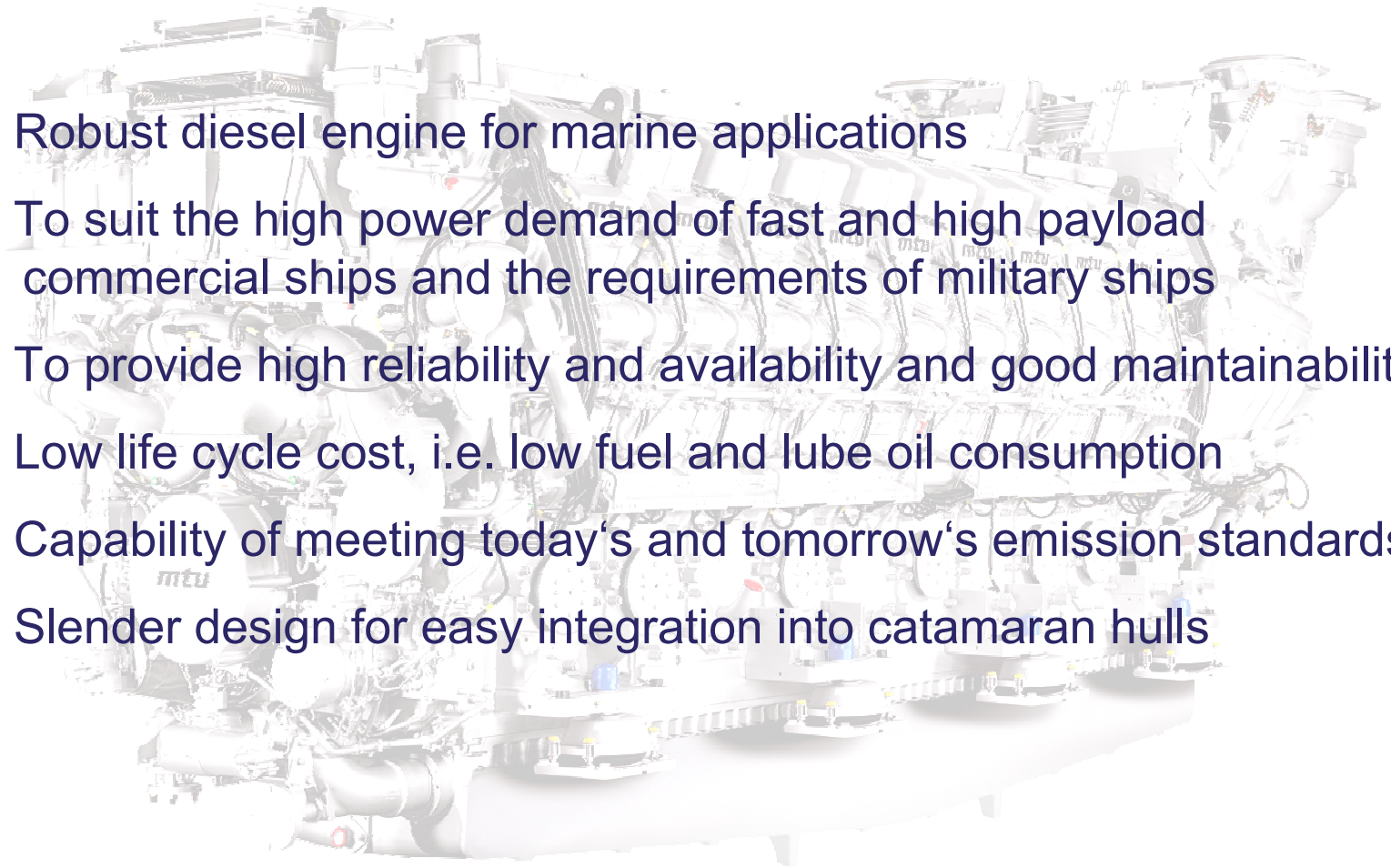
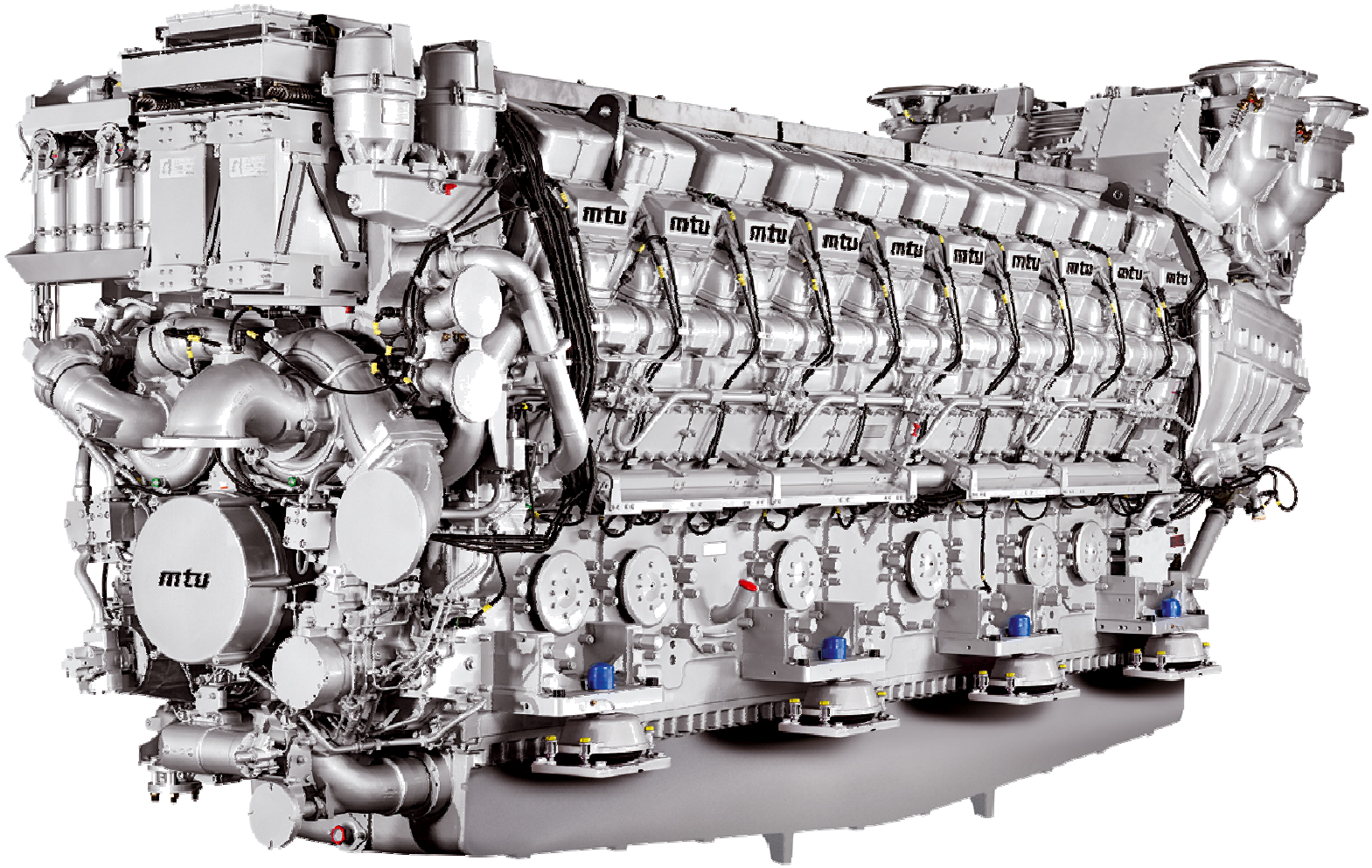

MTU
Series 8000

Series 8000
Main Development Targets

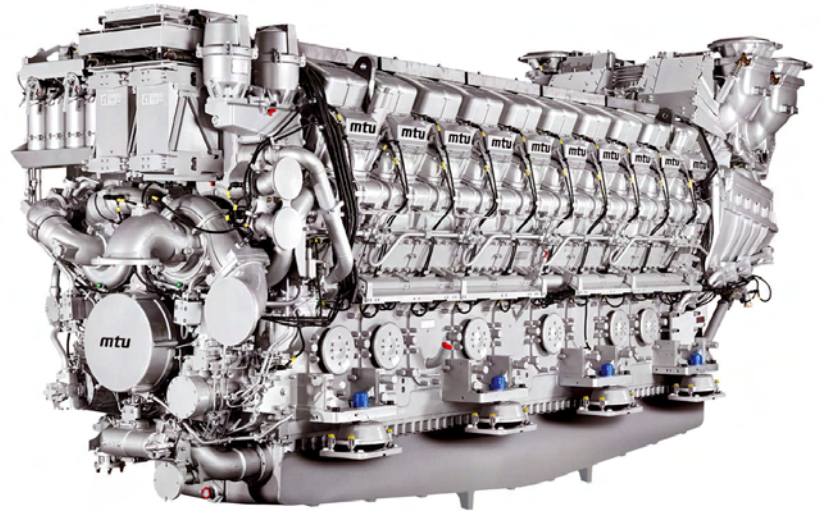


- Robust diesel engine for marine applications
- To suit the high power demand of fast and high payload commercial ships and the requirements of military ships
- To provide high reliability and availability and good maintainability
- Low life cycle cost, i.e. low fuel and lube oil consumption
- Capability of meeting today‘s and tomorrow‘s emission standards
- Slender design for easy integration into catamaran hulls

Series 8000
20V 8000



Series 8000
Main Features

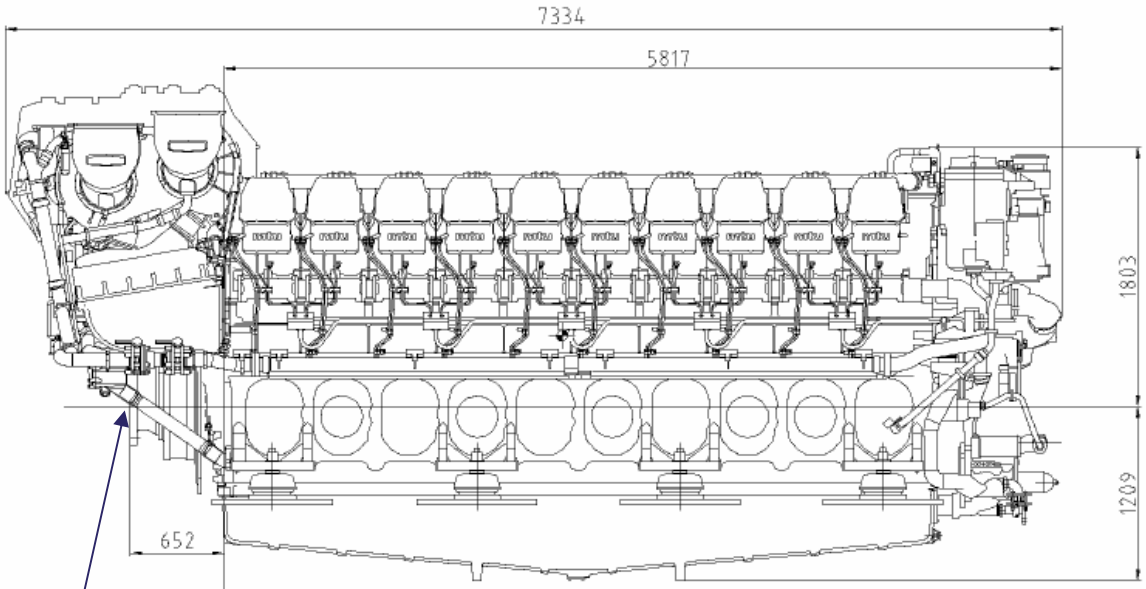


- Bore / Stroke 265 mm / 315 mm
- Bank-Configuration 48° V
- Swept volume 17.37 liter / cyl.
- Power range up to 9 100 kW
- Speed range 380 - 1,150 rpm

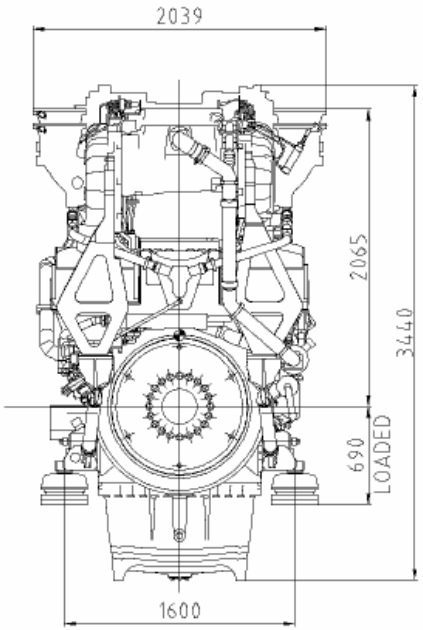
- The engine is capable of running without operational restrictions at 9100 kW
- At 45°C intake air and 32°C sea water, full power is available considering ISO standard tolerances.

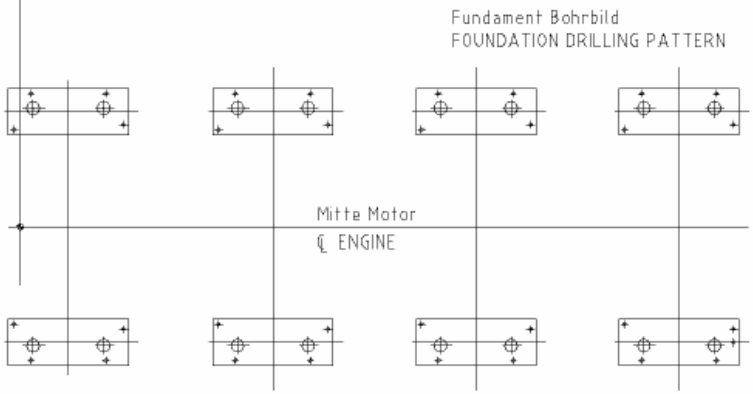
- Power unit concept
- Common Rail fuel injection system
- Sequential turbo charging
- Split Circuit Cooling System
- Electronic engine management

Series 8000
Main Dimensions



Main PTO end

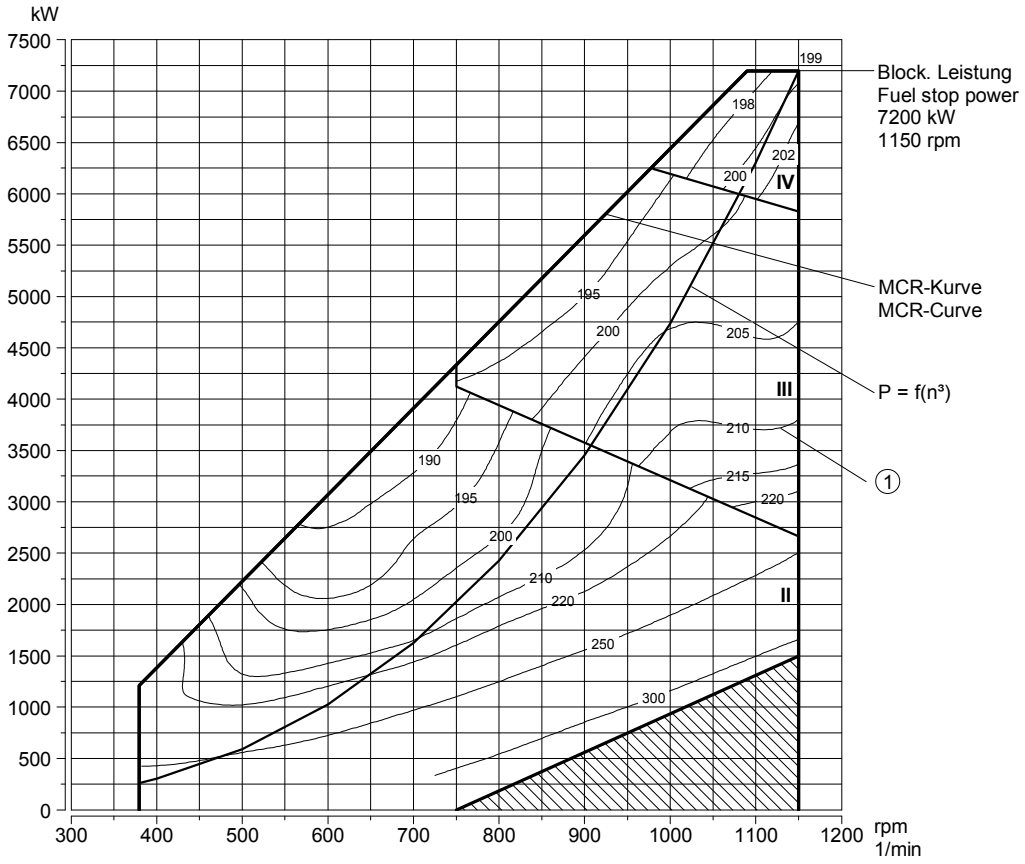




All dimensions in mm
Dry weight 20V 8000: 47.2 t

Series 8000
Performance Map & Fuel Consumption

20V 8000 M71R @ 7200 kW
with sequential turbocharging



1 B — **Application group**
Fast commercial vessels

Reference conditions

25	°C	Intake air temperature
25	°C	Raw water temperature
1000	mbar	Barometic pressure
25	mbar	Intake depression
30	mbar	Exhaust back pressure
25	°C	Fuel temperature at fuel feed

① **Specific fuel consumption**
Fuel consumption (g/kWh), tolerance +5% per DIN/ISO 3046, Diesel fuel to DIN EN 590 or DMA to ISO 8217 with a min. L.H.V. of 42800 kJ/kg (18390 BTU/lb).

All pumps necessary for engine operation included.

Definitions
Ratings are net brake power per DIN/ISO 3046
II, III, IV — Status, sequential turbocharging
MCR-Curve: Maximum continuous rating
Continuous operation (limited duration)

TBO 32000 h — **Estimated time between overhauls**

a)	b)
100	3
85	82
<15	15

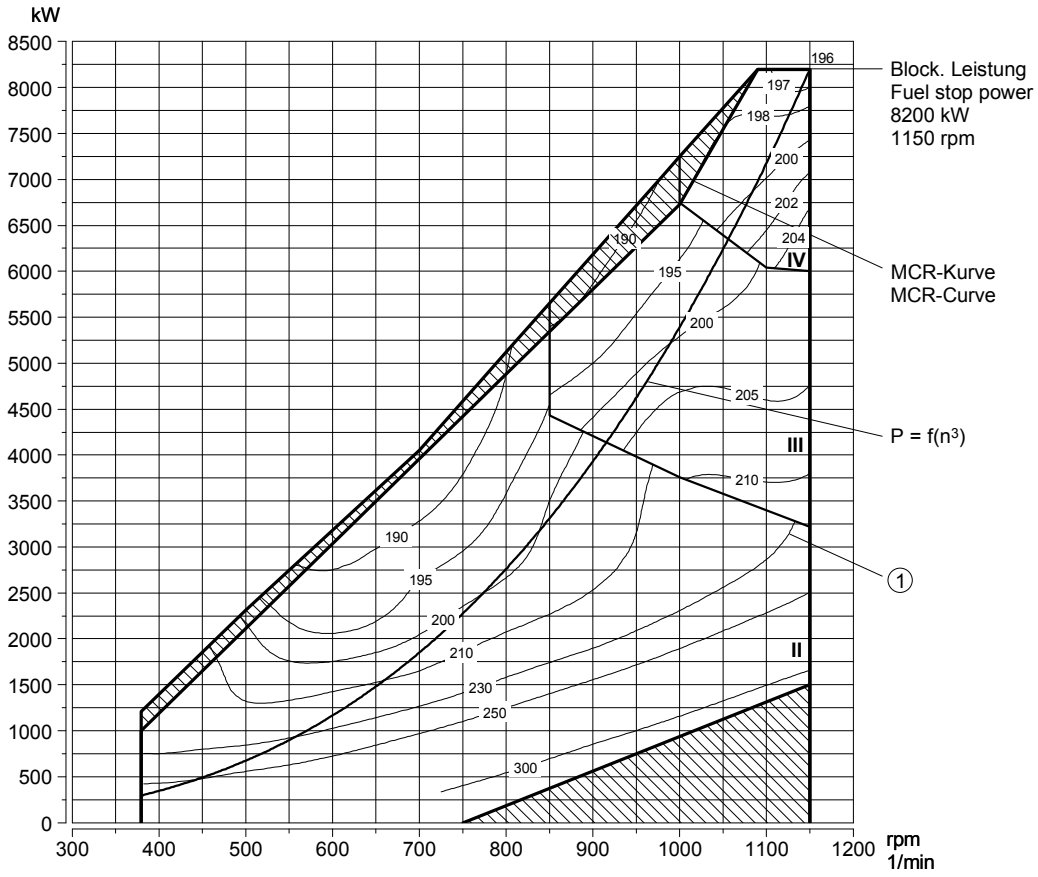
Associated standard load profile
a) Load related to fuel stop power (%)
b) Operating time share (%)

Engine settings and design configuration:
Optimized for exhaust emission (IMO NO_x -2000 specification), per ISO 8178-4

* At 45°C Intake air temperature and 32°C Sea water temperature:
No **Power reduction, Increase of fuel consumption: 2,0%**

Series 8000
Performance Map & Fuel Consumption

20V 8000 M71 @ 8200 kW
with sequential turbocharging



1 B	**Application group** Fast commercial vessels
	Reference conditions
25 °C	Intake air temperature
25 °C	Raw water temperature
1000 mbar	Barometic pressure
25 mbar	Intake depression
30 mbar	Exhaust back pressure
25 °C	Fuel temperature at fuel feed
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	Continuous operation (limited duration)
II, III, IV	Status, sequential turbocharging

TBO 24000 h	
a)	b)
100	3
85	82
<15	15

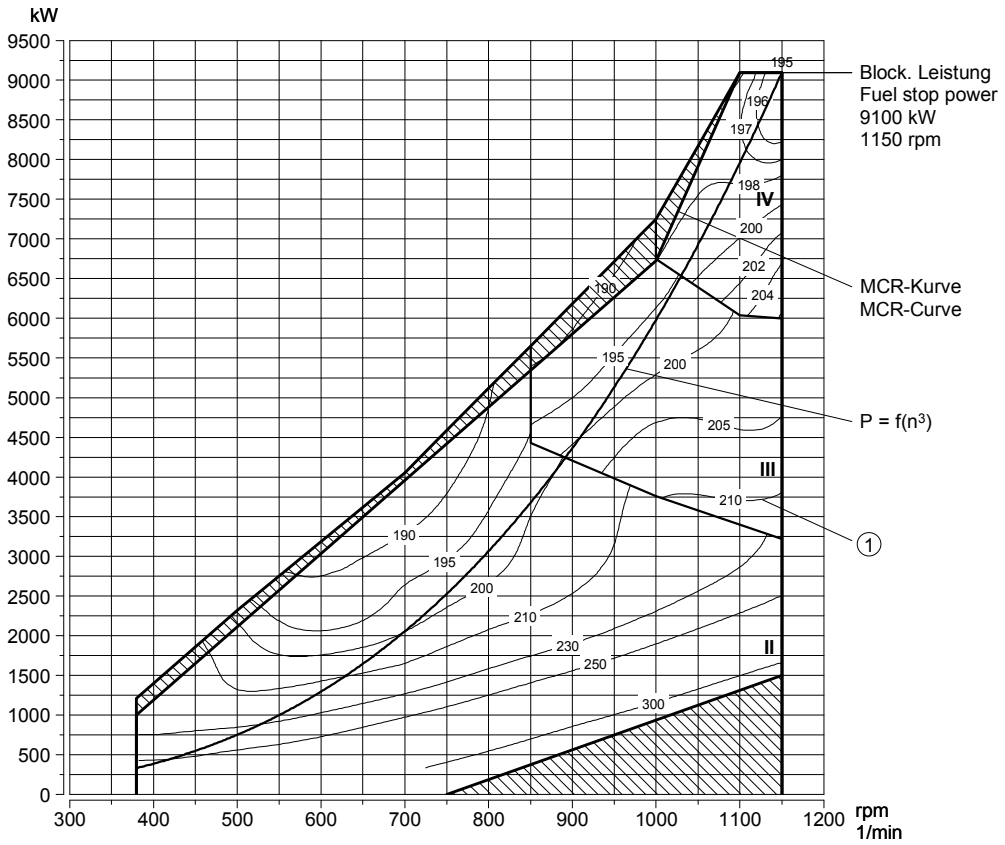
Estimated time between overhauls
Associated standard load profile
a) Load related to fuel stop power (%)
b) Operating time share (%)

Engine settings and design configuration:
Optimized for exhaust emission
(IMO NO_x-2000 specification),
per ISO 8178-4

* At 45°C Intake air temperature and 32°C Sea water temperature:
No **Power reduction, Increase of fuel consumption: 2,0%**

Series 8000
Performance Map & Fuel Consumption

20V 8000 M71L @ 9100 kW
with sequential turbocharging



1B	**Application group** Fast commercial vessels
	Reference conditions
25 °C	Intake air temperature
25 °C	Raw water temperature
1000 mbar	Barometic pressure
25 mbar	Intake depression
30 mbar	Exhaust back pressure
25 °C	Fuel temperature at fuel feed
①	**Specific fuel consumption** Fuel consumption (g/kWh), tolerance +5% per DIN/ISO 3046, Diesel fuel to DIN EN 590 or DMA to ISO 8217 with a min. L.H.V. of 42800 kJ/kg (18390 BTU/lb).
	All pumps necessary for engine operation included.
	Definitions Ratings are net brake power per DIN/ISO 3046 MCR-Curve: Maximum continuous rating
II, III, IV	Continuous operation (limited duration) Status, sequential turbocharging

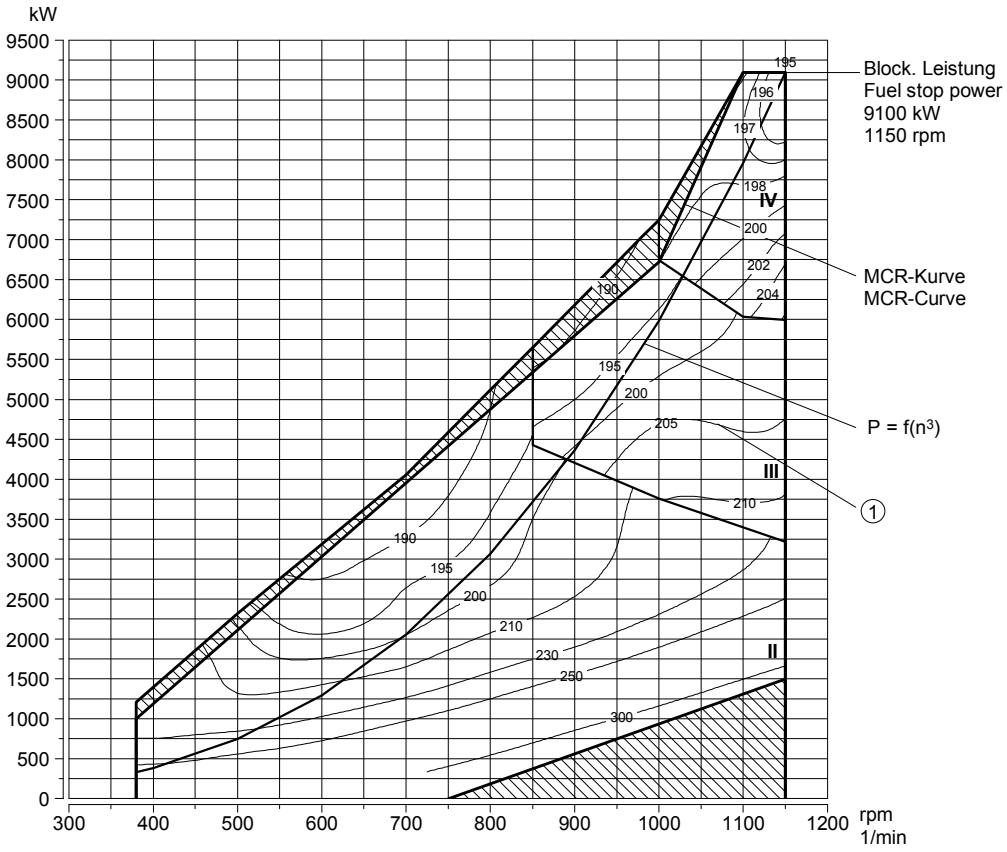
TBO 24000 h		
a)	b)	**Estimated time between overhauls**
100	3	Associated standard load profile
85	82	a) Load related to fuel stop power (%)
<15	15	b) Operating time share (%)

Engine settings and design configuration:
Optimized for exhaust emission
(IMO NO_x -2000 specification),
per ISO 8178-4

* At 45°C Intake air temperature and 32°C Sea water temperature:
No **Power reduction, Increase of fuel consumption: 2,0%**

Series 8000
Performance Map & Fuel Consumption

20V 8000 M91 @ 9100 kW
with sequential turbocharging



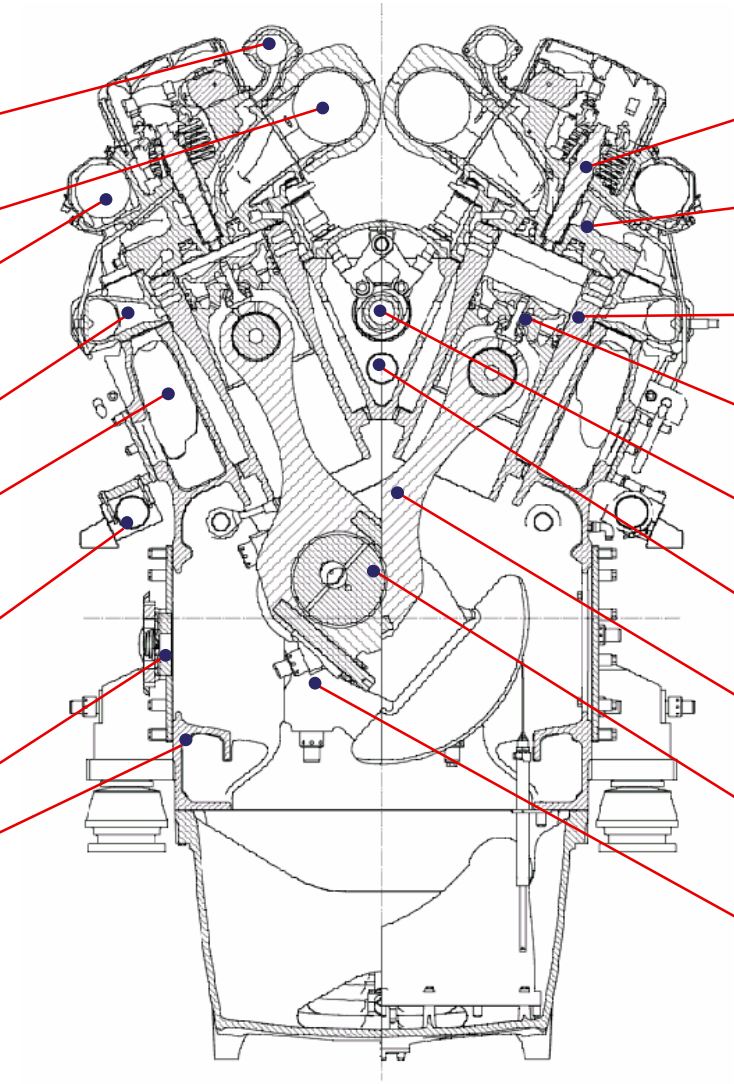
1DS	**Application group** Fast commercial vessels
	Reference conditions
25 °C	Intake air temperature
25 °C	Raw water temperature
1000 mbar	Barometic pressure
25 mbar	Intake depression
30 mbar	Exhaust back pressure
25 °C	Fuel temperature at fuel feed
①	**Specific fuel consumption** Fuel consumption (g/kWh), tolerance +5% per DIN/ISO 3046, Diesel fuel to DIN EN 590 or DMA to ISO 8217 with a min. L.H.V. of 42800 kJ/kg (18390 BTU/lb).
	All pumps necessary for engine operation included.
	Definitions Ratings are net brake power per DIN/ISO 3046 MCR-Curve: Maximum continuous rating
II, III, IV	Continuous operation (limited duration) Status, sequential turbocharging

TBO 24000 h		**Estimated time between overhauls**
a)	b)	Associated standard load profile
100	10	a) Load related to fuel stop power (%)
70	70	b) Operating time share (%)
<10	20	

Engine settings and design configuration:
Optimized for exhaust emission
(IMO NO_x-2000 specification),
per ISO 8178-4

* At 45°C Intake air temperature and 32°C Sea water temperature:
No **Power reduction, Increase of fuel consumption: 2,0%**

Series 8000
Cross Section



Fresh water return line

Exhaust gas manifold

Fuel accumulator

Intermediate cooling water housing

Charge air duct

Fresh water supply manifold

Crankcase doors

Crankcase

Injector

Cylinder head

Cylinder liner

Composite piston

Central cam shaft

Main oil supply line

Connecting rod

Crankshaft

Main bearing cap

Series 8000
Engine Design - Crankcase

Technical features

Rigid design, nodular cast iron

Integrated charge air ducting

Single centrally located camshaft and main oil channel

Hydraulically tensioned studs for fixing main bearing caps

Large crankcase doors for easy maintenance

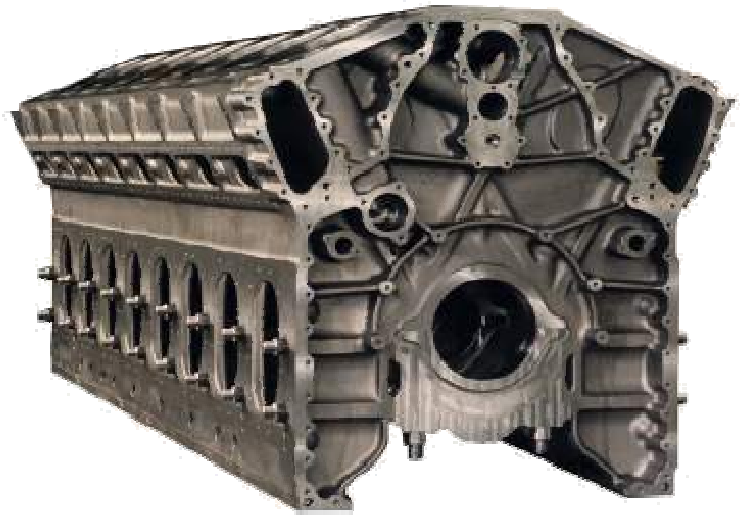
Benefits:

Extremly stiff crankcase

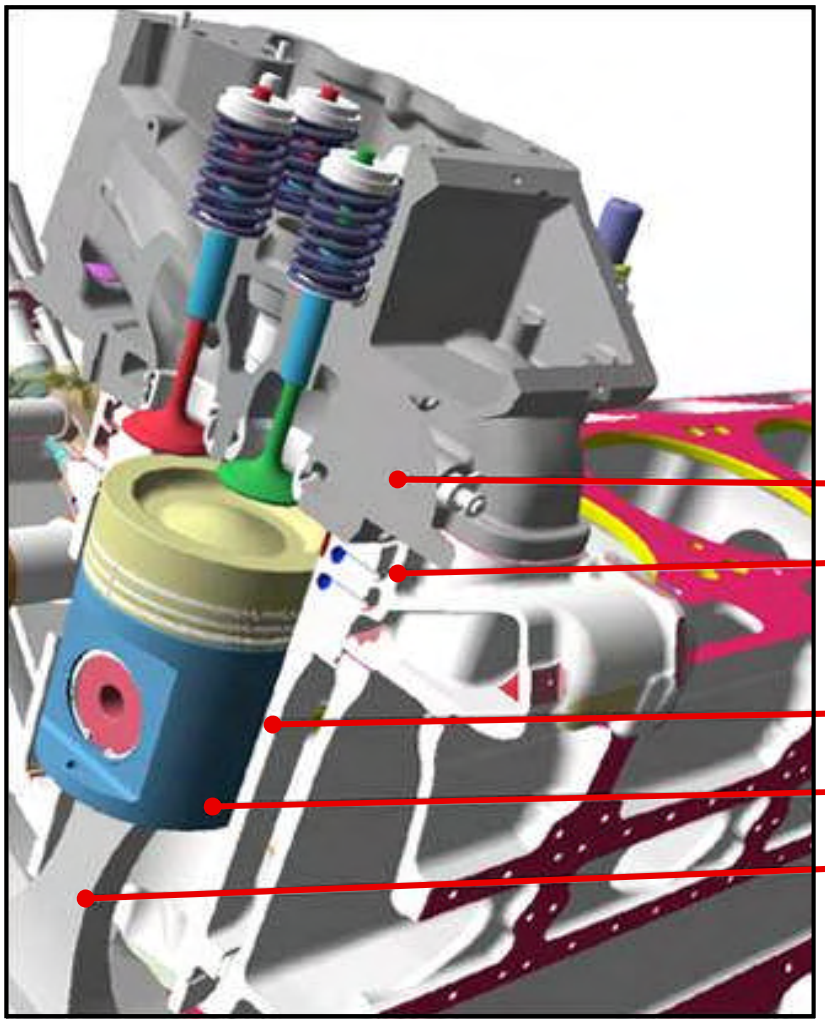
Strong crankshaft support

No contact with cooling water

Main bearings replaceable in-situ



Series 8000
Engine Design - Power Unit



Cylinder head

Intermediate cooling water housing

Cylinder liner with anti-polishing ring

Piston

Conrod

Series 8000
Engine Design - Power Unit

Technical Features

Split of sealing function and retention function

Sealing function:

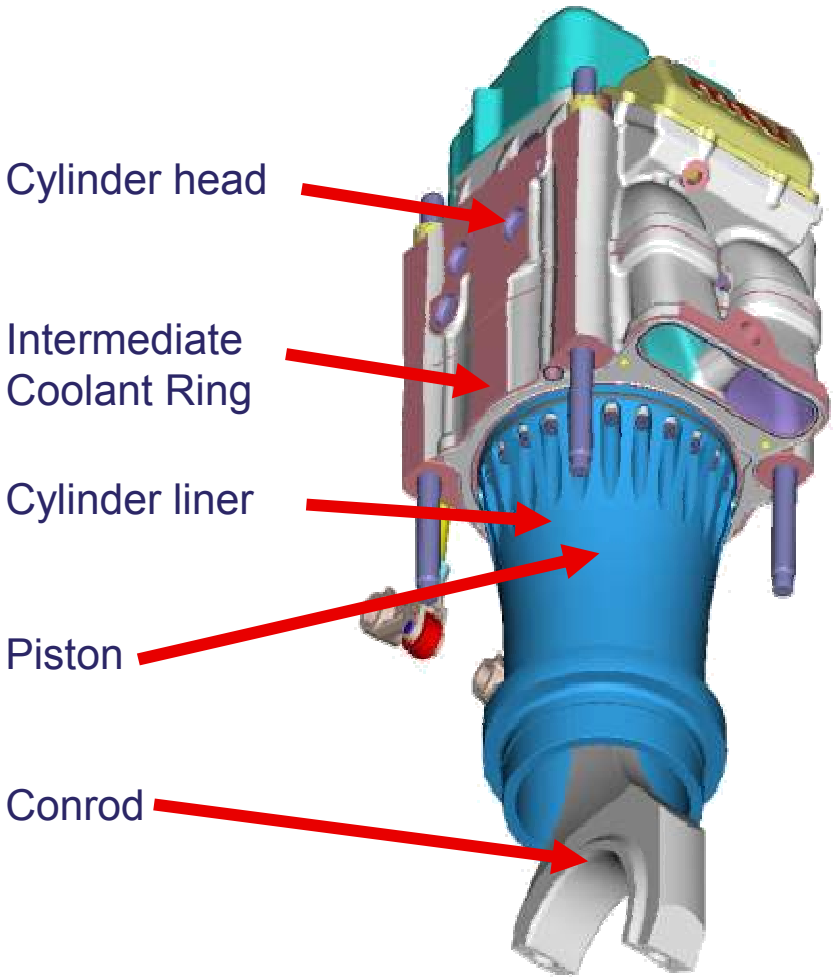
Liner with intermediate cooling water housing bolted onto cylinder head via 24 bolts

- → perfect sealing
- → optimal circularity of liner
- → minimum blow by
- → low wear between piston rings and liner

Retention function:

Power unit bolted onto crankcase via 4 bolts

- → large space for intake/exhaust channel
- → easy removal / installation



Series 8000
Engine Design - Power Unit

Exchange

- easy exchange
- run-in Power Units can be used
- reduced downtime
- maintenance on shore
  under workshop conditions
- reman power limits available

Series 8000
Engine Design - Cylinder Head

Technical features

Nodular cast iron

Cast annular cooling water channel in the fire deck

Two inlet and two exhaust valves

Cooled inlet and exhaust valve seat inserts

Valve rotators

Large, optimised intake and exhaust channels

Benefits:

Suitable for high firing pressures

Replaceable seat inserts provide reduced maintenance cost

Low black smoke and NO_X emissions

Series 8000
Engine Design - Piston

Technical features

Composite piston with forged steel crown and steel skirt

Oil-cooled via spray nozzle

Two compression rings and one oil-control ring

Large piston pin diameter

Benefits:

Suitable for high firing pressures

Low oil consumption

Low black smoke and NO_X emissions

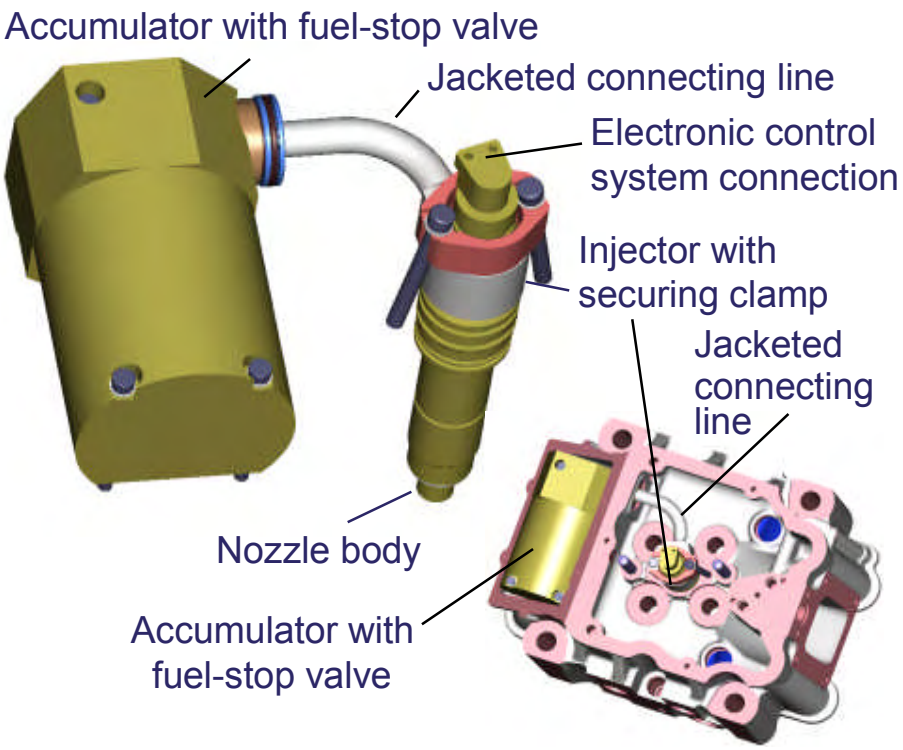
Series 8000
Engine Design - Common Rail Fuel Injection System

Technical features

New but proven technology

Operational status-related fuel injection

High injection pressure over speed band



Benefits:

Continuously optimized injection timing, pressure and flow controlled by the engine management system

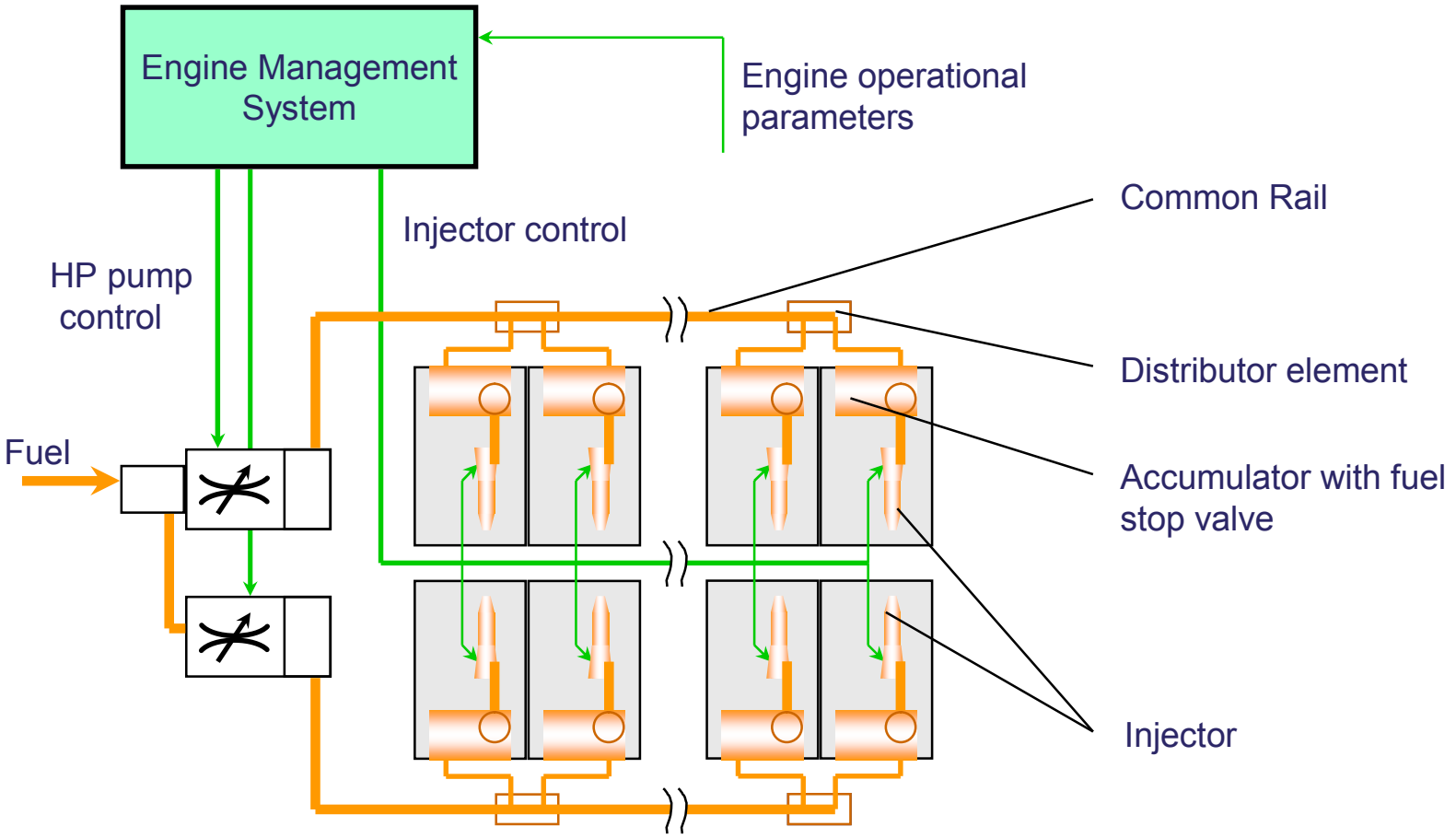
Significant reduction of black smoke emission at low engine speeds

Low fuel consumption over the entire performance range

No mechanical adjustment required

Series 8000
Engine Design

Common Rail fuel injection system

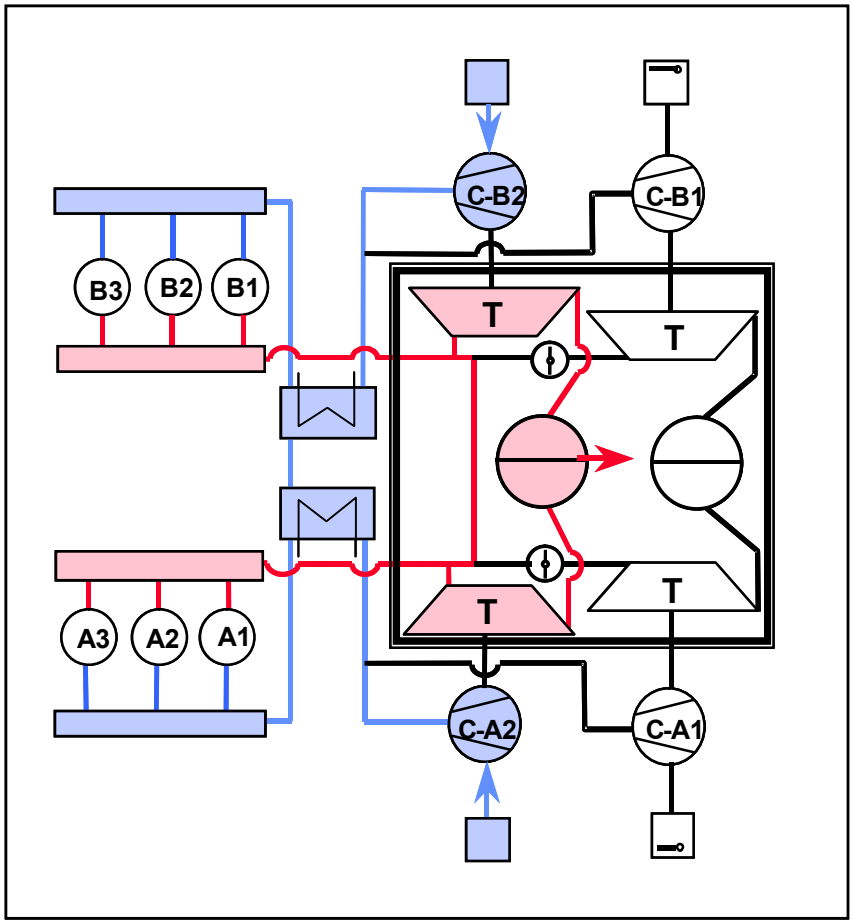


Series 8000
Sequential Turbocharging

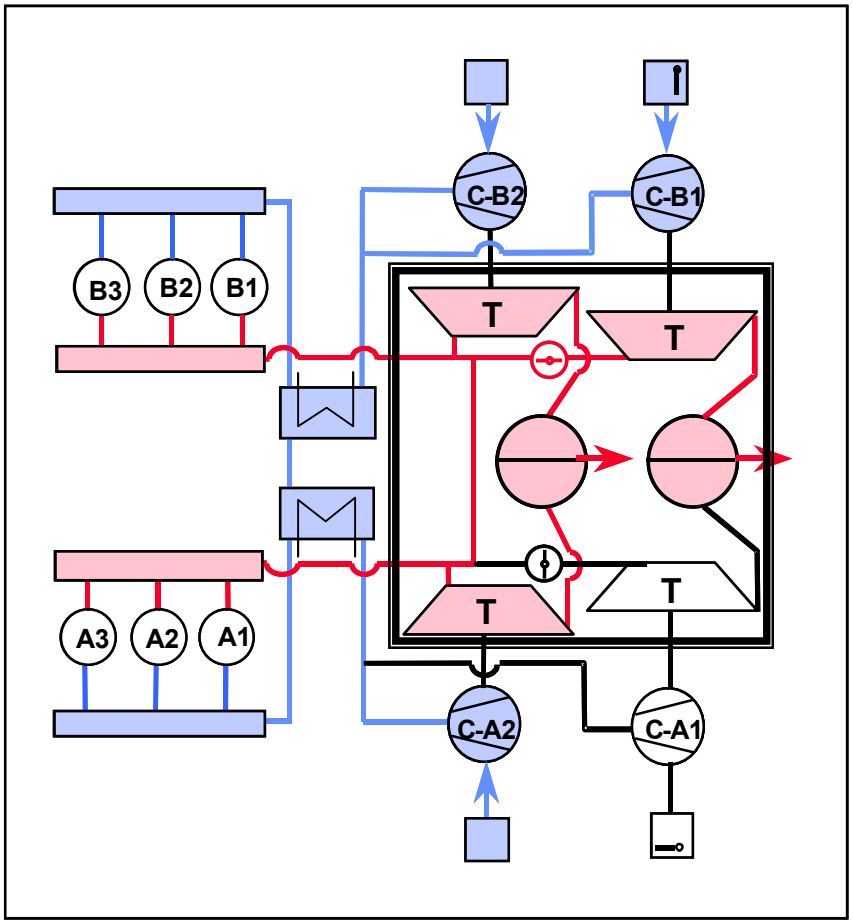
Technical Features

- Load-depended switching of turbo chargers
- Two base chargers and two switch able (three-stage switching)
- Hydraulic actuation of compressor and turbine flaps
- Small chargers with low mass inertia (quick response/ acceleration)
- Single stage charging

Series 8000
Sequential Turbocharging



Base charger in operation



Charger B1 switched into operation

Series 8000
Sequential Turbocharging

Benefits

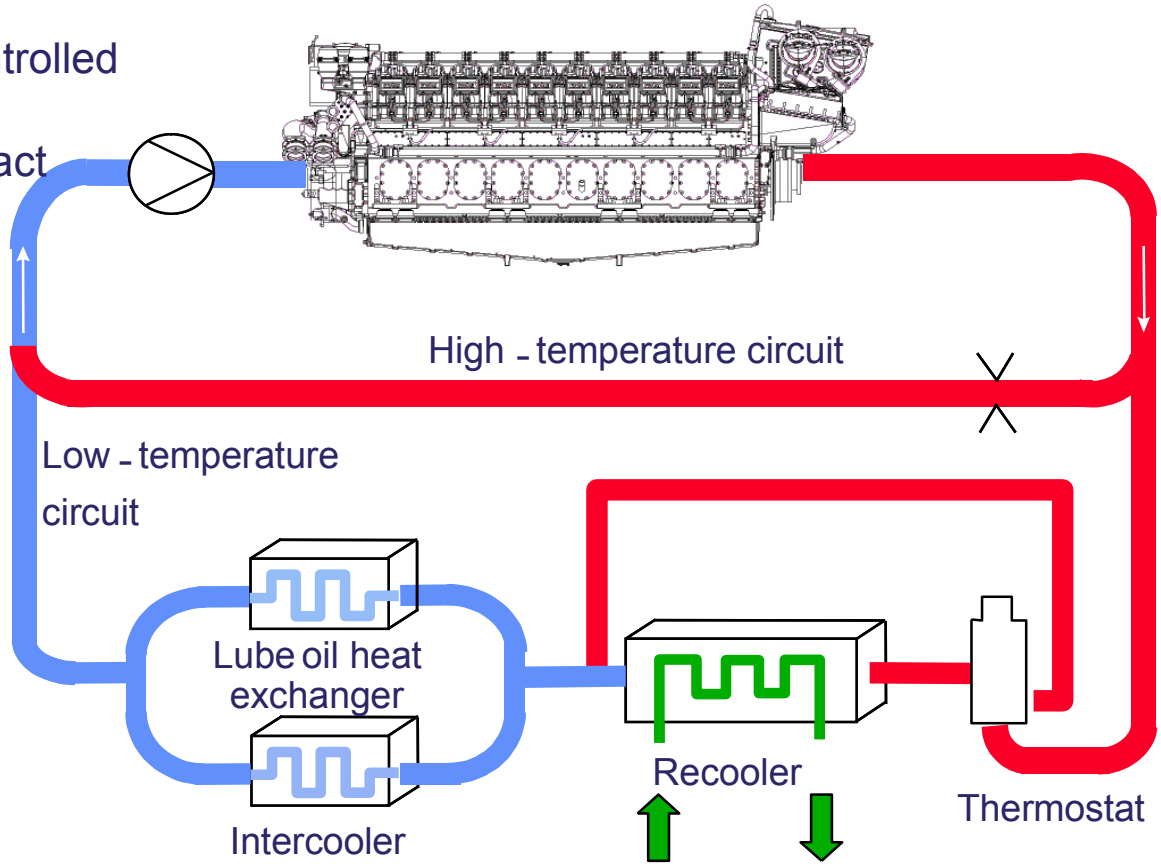
- High torque surplus enables quick acceleration and maneuvering
- Low fuel consumption even at part load
  (less than 195 g/kWh down to 25% of nominal power)
- Minimized black and white smoke emissions at part load

Series 8000
Engine Design

Split-circuit coolant system, functional diagram

Technical features

2 separate thermostatic controlled coolant circuits
Engine components in contact with fresh water only

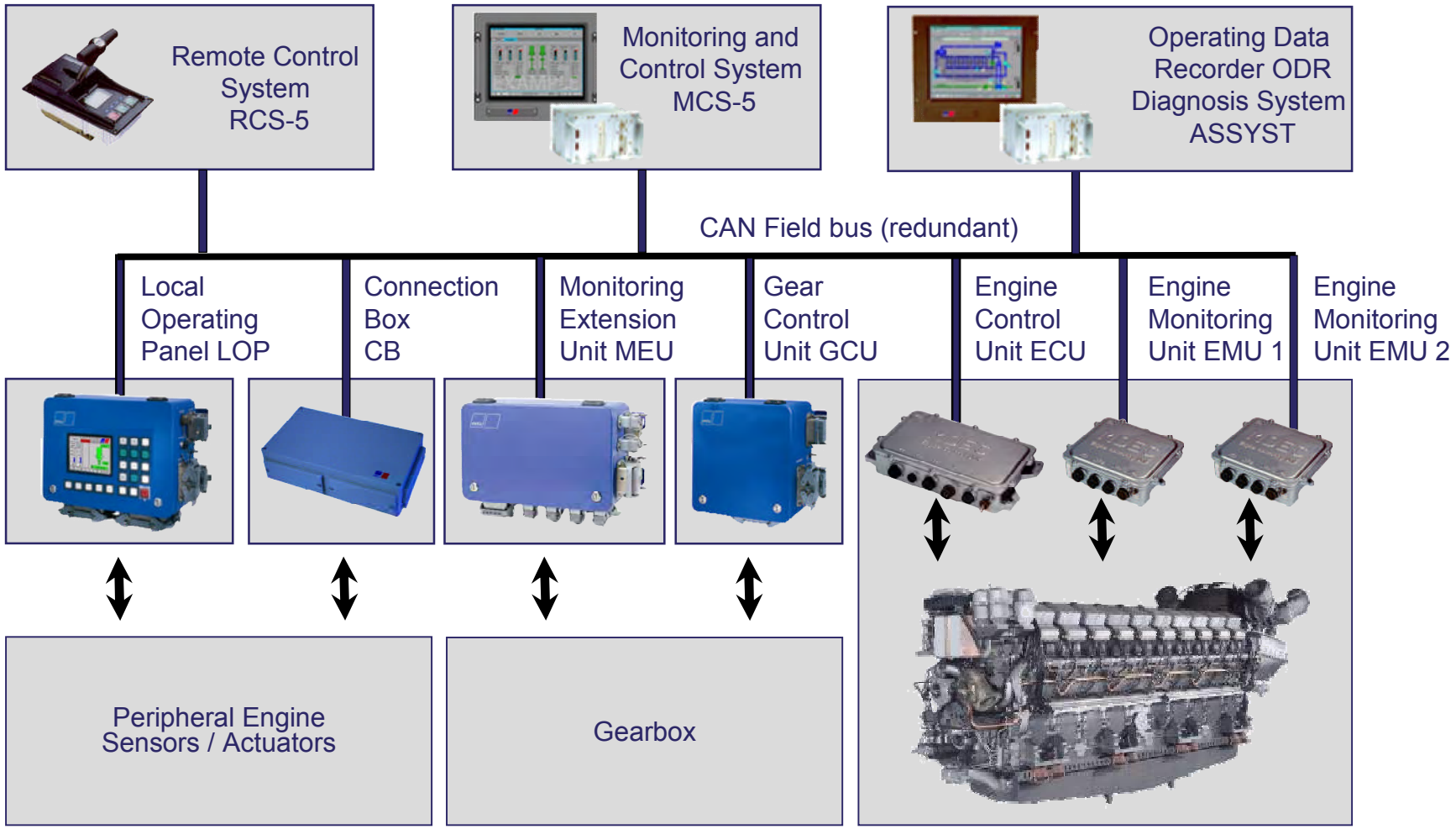


Benefits:

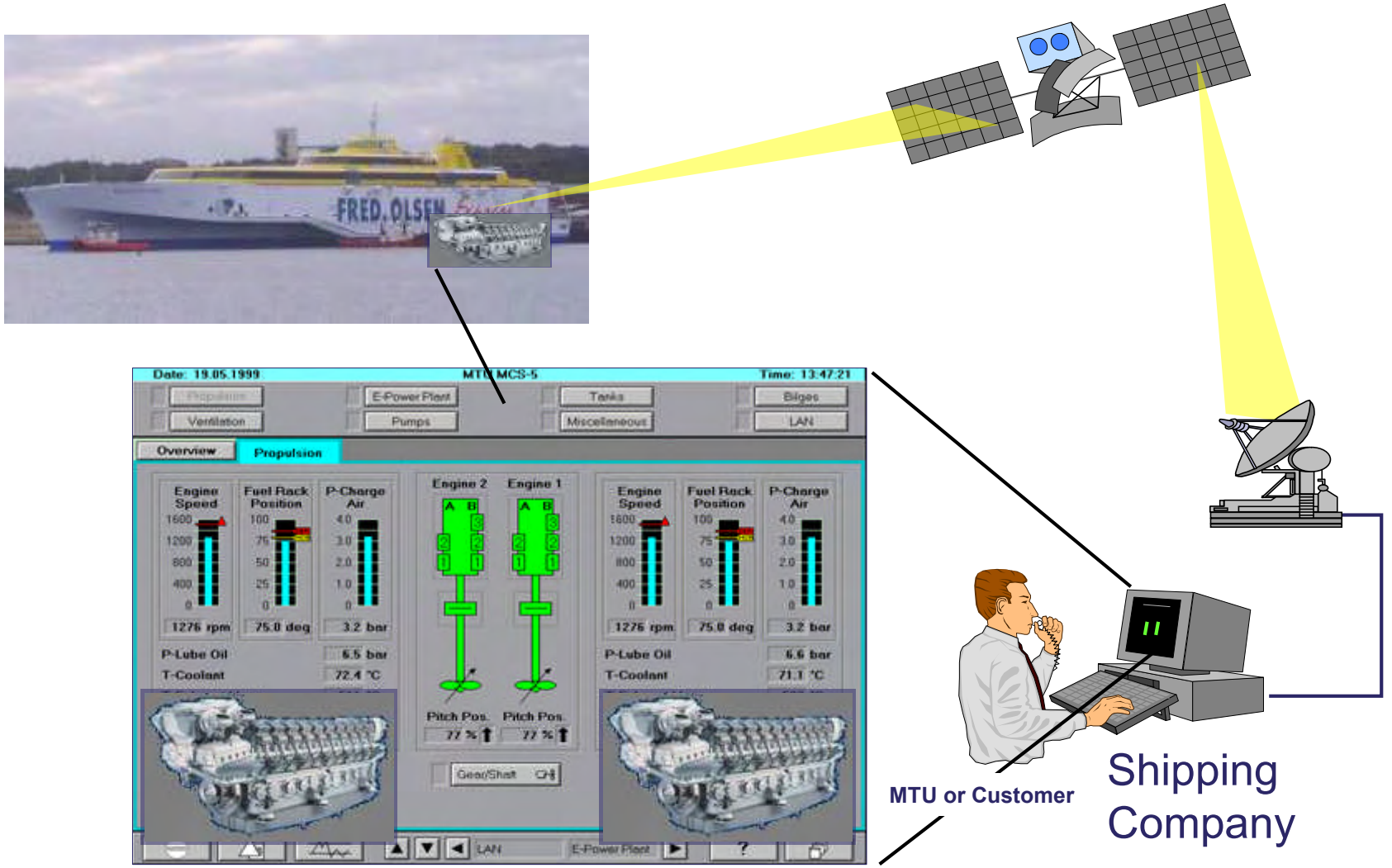
Provides optimal coolant, lube oil and charge air temperature under all operating conditions in the entire performance map for engine protection

Series 8000
Monitoring and Control

System configuration with adapted system interface



Series 8000
MTU Ship Automation System - Remote Diagnosis

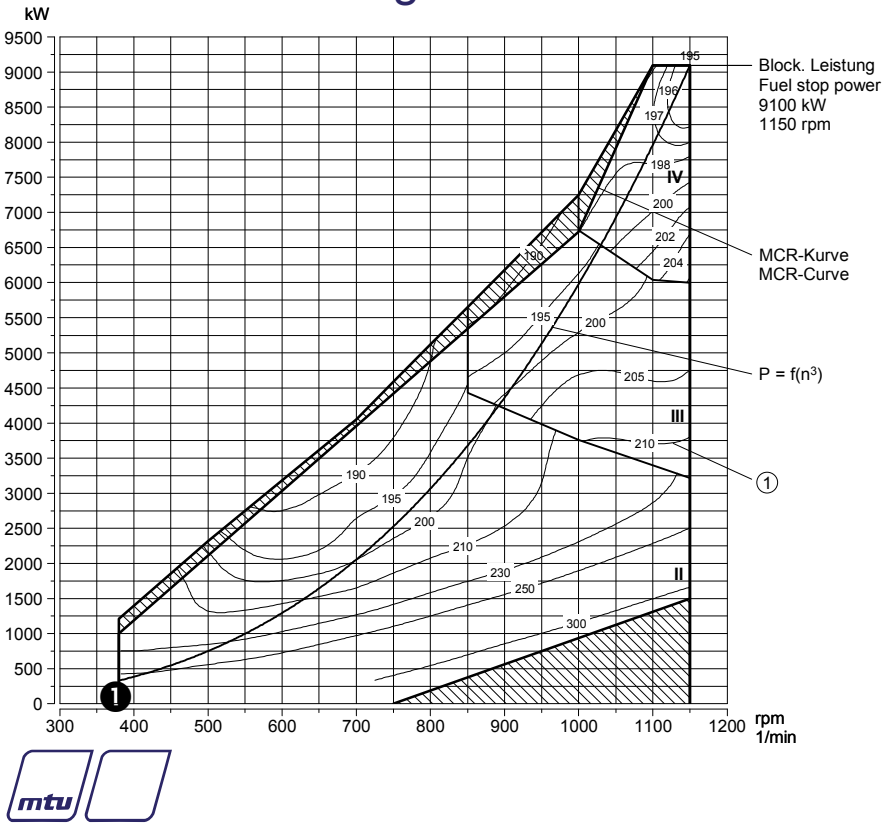


Series 8000
Emissions

Black Smoke Emission

20V 8000, M71L on test bed

❶ 22 kW / 380/min / 4 TC
AVL_FSN: 0.3
TC = Turbocharger

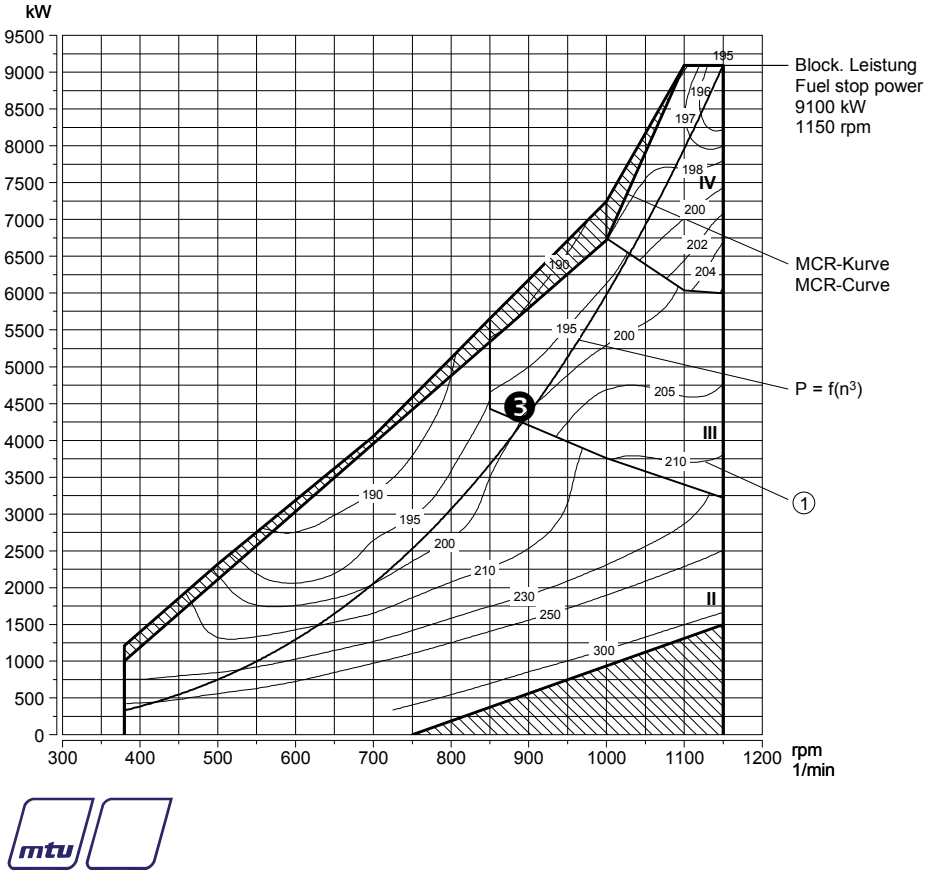


Series 8000
Emissions

Black Smoke Emission

20V 8000, M71L on test bed

❸ 4550 kW / 915/min / 3 TC
AVL_FSN: 0.2

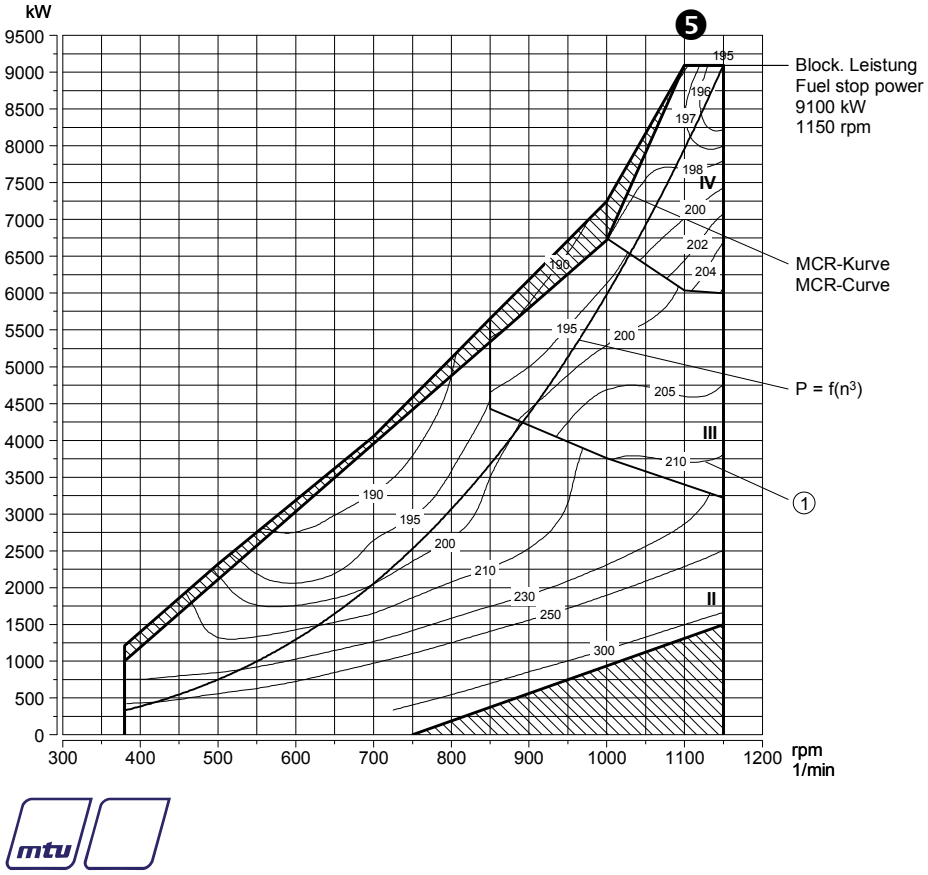


Series 8000
Emissions

Black Smoke Emission

20V 8000, M71L on test bed

❺ 9100 kW / 1150/min / 4 TC
AVL_ FSN: 0.15



Series 8000
Engine Design

Service module at free end

Technical features:

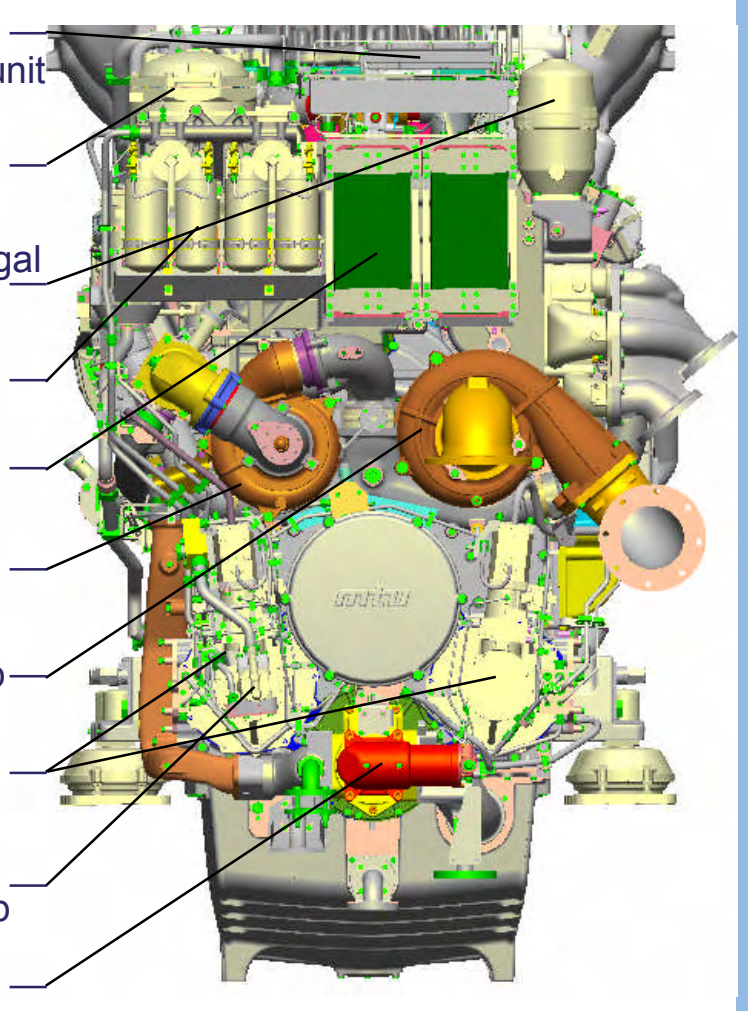
All main accessories installed at the free end

Benefits:

Easy servicing of filters and pumps

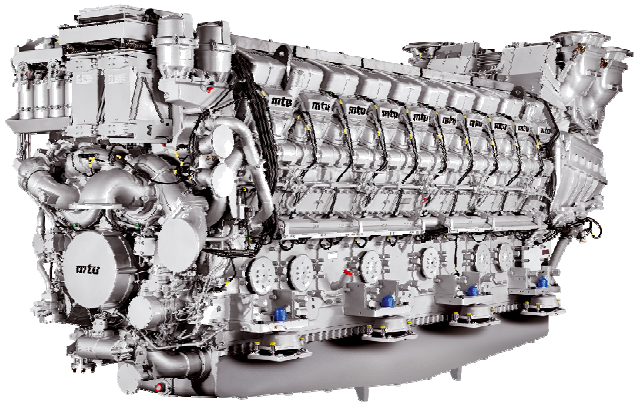
Well-accessible interfaces for fuel, raw and fresh water

Minimized interfaces to ship connections (reduced complexity of shipside installations)



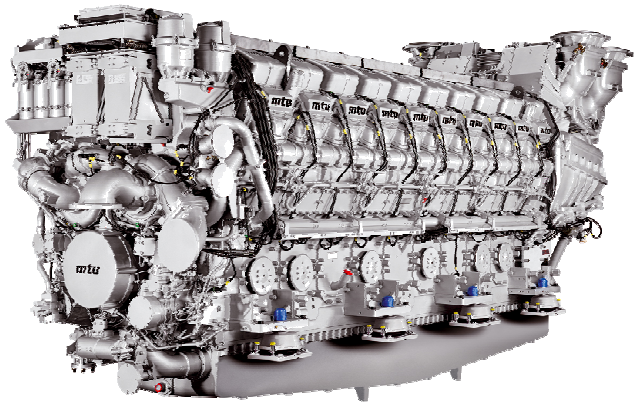
Series 8000
Engine Design

Crankshaft	Alloyed steel forged design with bolted-on counterweights, machined all over
Exhaust piping	Dry, insulated exhaust manifolds
Turbocharging	Four radial / radial-type turbochargers Single-stage turbocharging with charge-air cooling sequential turbocharging

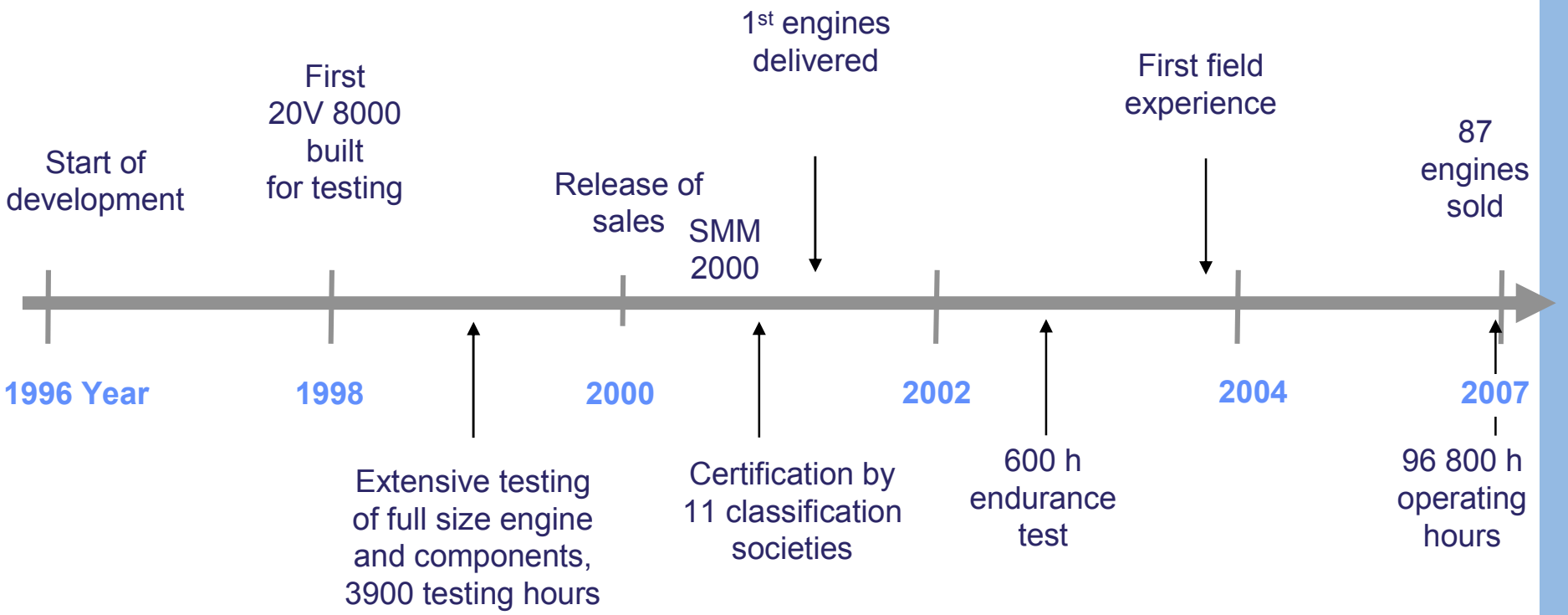


Series 8000
Engine Design

Mounting	Resilient engine mounting with integrated deflection limiters and vertical adjustment device
Power transmission	Torsionally-resilient coupling and offset-compensating coupling system
Starting system	Air starting motor, with slow cranking and positioning device



Series 8000
Status from Development to Operation



Series 8000
Status - Sales & Delivery June 2007

87 engines sold since market introduction in Sept. 2000

- **24 engines with 9000 kW for Asian Navy, 24 engines delivered**
- **4 engines with 9000 kW for Yacht, delivered with GL classification**
- **4 engines with 8200 kW for 2 Danish Supply Vessels, delivered**
- **4 engines with Service Power of 8200 kW sold for an AUSTAL 86 m Ferry, delivered with GL & DNV classification, installed, and in operation**
- **4 engines with Service Power of 8200 kW (Service Power 9100 kW late 2006 available) sold for an AUSTAL 126 m Ferry (Fred Olsen),**
- **2 engines with 8200 kW for Cruise Yacht with GL classification**
- **2 engines with 8200 kW for Repower of a Fast Ferry**
- **8 + 1 engines, each 8 200 kW for two US Fast Ferries with GL classification**
- **8 engines, each 7 200 kW for two EU Fast Ferries with GL classification**
- **2 engines, each 9100 kW for Naval Vessel**
- **12 engines, each 8200 kW for Large Patrol Vessel**
- **6 engines, each 9100 kW for Large Offshore Patrol Vessel**
- **6 engines, each 9100 kW for Indian Coast Guards**

61 engines delivered, 28 engines with 9000kW, 25 engines with 8200 kW, 8 engines delivered with 7200 kW

approx. 96 800 operating hours in June 2007

Series 8000
Application in a Trimaran Fast Ferry

Series 8000
Status - Operation June 2007

Fast Ferry Fred Olsen - 4 x 20V 8000 M70

Sea Trial successfully performed in Dec. 2004 & Jan. 2005

Transfer from Australia to Tenerife in April, 2005
Start of regular Service in Mai 2005

Until November 2006, each of the 4 engines accumulated approx. 7000 hours

Initial technical difficulties experienced with:
- leaking cooling water gasket
- one exhaust valve damage
- leakages in coolant and fuel circuit
- failure of fuel pump

During November 2006 all 4 engines have been modified into series **8000M71L @ 9100 kW**.

Each of the 4 engines 20V8000M71L have now accumulated approx. 3000 hours

Series 8000
Status - Operation June 2007

Fast Ferry Spirit of Ontario - 4 x 20V 8000 M70

Transfer from Australia to US in spring 2004 over 17 000 nm

Start of regular Service on Lake Ontario in May 2004

Until today, each of the 4 engines accumulated approx. 4000 hours

Initial technical difficulties experienced with:

- leaking cooling water gasket
- broken fuel supply line
- leakages in coolant and fuel circuit

Tanger Jet II - New operator Förderreederei

Transfer from Bremerhaven to Spain in August 2007

Start of regular Service in Spain on Gibraltar to Tanger in September 2007

Series 8000
Status - Operation June 2007

Naval Vessel - 4 x 20V 8000 M90

1st vessel in operation since July 2005, approx. 2000 h per engine

2nd vessel in operation since July 2005, approx. 1500 h per engine

3rd vessel in operation since July 2005, approx. 350 h per engine

Two Supply Vessel - each 2 x 20V 8000 M70

Sea Trials on first & second vessel performed with
max. continuous power of 8200 kW

Start of Service in January 2005
Until today, each of the 2 engines accumulated approx. 2250 hours of operation
Until today, each of the 2 engines accumulated approx. 1800 hours of operation

Initial technical difficulties experienced with:
- seized piston pin

Series 8000
Status - Operation June 2007

Large Yacht - 4 x 20V 8000 M90

Sea Trials performed with maximum continuous power of 9000 kW

Start of Service in December 2004
Until today, each of the 4 engines accumulated approx. 2500 hours

Initial technical difficulties experienced with:
- leakages in coolant and fuel circuit

Repower MAN 20PA6 B STC @ 8100 kW to MTU 20V 8000 M70 @ 8200 kW

NEL Lines - „Aeolos Kenteris“

First operation of the vessel after repowering on 29th of July 2006

Until today, each of the 2 engines accumulated approx. 650 hours

Series 8000
Application in a Super Ferry

Series 8000
Status - Operation June 2007

IDO - 4 x 20V 8000 M70R

1st vessel in operation since April 2007, approx. 1500 h per engine

2nd vessel sea trials are performed in June 2007

Transfer from Australia to Turkey in August 2007

Start of regular Service on Marmara Sea in September 2007

Hawaii Super Ferry - 4 x 20V 8000 M70

1st vessel sea trials are performed in Mai 2007

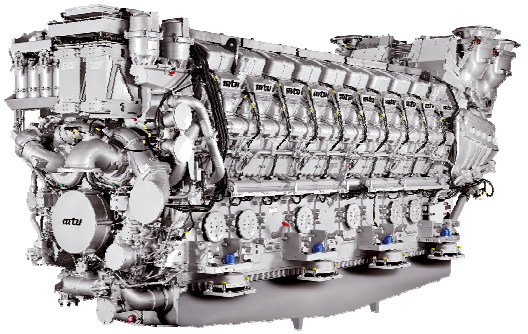
Transfer from Mobile USA to Hawaii in August 2007

Start of regular Service on Hawaii in September 2007

2nd Start of regular Service approx. in 2009

Series 8000
Operational Experience in Fast Ferry Applications

- More than 4000 MTU engines are installed in ferries. This is a market share of > 40 %
- In ships up to 50 m, the engine series 183, 2000, 396 and 4000 are very successful
- In ferries up to 75 m and in the power range of 3500 to 3900 kW, more than 40 engines of series 595 are installed
- In ferries above 75 m, 120 engines of series 1163 with power from 5,200 to 6,500 kW have accumulated more than 1.000,000 operating hours
- 10 engines Series 8000 enter service now.
  The Series 8000 will continue this long experience in larger ferries with increased demand in power and efficiency



Series 8000
Summary

The Series 8000 has been developed by MTU between year 1996 and 2000 in order to suit the increased power demand of vessels with high payload and speed.

The engine is currently available as a 20-cylinder version, which has a max. continuous rating of

- 20V 8000 M71R @ 7200 kW
- 20V 8000 M71 @ 8200 kW
- 20V 8000 M71L @ 9100 kW
- 20V 8000 M91 @ 9100 kW

Three prototype engines have been tested during development in our facility with accumulation of approx. 4000 testing hours.
Up to now **87 engines** have been **sold**, 61 engines have been delivered and accumulated approx. 96 800 operating hours.

To support the operator with plan able operating cost and highest availability, we offer a **Service Package** which includes for very competitive cost all labor and parts until the main overhaul, a local depot of spares, attendance of an MTU service engineer on board for one season and a warranty of up to 3 years

The major features of the 20V 8000 are:
- the very low fuel (< 195 g/kWh) and lube oil consumption (0.6 g/kWh),
- the low maintenance cost (parts incl. main overhaul approx. 40 €/hour)
- the smokeless operation in all operating conditions

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