



FLOATING PRODUCTION SYSTEMS



Aalborg Industries is an equipment and service provider for the upstream section of the offshore industry.

Above: MISSION™ D boiler

Below: The first Aalborg boiler was built in 1919

Equipment & service for Floating Production Systems

The Aalborg Industries Group is a leading supplier of equipment and services for Floating Production Systems such as FPSOs, FSOs, FSUs, FSRUs, etc.

Large capacities of steam, hot-water or thermal oil are required for the processes onboard Floating Production Systems. As a part of the mandatory safety equipment, we can also supply an inert gas system.

A leading supplier of boilers, burners, safety/control systems, thermal fluid systems, heat exchangers and inert gas systems, Aalborg Industries have the experience and resources to offer advanced and environmentally friendly solutions for new equipment or services such as boiler and burner conversions and repair jobs.

Aalborg Industries are a trend-setting supplier of modularised boiler and inert gas system installations for the FPS segment.

Professional partner

Thanks to Aalborg Industries' engineering

capacity together with a wide range of products and services, we can combine various systems and services into a complete, integrated turnkey package with the best environmental solution. We can, for instance, design and deliver an integrated boiler and inert gas system or repair and convert an existing boiler or burner. To cut the installation time, Aalborg Industries have developed a concept where the boiler including dual- or triple fuel combustion systems and all accessories can be delivered as an assembled unit ready to be lifted onboard the vessel.

Experienced developers

We have been an international boiler supplier for almost 90 years (for offshore vessels since 1974) and a well-known name on most makers' lists for just as long. Our inert gas history is as long as the IMO legislation in this area.

We listen to our customers' needs and wishes, and we keep an open dialogue with classification societies on new standards and product development which enables us to offer the most user-friendly, reliable complete solutions.



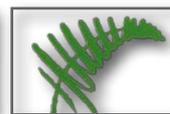
1967

Smit Ovens, the Netherlands, delivered its first maritime inert gas system to M/V "Willem Barendsz".



1970s

Aalborg Industries, Japan, became representatives of Smit Ovens/Smit Gas for inert gas generators.



1988

Gosfern Pty Ltd, Australia, established (from a Foster Wheeler subsidiary) to market dual-fuel burners and safety systems



1997

Aalborg Industries, Japan, developed its own design of inert gas systems (flue gas type)



1999

Global FPSO Centre established in Stockholm, Sweden, for new equipment supply for Floating Production Systems

We know how



Steam, heat and power generating solutions

Aalborg Industries have the market's widest range of steam and hot-water boilers, thermal fluid systems, exhaust gas economizers after diesel engines, waste heat recovery units after gas turbines, oil/gas-fired burners, safety/control systems and heat exchangers; for installation in safe or hazardous areas.

Inert gas systems

Since 1974, when we delivered our first inert gas generator installation to an FPSO, we have delivered a wide variety of designs to meet our customers' requirements. With a dedicated specialized FPS team, we can deliver a wide variety of inert gas- and flue gas systems; below deck or in hazardous areas; marine standard speci-

cation or package mounted modules, single- or dual-fuel fired.

Environmental concerns

Aalborg Industries constantly strive to develop our product portfolio to comply with future regulations and environmental legislation at large. When developing boilers and burners, we emphasize reducing their emissions. Designing our equipment for easy and logical operation and maintenance ensures correct use, resulting in the lowest possible environmental impact. Specific development activities are focusing on emission levels such as NO_x emission from fired boilers, resulting in the development of low NO_x combustion systems, installation of economizers and waste heat recovery units (WHRU). The emissions per produced energy unit are then reduced.

*Expertise in inert gas systems and hot-water / steam boiler systems especially suited for use on board Floating Production Systems.
Below: MISSION™ D boiler for 40 bar, 400°C developed in 2005 specifically for the FPS segment.*



2005 Global FPS organization set-up at Aalborg Industries in Denmark for both new equipment and services.

2005 Service company set up in Macaé, Brazil, specifically for FPS segment (maintenance contracts and service)

2006 Gosfern Pty Ltd in Australia (combustion and safety technology) acquired by Aalborg Industries, Denmark

2006 Smit Gas BV in the Netherlands (engineering and global marketing of inert gas systems) acquired by Aalborg Industries, Denmark

2008 Combining long-term practical experience, innovation, and a tradition of high quality and environmentally friendly systems.



MULTIPLE FUEL FIRED BOILERS FOR STEAM OR HOT-WATER

BURNERS & CONTROLS

MISSION™ OM

MISSION™ OL

MISSION™ D

GOSFERN™



8.0 - 45.0 t/h

12.0 - 55.0 t/h

25.0 - 130.0 t/h

5 - 45 MW

The boiler is available as a steam boiler in capacities up to 45 t/h or as a hot-water boiler in capacities up to 30 MW at 11 or 18 bar design pressure.

The boiler consists of a furnace and a convection part integrated with the steam drum. The flue gas flows vertically from the furnace up through the pin element tubes in the drum to the flue gas box at the top of the boiler.

The boiler is side-fired, which makes the boiler very easy to ventilate and gives an operation and maintenance friendly location of the burner and its controls.

The boiler is available as a steam boiler in capacities up to 55 t/h, or as hot-water boiler in capacities up to 35 MW with a design pressure of up to 18 bar.

The convection section consists of straight tubes extended with pins which are bent to create a flue gas flow increasing the heat transfer at the same time as it reduces the pressure loss across the convection section.

The boiler is top-fired, which gives optimum conditions for the flame resulting in a very good combustion.

The boiler is compact and requires a minimum of space.

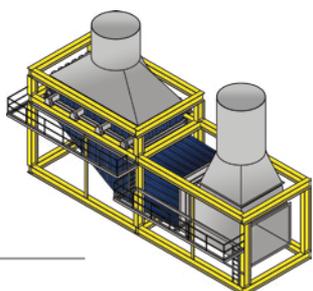
The ideal choice when large steam capacities are required. The standard capacity range is 45–120 t/h saturated steam at 18–25 bar. As a hot-water boiler, it can be delivered with a capacity of up to 80 MW. For FPS applications, the boiler can also be delivered for capacities up to 130 t/h at 40 bar and 400°C superheated steam. The MISSION™ D boiler consists of a steam and water drum connected by a generating tube bank. The furnace is made of membrane walls forming a fully water cooled furnace. The convection section consists of straight pin tubes with bent pins that provide a high heat transfer coefficient and a low pressure loss. Large external downcomers secure good natural circulation at all loads.

The GOSFERN™ MPF (Marine Para-Flow) burner comes in roof/wall fired designs, capable of burning MDO, HFO, crude oil or fuel gas in single, dual or triple fuel combinations.

Another burner is the MPF-LE (Low Emissions) burner for environmentally sensitive applications.

The burner assembly is provided as a complete module, incorporating dual redundant flame scanners, internal gas ring, oil gun and igniter with all electrical components precabled to the front-plate mounted SS junction box.

In addition, all instrument air users are pre-tubed (SS) to a common manifold, also mounted on the burner.



Equipment solutions for FPS



WASTE HEAT RECOVERY	INERT GAS SYSTEMS	THERMAL FLUID SYSTEMS	HEAT EXCHANGERS
<p>MISSION™ WHR-GT</p>  <p>10.0 - 50.0 t/h</p> <p>MISSION™ WHR-GT heat recovery unit (WHRU) is designed for installation after a gas turbine. The WHRU is supplied in various configurations such as supplying 40 bar superheated steam to power generation, saturated steam, or hot water for the process.</p> <p>MISSION™ WHR-GT can be supplied as a ready module with exhaust gas by-pass damper for load modulation, or as a single element to build into the exhaust duct. Our design offers the best solution in respect of efficiency, accessibility, weight and foot print.</p> <p>Special advantages for MISSION™ WHR-GT are low maintenance cost, high reliability and simple control; enabling easy integration into any existing control system.</p>	<p>SMIT GAS™</p>  <p>500 - 30,000 m³/h</p> <p>For converted crude oil tankers, the existing flue gas type inert gas installation will have to be refurbished. For newbuilding projects or in case of decommissioning of the boilers, an independent inert gas generator is installed.</p> <p>The inert gas systems supplied are often equipped with dual fuel burners (Ultramizing burner®). Most FPSOs are fitted with a double system for full redundancy.</p> <p>Onboard FPSOs and FSOs, the inert gas system execution may be a standard inert gas generator for installation below deck (engine room) or suitable for installation on deck in non- or classified areas.</p> <p>Complete packaged inert gas units are supplied.</p>	<p>MISSION™ TFO</p>  <p>100 - 20,000 kW</p> <p>The oil- and gas-fired thermal fluid heater is constructed with a double coil system of large bare tubes and can be delivered in vertical or horizontal design. The design pressure is 10/13 bar, and the thermal fluid design temperature is 280-350°C.</p> <p>The heater has a low thermal fluid pressure drop and comes in a three-pass flue gas configuration with a heavy insulation jacket.</p> <p>A removable top plate provide access for inspection and cleaning of the coils.</p>	<p>VESTA™ MP-C</p>  <p>300 - 2,000 kW</p> <p>Consisting exclusively of AISI 316 L materials, the VESTA™ MP-C shell & tube design cargo heater is the ideal choice when heating of oil or corrosive storage is required.</p> <p>The heating surface is optimised by the use of specially designed baffle plates resulting in a very compact, highly efficient, and cost effective heater.</p> <p>The VESTA™ MP-C can be delivered complete with accessories such as valves, monitoring equipment and regulating equipment.</p>

←The products shown in the form are a selection from our comprehensive product range, that are specially suited for FPS applications.
Below:
Wall-fired GOSFERN™ burner.





Conversions of combustion and fuel systems



Several of our MISSION™ boilers like MISSION™ D feature the unique pin tubes (see below) providing an extended heating surface.

Conversion projects

Conversion of an oil tanker to an FPSO or FSO can involve changeover of fuel types from MDO and HFO firing to fuel gas and/or crude for existing Aalborg Industries or 3rd party brand boilers. Alternatively, new boiler systems complete with the required safety and control systems can be supplied. The inert gas system is refurbished or replaced depending on the boiler solution.

Fuel conversions on existing boilers

Our experience with conversion of fuel/burner systems on existing FSO and FPSO boilers dates back to the late 1980s. Aalborg Industries provide design of steam propulsion, auxiliary and process applications for boilers ranging from 15-130 t/h, operating at pressures from 7-40 bar (g). We adopt a turnkey approach to fuel conversion projects providing plan, design, manufacturing, installation, commissioning and approvals with the classification societies.

Burners/combustion

Aalborg Industries have extensive combustion & burner design experience with

marine combustion applications utilising various fuels including gas, diesel oil, gas oil, and various heavy and crude oils. Although our burner designs are application and project specific, they are based on proven designs.

GOSFERN™ combustion solutions come complete with fuel/air delivery modules and advanced safety and control systems.

The offshore oil and gas industry has come to recognise the need for better environmental control in addition to good flame stability, turndown and fuel efficiency.

Aalborg Industries' shore-based applications have long since been exposed to stringent control regulations and various pollution reduction techniques have thus evolved. We have recognised the need to provide marine burner performance with similar pollution reduction techniques as that required from shore-based applications.

The GOSFERN™ MPF burner is our basic marine dual fuel (gas and liquid) burner, and the new range of pollution-reducing marine burners is designated GOSFERN™ MPF-LE.





Safety is about being in control

Safety and control systems

The safety and control of boilers and fuel systems is critical on offshore Floating Production System installations. Aalborg Industries are dedicated to perfecting these applications and utilises only TÜV certified safety and control systems that are approved by the majority of the IACS members.

The design criterion used in the design of these systems is the IEC 61508 Safety Standards for Safety Instrumented Systems. Coupled with this hardware specification, our boiler specific safety applications are designed to the NFPA 85 Combustion Systems Hazards Codes, which meets the requirements of all of the classification societies. Additionally, NFPA supports IEC 61508 and the process industry's requirements in IEC 61511 for the physical and functional segregation of control logic/hardware from the safety system.

Various system configurations are available for operator interface, local and remote operation and/or monitoring.

Being safe for the future

Aalborg Industries always supply a true SIL2 (Safety Integrity Level) integrated system for boiler plants on FPS units.

Global After Sales

From the time we carry out commissioning of new boiler plants and inert gas systems and train the future operators in daily maintenance and safety features, Aalborg Industries maintain a close contact with shipowners and end users worldwide. Our Global After Sales organization provides professional support and complete service.

Aalborg Industries supply OEM spare parts and carry out inspections, service, repairs, retrofit and upgrade on our own brand boilers, burners, control systems, inert gas systems and heat exchangers, but 3rd party brand equipment can be serviced as well.

Maintenance contracts

Aalborg Industries have service & maintenance contracts with a number of oil companies and thus have the fully trained and certified personnel and testing equipment to go on board and help secure a safe and economical operation.



Control & safety systems for boiler and combustion systems are designed to meet the requirements pertaining to each individual project.





MARINE BOILERS & HEAT EXCHANGERS

THERMAL FLUID SYSTEMS

INERT GAS SYSTEMS

FLOATING PRODUCTION SYSTEMS

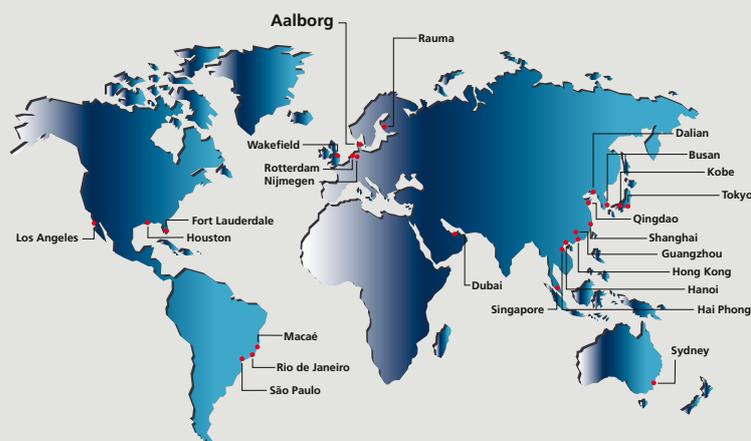
GLOBAL AFTER SALES

INDUSTRIAL BOILERS & SERVICE

Your Preferred Partner

Aalborg Industries' **mission** is, on the basis of world leading technology within our defined core business, to provide our customers with reliable, innovative and optimal steam, heat and safety solutions that are environmentally friendly and ensure the lowest life cycle cost.

Aalborg Industries' **vision** is to become the Preferred Partner to all our customers and business relations.



Contact us:

Denmark: +45 99 30 40 00 • 24-hr: +45 40 16 66 86
Australia: +61 2 4399 0000 • Brazil: +55 24 2233 9963
Dubai/UAE: +971 4 3241 061 • Holland: +31 24 352 31 00
Holland: +31 181 650 500 • 24-hr: +31 181 650 550
Singapore: +65 6261 9898 • USA: +1 954 435 5999

fps@aalborg-industries.com
www.aalborg-industries.com