

RETROFIT SOLUTIONS

by WinGD

Engine retrofits and
upgrades tailored for
existing WinGD engines

WINGD

Retrofits & Upgrades

Optimising Energy Intensity and Enhancing Reliability Of Existing Ships

Reducing Energy Costs for Ships in Service

WinGD Retrofit & Upgrade solutions help keep your existing vessels reliable, compliant, competitive and cost-effective for longer.

As emissions regulations including the IMO Net Zero Framework, FuelEU Maritime and EU Emissions Trading System increase the cost of energy used onboard, ship owners need to make significant decisions to minimise costs on their existing fleets. In this context, ensuring reliable operations and cost-effective upgrades to more efficient technologies are crucial for controlling costs.

When considering new fuels and new efficiency measures, existing vessels face their own challenges. While new ships can be designed from scratch for low energy use, for existing vessels the right investments—or whether to invest at all—will depend on many factors, all of which will depend on the unique vessel in question.

These include:

- Installed machinery and equipment
- Remaining service life
- Exposure to regional regulations
- Operating profile
- Availability and cost of new technologies
- Drydocking schedule and time off-hire

For ships with our engines installed, WinGD simplifies those decisions. Our Retrofit & Upgrade experts can advise you on the best solution to meet your specific commercial, regulatory and environmental goals. Whether you are aiming to meet short-term compliance requirements or secure many more years of services, planning to use cleaner fuels or simply use your current fuels more efficiently across the vessel lifecycle, WinGD's portfolio includes a cost-effective solution tailored to your needs.

Speak to your local WinGD sales representative to arrange an expert assessment of your requirements and the Retrofit & Upgrade options available.

WinGD Retrofit & Upgrade portfolio highlights

- Engine conversions for LNG, methanol or ammonia fuel
- Engine and engine control upgrades
- Emissions abatement installations and upgrades
- Engine derating and advanced tunings
- Hybrid power and energy management systems installations
- Digital optimisation solution installations and upgrades
- Reliability upgrade to ensure trouble-free operation

Why Upgrade with WinGD?

With the latest technology updates installed by the original equipment designer, operators can improve efficiency, reduce emissions and extend the service life of their vessels while optimising operational costs and contributing to a more sustainable future.

Our engines are designed to be upgradable, with a modular design approach and a common base platform across engines for all fuel types. Similarly, WinGD control, monitoring, emissions abatement and efficiency technologies are designed from the beginning to be applied to both new and existing engines.

Through our unique product expertise, and using our strong supplier and project partner network, WinGD provides a one-stop-shop for fuel conversions and energy efficiency upgrades for its engines already in service—assuring a robust, reliable and high-quality installation while significantly reducing project cost and duration compared to third-party service providers.

Fuel Conversions

Switching from fuel oil to potentially zero- or near-zero emission fuels—including LNG, methanol and ammonia—is the most direct way to reduce the energy intensity of existing vessel operations. While ship design, fuel storage and bunkering plans need to be considered carefully, WinGD's design approach and project expertise ensure that converting your engine is straightforward.

All single-fuel X-Engines and dual-fuel X-DF engines are designed with a robust, common base that can withstand the pressures and temperatures across all fuels, meaning they can all be converted for dual-fuel operation with any other fuel. The injection and fuel supply system retrofit involves replacing cylinder heads, upon which fuel injectors are installed, along with any other changes needed for material compatibility specific to the intended fuel.

WinGD has conducted methanol conversions on ultra- large container ships and methanol-ready engine installations (with conversions already planned) on tankers and container vessels—meaning we have both first-hand project expertise and available retrofit packages for relevant engine bore sizes.



X-DF LNG Conversion

WinGD X-Engines can be converted into X-DF engines. X-DF engines can be operated in Gas mode with pre-mixed lean-burn “Otto-cycle” combustion or in Diesel mode with “Diesel-cycle” combustion.

Benefits

- Lower CO₂, NO_x and particle emissions than Diesel engines
- NO_x Tier-III compliance in gas mode without SCR
- Improved EEXI and CII

Retrofit scope

- Engine side
- Cylinder cover replacement
- Cylinder liner replacement
- Additional gas admission valves and gas supply piping
- Piston and piston rod replacement
- Additional iGPR or GVU
- Additional pilot fuel injection system
- Engine control system modification
- Ship side
- LNG storage tank and FGSS
- Inert gas system
- Gas monitoring system
- Propulsion control system, safety system and alarm system update

Lead time and duration

- 12 months from contract to engine components delivery
- 80-100 days vessel conversion work at Shipyard, includes the parallel engine conversion work 60 to 80 days.
- 20-30 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

X-DF ready engines: X52, X52-1.1, X62-B, X62-1.1, X72-B, X72-1.1, X82-B, X92-B, X92-1.1
Older X-engine models to be checked case-by-case



X-DF-M Methanol Conversion

X-DF-M engines are designed to operate with both methanol or diesel with the same energy efficiency, ensuring flexibility and compliance with international maritime regulations. Methanol is injected into the combustion chamber by the Methanol Booster Unit (MBU) used on new WinGD portfolio engines.

Benefits

- CO₂ neutral (with e-Methanol)
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems
- Lower EEXI and CII

Retrofit scope

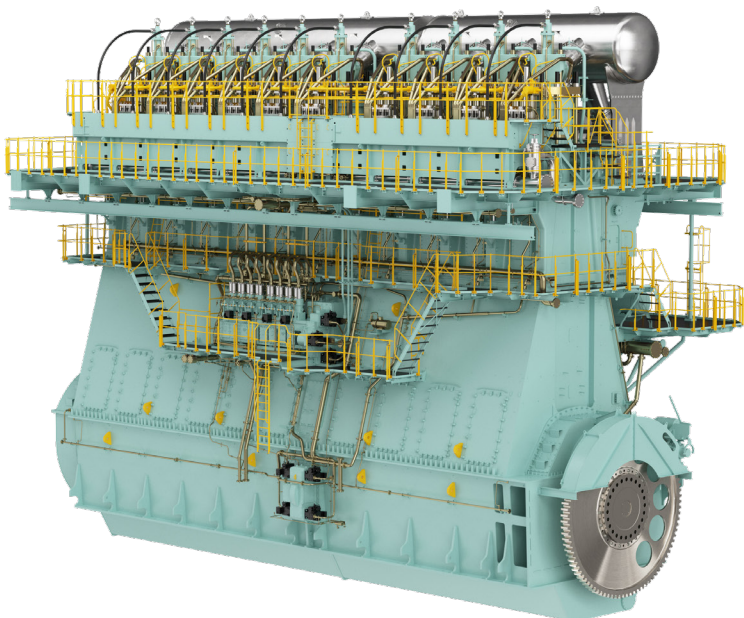
Engine side	Engine control system update
Cylinder cover replacement	Ship side
Additional methanol injection system	Additional methanol storage, transfer, supply system and purging system
Additional actuation oil rail	Gas monitoring system
Additional actuation oil supply unit	Propulsion control system, safety system and alarm system update

Lead time and duration

- 12 months from contract to engine components delivery
- 80-100 days vessel conversion work at Shipyard, includes the parallel engine conversion work 50 to 60 days.
- 10-20 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

- Dual-fuel ready X-Engines and X-DF engines: X52-S2.0, X52-1.1, X62-1.1, X62-S2.0, X62-B, X72-B, X82-2.0, X92-B, X92-1.1
- Older X-Engine and X-DF models to be checked case by case



X-DF-A Ammonia Conversion

X-DF-A engines are designed to operate with both ammonia and diesel with the same energy efficiency, ensuring flexibility and compliance with international maritime regulations. Ammonia is injected into the combustion chamber by hydraulic booster injectors that are controlled by an Actuation Control Unit (ACU) as applied on new WinGD portfolio engines.

Benefits

- CO₂ neutral (with e-Methanol)
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems
- Lower EEXI and CII

Retrofit scope

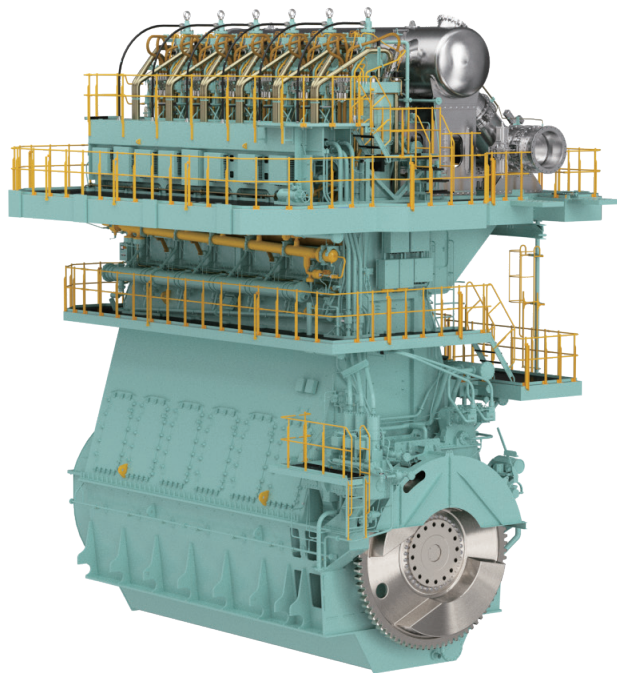
Engine side	Engine control system update
Cylinder cover replacement	Ship side
Gland box replacement	Additional ammonia storage, transfer, supply system, purging system,
Additional ammonia injection system	ammonia vapour processing system
Additional actuation oil rail	Gas monitoring system
Additional actuation oil supply unit	Propulsion control system, safety system and alarm system update

Lead time and duration

- 12 months from contract to engine components delivery
- 80-100 days vessel conversion work at Shipyard, includes the parallel engine conversion work 60 to 70 days.
- 10-20 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

- Dual-fuel ready versions of: X52-S2.0, X52-1.1, X62-1.1, X62-S2.0, X62-B, X72-B, X82-2.0, X92-B, X92-1.1
- Older X-Engine and X-DF models to be checked case by case



X-DF-P LPG Conversion

The X-DF-P is a dual-fuel engine equipped with technology enabling the engine to operate either on LPG or diesel fuel. The engine operates according to the diesel principle in both diesel mode and LPG mode. It is equipped with two separate fuel injection systems.

The diesel fuel injection system is used for diesel mode and remains active in LPG mode for injecting a small amount of pilot fuel, needed for stable ignition of LPG fuel.

The X-DF-P engine is designed for modification to an ammonia-fuelled X-DF-A engine and vice versa, offering fuel flexibility to LPG/ammonia carriers.

Benefits

- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems
- Lower EEXI and CII
- Operational flexibility for LPG/ammonia carrier vessels

Retrofit scope

Engine side	Ship side
Cylinder cover replacement	LPG storage tank and FGSS
Additional LPG injection system	Inert gas system
Additional actuation oil rail	Gas monitoring system
Additional actuation oil supply unit	Propulsion control system, safety system and alarm system update
Engine control system update	

Lead time and duration

- 12 months from contract to engine components delivery
- 80-100 days vessel conversion work at Shipyard, includes the parallel engine conversion work 60 to 70 days.
- 10-20 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

- Future fuel ready designs of: X52-S2.0, X52-1.1, X62-1.1, X62-S2.0, X62-B, X72-B, X82-2.0, X92-B, X92-1.1
- Older X-Engine models to be checked case-by-case



X-DF A

by WinGD



Ammonia

X-DF M

by WinGD



Methanol

Future Fuel Ready Upgrade

All new WinGD X-Engines and X-DF engines are manufactured according to WinGD's standard design of ammonia- or methanol -readiness. If a conversion is anticipated, or in case engine room space does not allow the installation of the actuation oil rail in situ, customers can purchase this additional ammonia or methanol ready upgrade before ship delivery.

Benefits

- Engine prepared for future fuel conversion
- Less conversion time in repair yard

Project scope

- Engine side
- Additional actuation oil rail
- Actuation oil pump gear-drive

Engine applicability

- All X-Engine and X-DF engine models.

X-DF LNG Upgrades

To further reduce emissions from X-DF LNG engines – in particular methane slip and overall greenhouse gas emissions – WinGD offers upgrades to X-DF2.0 technologies. X-DF1.0 engines can be upgraded to X-DF2.0 engines with addition of the Intelligent Control by Exhaust Recycling (iCER) system, and both X-DF1.0 and X-DF2.0 engines can be upgraded with the addition of variable compression ratio (VCR) technology.

In addition to iCER and VCR technology, WinGD has also introduced two measures to further reduce methane slip and unburned hydrocarbons – a filler gasket and a smaller gas admission valve (GAV) – which can both be installed on X-DF engines.

iCER Upgrade for X-DF-1.0 Engines

Using Intelligent Control by Exhaust Recycling (iCER) allows up to 50% of exhaust gas to be cooled and fed back to turbochargers, where it is mixed with fresh air before entering the scavenging air receiver. The recirculated exhaust gas reduces the oxygen concentration in the air/gas mixture, both reducing the risk of early ignition and allowing an increase in compression ratio, thereby increasing the engine efficiency.

Benefits

- Reduced gas and fuel consumption
- Reduced CO₂ and CH₄ (methane) emissions
- Improved EEXI and CII
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems
- IMO Tier III NOx compliance in iCER gas, iCER diesel and combustion stability (CSM) mode – without SCR

Retrofit scope

Engine side
Cylinder cover replacement
T/C compressor, silencer and matching parts replacements
Scavenge air cooler replacement
Additional SAC wetting system
Engine control system upgrade (WiCE control system required)
Ship side
Exhaust gas cooling system (EGC)
Additional exhaust gas control valves
Water treatment system and tanks
Propulsion control system, safety system and alarm system update

Lead time and duration

- 12 months from contract to engine components delivery
- 30-50 days conversion work at shipyard
- 10-20 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

RT-flex50DF, X52DF, X52DF-S1.0, X52DF-1.1, X62DF, X62DF-1.1, X62DF-S1.0, X72DF, X72DF-1.1, X72DF-1.2, X82DF, X82DF-1.0, X92DF



VCR Upgrade for X-DF-1.0 and X-DF-2.0 Engines

Variable Compression Ratio Technology (VCR) is a technology that dynamically adjusts the compression ratio of an engine to optimize combustion efficiency. By adapting the compression ratio according to operating conditions, VCR enhances fuel efficiency and reduces CO₂ emissions in diesel mode and gas mode, as well as further reducing methane slip in gas mode.

Benefits

- Reduced gas and fuel consumption
- Reduced CO₂ and CH₄ emissions
- Improved EEXI and CII
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems

Project scope

Engine side
Cylinder liner replacement
Piston rod replacement
Crosshead replacement
Connecting rod replacement
Additional VCR pump, pipes and valves
Column modification – to enable knee lever, VCR servo oil and control box installation
Engine control system update (WiCE control system required)

Lead time and duration

- 12 months from contract to engine components delivery
- 20-30 days conversion work at shipyard
- 5-10 days tests, sea trial, tuning, emission measurements and engine re-certification

Engine applicability

RT-flex50DF, X52DF, X52DF-S1.0, X52DF-2.1, X52DF-1.1, X52DF-S2.0, X62DF, X62DF-S2.0, X62DF-1.1, X62DF-2.1, X62DF-S1.0, X72DF, X72DF-1.1, X72DF-1.2, X72DF-2.1, X82DF, X72DF-2.2, X82DF-2.0, X82DF-1.0, X92DF, X92DF-2.0



iCER and VCR Upgrade for X-DF-1.0 Engines

A comprehensive upgrade for first-generation X-DF engines comprises both iCER and VCR technology installation, allowing all existing X-DF engines to reach the highest levels of fuel efficiency and emissions reductions achievable by the latest X-DF2.0 technology.

Benefits

- Reduced gas and fuel consumption
- Reduced CO₂ and CH₄ emissions
- Improved EEXI and CII
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems
- IMO Tier III NOx compliance in iCER gas, iCER diesel and combustion stability (CSM) mode - without SCR

Project scope

- Engine side
 - Cylinder cover replacement
 - Cylinder liner replacement
 - Piston rod replacement
 - Crosshead replacement
 - Connecting rod replacement
 - Additional VCR pump, pipes and valves
 - Column modification
 - Turbocharger compressor, silencer and matching parts replacements
 - Scavenge air cooler (SAC) replacement
 - Additional SAC wetting system
 - Engine control system upgrade (WiCE control system required)
- Ship side
 - Exhaust gas cooling system (EGC)
 - Additional exhaust gas control valves
 - Water treatment system and tanks
 - Propulsion Control System, Safety System and Alarm System update

Lead time and duration

- 12 months from contract to engine components delivery
- 30-50 days conversion work at shipyard
- 10-20 days tests, sea trial, tuning, emission measurements and vessel/engine re-certification

Engine applicability

RT-flex50DF, X52DF, X52DF-S1.0, X52DF-1.1, X62DF, X62DF-1.1, X62DF-S1.0, X72DF, X72DF-1.1, X72DF-1.2, X82DF, X82DF-1.0, X92DF

Filler Gasket for All X-DF Engines

In order to reduce methane slip from X-DF engines, and additional filler gasket reduces the amount of unburnt fuel gas in the crevice between cylinder cover and cylinder liner, which is carried away with the exhaust gases during the scavenging process.

Benefits

- Methane slip reduced by 0.2g/kWh
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems

Project scope

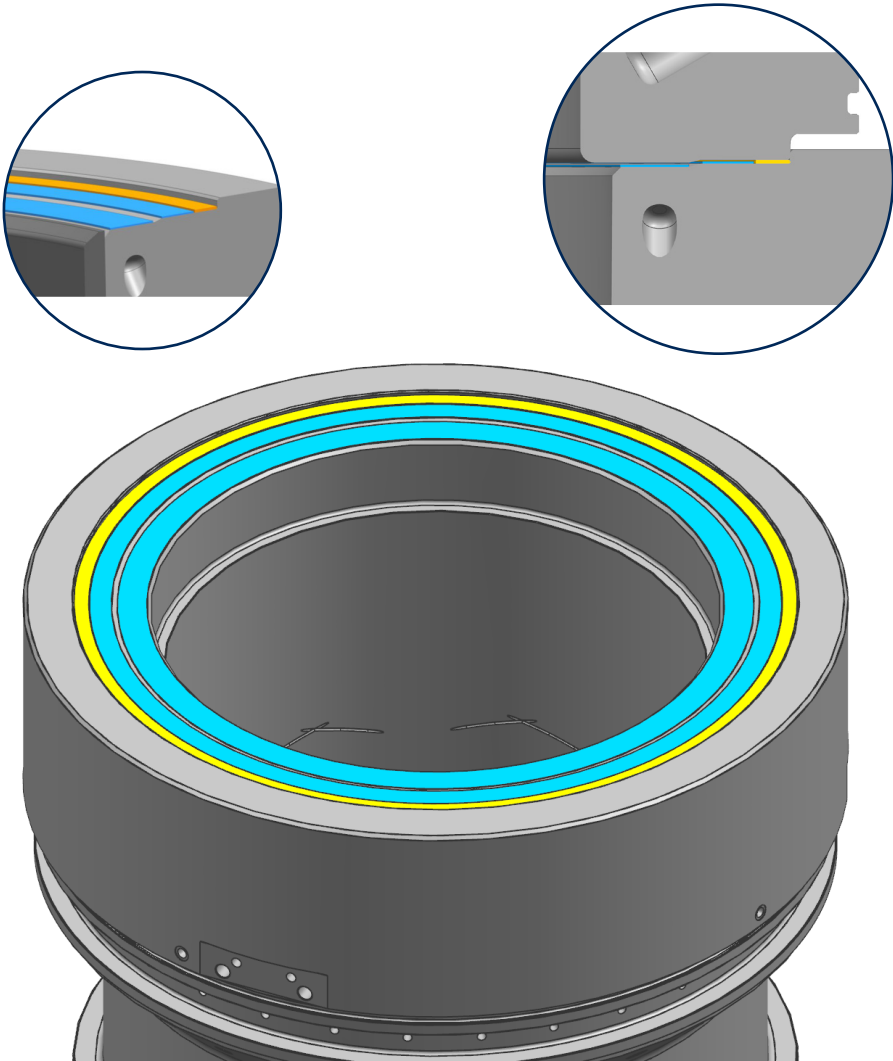
- Engine side
 - Additional filler gasket between cylinder cover and cylinder liner

Lead time and duration

- 3 months from contract to engine components delivery
- 2-4 days conversion work at shipyard

Engine applicability

RT-flex50DF, X52DF, X52DF-S1.0, X52DF-2.1, X52DF-1.1, X52DF-S2.0, X62DF, X62DF-S2.0, X62DF-1.1, X62DF-2.1, X62DF-S1.0, X72DF, X72DF-1.1, X72DF-1.2, X72DF-2.1, X82DF, X72DF-2.2, X82DF-2.0, X82DF-1.0, X92DF, X92DF-2.0



Small Gas Admission Valve for All X-DF Engines

In order to reduce methane slip from X-DF engines, a smaller gas admission valve (GAV) can be applied.

Benefits

- Methane slip reduced by 0.2g/kWh
- Reduced energy intensity and penalties under IMO Net Zero Framework, FuelEU Maritime and Emissions Trading Systems

Project scope

Engine side
Replace GAVs
Additional adapter for GAVs

Lead time and duration

- 6 months from contract to engine components delivery
- 2-4 days conversion work at shipyard

Engine applicability

All X-DF engines



Engine Upgrades



Engine Derating

WinGD engines can be rematched to a lower power output, resulting in lower specific fuel consumption by reducing the mean effective pressure while keeping firing pressure at an optimum level. The new contracted maximum continuous rating (CMCR) is either selected along the existing propeller line, or the propeller can be modified at the same time for even better overall efficiency.

Benefits

- Lower fuel and/or gas consumption
- Significantly reduce CO₂ emissions
- Better EEXI and CII

Retrofit scope

Engine side
Nozzle tip replacement
Turbocharger matching parts replacement

Higher compression shim
Torsional vibration check for shafting
Engine control system update

Lead time and duration

- 9 months from order to engine components delivery
- 5-10 days conversion work
- 3-5 days sea trial, tuning, emission measurements and engine re-certification

Engine applicability

All engines, original CMCR near R1-R3 MEP line (high MEP)

Automated Sequential Turbocharging (aSTC)

Automated Sequential Turbocharging (aSTC) is an optional feature for WinGD big bore engines (X82, X92) equipped with two or three turbochargers. It enhances engine efficiency by cutting out one turbocharger at partial loads (40-60% CMCR engine power), resulting in fuel savings of up to 5g/kWh at low and partial engine power. The turbocharger cut-out is performed automatically without stopping the engine.

Benefits

- Lower specific fuel consumption at low and partial engine power
- Lower CO₂ emissions

Retrofit scope

Engine side
Additional T/C cut off valves and pipes
Engine control system update
Torsional vibration calculation prior to upgrade
Ship side
Pneumatic air supply piping

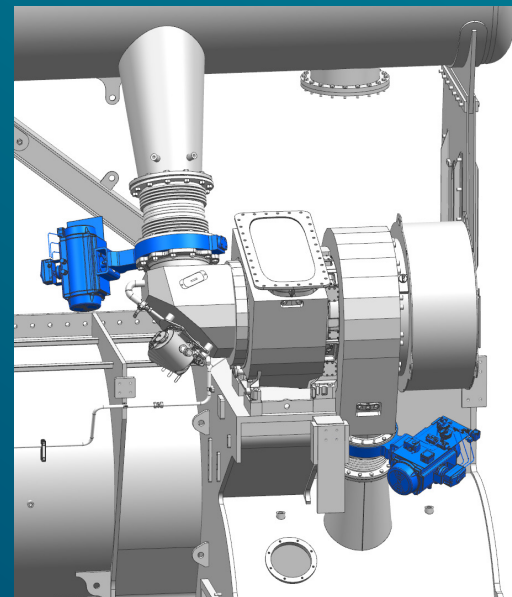
Lead time and duration

- 6 months from contract to engine components delivery
- 5-10 days conversion work
- 1-2 days function checks tuning, emission measurements (during commercial voyage) and engine re-certification

Engine applicability

RT-flex, X-, X-DF-M and X-DF-A engines with 2 or 3 turbochargers.

Note: 82 and 92 bore engines with 2 turbochargers will require a crosshead lubrication upgrade (see page 19) before adding aSTC.



WinGD Engine Rating Optimisation

WinGD engine rating optimisation is a retrofit solution that optimizes fuel consumption at low loads by replacing or retrofitting turbochargers. The optimisation works by reducing the size of the turbocharger's turbine and compressor, combined with derating the main engine and/or aSTC. The optimisation allows for more efficient fuel consumption during slow-speed or partial load conditions.

Benefits

- Lower specific fuel consumption at low and partial engine power
- Lower CO₂ emission

Project scope

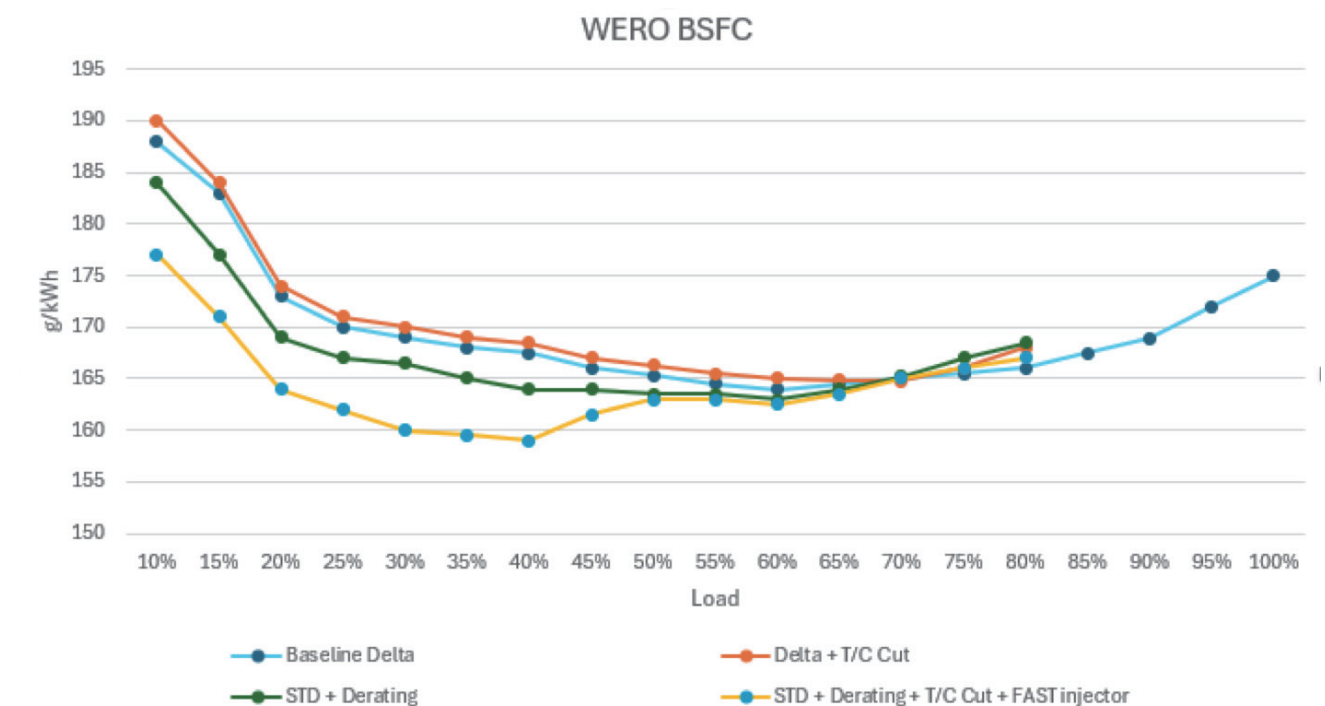
Engine side
Turbocharger parts replacement
Software update
Torsional Vibration Calculation recheck

Lead time and duration

- 6 months from contract to engine components delivery
- 5-10 days conversion work
- 1-2 days function checks tuning, emission measurements (during commercial voyage) and engine re-certification

Engine applicability

RT-flex, X and X-B engines



Crosshead Lubrication Upgrade

WinGD offers a high-pressure lubrication upgrade for crosshead bearing and crank pin bearings in order to improve bearing performance for X82 and X92 engines that are operated at low engine power for extended periods of time.

Benefits

- Improved performance of crosshead bearings and crank pin bearings
- Pre-requisite for aSTC upgrade and future fuel retrofit on X82 and X92 engines

Project scope

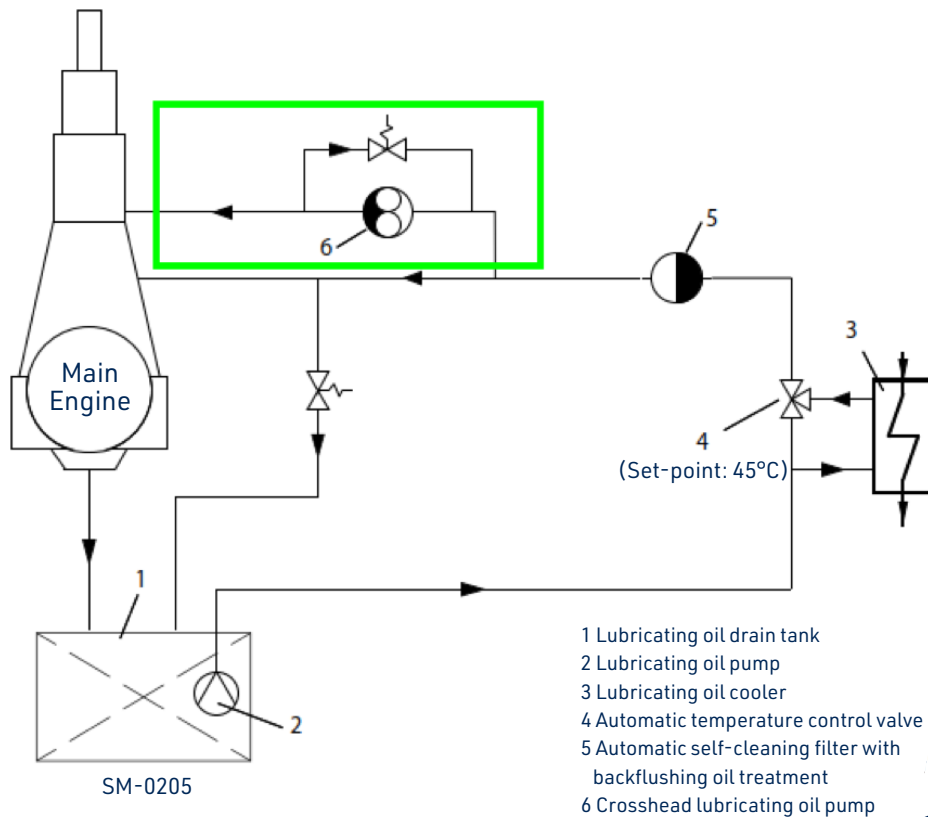
Engine side
Crosshead bearing shells of latest design
Additional piping and monitoring sensors
Ship side
Additional crosshead lubrication pumps and piping
Safety system and alarms system update

Lead time and duration

- 9 months from order to engine components delivery
- 10-20 days conversion work
- 1-2 days function checks during commercial voyage

Engine applicability

X82 and X92



Cylinder Lubricating Oil Pump Upgrade FlexLub Mk-1 to Mk-ε

The new-generation cylinder oil pump Mk-ε is a comprehensive upgrade from the Mk-1. It has now been fully installed in newly manufactured engines, while the Mk-1 type cylinder oil pumps have been phased out for new builds. Going forward, sourcing spare parts for Mk-1 type pumps may become challenging. Therefore, it is recommended that all main engines currently equipped with flexLub Mk-1 be upgraded to Mk-ε.

Benefits

- More affordable spare parts pricing
- More stable pumping volume
- Easier installation and disassembly
- Lower servo oil consumption
- Improve venting operations

Project scope

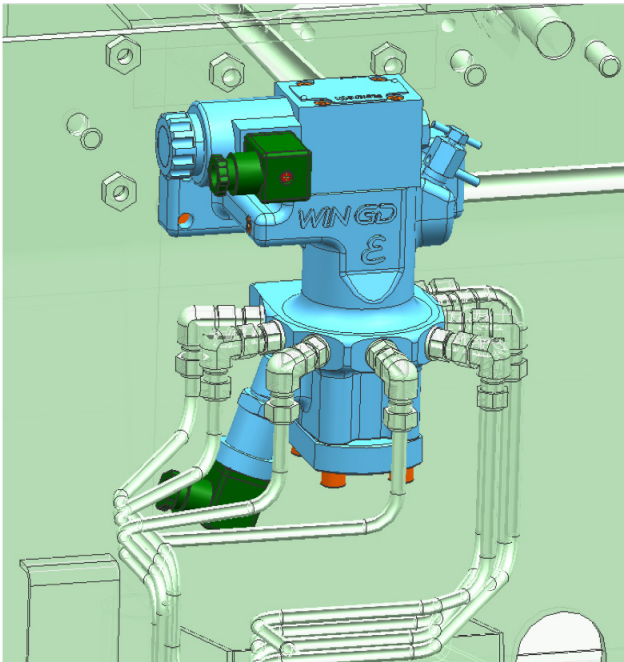
Engine side
Replacement of Mk-1 pumps to Mk-ε
Cylinder lubricating oil piping modifications

Lead time and duration

- 6 months from contract to engine components delivery
- 5-10 days conversion work

Engine applicability

X35-B, X40-B, RT-flex50DF, X52, X52DF, X62, X62-B, X62DF, X72, X72DF, X92



Engine Control and Tuning

Constant Torque Mode

With Constant Torque Mode (CTM) for WinGD's UNIC and WiCE engine control systems, the consistency of fuel injection quantity is enhanced and the power absorption of the propeller naturally matches the engine power, with only small changes in engine and ship speed.

Benefits

- Optimised fuel consumption and resultant emissions

Project scope

ECS software update

Lead time and duration

- 3 months from order
- 2-4 days conversion work at repair- or shipyard

Engine applicability

All WinGD engines with a UNIC or WiCE engine control system

Advanced Diesel Tuning

Advances in WinGD technology have shown that optimizing the fuel injection system of older engine types can significantly enhance fuel efficiency and reduce emissions. The Advanced Diesel Tuning aims at achieving this goal by an increase firing pressure while lowering the fuel rail pressure and optimizing injection parameters. It can be applied to RT-flex or X-engines equipped with ICU and with sufficient firing pressure margin compared to the maximum design limits. An increase in firing pressure by 10bar can for example reduce fuel consumption by about 2g/kWh.

Benefits

- Lower fuel and/or gas consumption
- Significantly reduce CO₂ emissions
- Better EEXI and CII

Project scope

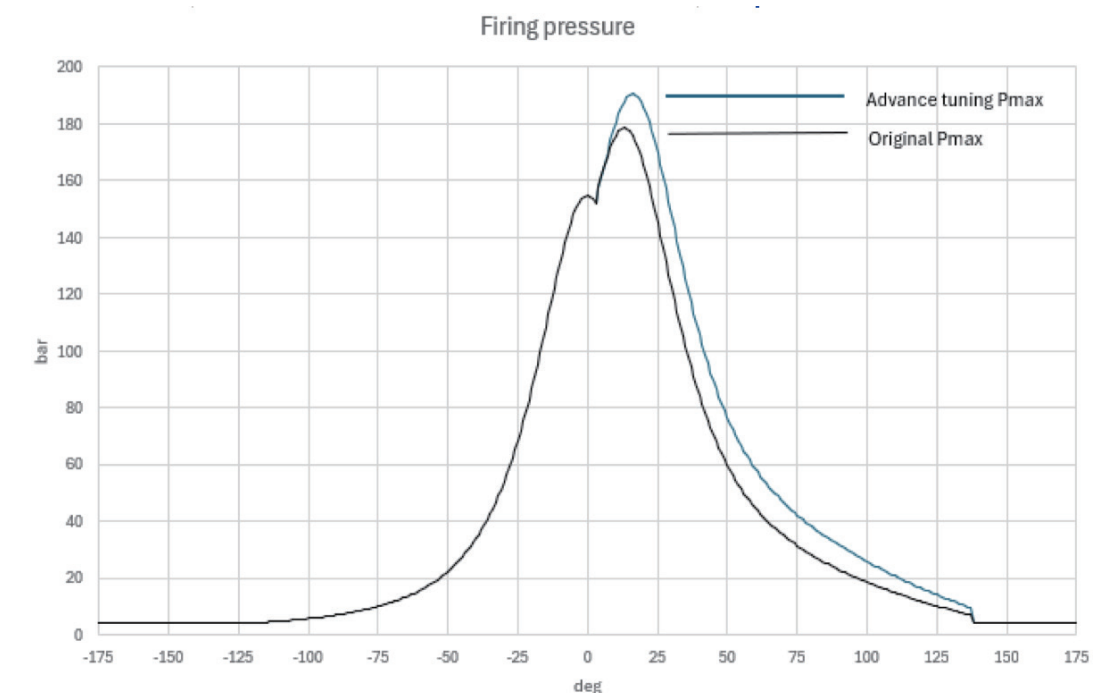
Engine side
Injector nozzle tip replacement
Injection related parameter adjustment in ECS
Torsional Vibration Calculation recheck

Lead time and duration

- 6 months from order to engine components delivery
- 3-5 days conversion work onboard
- 5 days tuning, emission measurements (during commercial voyage) and engine re-certification

Engine applicability

RT-flex48T-D, RT-flex50, RT-flex50-B, RT-flex50-D, RT-flex58T-D, RT-flex58T-E, RT-flex60C-B, RT-flex68-B, RT-flex-68-D, RT-flex82T, RT-flex82C, X82, X82-B, RT-flex84T-D, X92, X92-B, X92-1.1, RT-flex96C-B



Intelligent Combustion Control (ICC)

Intelligent Combustion Control (ICC) can be integrated into the Engine Control System (ECS) to monitor and automatically adjust the combustion process depending on ambient conditions. Its primary purpose is to ensure safe and reliable engine operation while optimizing performance.

Ambient conditions change continuously due to regional weather, climate and day/night temperature changes ICC adjusts injection- and exhaust valve timing to compensate for different conditions, including:

- Suction air inlet temperature
- Scavenge air temperature
- Barometric pressure

Benefits

- Optimised combustion and piston running behaviour in different ambient conditions
- Lower fuel consumption
- Reduced wear on engine components

Project scope

Engine side
Additional cylinder pressure sensors
Additional ambient pressure sensors

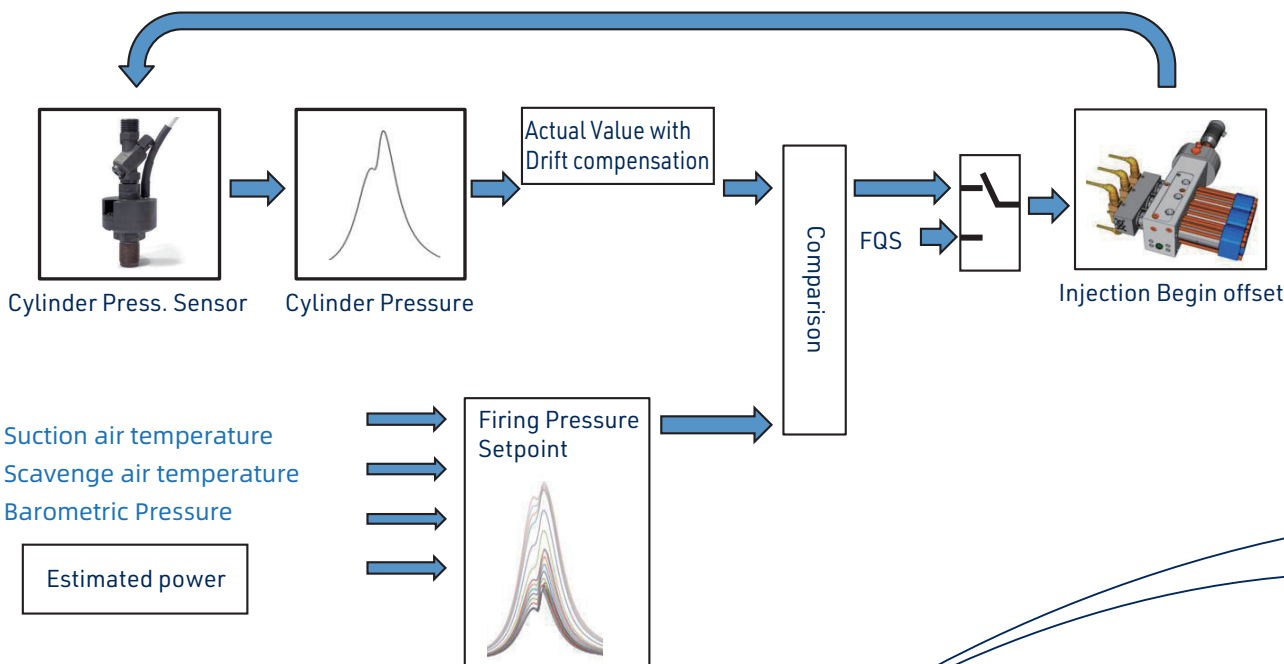
Additional T/C inlet air temperature sensors
Additional scavenging air temperature sensors
Engine control system update

Lead time and duration

- 4 months from order to engine components delivery
- 2-3 days conversion work onboard
- 2-3 days function test (during commercial voyage)

Engine applicability

RT-flex, X- engines



Engine Power Limitation (EPL)

Engine power limitation (EPL) is a permanent power limitation measure that reduces the maximum power output of a ship's engine, ensuring compliance with IMO's Energy Efficiency Index for Existing Vessels (EEXI). This limitation is typically achieved through electronic means to ensure that the engine does not exceed the specified power threshold during operation.

Benefits

- Improved EEXI score and CII rating

Project scope

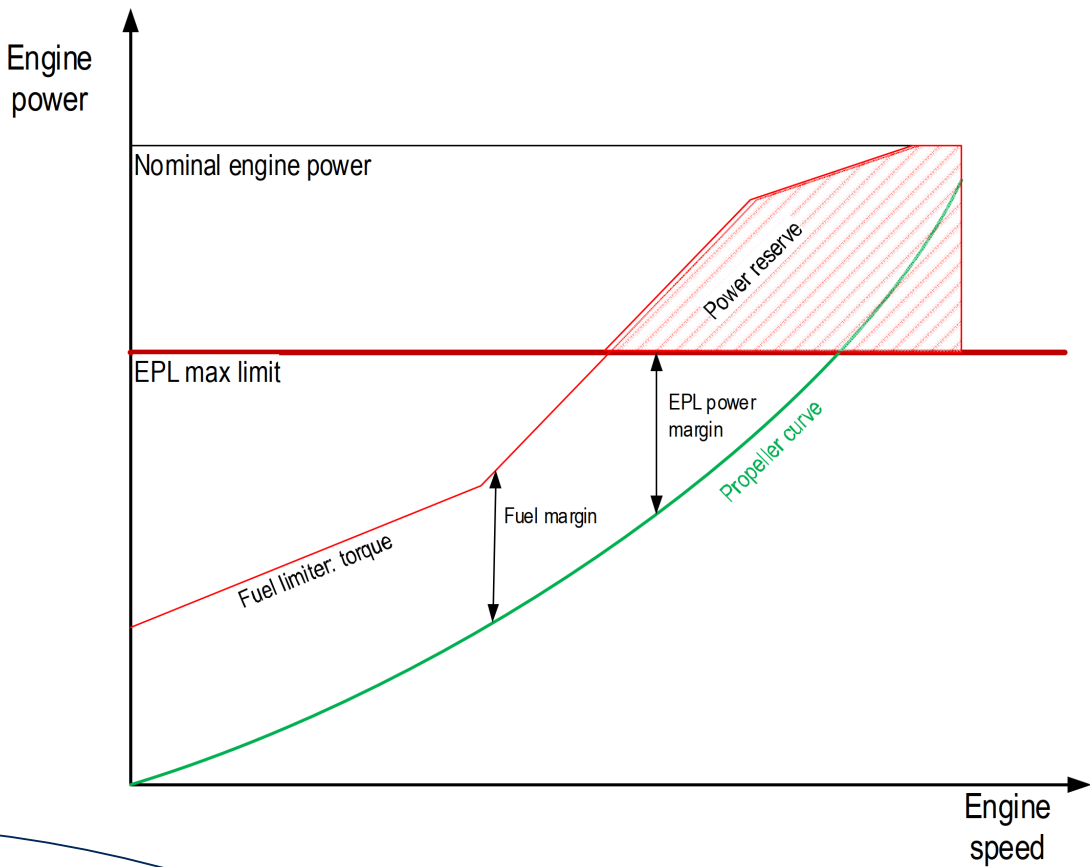
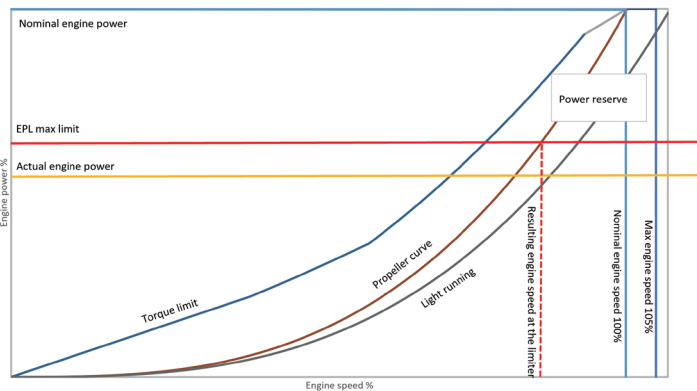
Engine side
Engine control system update

Lead time and duration

- 3 months from order to engine components delivery
- 1-2 days conversion work

Engine applicability

All RT-flex, X-, X-DF, X-DF-M and X-DF-A engines



UNIC Engine Control System Software Update

The latest UNIC Engine Control System (ECS) software update, specifically version 2.3.6, is a significant advancement for WinGD engines. The update enhances engine control by incorporating several new features to improve operational efficiency and ensure compliance with regulatory requirements (see service letter SL-0057 for full details).

UNIC SW 2.3.6 represents the most advanced UNIC development with no further significant upgrades planned, as WinGD's focus shifts to the WiCE ECS applied on all new engine types.

Benefits

Recent updates included in UNIC SW 2.3.6 for all engines with UNIC ECS (X- and X-DF) include:

- Heavy Sea Mode (HSM) auto-deactivation with changing engine speed setpoint
- A soft button reboot of the whole UNIC system from either Local Display Unit (LDU) or Engine Control Room (ECR)
- Pulse Width Modulated (PWM) driver system reset for main fuel injectors
- Minor Alarm for staying in the Barred Speed Range (BSR) too long
- Engine Power Limitation (EPL) to comply with IMO EEXI regulation of MEPC
- Improved dynamic load detection for automatic cylinder lubrication feed rate adjustment
- Enhanced wire break monitoring for PWM channels
- Statement of expected cylinder lubrication oil consumption

Additional new features for dual fuel engines only include:

- Improvement in exhaust ventilation
- Gas trip for high compression pressure (pre-ignition detection feature)
- Manual exhaust venting activation button on Local Display Unit (LDU) and Remote Control System (RCS) is disabled in gas mode
- Reset of estimated power correction in case of shaft power meter failure (to avoid false corrections of power estimation)
- Enhanced dither frequency of pilot fuel Flow Control Valve (FCV) to reduce pressure fluctuations

Project scope

Engine side
UNIC software update
Ship side
AMS software update to display new signals

Lead time and duration

- 1 month from order to engine components delivery
- 1 day UNIC update

Engine applicability

X35, X35-B, X40, X40-B, RT-flex50DF, X52, X52DF, X62, X62-B, X62DF, X72, X72DF

WiCE Engine Control System Upgrade

In 2019, WinGD introduced the next generation engine control system, WiCE, which is today's standard and offers numerous advantages over UNIC in terms of functionality and cyber security. Updating UNIC-controlled engines to WiCE ECS is a pre-requisite for the latest WinGD technologies, including engine conversion to X-DF, X-DF-M and X-DF-A, and for installing iCER and VCR upgrades on X-DF engines.

Benefits

- Better spare parts availability (control modules)
- Higher level of Cyber Security (SP1)
- Enhanced functionality

Project scope

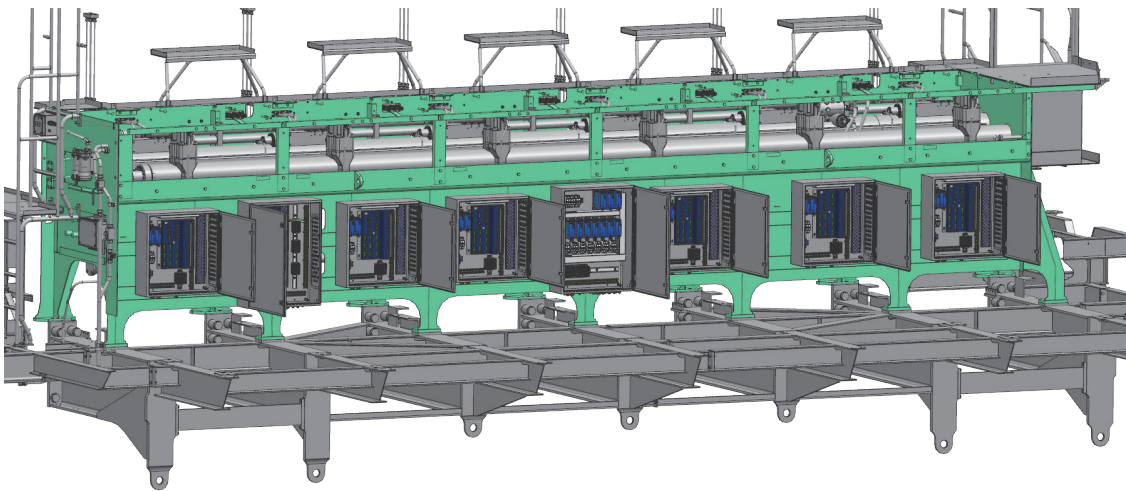
Engine side
Rail unit modification for E-Box installation
Replacement of control modules on the engine and re-wiring
Ship side
Update of remote control, safety and alarms systems

Lead time and duration

- 9 months from order to engine components delivery
- 10-15 days conversion work
- 1-2 days function checks, tuning, emission measurements (during commercial voyage) and engine re-certification

Engine applicability

X35, X35-B, X40, X40-B, RT-flex50DF, X52, X52DF, X62, X62-B, X62DF, X72, X72DF



Digital Engine Optimisation

Wide Data Collection Monitor Installation

WinGD Integrated Digital Expert (WiDE) is WinGD's state-of-the-art engine performance and remote diagnostics platform, delivering optimisation, advisory and troubleshooting to deliver improved efficiency, emissions and lifecycle costs for operators and crews.

WiDE is based on a data collection monitoring (DCM) unit for collecting and visualising the engine and ship data, as well as engine diagnostic system (EDS) software. It analyses the data and creates value and insight. These capabilities are integrated into a user-friendly, on-board system comprising state-of-the-art hardware, expert-developed software and efficient data analytics techniques.

Benefits

- Real time component diagnostics
- Full access to all engine data
- Real time engine performance monitoring and benchmarking
- Advanced troubleshooting
- Dynamic maintenance planning

Project scope

Engine side

Additional fast signal module (FSM) and wiring

Ship side

Additional DCM unit, DCM power supply, DCM PC located in engine control room

Additional DCM bridge module located in bridge

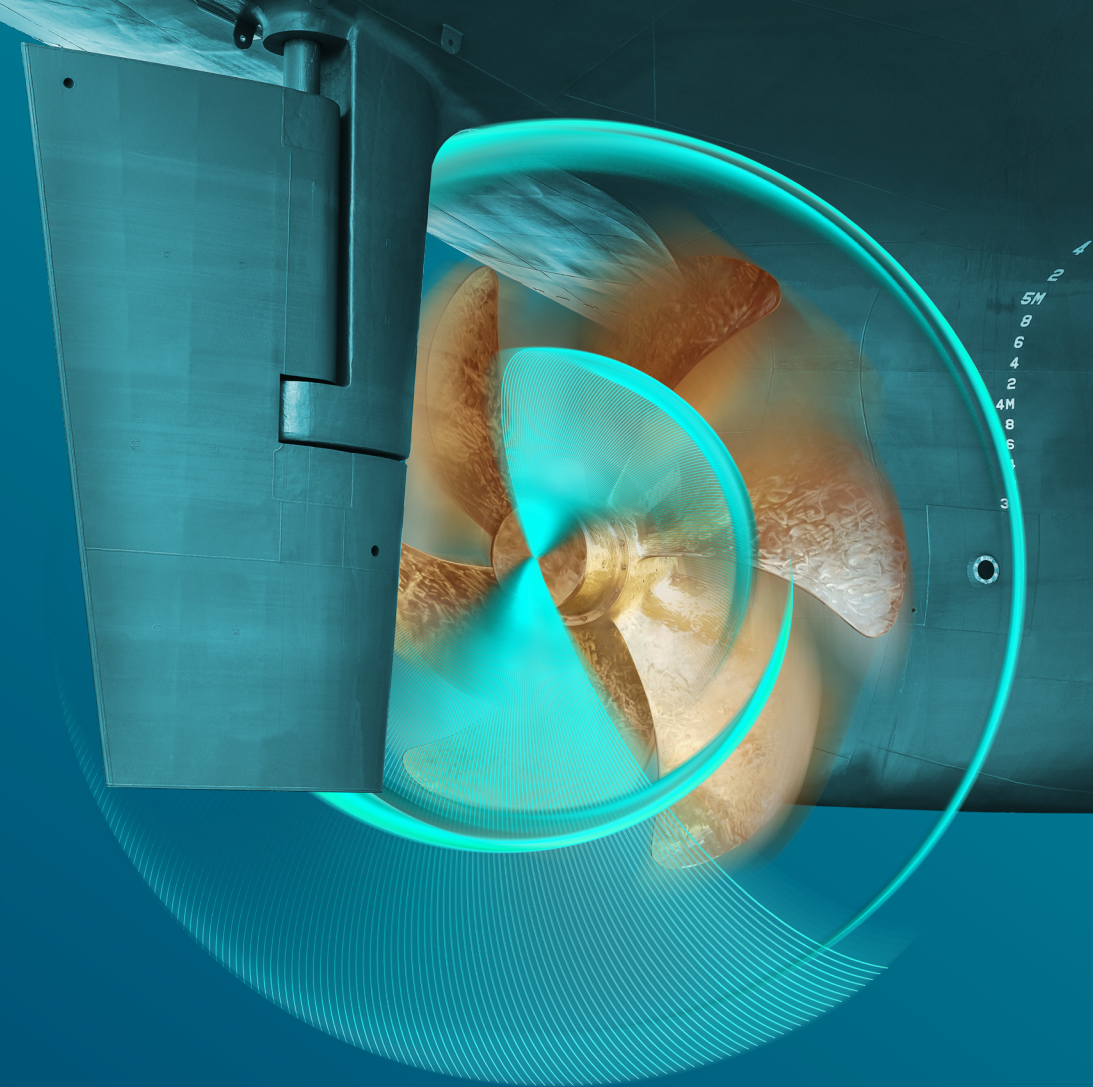
Additional signal from vessel side to DCM

Lead time and duration

- 6 months from order to engine components delivery
- 10-20 days installation

Engine applicability

All WinGD engines



Hybrid Power and Energy Management

WinGD delivers hybrid power configuration and integration services that put the most efficient engine onboard at the heart of the vessel's electrical network. X-EL Energy Management supports shipowners in identifying and scoping the ideal combination of hybrid power solutions to make the optimal use of main engine margin, with benefits ranging from reduced maintenance to significantly reduced lifecycle and carbon costs.

X-EL Energy Management System retrofits boost operational flexibility, reduce fuel consumption and minimise emissions with installation of shaft generators, battery packs, DC bus components and WinGD's advanced energy management system—alongside other hybrid solutions including wind-assisted propulsion systems.

There are several different hybrid solutions that will be candidates for your vessels depending on your exact ship specifications, business goals and operating profile.

To learn more about which solutions can help you to reduce total lifecycle costs on your in-service vessel, visit wingd.com/products-solutions/energy-management

Global Service by WinGD

WinGD's Retrofit and Upgrade solutions are supported by Global Service by WinGD, putting the Swiss engineering excellence and unparalleled knowledge of our experts at your disposal for effective maintenance, rapid support and original parts – when and wherever you need them.

Our combination of tailored 24X7 lifecycle engine support and comprehensive upgrade solutions makes WinGD an ideal partner for keeping engines performing at their best. Because when it comes to finding a lifecycle partner to safeguard your profitable ship operations, trust is everything.

- Dependable service for continuous operations
- Fast, responsive and reliable global support 24X7
- Exclusive expertise from the engine designer
- Forward-thinking partnerships for sustained success

WinGD Field Services: Fast, responsive field service by expert engineers for maintenance, troubleshooting and customised solutions – maximising uptime and ensuring safe, efficient and compliant operation worldwide.

WinGD technical services: Expert services including scheduled maintenance and performance, emissions and compliance optimisation – safeguarding engine reliability, minimising total overall costs and extending operational life.

With Global Service by WinGD, users of WinGD engines now have choice for their service needs, alongside authorised service provider Wärtsilä Services and the engine builder service organisations.



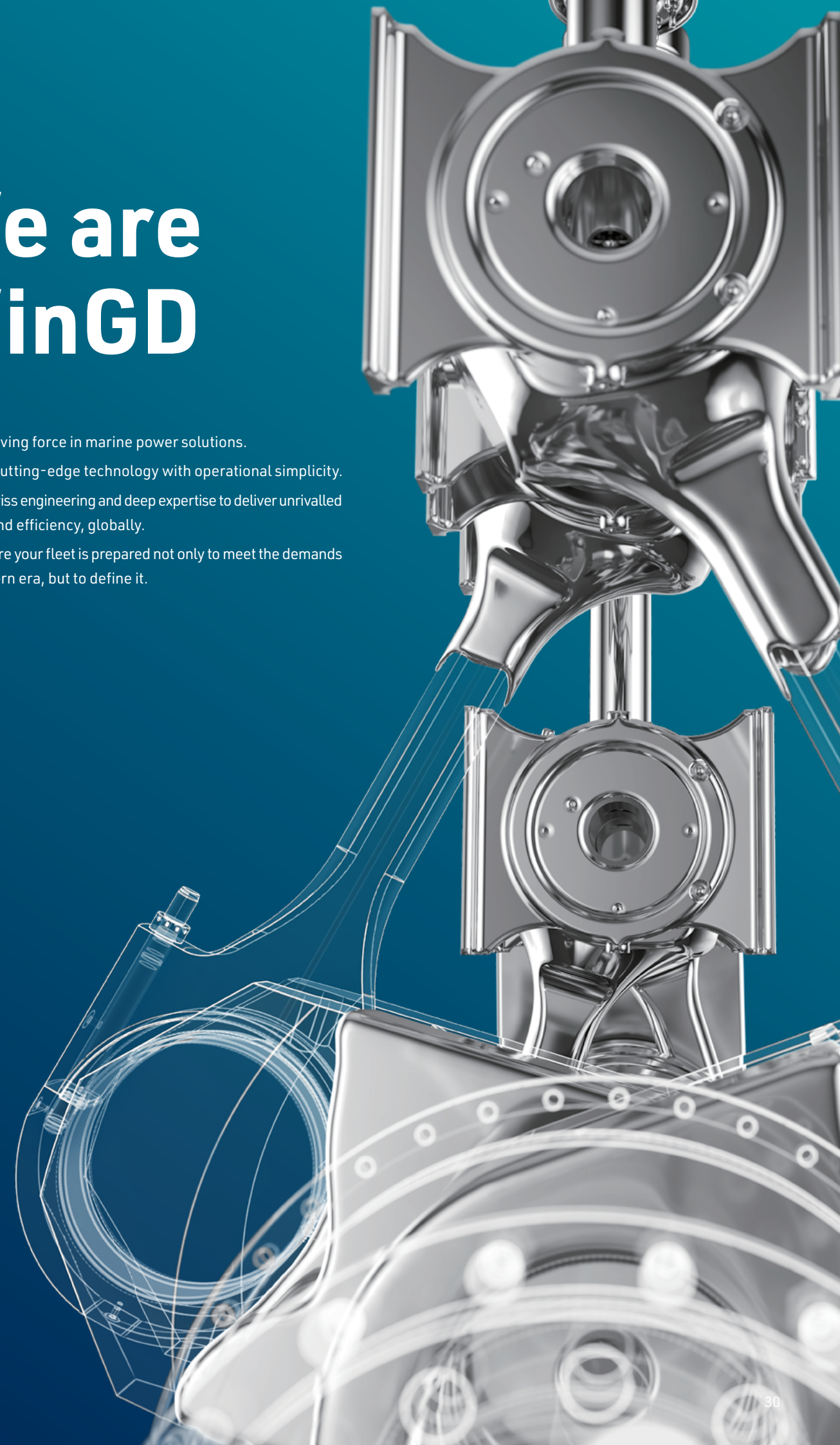
We are WinGD

We are a driving force in marine power solutions.

We merge cutting-edge technology with operational simplicity.

We apply Swiss engineering and deep expertise to deliver unrivalled reliability and efficiency, globally.

We make sure your fleet is prepared not only to meet the demands of the modern era, but to define it.



Committed to the decarbonisation of marine transportation through our ensemble of sustainable energy systems

WinGD designs marine power ecosystems utilising the most advanced technology in emissions reduction, fuel efficiency, digitalisation, service and support. With our two-stroke low-speed engines at the heart of the power equation, WinGD sets the industry standard for reliability, safety, efficiency and environmental design.

Headquartered in Winterthur, Switzerland, since our inception as the Sulzer Diesel engine business in 1893, we are powering the transformation to a sustainable future.

WinGD is a CSSC Group company.