WinGD Engine Training

Design of WinGD 2-Stroke Technology

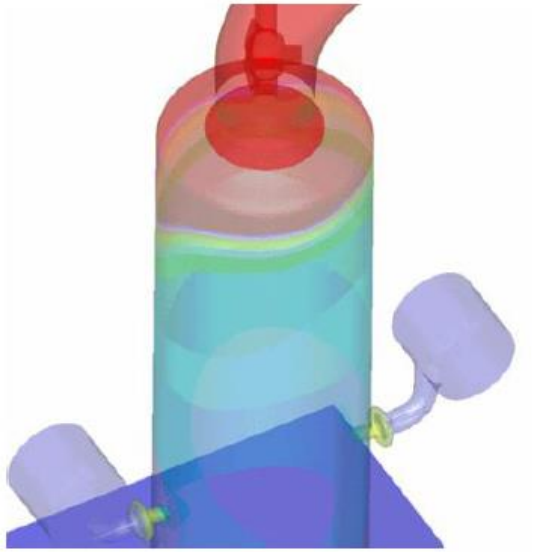
WIN GD
Simply a better different

History

- History of
  - RTA
    - RTA introduced in 1982
    - Over **2’800** RTA engines sold with more than **51 GW**
  - RT-flex
    - First RT-flex workshop in 1996
    - Start of first RT-flex engine in 2001 (6RT-flex58T-B **/ GYPSUM CENTENNIAL**)
    - Over **1’250** RT-flex engines sold with total more than **32 GW**
  - X
    - Start of first 6X35 engine in 2012
    - Start of first 6X72 engine in 2013
    - Over **650** X Diesel engines sold with app. **20GW** (2023)
  - X-DF
    - Start of first RT-flex50DF engine in 2013
    - Already **600** X-DF engines sold with app. **11GW** (2023)

History

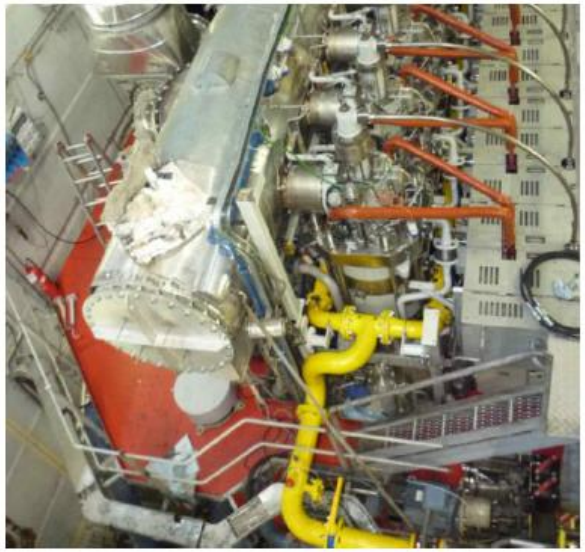
2S DF Development step



2011

Concept development:

- *Simulations and CFD*
- *Basic design*
- *Rig- and 1-cylinder testing*



2013

Engine testing RT-Flex 50DF

- *Concept and reliability verification*
- *Full scale (6-cyl) testing*
- *Performance optimization*

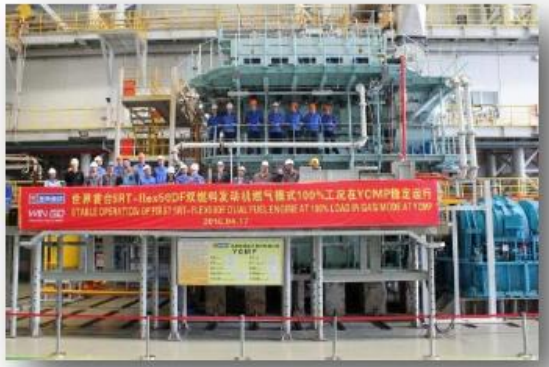
2015

Tech-demonstrator 6X72-DF

- *Verify technology on large bore*
- *Engine testing and further development*

History

2S DF Development step



2015

Factory Acceptance and Type Approval testing of first RT-flex50DF engines

2016

Sea trials of first RT-flex50DF engines:

- *Small scale LNGC*
- *Product carriers*

2017

Sea trials of first W-X62/72DF engines:

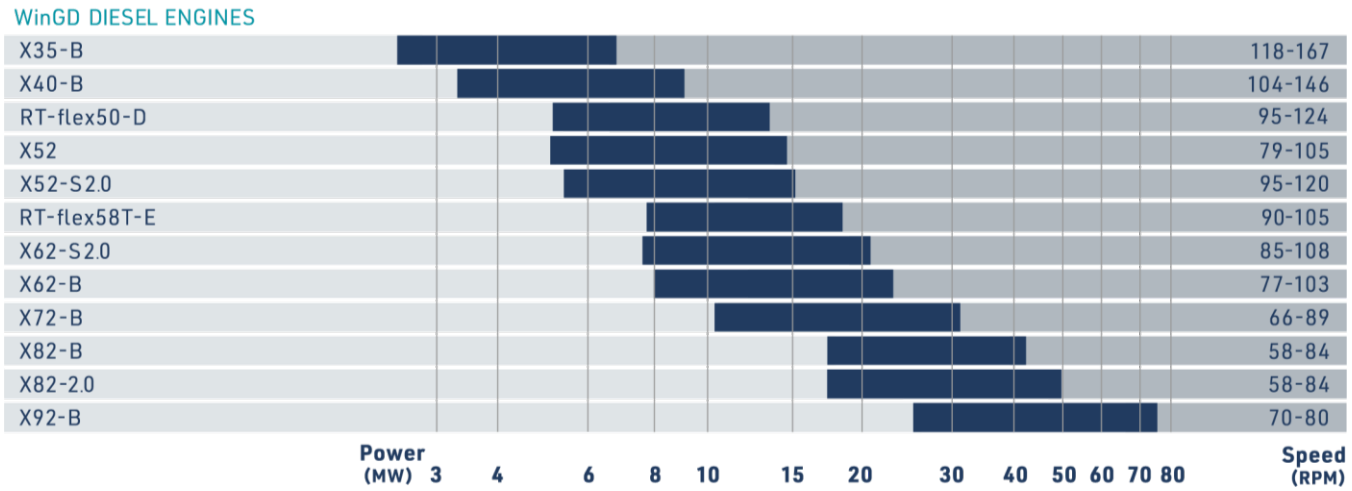
- *LNGC's*

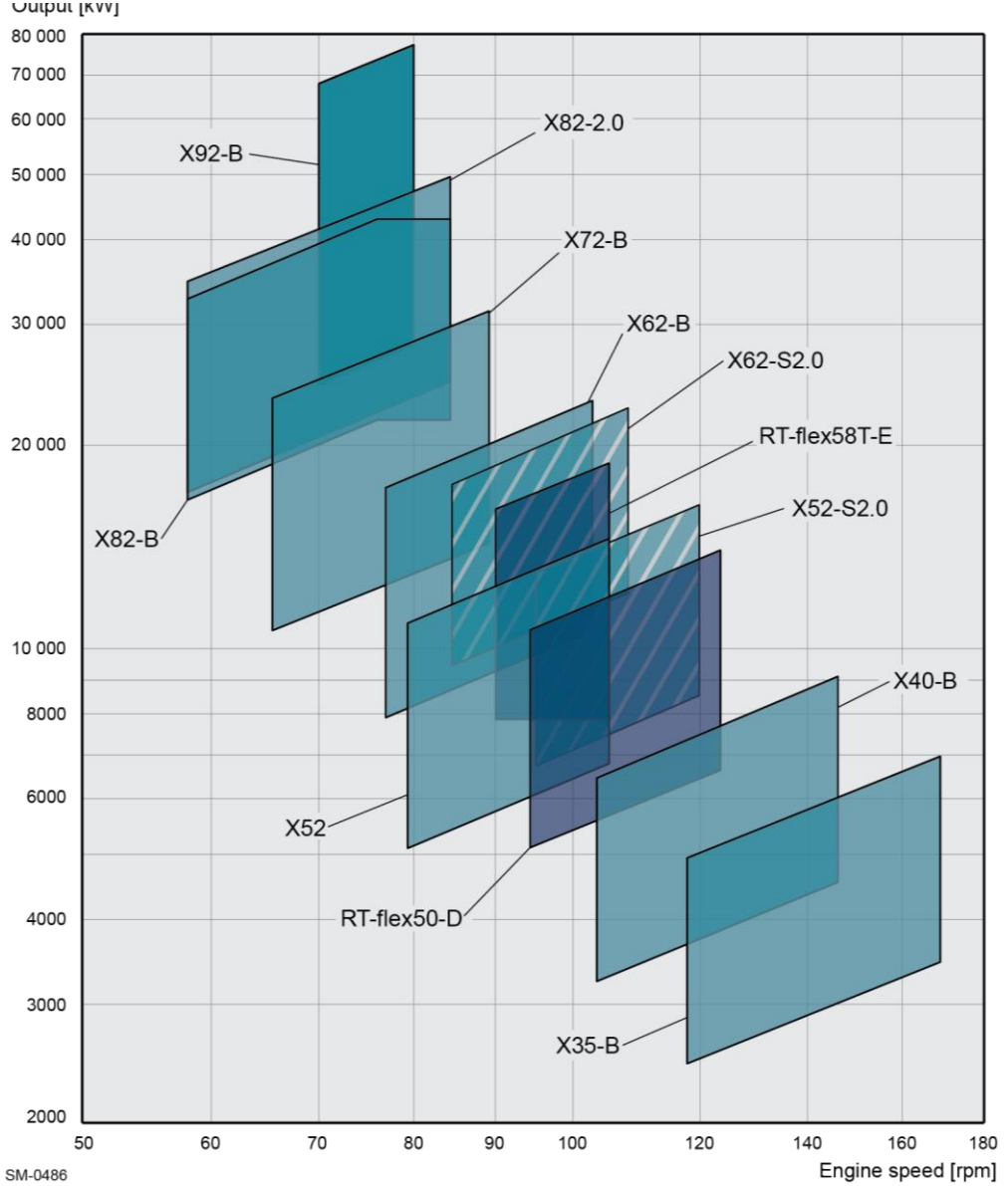
Latest History

2S DF Development step

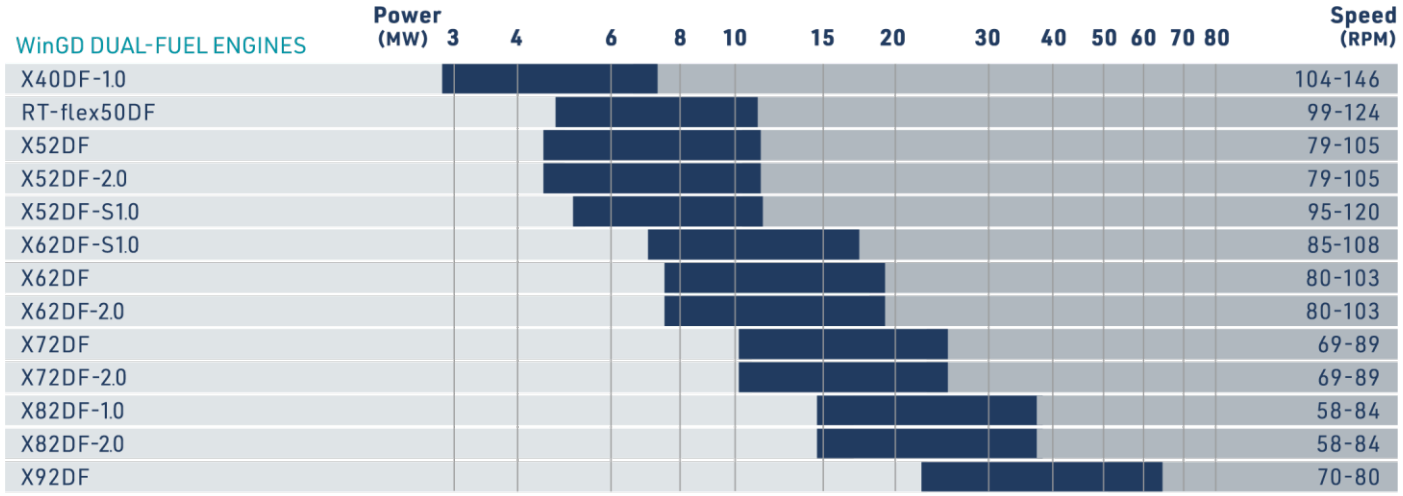
- 2020
- TAT of the first X92DF
- Seatrial of the first X92DF
- 22.Sept 2020 Delivery of:

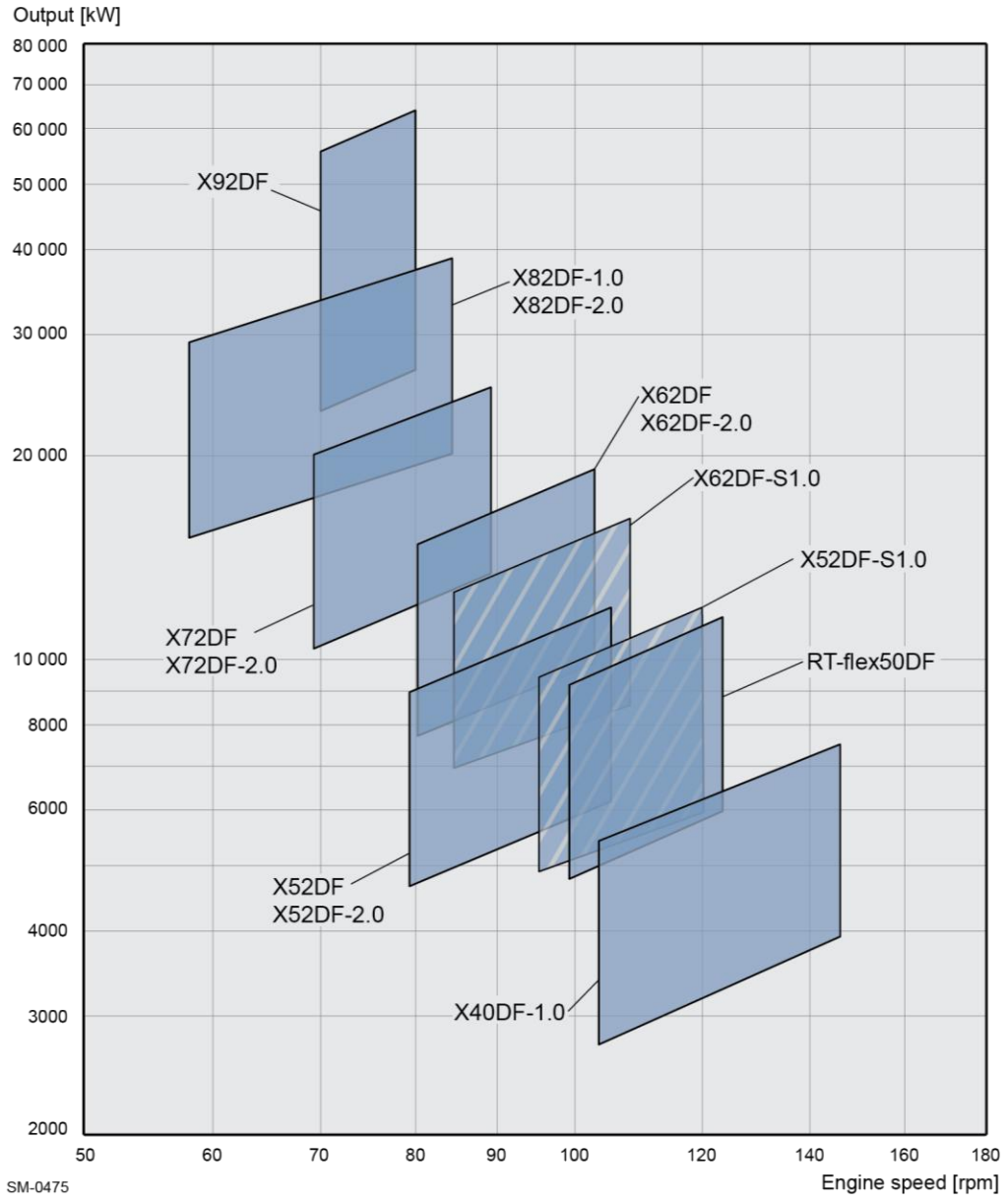
Engine Rating Fields



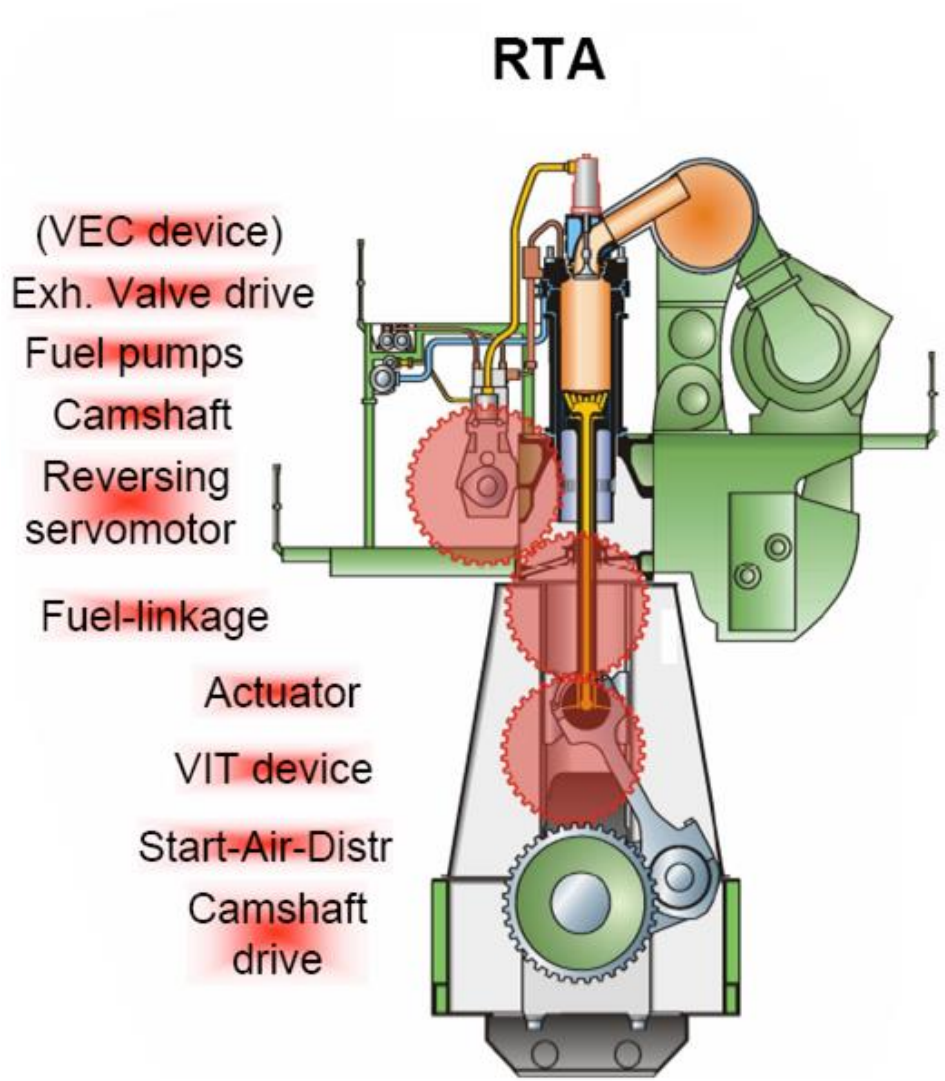


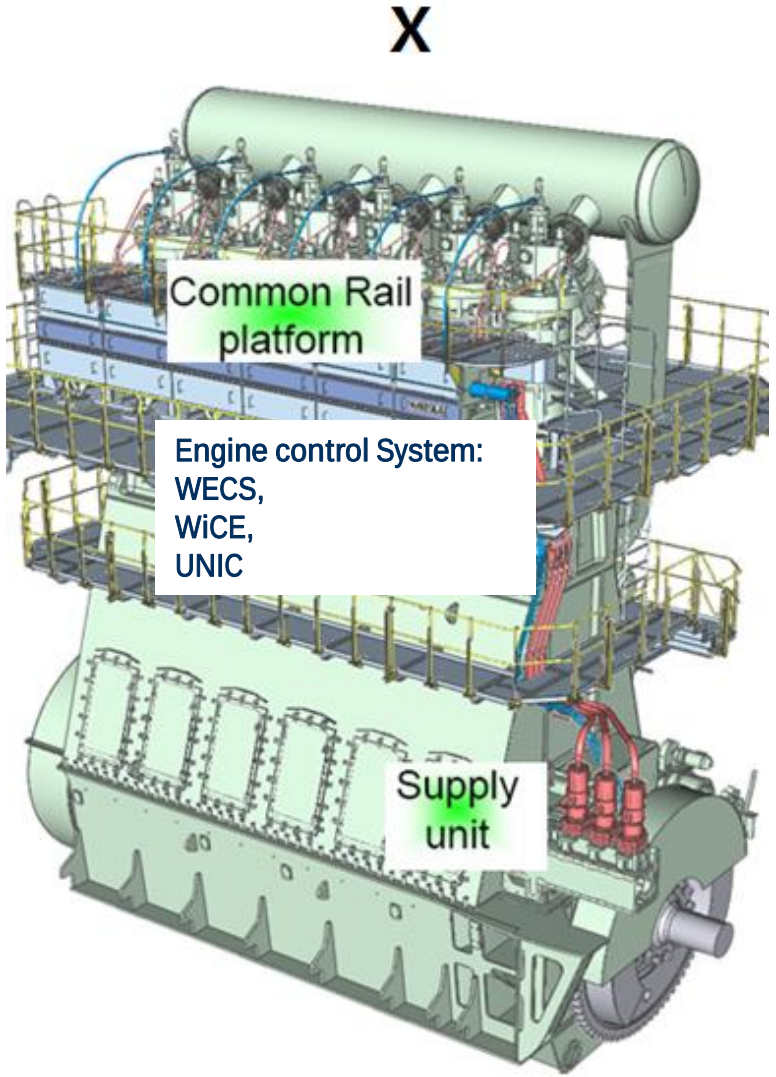
DF Engine Rating Fields





Differences RTA to X engines





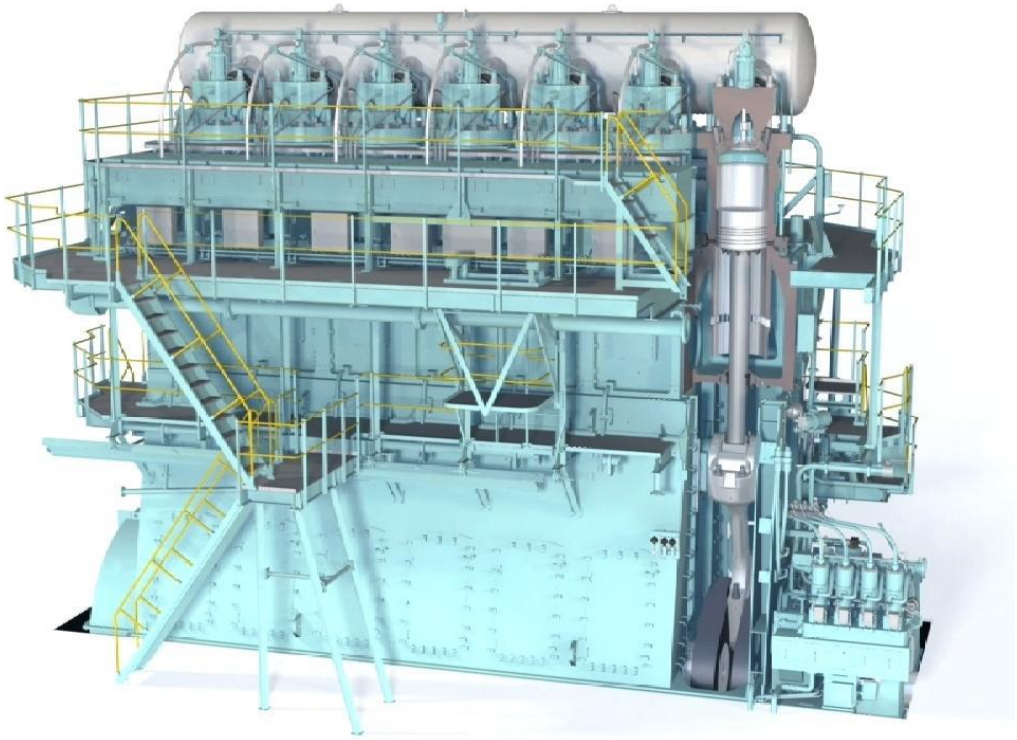
Comparison Table

	Diesel	Dual Fuel
Engine Control System	WiCE, WECS, UNIC	WiCE, UNIC
Developing fuel oil pressure	Fuel pumps on supply unit	Fuel pumps on supply unit
“Storing” of fuel oil pressure	Fuel rail	Fuel rail
Control of injection (Diesel)	WiCE -> ICU or Fuel Injector WECS -> ICU UNIC -> Fuel Injector	WiCE -> ICU and/or Fuel Injector UNIC -> Fuel Injector
Fuel pump actuator	Controlling Fuel rack position	Controlling Fuel rack position
Developing pilot fuel pressure	N/A	Pilot fuel pump
Control of pilot fuel injection	N/A	Pilot fuel injector
Gas pressure regulation	N/A	iGPR (GVU)
Gas release	N/A	GAV
Cylinder lub.	Flex-Lube	Flex-Lube / iCAT
Developing pressure for exhaust valve activation	Servo pumps on supply unit	Servo pumps on supply unit
“Storing” of servo oil pressure	Servo oil rail	Servo oil rail

Comparison Table

	Diesel	Dual Fuel
Timing of exhaust valve activation	VCU	VCU
Electronic governor for speed controlling	WiCE -> MCU #1 WECS -> PCS UNIC -> MCM	WiCE -> MCU #1 UNIC -> MCM
Control of starting air	Start Pilot Valve	Start Pilot Valve
Reversing	WiCE/WECS/UNIC	WiCE/UNIC
Alarm and monitoring system	External	External
Manual/Local control	Two MCP/LDU deliver speed setting or fuel commands to WiCE /WECS/UNIC, independent from the RCS	Two MCP/LDU deliver speed setting or fuel commands to WiCE /UNIC, independent from the RCS
Load signal	ECS supplies a calculated feedback to the RCS	ECS supplies a calculated feedback to the RCS
VIT, VEC, VEO, FQS	Functions included in ECS	Functions included in ECS
Communication from engine to external	Bus (Can or Mod)	Bus & Ethernet

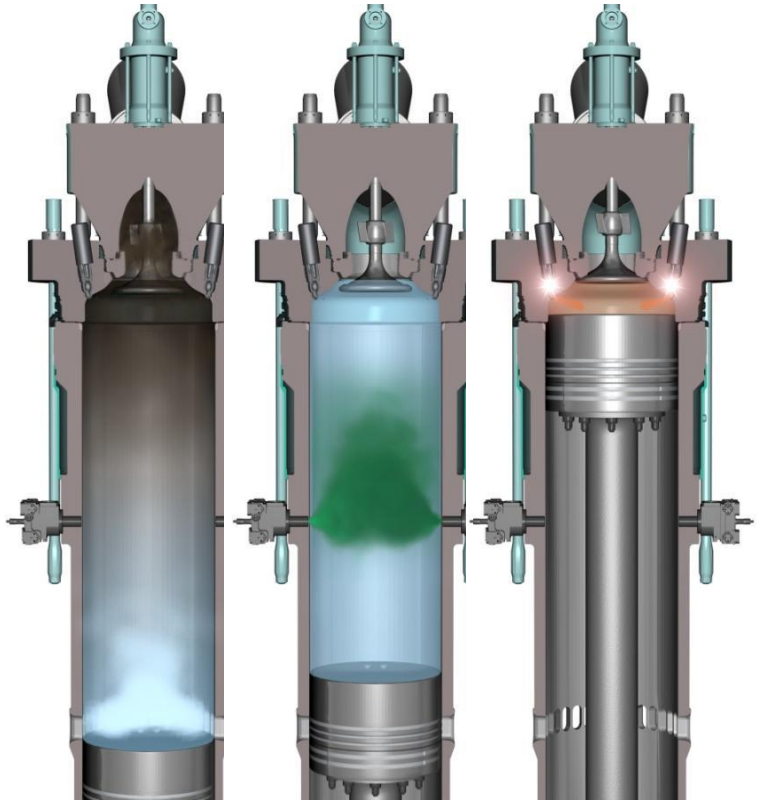
2S Low pressure DF concept



The Principle

- Engine operating according to Otto process
- Pre-mixed ‘Lean burn’ technology
- Low pressure gas admission at ‘mid stroke’
- Ignition by pilot fuel in pre-chamber

2S Low pressure DF concept



‘Pre-mixed lean-burn’ combustion

The main merits

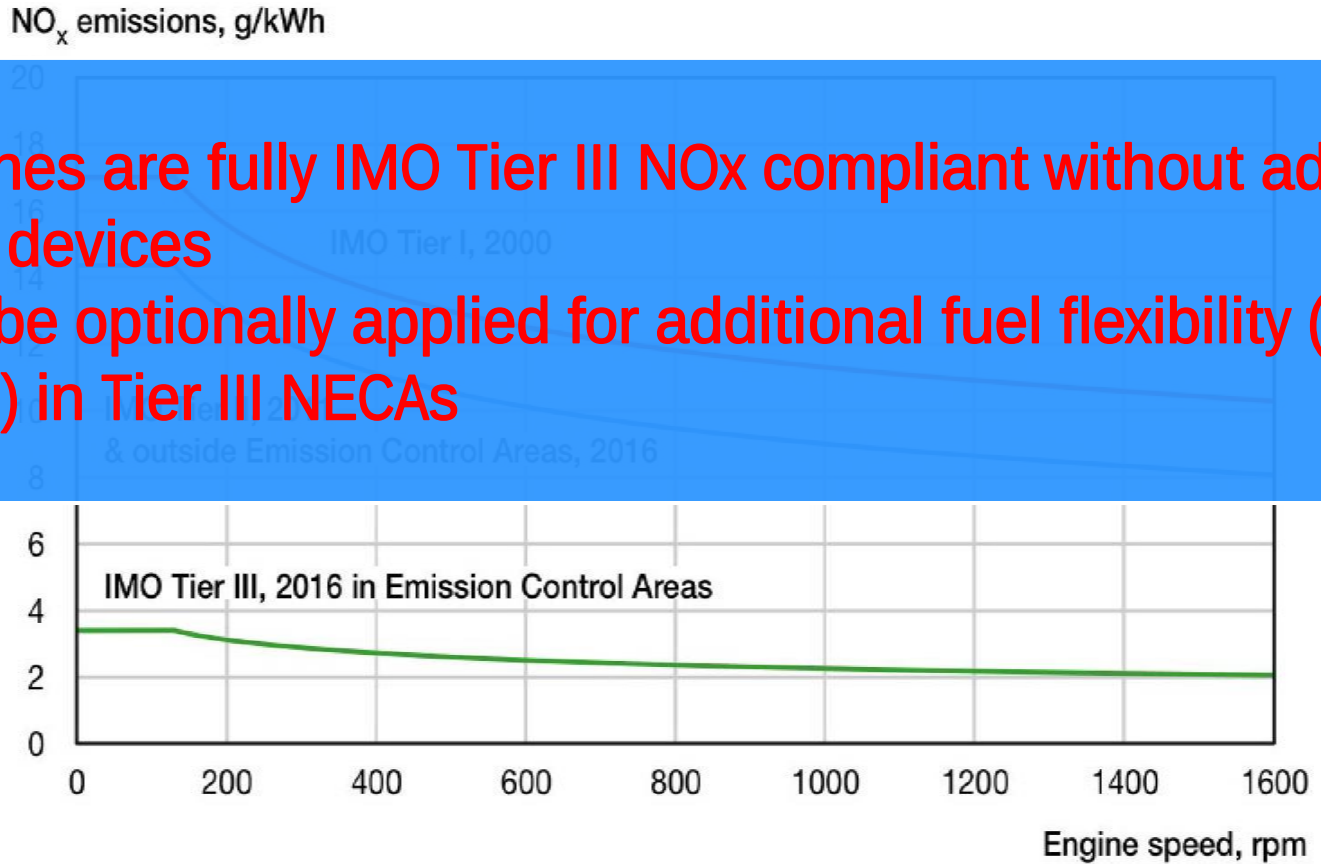
Low gas pressure < 13 bar (92→16 bar)

- Simple and reliable gas supply system
- Simple gas sealing
- Wide selection of proven compressors/pumps (piston or centrifugal)

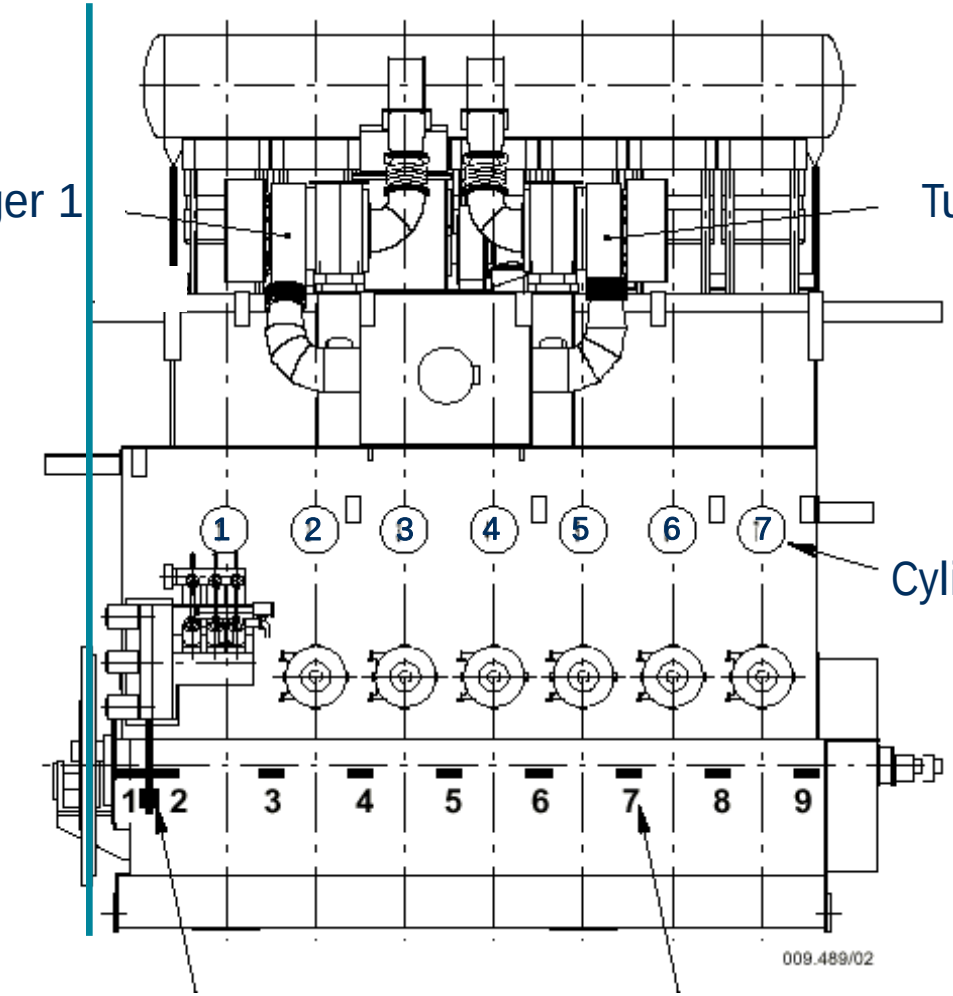
Lean Burn ‘Otto’ combustion means, IMO Tier III compliance without any additional equipment.

IMO NO_x Limits

X-DF engines are fully IMO Tier III NOx compliant without additional NOx reduction devices
SCR may be optionally applied for additional fuel flexibility (operation on liquid fuel) in Tier III NECAs



Engine Numbering and Designations



Engine Numbering and Designations