WÄRTSILÄ

Wärtsilä HYTug series

As environmental issues and sustainability are becoming more and more important globally, Wärtsilä is launching a new portfolio of tug designs emphasising environmental sustainability, utilising the company's strong competences in hybrid propulsion technology. Since they typically operate in or close to harbours, tugs are particularly affected by environmental aspects, and the need for compliance is an increasing concern for tug owners and operators.

The new designs are based on Wärtsilä's recently introduced Wärtsilä HY concept. Among the benefits of the new designs are the flexibility and efficiency provided to the operation of the tug by the Wärtsilä HY technology. Furthermore, the total installed main engine power is less than with conventional hybrid tug designs, while maximum bollard pull is achieved via power boosting from the batteries. Using less engine power also decreases emissions, fuel bill as well as the amount of engine maintenance needed, which again adds both to the cost savings and the environmental impact.

Wärtsilä HY tug is designed for the following duties:

- To assist in the berthing and un-berthing operation of vessels calling at ports/ terminals
- To perform towing, ship handling operation in Ports/ terminals
- Escorting at high speed (for escort tug version)
- Fire-Fighting (optional)

DESIGN HIGHLIGHTS

- Optimised hull for low hull resistance and high towing/ escort performance, with good seakeeping, high maneuverability, safety and comfort for crew
- Distinctive design outlook
- Designed for building & maintenance friendliness
- Modular engine and hybrid propulsion concept
- Guaranteed performance
- Less installed mechanical power
- Instant load taking capability
- No visible smoke under all normal conditions
- Green mode (Zero-emission)
- Built–in redundancy for safety and reliability
- Easy and safe to operate
- Reduced maintenance (less cylinder-hours, reduced stress to components)
- Increased efficiency (lower fuel consumption, reduced emission)
- Approval in Principle from BV, ABS & LR

ECO-FRIENDLY
TUG DESIGN

Wärtsilä HYTug series

These newly launched Wärtsilä HY Tug designs come in three different hull sizes, namely a 28m harbour tug with a 50t bollard pull, a 29.5m harbour tug with a 75t bollard pull, and a 35m escort tug with a 75t bollard pull. The propulsion configuration is such that each design comes with the option to select either diesel mechanical hybrid, or diesel electric hybrid propulsion, and the designs are able to cover a 40 to 90t bollard pull range with the appropriate Wärtsilä equipment modules.

As tugs are running on a wide power range with most of the time on low load, the potential for improvements are there by flexible power generation and energy storage. E.g. to run purely on batteries on low loads or a combination of battery and gensets in other modes.

Since the tugs usually operate in or close to harbours, tugs are particularly affected by environmental regulations.

Wärtsilä HY tug's hybrid configuration provides the simultaneous optimisation of both low and high load performance as well as reducing emission significantly. This technology has already been tested and matured from other Wärtsilä projects and vessel segments. It also gives the possibility of increased redundancy to secure the most important, uptime of the tug.

Furthermore, the new Wärtsilä HY tugs are designed with thrusters from the Wärtsilä WST series, which have a large diameter propeller to provide efficient and high performance propulsion. As well as excellent hydrodynamics, the WST thrusters designs emphasise reliability as well as ease of installation, operation and maintenance. The efficiency and low operational costs enabled by the WST thrusters, enhance the environmental friendliness and overall economics of the new tugs.

SPECIFICATION IN BRIEF

	50t BP WÄRTSILÄ HY Harbour TUG	75t BP WÄRTSILÄ HY Harbour TUG	75t BP WÄRTSILÄ HY Escort TUG
Length Over All (Excluding Fenders)	28.00 m	29.50 m	35.40 m
Beam (Excluding Fenders)	10.80 m	11.60 m	14.00 m
Depth, moulded	4.70 m	5.54 m	6.70 m
Draught, Design	3.50 m	4.00 m	4.60 m
Complement (Max)	8 pax	10 pax	12 pax
Gross Tonnage (GRT)	< 400	< 500	> 500
Service Speed	12 knots	13 knots	13 knots

50t BP Wärtsilä HY harbour tug

75t BP Wärtsilä HY harbour tug

75t BP Wärtsilä HY escort tug

COMPARED PERFORMANCE FOR 75t BP HARBOUR TUG

	Wärtsilä Conventional Tug DM Medium Speed	Conventional Tug DM High Speed	Wärtsilä HY DM W8L20E +400 kWh	Wärtsilä HY DE W8L20 +500 kWh
Total Installed Mechanical Power	✘ Ref	✘ Similar to Ref	✓ -16.8%	✓ -26.4%
Power boost	✘ Not available	✘ Not available	✓ +1200 kW	✓ +1500 kW
Duration of Max BP with Power boost	✘ Not available	✘ Not available	✓ Min. 15 mins	✓ Min. 15 mins
Response	✘ Load ramps	✘ Load ramps	✓ Instant	✓ Instant
Smoke	✘ At start / load taking	✘ At start / load taking	✓ Zero	✓ Zero
Green mode Supported by Start & Stop	✘ Not available	✘ Not available	✓ Yes	✓ Yes
Duration of Eco Transit Mode	✘ Not available	✘ Not available	✓ 20-45 mins	✓ 25-55 mins
Main Engines Running Hours	✘ Ref	✘ Similar to Ref	✓ -32.9%	✓ -58.3%
Maintenance costs	✘ Ref	✘ More cyl-hours, shorter TBOs	✓ Less cyl-hours, longer TBOs	✓ Less cyl-hours, longer TBOs

FUEL EFFICIENCY COMPARISON FOR 75t BP HARBOUR TUG

Several propulsion configurations or alternative system, such as high speed vs medium speed engines, FPP vs CPP have been studied and compared against Wärtsilä HY solutions with battery support.

The results showed that the best efficiency is achieved by Wärtsilä HY diesel- mechanical with CPP configuration and diesel electric with FPP configuration.

The efficiency comparison has been performed based on fuel consumption per kW of power delivered to the thrusters, and all losses (mechanical and electrical) in the different alternatives are taken into account.

Fig.1 Harbour tug typical operating profile

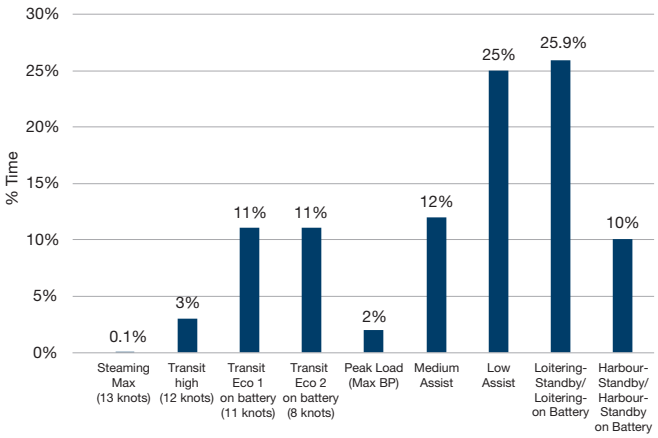


Fig.2 Fuel efficiency comparison

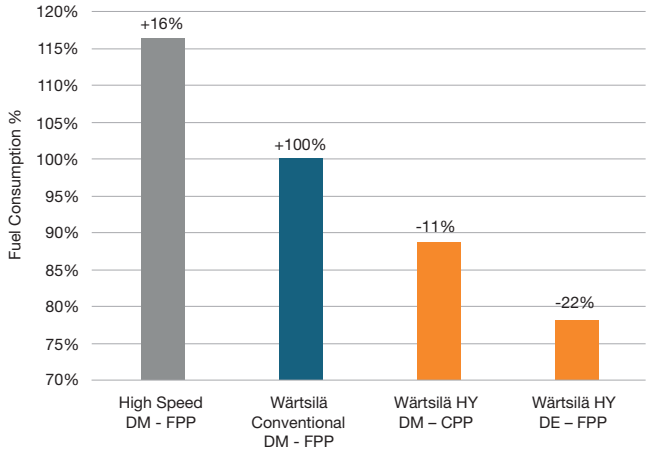
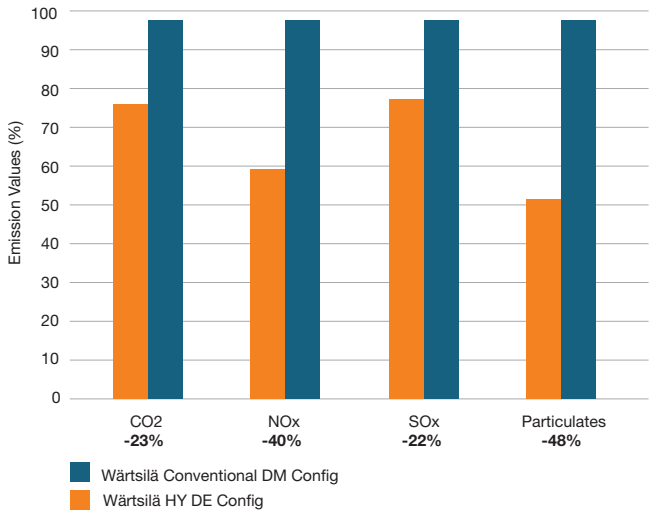


Fig.3 Emission comparison



LESS INSTALLED POWER

This configuration will be able to keep the max bullard pull (BP) with less installed power in a certain time period based on design requirement. Using less engine power also decrease the amount of maintenance needed.The battery can be charged from the PTOs, genset or from shore connection.

LOW FUEL CONSUMPTION > EMISSIONS

Significant reduced fuel consumption is achieved by operating the engines and propellers as close as possible to its optimal curve. Supported by the battery system to handle variations and low load modes.

LOW LOAD OPERATIONS ON BATTERY

Transit ECO and Loitering modes can be operated purely on battery only.

OPTIMUM ENGINE LOADING

It is possible to run engines at optimum load at all modes, and with the battery handling peaks, the engines will have a better operation that also will reduce the maintenance. For the Diesel mechanical - CPP Hybrid configuration, the electrical motor will also act as generator/ PTO (Power Take Off) with the combination including controllable pitch propellers.The converters gives the opportunity to run the main engines on variable rpm to follow the propeller curve.

SMOKELESS OPERATION

With the battery instant power available the load peaks will be handled by the PTI drive line and avoid the main engines to see these peaks.

COLD SYSTEM START-UP

The necessity to wait for the engines to warm-up is overcome by the energy storage, leading to instant ship readiness.

AUTOMATIC POWER BACK-UP

An increased level of safety is reached through emergency back-up algorithms and built-in redundancy of the power sources.

FLEXIBILITY IN POWER GENERATION

For the Diesel electric Hybrid configuration, it gives the operator the best flexibility to run in the most efficient way between the gensets and batteries. Variable rpm on gensets and propellers to automatically select the optimum point at all modes.

REDUCED RUNNING HOURS

Ref. comparison the engines running hours are reduced up to 58% due to this flexibility of correct engine loading and energy storage in the batteries.

CONNECTION FOR FUTURE POWER SOURCES

By introducing the DC bus and batteries, the system is prepared for possible future upgrades and power source, e.g. fuel cell.

INCREASED RELIABILITY WITH LOW COMPLEXITY

In case of failure on a generator, DC-bus or propulsion motor the vessel will still be able to operate with reduced BP. This means for an operator that the vessel is still in operation and will be able to get out of the sailing course for the assisted vessel in case of a failure.

EASY AND SAFE TO OPERATE

Control system (Power & Energy Management System) and operator interface will secure an intuitive operation of the complete system. To enable the crew to keep full focus on the tug operation, the system has been developed to simply select mode of operation, then the control system will ensure that needed power for this mode. The control system will also secure that any sudden load step cannot overload the system.

INSTANT LOAD TAKING

Due to the instant power available from the battery the response from the system improve the maneuverability of the vessel.

Wärtsilä HYTug solution

Fig.4 75t BP Wärtsilä HY Harbour Tug Diesel Electric Hybrid Configuration

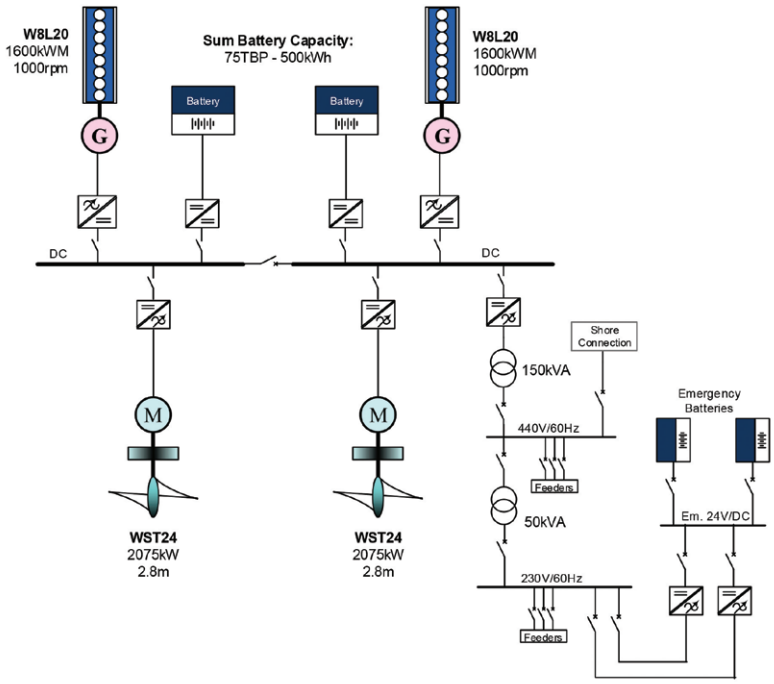
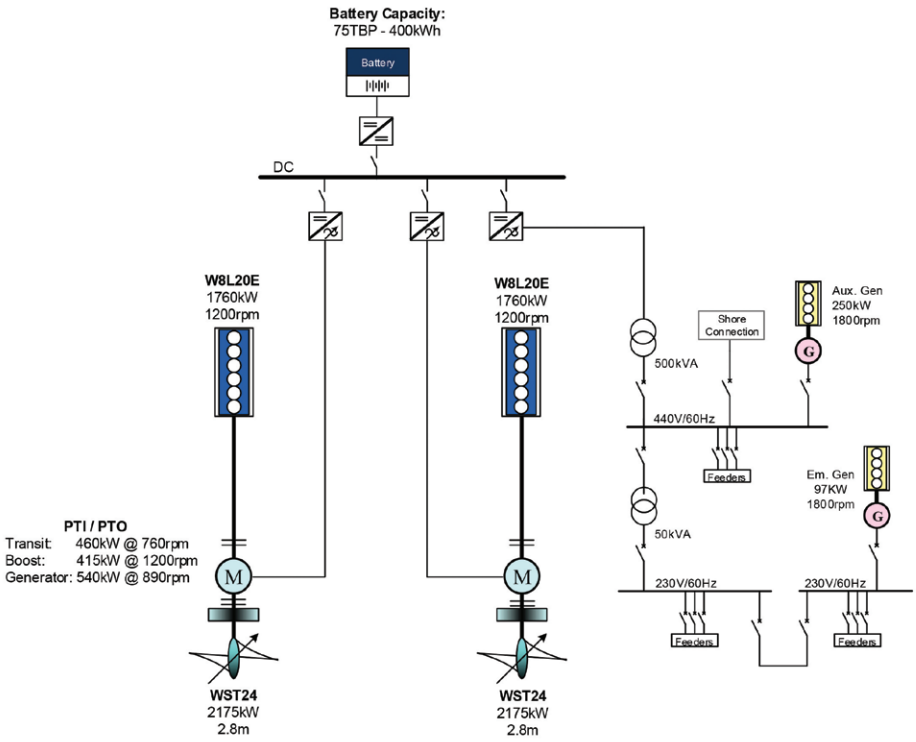


Fig.5 75t BP Wärtsilä HY Escort Tug Diesel Mechanical Configuration



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