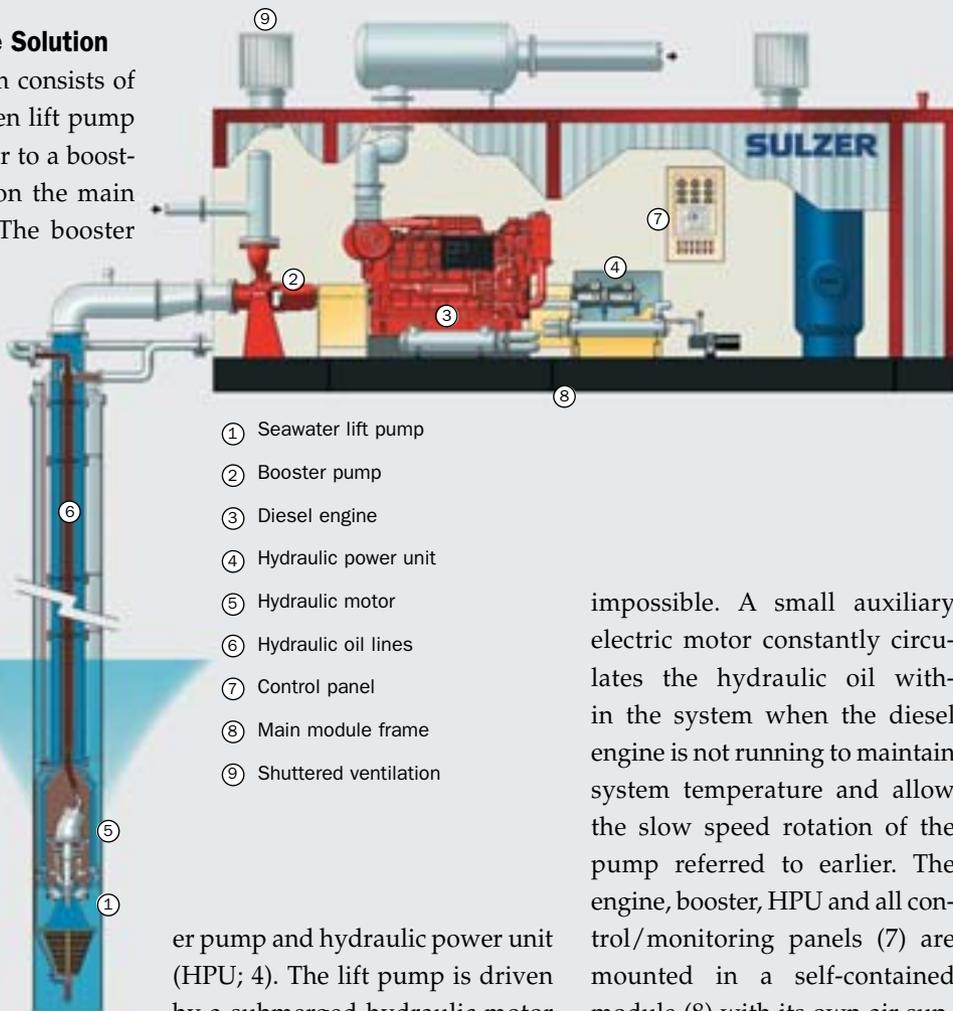
## The Hydraulic Drive Solution

The pumping system consists of a hydraulically driven lift pump that propels seawater to a booster pump mounted on the main deck of the FPSO. The booster pump, in turn, pressurizes the firewater ring main system. The single-stage BKn 450 vertical pump (1) provides sufficient pressure at the inlet of the booster to guarantee cavitation-free performance under all operating conditions.

The booster (2), a Sulzer ZE8 400-500, is fitted with a mechanical seal that will allow dry running during start-up as there is a short time lag between the fire set being started and the lift pump delivering seawater to the booster.

A marinized diesel engine (3), which may be started pneumatically, electrically or hydraulically, directly drives both the boost-

er pump and hydraulic power unit (HPU; 4). The lift pump is driven by a submerged hydraulic motor (5) that receives hydraulic oil from the HPU via high-pressure lines (6) located within the lift pump pipe stack. These lines operate at a higher pressure than the lift water so that contamination of the oil by seawater in the event of a leak is



- ① Seawater lift pump
- ② Booster pump
- ③ Diesel engine
- ④ Hydraulic power unit
- ⑤ Hydraulic motor
- ⑥ Hydraulic oil lines
- ⑦ Control panel
- ⑧ Main module frame
- ⑨ Shuttered ventilation

impossible. A small auxiliary electric motor constantly circulates the hydraulic oil within the system when the diesel engine is not running to maintain system temperature and allow the slow speed rotation of the pump referred to earlier. The engine, booster, HPU and all control/monitoring panels (7) are mounted in a self-contained module (8) with its own air supply ducts (9) that are opened or closed depending on the alarm condition. This arrangement effectively isolates the module from the FPSO, ensuring fire pump availability under the most extreme conditions.

## CONTACT

Sulzer Brasil S.A.

João Menin

Rua Manoel Cremonesi

1 Jardim Belita

09851-427

São Bernardo do Campo

Brazil

Phone + 55 (0)11 4393 23 50

Fax + 55 (0)11 4392 56 00

joao.menin@sulzer.com