

Trends in boiler design for FPSOs/FSOs

Aalborg Industries offers boiler solutions for both gas turbine and diesel engine installations onboard offshore installations - and solutions for both boiler/burner conversion and new supply.

General

Aalborg Industries is one of the leading suppliers of marine boilers for the world's commercial fleet as well as for FPSOs and FSOs. Our wide range of products and a strong after sales organization provide a solid platform to work from. Some of the boilers for FPSOs and FSOs are installed in safe area engine rooms, but most of them have been installed on open deck in hazardous areas.

Gas or steam as power source?

In recent years, a number of gas turbines have been installed for power production onboard FPSOs. In many cases, heat recovery boilers have been installed after the gas turbines for production of steam or hot-water for the process.



"NORTH SEA PRODUCER" with heat recovery boilers after gas turbines

But which is the better solution? A system based on gas turbines with heat recovery boilers, or gas fired steam boilers feeding steam to steam turbines? The answer has at least two dimensions - facts and company culture. But as far as facts are concerned, the best choice

seems clear - the alternative with steam turbines after steam boilers is the best option.

For higher capacities, where few brands of gas turbines are available and it can be hard to find a gas turbine with exactly the required capacity, the total investment for the gas turbine installation can easily be as much as four to five times higher than for the steam alternative. For lower capacities where a better selection of gas turbines in suitable sizes is available on the market, and at more reasonable prices, the total cost for the gas turbine alternative might be only twice as high as for the steam alternative.

The difference between the two investment alternatives is even more apparent when it comes to the costs of operation, maintenance and downtime. A gas turbine needs to be stopped a few days per year for maintenance and once every 4-5 years for a larger overhauls. The cost of maintenance is high, but as the turbine must be stopped for a few days, the total costs are even higher, much higher.

Steam boilers and steam turbines are known to run day in and day out, more or less without supervision or maintenance. With correct water quality in the system and with normal maintenance procedures, the boiler and turbine can run continuously for months, even years.



"ESPOIR FPSO" out on the field

To make the steam system even more reliable, Aalborg Industries pay special attention to the design of the system. Experience from industrial boiler systems is combined with extensive experience from marine main propulsion and auxiliary boiler systems. The MISSION™ boilers are designed to withstand rough seas, even on deck where the g-forces are higher than for the same boilers below deck.

Our standard designs for steam and hot-water boilers are based on using heating surfaces extended by means of pins. The pins are welded on tubes resulting in a highly effective surface, which also results in a very compact boiler that can be installed in narrow spaces. Due to the turbulent gas flow around the pins, the self-cleaning effect is high. This type of extended surface has been used in thousands of boilers worldwide!

New boilers or conversion of existing boilers?

The boiler and combustion system onboard a turbine tanker is designed for firing heavy fuel oil with diesel as backup. But onboard an FPSO or FSO, the boilers are required to run on gas or crude with diesel as backup.

When an existing boiler needs to be modified to become optimised for other fuels than it was originally built for, a boiler survey should be made to determine its fitness for the new operation.

Before deciding whether the existing boiler should be converted, the boiler must be inspected. Aalborg Industries' experienced boiler engineers can make a survey of the boiler to check its condition. Depending on the boiler's level of maintenance, the conversion of the boiler can vary from replacing a few tubes to an extensive retubing of the boiler and installation of a new superheater.

When changing from HFO and diesel firing to gas, crude and diesel firing, a new burner has to be installed. The control system must be changed and new fuel supply lines for the gas and crude must be installed. Double pipe-work, gas detection systems and extraction air systems must also be installed to ensure safe containment of these hazardous fuels below deck in the engine spaces.

The answer to the question in the headline is a combination of the total investment for converting the existing boiler or installing a new boiler, keeping the time schedule for the project and ensuring the FPSO's life length of 20 to 25 years.

Quite often the clients choose to

install new boilers on deck, keeping the existing boilers in the engine room for back-up.

Boiler installation on deck or in the engine room?

Some of the boilers we have installed on FPSOs during the years have been placed in the engine room, but most of them have been on the open deck and in hazardous areas. It might sound easier and much less expensive to install the boiler in a safe area engine room, but it is actually quite the opposite. In order to keep the area safe, the gas fuel valves and the burner have to be enclosed and gas detection and extraction systems have to be installed.

If the boilers are installed in a hazardous area on deck, the boiler, feedwater tank, combustion system and all other equipment have to be designed for exposure to the weather with carefully selected materials, special painting, insulation with stainless cladding, etc. Instruments and electric motors must have the correct Ex-rating and protection to a minimum of IP 56.

A boiler system on deck is quite straight forward. Ex-rated equipment is today generally available at reasonable prices. The price of Ex-rated equipment is still higher, but the difference is shrinking as the availability of the equipment increases. The total cost for a steam system on deck in a hazardous area is normally lower and the system is less complicated compared to the same system in a safe area engine room.

New, more powerful boiler

Aalborg Industries' standard MISSION™ D-type boiler, designed for capacities up to 120 t/h and 18 barg saturated steam has been selected

for some of the latest large FPSO projects.

A few years ago, a large FPSO pumped up to 100,000 bpd. Today it pumps twice as much, or more. As a result of the trend towards larger FPSOs and the increasing need of steam onboard these vessels, Aalborg Industries have developed an even more powerful version of the MISSION™ D-type boiler.

Today, the boiler can be delivered with an internal superheater for steam production up to 120 t/h at 40 barg. The boiler is a result of decades of experience from industrial boilers combined with marine main propulsion boilers and auxiliary boilers.

Wide product range

In order to meet market expectation, Aalborg Industries have combined the best technologies from our industrial and marine boilers in a new generation of marine boilers.

- Steam boiler capacities up to 120 t/h



MISSION™ D-type up to 120 t/h, 40 bar superheated steam

- Hot-water boiler capacities up to 30 MW
- MISSION™ thermal fluid heater capacities up to 20 MW
- Heat recovery boilers after gas turbines