



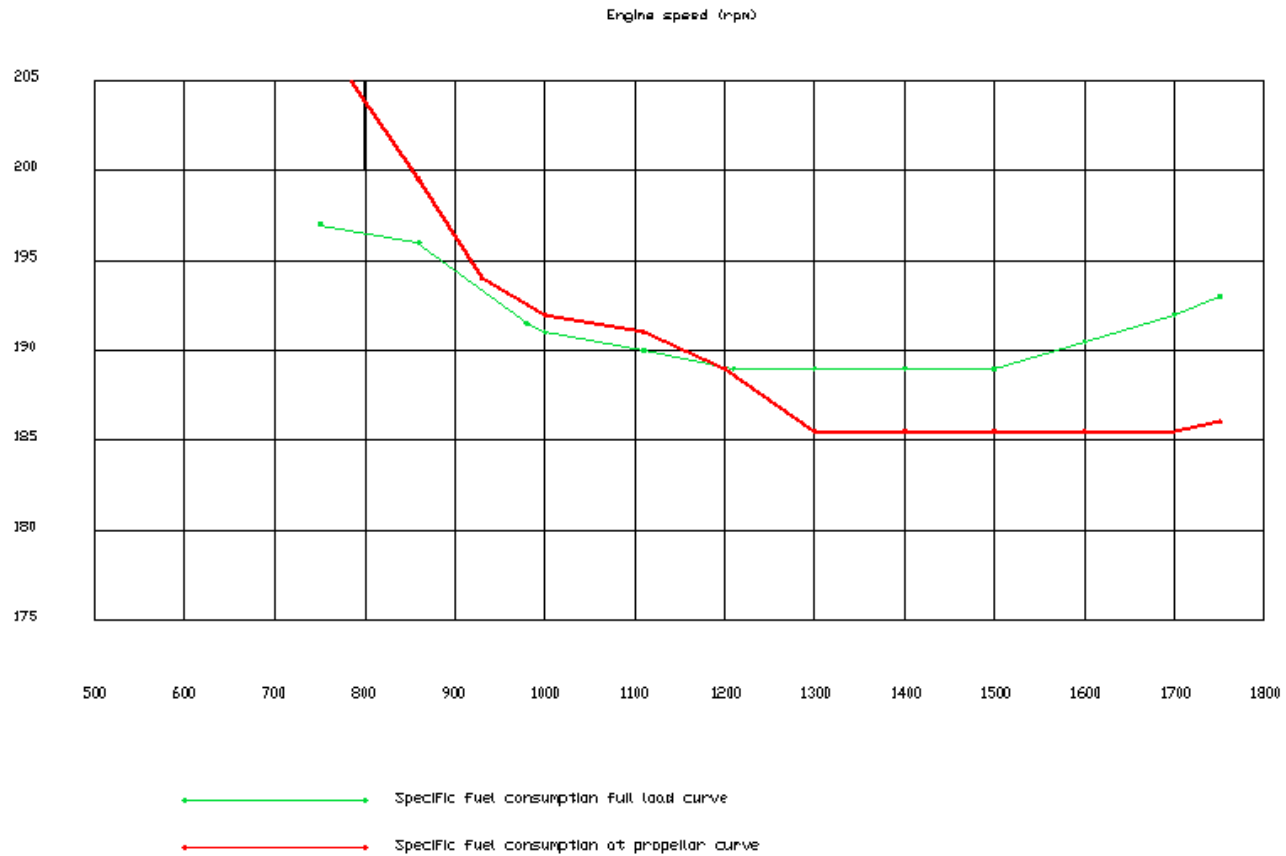
Paccar Euro VI truck engines in an inland vessel

Sander Langenberg

Paccar Euro VI engine.

- Ultra low fuel consumption
- High torque at low engine speed
- High emission standards
- Ultramodern technologies
- Engine and After treatment : one system
- Proven quality and reliability
- Long service intervals
- Low Total Costs of Ownership
- Low sound levels
- Paccar → Made in Holland

Specific fuel consumption 186 gr/kWh at propellor curve



Exhaust After Treatment System (EAS)

- Engine and After Treatment System works harmonious together
- Paccar After Treatment Control Module
- On Board Diagnostic System

Filter box

- Diesel Oxidation Catalyst
- Diesel Particular filter

SCR box

- Exhaust silencer
- Selective Catalytic Converter
- Ammonia Oxidation Catalyst
- Airless AdBlue dosing



Exhaust After Treatment System

- Reducing PM and NOx to Euro VI requirements

- Regeneration of DPF Filter

 - Passive regeneration

Normal conditions, NOx and Temperature are favourable

 - Active regeneration

Fuel/air mixture is injected in exhaust
During normal engine operation

 - Forced regeneration

Forced regeneration by low engine load



Economical.

Total Costs of Ownership

- Investment
- Fuel Consumption
- Maintenance

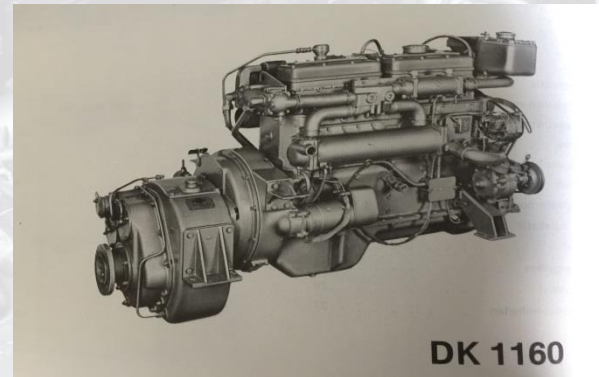
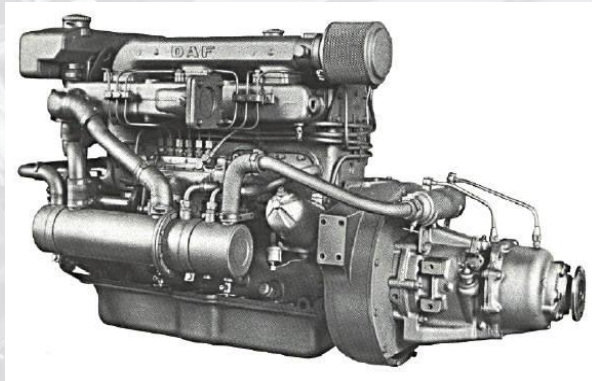
Invest Return

- Return time of Invest in 6.400 hrs



Paccar / DAF

- DAF engines since 1958





Paccar MX series

Engine

Output kW (hp)

Torque Nm

MX-11 210

210 (286)

1200 at 1000 – 1700 rpm

MX-11 240

240 (326)

1400 at 1000 – 1650 rpm

MX-11 271

271 (369)

1580 at 1000 – 1650 rpm

MX-11 291

291 (396)

1900 at 1000 – 1450 rpm

MX-11 320

320 (435)

2100 at 1000 – 1450 rpm

MX-13 300

300 (412)

2000 at 1000 – 1425 rpm

MX-13 340

340 (462)

2300 at 1000 – 1425 rpm

MX-13 375

375 (510)

2500 at 1000 – 1425 rpm



Can a Euro VI truck engine be used in a maritime environment?

- Engine load
- Cooling system
- Electrical system
- Exhaust system
- Monitoring
- Engine throttle control
- Mechanical adjustments

Engine Load

Truck : Rating acc. ISO 1585

Marine : Rating acc. ISO 3046

Engineering data.

- Propellor curve
- Torque curve

M1 rating Continues Duty +/- 90% Torque

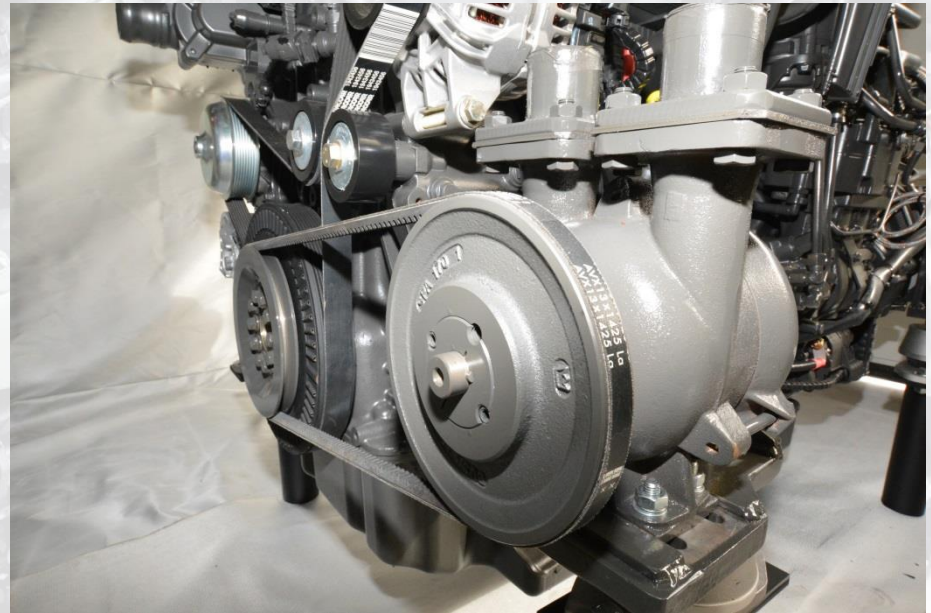
M2 rating Continues Duty 100 %

Cooling system

- Charge air cooler



Cooling water pump LT circuit



Cooling system

Old box cooler



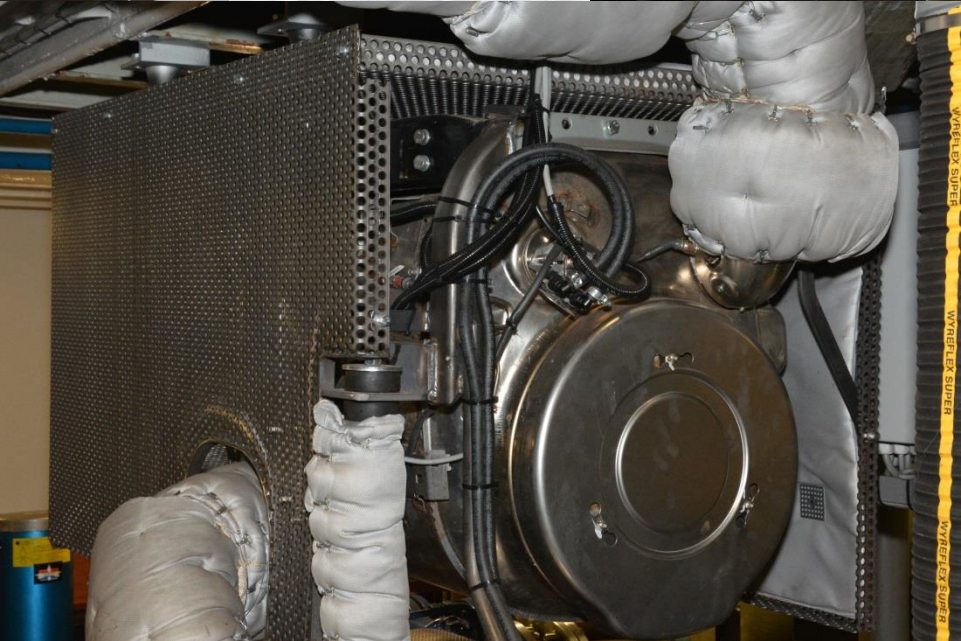
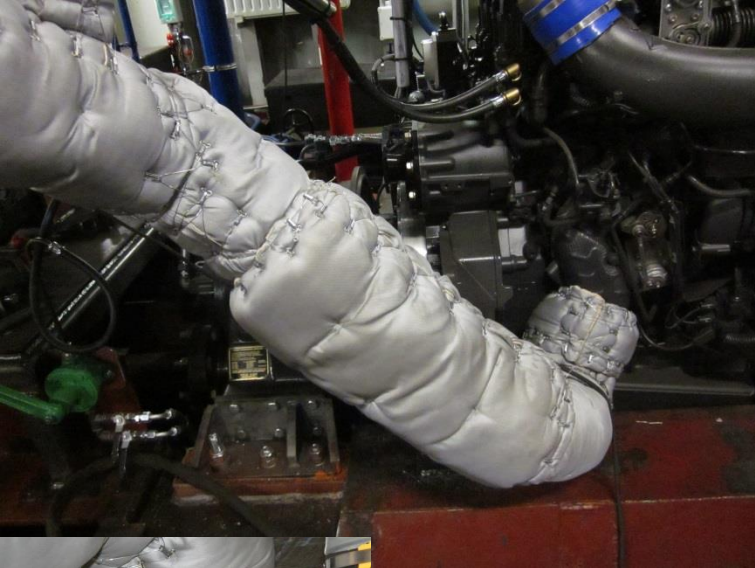
Enlarge box



New box cooler

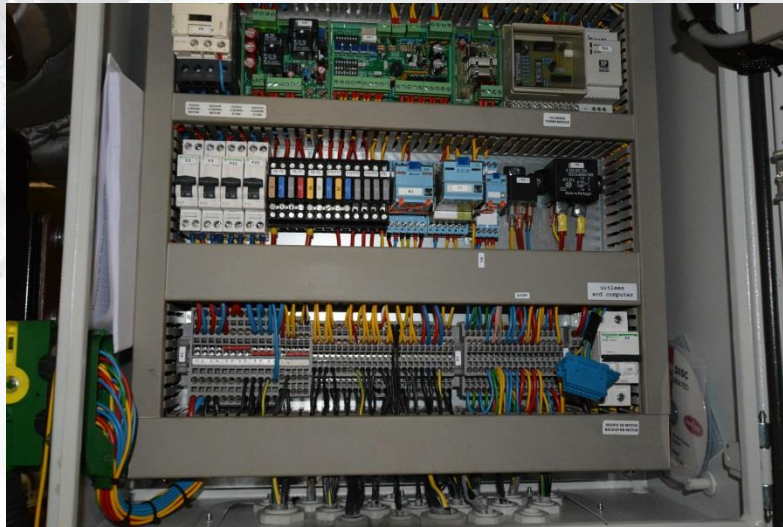


Ventilation / Isolation



Electrical system

- Engine harness is fully integrated in truck wiring loom
- Reprogram missing inputs on ECU
- Simulate inputs on ECU
- 24 Volt insulated return electrical system
- Back up power supply



Electrical system

- Engine control / monitoring



Engine operation

Truck → Torque request

Ship → Speed request



Mechanical adjustments



Certification



Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Milieu

NBKB



Inspectierapport

Scheepsnaam:	NOORD	NBKB nummer:	2017.02.08347
ENI-nummer:	02312524	Datum inspectie:	20 april 2017
Soort vaartuig:	motorvrachtschip	Plaats inspectie:	Sliedrecht
Soort certificaat:	CvO	NBKB inspecteur:	ing. P. van Weelden re



THE NETHERLANDS
(N E D E R L A N D)



RDW

TYPE-APPROVAL STATEMENT



PACCAR



THE NETHERLANDS
(N E D E R L A N D)



COMMUNICATION

Technical requirements for inland waterway vessels

This Directive is intended to promote European river transport by improving the technical harmonisation of vessels. It is down a high level of safety equivalent to that for shipping on the Rhine. To achieve this, it provides for the introduction of certificate for inland waterway vessels in each Member State, to be issued by the competent authorities, authorising them Community waterways, including the Rhine.

ACT

Directive 2006/87/EC of the European Parliament and of the Council of 12 December 2006 laying down technical requirements for inland waterway vessels

VERORDENINGEN

VERORDENING (EG) Nr. 595/2009 VAN HET EUROPEES PARLEMENT EN DE RAAD

van 18 juni 2009

betreffende de typegoedkeuring van motorvoertuigen en motoren met betrekking tot emissies van zware bedrijfsvoertuigen (Euro VI) en de toegang tot reparatie- en onderhoudsinformatie, tot wijziging van Verordening (EG) nr. 715/2007 en Richtlijn 2007/46/EG en tot intrekking van de Richtlijnen 80/1269/EEG, 2005/55/EG en 2005/78/EG

(Voor de EER relevante tekst)

Communication concerning:
either ⁽¹⁾:

- approval
- ~~refusal of approval~~
- extension of approval
- ~~withdrawal of approval~~
- ~~production definitely discontinued~~

of a vehicle/engine type ⁽¹⁾ with regard to emissions or: measurement of power of the engine only, pursuant to Regulation number 24.

Approval number: E4-24R-030583

Extension number: 02

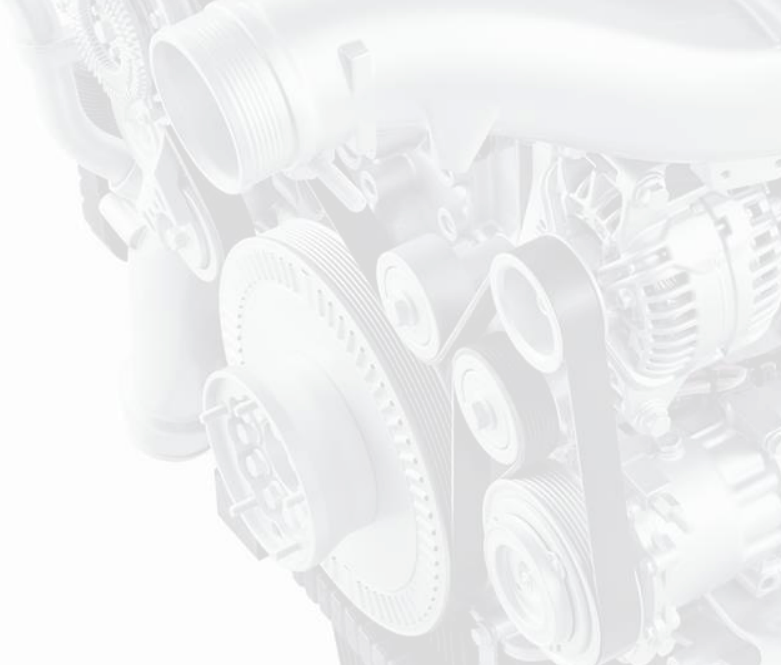
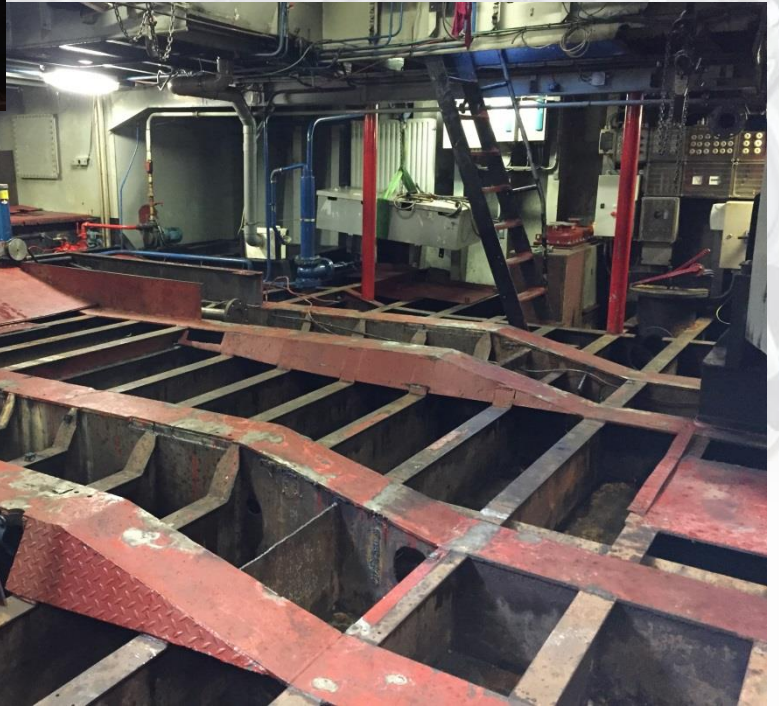
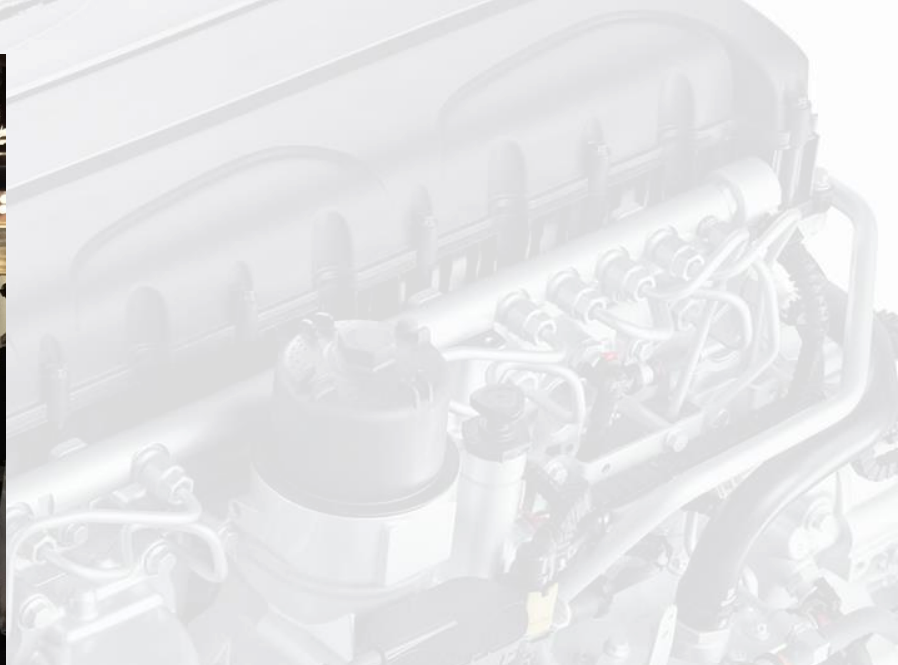
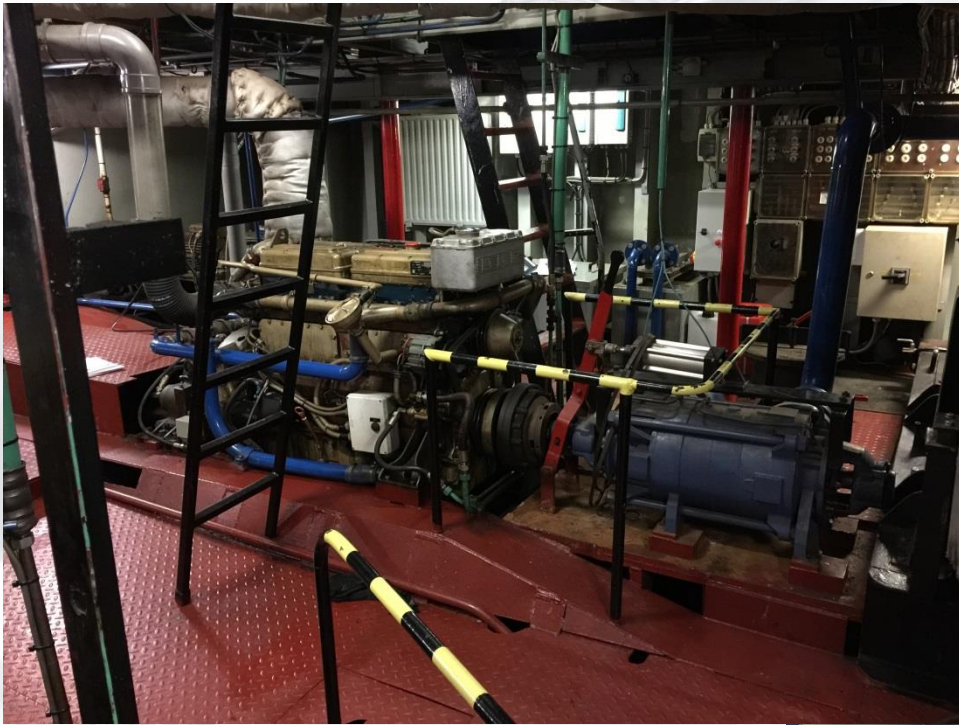
1. Trade name or mark of the vehicle ⁽²⁾ : DAF
 2. Trade name or mark of engine : PACCAR
 3. Vehicle type ⁽²⁾ : H4?N3 / M4?N3 (XF / CF Series)
 4. Engine type : MX-11 210 H1
- Engine approval number ⁽²⁾ : E4-24R-030583

Project. Ms NOORD

L x B 54,20 x 9,50 m

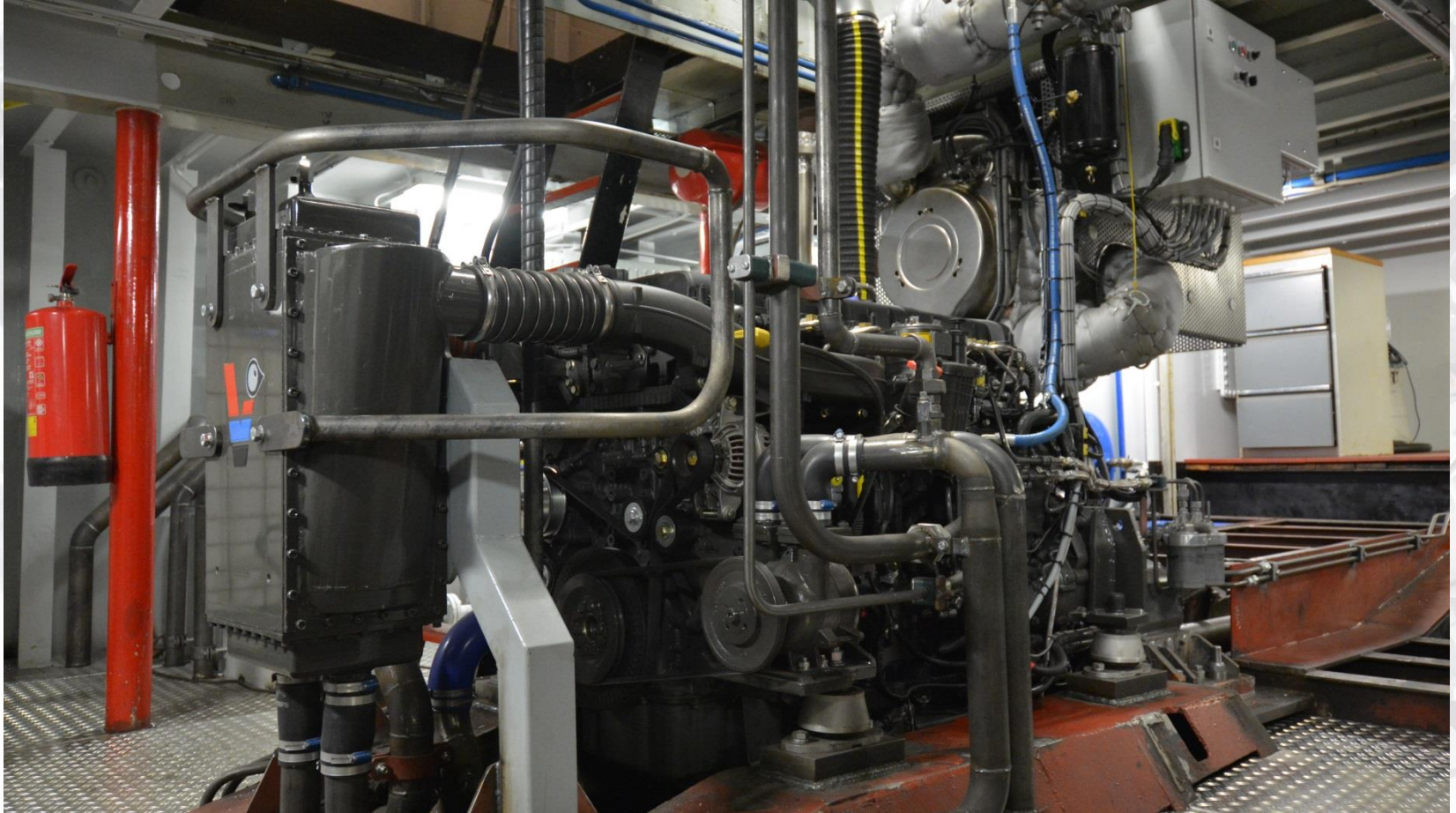
2 x MX11 – 210 propulsion

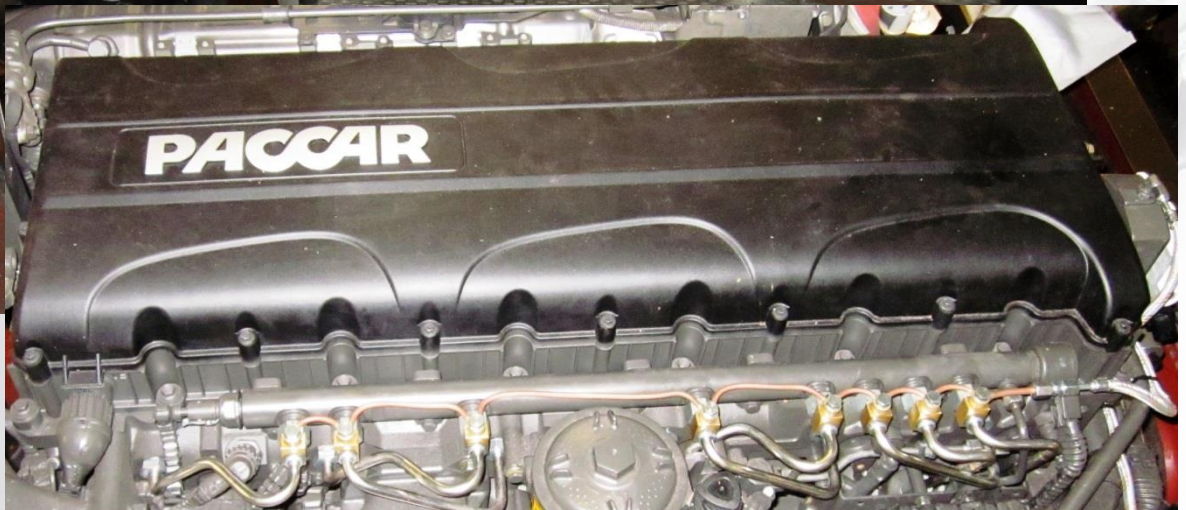




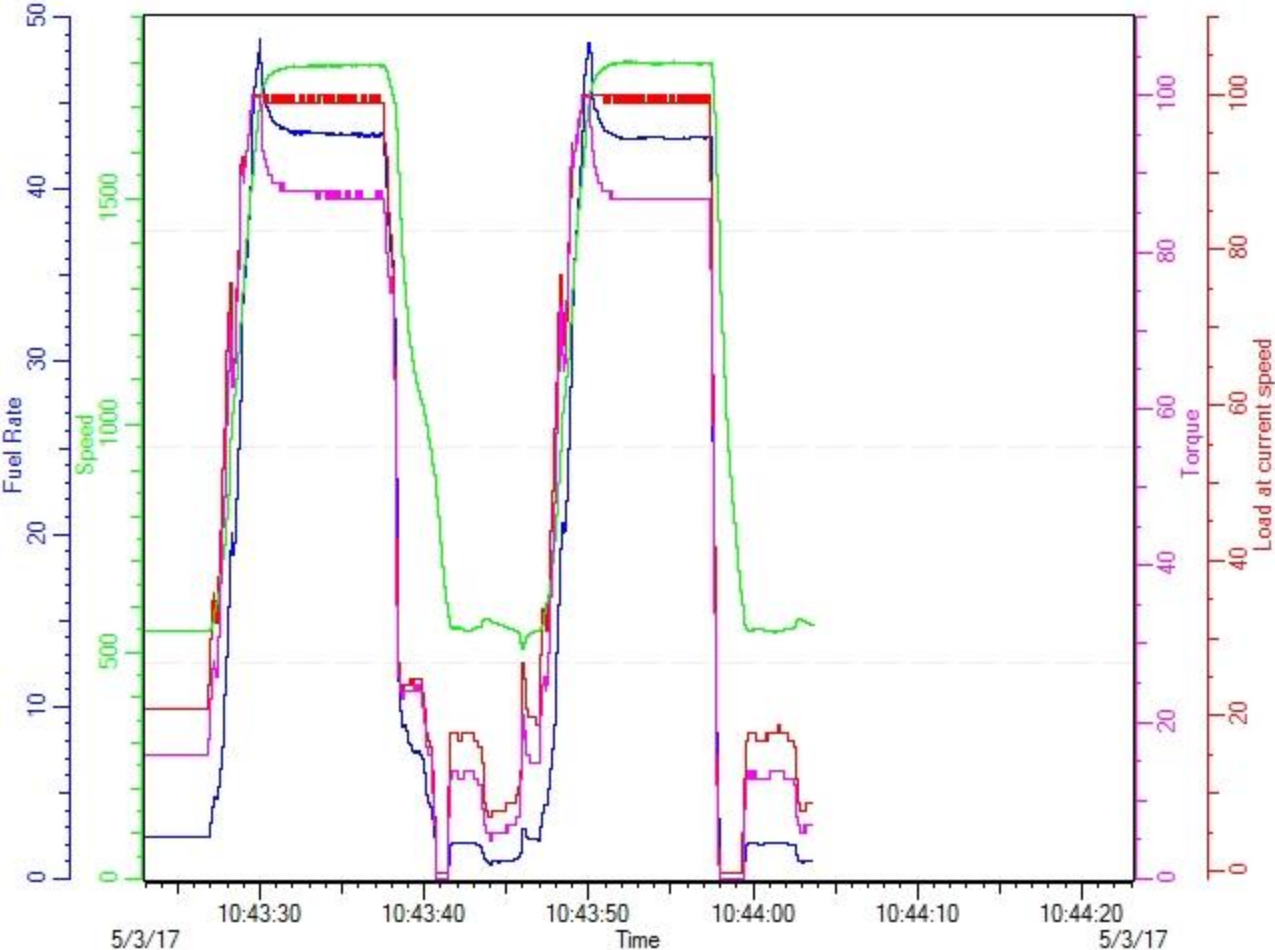








Test results.



Results at full load

Engine speed	: 1.802 rpm	
Engine load	: 90 %	(189 kW)
Coolant temp	: 88.0 °C	
Exhaust gas before DPF	: 269 °C	
Exhaust gas before SCR	: 269 °C	
NOx concentration before SCR	: 622.08 ppm	
NOx concentration after SCR	: 11 ppm	
SCR efficiency	: 98.16 %	
Fuel consumption	: 39.2 l/hr	
Noise level (engine room)	: 98 dB(a)	
Free exhaust noise (at 1 m)	: 54 dB(a)	



Applications

- **Propulsion engine**, range 200 to 375 kW
- **Bow thruster**
- **Auxiliary**
- **Alternative**
 - Diesel electric
 - Hybrid
 - Twin set
 - Modular



Can an Euro VI truck engine be used as marine engine?



Technical

If technical conversions are made, it's technical possible



Economical

- Acceptable investment
- Low fuel consumption
- Low maintenance costs
- Short invest-return time

