Aalborg XW-TG

Waste heat recovery economizer after diesel engine

The Aalborg XW-TG is a water tube, forced circulation exhaust gas economizer designed to utilize thermal energy in diesel engine exhaust gas. The standard Aalborg XW design has been enhanced to more efficiently utilize the wasted energy after large diesel engines with saved fuel consumption and reduced CO_2 emissions as a result.

Aalborg XW-TG generates superheated steam for power generation by means of a steam turbine driven generator (turbo generator).

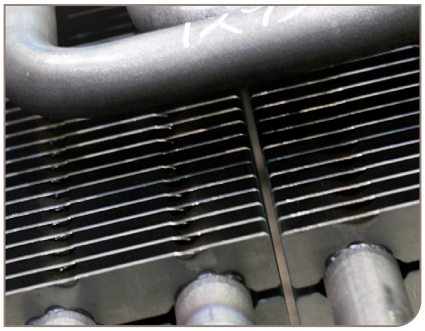
The Aalborg XW-TG is based on and has the same characteristics as our well-known Aalborg XW which is a water tube, forced circulation exhaust gas economizer with double gilled tubes specially designed for heat recovery from diesel engine exhaust gas.

When applied for large heat recovery rates, the heating surfaces are required to be much increased in size and it is increasingly more important to focus on operation reliability to provide full benefit of the relatively high investment.

For enhancement of an efficient, safe and reliable operation, the Aalborg XW-TG is therefore among other things supplied with the following equipment (advantageous for ordinary economizers as well):

- Steam drum(s) for efficient separation of dry steam for superheating
- High-efficient, electrical operated sootblowers using steam or compressed air as blowing medium for on-load cleaning
- Fixed nozzle pipes for off-load water washing
- Extended monitoring equipment (e.g. exhaust gas pressure drop/temperatures and fire detection)
- Dampers for by-passing of exhaust gas at low load operation (and in case of emergency)
- Circulation pumps of canned motor type (with external cooling) with flow monitoring system
- PLC based control system including online performance monitoring and help functions

The Aalborg XW-TG can be arranged in many different configurations, e.g. for a single pressure or dual pressure system, according to each individual requirement for steam and power output.



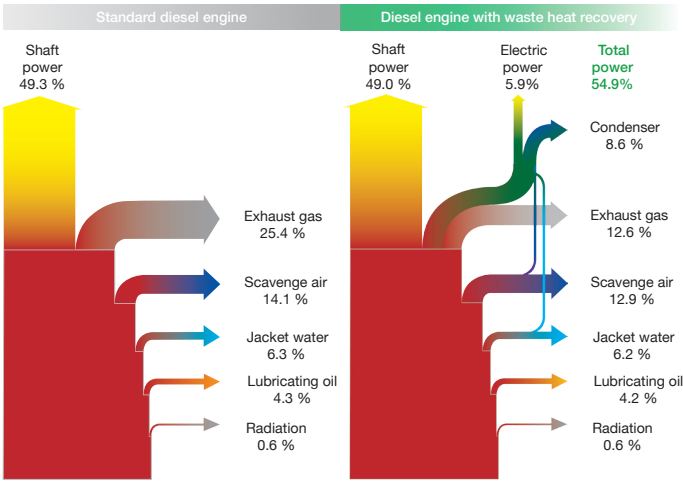
The heating surface consists of double gilled tubes with a spacing which minimizes soot build-up. The economizer is supplied with an efficient cleaning system with steam or compressed air sootblowers.

We have developed and supplied the Turbo Compound System in co-operation with Dresser Rand, Siemens AG and Wärtsilä Corporation. Naturally, the system works equally well with other diesel main engines, e.g. MAN engines. The Turbo Compound System generates electric power equal or up to more than 11% of the main engine output on large container ships from waste heat while at the same time reducing emission of harmful exhaust gases like CO_2, SO_X and NO_X into the environment.

We have achieved documented fuel savings and thereby reduced CO_2 emissions in double digit percentages.

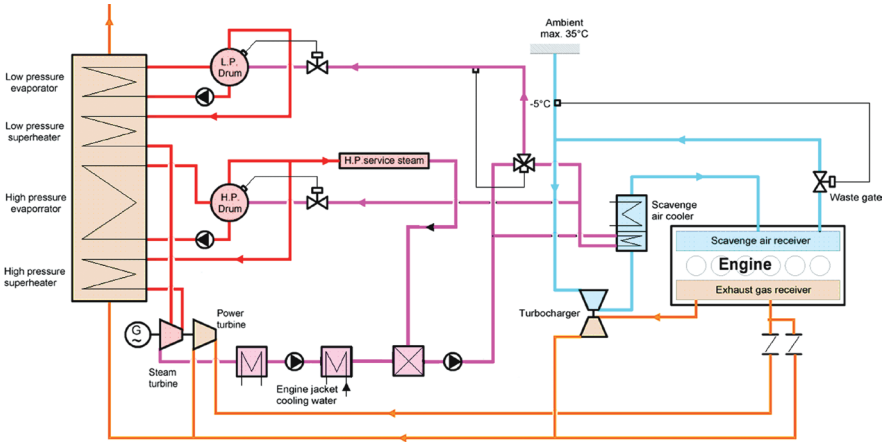
Besides container ships, the Turbo Compound System can also be applied with advantage to other ship types such as VLCCs, bulk carriers, etc.

Heat balance example for RTA96C diesel engine - ISO conditions, 100% load



M.E. efficiency improvement with waste heat recovery: 54.9 / 49.3 = 11.4%

System layout - case example



Total waste heat recovery system (after diesel engine) with dual pressure steam plant

DATA & CAPACITY (custom designed from case-to-case) - case example

Main engine:	Wärtsilä RT-flex96C*
Engine output at MCR:	68,640 MW
Engine conditions:	Average aged
Ambient conditions:	ISO
Engine load:	85% MCR
Exhaust gas flow:	434.6 t/h
Exhaust gas temperatures HP inlet:	326°C
Exhaust gas pressure drop:	128 mm WG
HP feed water temperature:	155 °C
HP superheated steam flow:	23.3 t/h @ 7.8 bar(g) @ 294°C
HP saturated service steam flow:	1.8 t/h
LP feed water temperature:	140°C
LP superheated steam flow:	6.0 t/h @ 3.5 bar(g) @ 187°C
Total recovered waste heat	about 24,500 kW
Total recovered heat by exhaust gas economizer:	20,490 kW

*** with ambient suction and WHR tuning**

Our latest generation of large waste heat recovery (WHR) plants allows for up to 11% savings in fuel when the ship is in operation and thereby an equivalent reduction in the vessel's CO_2 footprint.

With orders for more than 50 large WHR plants in 2009, 42 of which will be supplied to A. P. Møller Maersk, the environment will be spared 650,000 tons CO_2 a year when these ships come into operation - an amount that equals half of the annual emissions of the inhabitants of Aalborg city.

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