mtu
FRIEDRICHSHAFEN

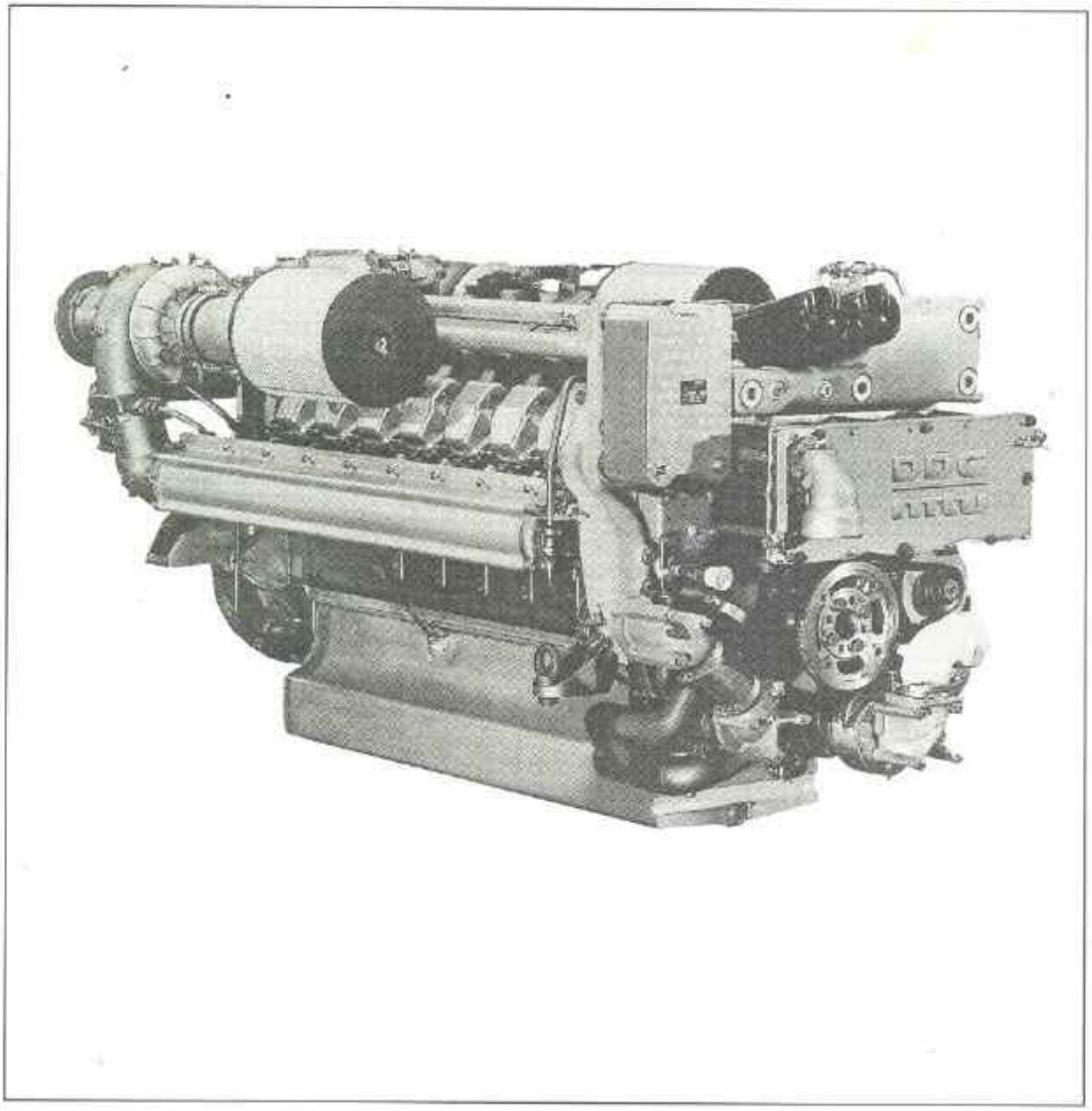
Standard Quotation

DDC/MTU Engine Series 2000

16V 2000 M90

Propulsion Plant for Fast, Non-Classified Ships

1343 kW · 2300 rpm



Engine Rating

Engine Model	Application Group	Fuel Stop Power		
		rpm	**kW**	HP (metric)
16V 2000 M90	**1DS**	2300	**1343**	1826

The rating shown represents net brake power (DIN/ISO 3046) at the PTO flange (raw water pump requirement deducted).

To calculate the power available at the gearbox output flange, a gearbox efficiency of 0.97 must be taken into account.

Application Group **1DS:** Fast Ships

Reference Conditions:				
	Intake air temperature	25 ° C*	Barometric pressure	1000 mbar
	Raw water temperature	25 ° C*	Intake depression	15 mbar
			Exhaust back pressure	30 mbar

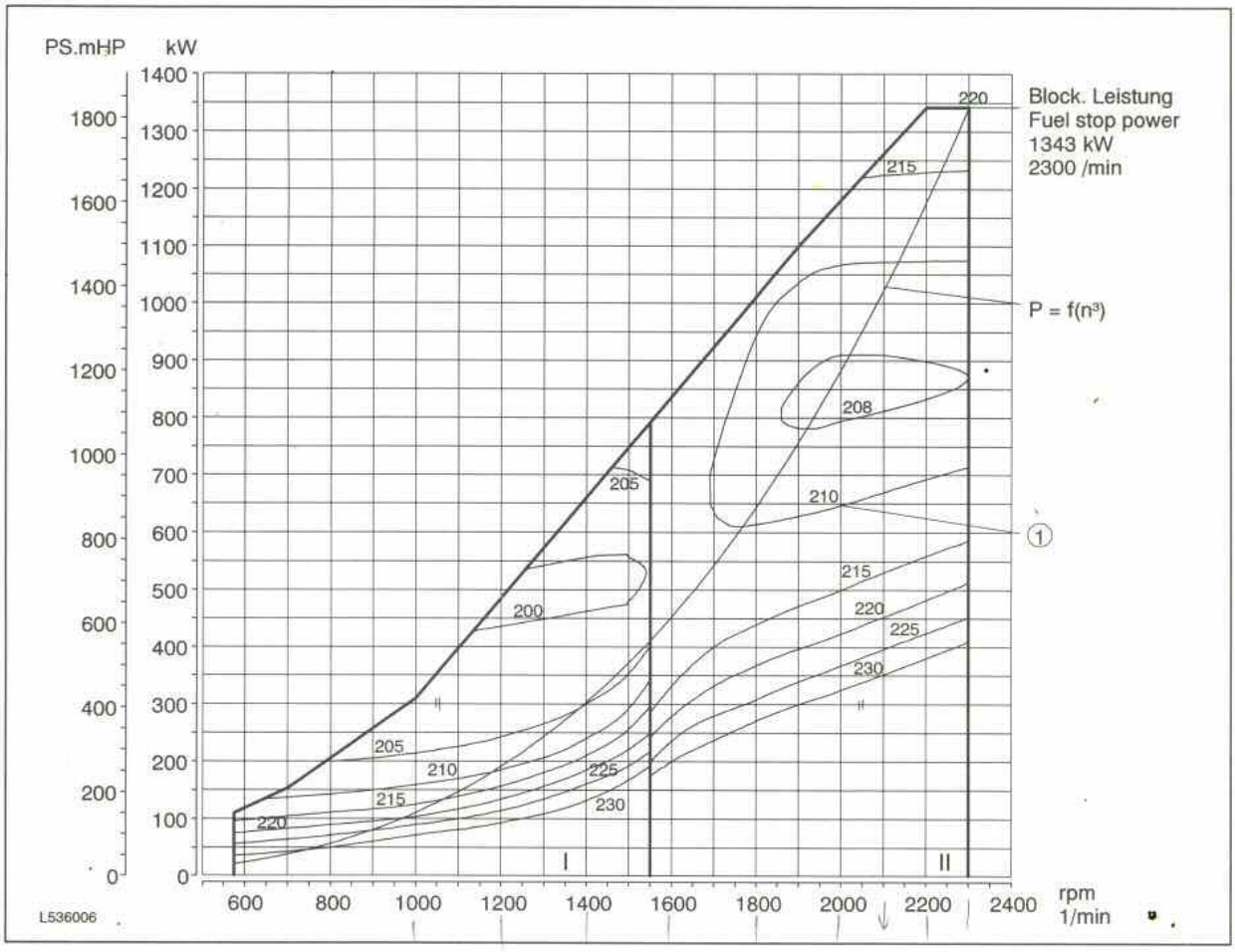
* At 45 °C intake air temperature and 32 °C raw water temperature: 1.5 % derating.

Performance Diagram

Remarks:

① Specific fuel consumption
Fuel consumption curves (g/kWh), tolerance +5% to ISO 3046, diesel fuel to DIN EN590 with a minimum LHV of 42800 kJ/kg.
Including all pumps required for engine operation.

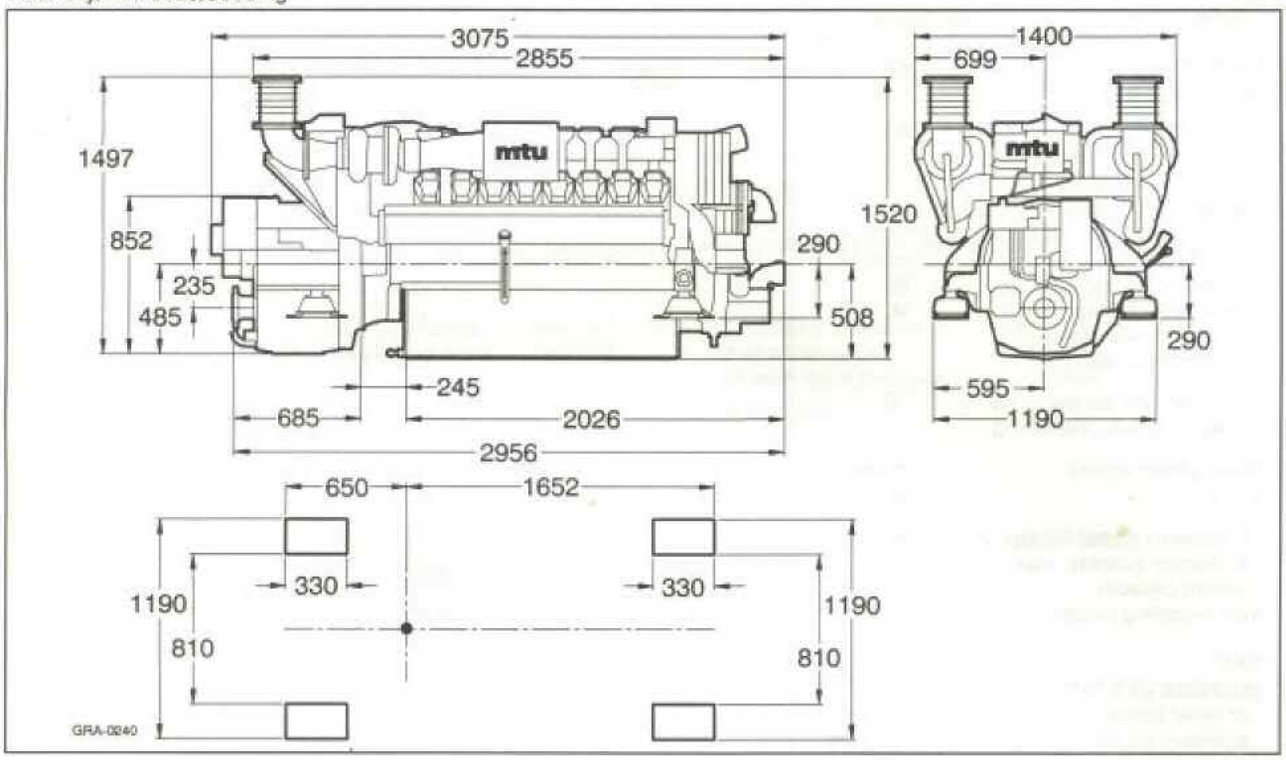
I, II Status sequential turbocharging



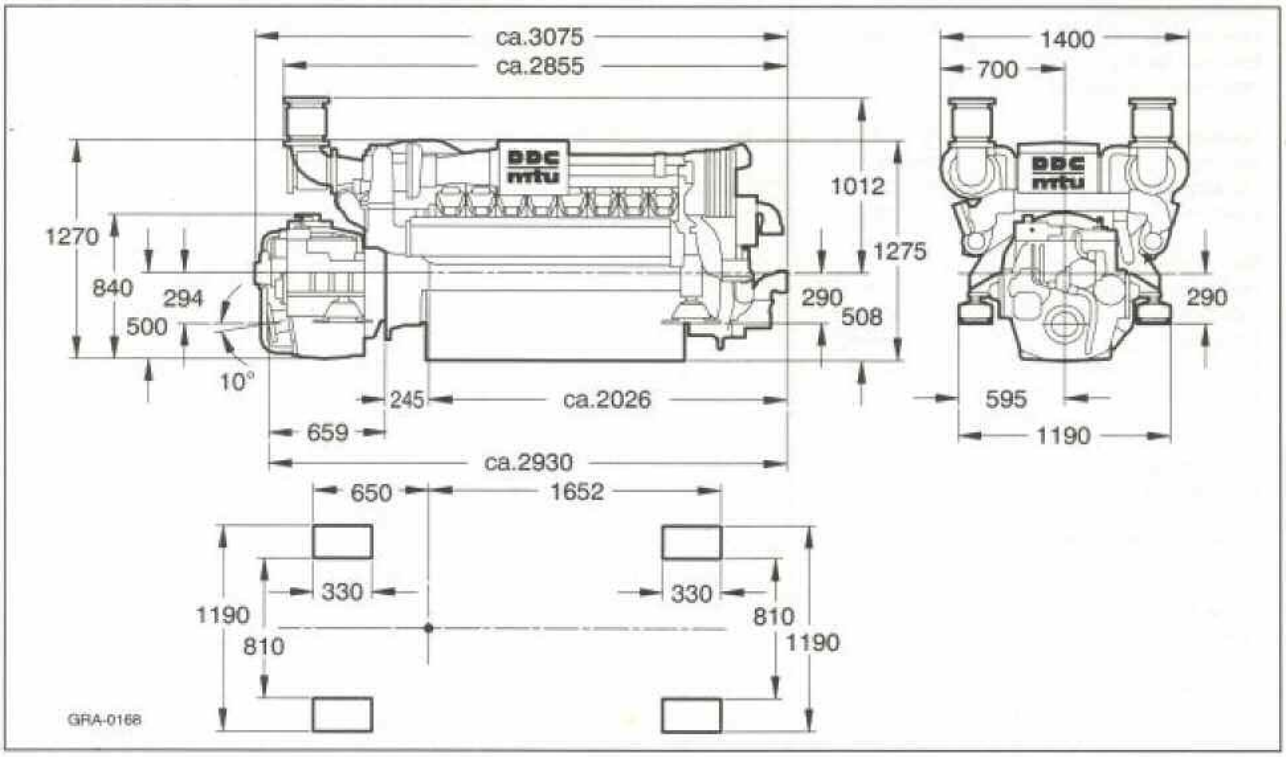
Technical Data

Engine Model		16V 2000 M90
General specifications		4-stroke diesel, liquid-cooled, turbocharged, intercooled, direct injection, wet-type cylinder liners, piston cooling, triple-wall liquid-cooled exhaust manifolds
Crankcase		cast iron
Direction of rotation		c.c.w. (facing main PTO end)
Valves per cylinder		2 inlet, 2 exhaust
Cylinder arrangement		90°V
Bore/stroke	mm	130/150
Displacement, cylinder	lit.	1.99
Displacement, total	lit.	31.86
Number of cylinders		16
Compression ratio		15.2 : 1
Cold Start: Air temperature unassisted, w/o preheating	°C	- 10
Mean piston speed	m/sec	11.5
M.E.P.	bar	22.0
Oil capacity (initial filling)	lit.	approx. 130
Oil change quantity, max.	lit.	approx. 120
Coolant capacity incl. recooling system	lit.	approx. 160
SFC (tolerance +5% to ISO)		
- at rated power	(g/kWh)	220
- optimum on performance map	(g/kWh)	200
Oil consumption (after approx. 100 hours)	(g/kWh)	approx. 0.5% of fuel consumption
Intake depression, new/max. permissible	mbar	15/50
Exhaust back pressure, new/max. permissible	mbar	30/60
Radiation and convection heat	kW	30
Coolant heat dissipation	kW	1140
Raw water flow requirement, approx.	m³/h	
Combustion air flow	m³/sec	63
Exhaust flow	m³/sec	1.68
Exhaust temperature after turbine	°C	4.25 425
Inclinations relative to waterline:		
(main PTO end down) Trim, permanent	∠ °	13.5
(main PTO end up) Trim, permanent	∠ °	5.0
List, permanent (left)	∠ °	22.5
List, permanent (right)	∠ °	22.5

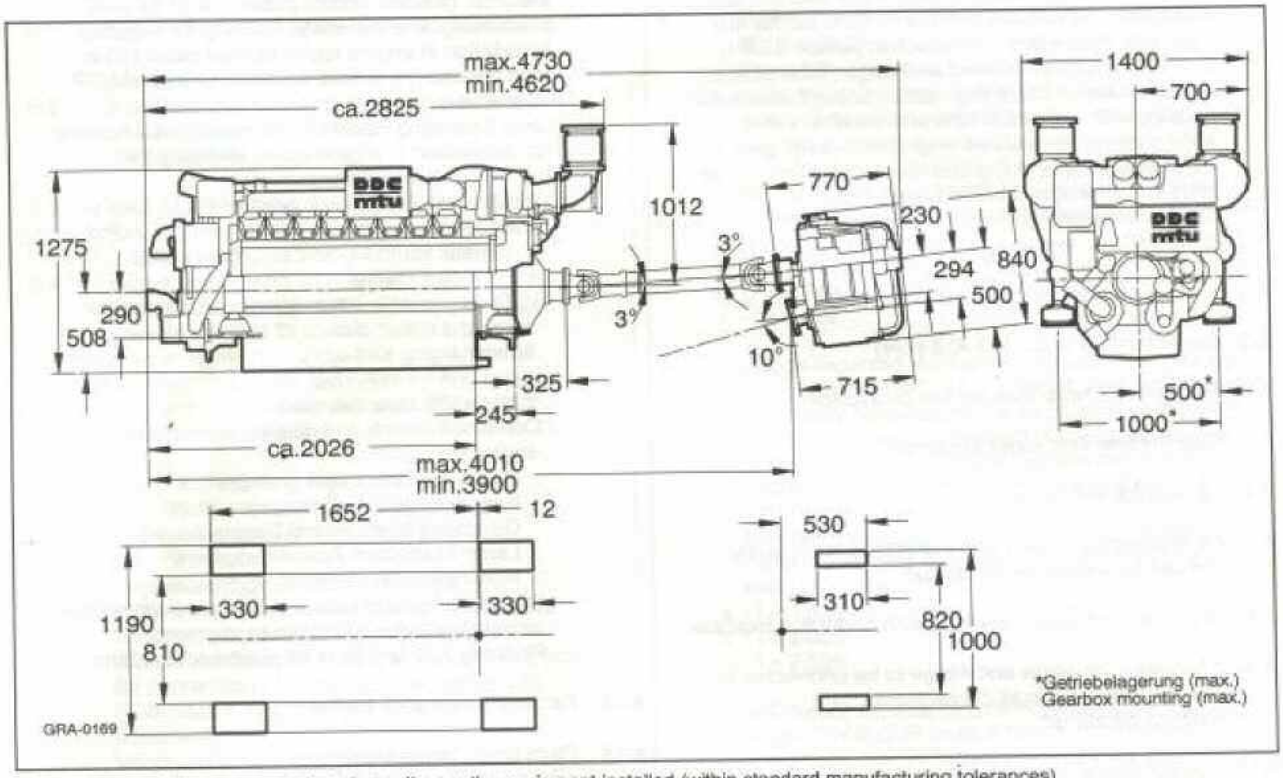
Engine with standard equipment, including coupling and flange-mounted ZF BW 255P gearbox
Mass dry/wet: 3625/3890 kg



Engine with standard equipment, including coupling and flange-mounted ZF BW 255AP gearbox
Mass dry/wet: 3625/3890 kg



Engine with standard equipment, including coupling, universal shaft and ZF BW 255VP gearbox (V-Drive)
Mass dry/wet: 3840/4160 kg



* Dimensions and mass may deviate depending on the equipment installed (within standard manufacturing tolerances)
Binding installation data after technical clarification of order.

A. Engine with Standard Equipment

A.1 Marine diesel engine with exhaust turbocharging and charge air cooling; liquid-cooled, triple-wall exhaust manifolds; fuel delivery pump with hand pump; fuel filter; individual electr. unit injection pumps (EUP); lube oil pump; lube oil heat exchanger, lube oil filter; coolant pump; coolant thermostat; coolant distribution housing with expansion tank and breather valve; engine carrier for resilient engine mounting; gear drive for engine coolant pump and raw water pump; V-belt drive for generator; vibration damper; Electronic engine governor and control unit (ECU-MDEC, see Item A.12)

A.2 Electric starter (24 VDC; 9.0 kW; 2-pole)

A.3 Generator (28 VDC; 140 A; 2-pole)

A.4 Flame-proof hose lines for fuel connection

A.5 Fuel prefilter with water separator

A.6 Oil dipstick (left or right)

A.7 Oil change equipment with semirotary hand pump (for use on engine and gearbox)

A.8 Dry-type combustion air filters with restriction indicator

A.9 2 bellows with elbow and flange to be connected to two on-engine exhaust connections (vertical discharge)

A.10 Coolant-to-raw water / fuel-to-raw water plate-core heat exchanger; self-priming raw water centrifugal pump; raw water connections for inlet/outlet (4" female thread with union for connection of molded tubing)

A.11 Resilient engine mount at aux. PTO end

A.12 Propulsion plant management system (standard version according to customer's specification)

Electronic propulsion plant management system PCS-5/MS I with CAN data bus/interface technology, with the following components/functions:

- Electronic engine control unit ECU-MDEC with integrated load profile recorder and data modules, programmed with engine and plant-related data, for engine speed control in response to speed setting with fuel injection and speed limitation as a function of engine status and operating conditions as well as MTU sequential-turbocharging control
- Set of on-engine sensors
- if gearbox is not supplied by MTU: electron. gearbox control system GCU for data processing, in sheet-metal housing for separate installation in engine room; system cable (10 m, plug connectors at both ends) for GCU and LOP connection
- Local Operating Panel LOP in sheet metal housing for installation in engine room, featuring the following functions/components:
  - Interface to ECU, EMU, gearbox GCU, Ship's-Side Monitoring System, and Remote Control
  - Automatic start/stop and emergency stop sequencing control
  - LCD-display with selector keyboard for sensor data, and status display of sequential turbocharging and cylinder cutout
  - Alarm unit for individual visual alarm with output for acoustic common alarm
  - Combined control and display elements for engine and gearbox
    Ready for Operation/Local Control/
    Engine Start/Stop/Emergency Stop/
    Gearbox Clutch Control/Engine Speed/
    Lamp Test/Alarm Acknowledgment/
    Illumination Dim Control
  - Set of connecting cables (10 m, plug connectors at both ends) for electronic components
  - Flashing light and horn for engine room alarm

A.13 Factory acceptance testing

A.14 Paint finish "white aluminium", single-component varnish, single color (RAL 9006)

A.15 Installation, operation and maintenance instructions

Mass dry/wet: 3000/3290 kg

B Additional and Alternative Equipment

ENGINE ACCESSORIES

B.1 Set of molded tubing for raw water inlet/outlet

Alternative to Item A.9

B.2 2 bellows with flange to be connected to two on-engine exhaust connections (horizontal discharge)

B.3 Lateral, not clutchable engine Aux. PTO SAE B-B (max. 316 Nm)

B.4 Bilge pump, mech. clutchable, flow rate approx. 10 m³/h at 1500 rpm engine speed (1x per ship)

B.5 Resilient engine mount at main PTO end (for V-Drive/free standing gearbox)

B.6 Coolant preheating (upon request)

B.7 Cylinder-head covers, chrome-plated

B.10 Engine/gearbox standard interface (only if "Remote Control" and/or "Ship's-Side Monitoring System" is not supplied by MTU) (Electronic data processing unit in terminal box for connection of customer-side systems to PCS-5/MS I, incl. interface definition and documen-tation

MARINE GEARBOX

B.20 Flange-mounted marine reverse-reduction gearbox; ZF, BW 255P (PTO axial, vertically off-set); electrically operated; hydraulic clutches and propeller thrust bearing; resilient coupling between engine and gearbox; resilient gearbox mount, on-gearbox sensors; electron. gearbox control unit GCU for data processing, in sheet-metal housing for separate installation in engine room; system cable (10 m, plug connectors at both ends) for GCU and LOP connection

a - i = 1.511
b - i = 2.030
c - i = 2.462

B.21 Flange-mounted marine reverse-reduction gearbox; ZF, BW 255AP (PTO 10° inclined, vertically off-set); electrically operated; hydraulic clutches and propeller thrust bearing; resilient coupling between engine and gearbox; resilient gearbox mount, on-gearbox sensors; electron. gearbox control unit GCU for data processing, in sheet-metal housing for separate installation in engine room; system cable (10 m, plug connectors at both ends) for GCU and LOP connection

a - i = 1.574
b - i = 2.029
c - i = 2.536

B.22 V-Drive ZF reverse-reduction gearbox Model BW 255VP (output flange 10° inclined); electrically operated; hydraulic clutches and propeller thrust bearing; resilient coupling and universal shaft between engine and gearbox; rigid gearbox mount; on-gearbox sensors; electron. gearbox control unit GCU for data processing, in sheet-metal housing for separate installation in engine room; system cable (10 m, plug connectors at both ends) for GCU and LOP connection

a - i = 1.574
b - i = 2.029

B.25 Free standing gearbox (upon request)

B.26 Trolling valve for ZF gearbox

B.27 Propeller shaft flange for ZF gearbox

B.28 PTO on ZF gearbox (for hydraulic pump, without pump, not clutchable)

a - size SAE A (max. 60 Nm)
b - size SAE B (max. 90 Nm)

B Additional and Alternative Equipment

Cont'd: **MARINE GEARBOX**

B.29 PTO on ZF gearbox
(for hydraulic pump, without pump, not clutchable; retrofitting not possible after placing of order)
a - size SAE B-B (max. 340 Nm)
b - size SAE C (max. 650 Nm)
c - size SAE C-C (max. 650 Nm)

(a, b, c not possible with BW 255VP)

B.30 PTO on ZF gearbox
(cylindrical shaft with key, not clutchable, max. 1000 Nm)

REMOTE CONTROL

B.40 Electronic engine and gearbox remote control RCS-5 FPP (for fixed pitch propeller plant), for the first control stand (closed)
consisting of:
microprocessor-controlled remote control system with CAN data bus/interface technology.
Engine speed and gearbox coupling control via control lever. Operating panel with command transfer selection, option "single lever control" for multiple shaft systems and LCD-display for operation status and program information
b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.40
B.41* Electronic engine and gearbox remote control for each additional control stand (closed or open) (scope analogous to B.40)
b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.40
B.42* Electronic engine and gearbox remote control for 2 wing control stands (closed or open) (scope 2x analogous to B.41)
b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.40
B.43 Portable remote control unit for auxiliary control stand
Portable manual control unit for docking maneuvers from an open control stand incl. connection box and cable
(for twin-engine plant)

Possible Addition to Item B.43
B.44 Additional connection box for manual control unit (max. 2 additional connections)

Possible Addition to Item B.40
B.45 Trolling mode for dead-slow propulsion (only in conjunction with B.26)
b - for twin-engine plant
c - for three-engine plant

* only in conjunction with Item B.40
B.41 + B.42 max. 5 slave control stands possible

B Additional and Alternative Equipment

SHIP´S-SIDE MONITORING SYSTEM

B.50 Engine and gearbox instrumentation for the first control stand (closed),
consisting of:
microprocessor-controlled panel-type monitoring system MCS-5, type 1, with integrated CAN bus interface for propulsion plant management system PCS-5/MS II, incl. dimmer control, ready for connection in console-fitting enclosure, with the following components:
- LCD display unit with selector key-board for quasi-analog and digital display of sensor data from CAN bus, such as:
  Speed / Fuel injection / Temperatures / Pressures
- Alarm unit with visual individual alarms for various engine and gearbox measuring points, incl. reset keys, lamp test and alarm buzzer
- Control panel with Engine Start, Stop, Emergency Stop and Override buttons, displays for Ready for Operation and Local Control
- Illuminated analog engine speed display

b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.50

B.52* Engine and gearbox instrumentation for the first slave control stand (closed or open),
consisting of:
- Control panel with integrated CAN bus interface, incl. dimmer control, ready for connection in console-fitting enclosure, with control units for Engine Start, Stop, Emergency Stop and Override, displays for Ready for Operation, Local Control as well as visual common alarm incl. reset keys and lamp test
- Horn for acoustic alarm
- Illuminated analog engine speed display

b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.52

B.54* Engine and gearbox instrumentation for each additional slave control stand (closed or open), consisting of:
- Control panel with integrated CAN bus interface, incl. dimmer control, ready for connection in console-fitting enclosure, with control units for Engine Start, Stop, Emergency Stop and Override, displays for Ready for Operation, Local Control as well as visual common alarm incl. reset keys and lamp test
- Horn for acoustic alarm
- Illuminated analog engine speed display

b - for twin-engine plant
c - for three-engine plant

Possible Addition to Item B.50

B.56* Engine and gearbox instrumentation for 2 wing control stands (closed or open),
each wing stand consisting of:
- Control panel with integrated CAN bus interface, incl. dimmer control, ready for connection in console-fitting enclosure, with control units for Engine Start, Stop, Emergency Stop and Override, displays for Ready for Operation, Local Control
- Horn for acoustic alarm
- Illuminated analog engine speed display

b - for twin-engine plant
c - for three-engine plant

* only in conjunction with B.50
B.52 + B.54 + B.56 max. 5 slave control stands possible

Note:
SHIP´S-SIDE MONITORING SYSTEM

Monitoring System (MCS-5, type 2) with graphic control stations (active process visualization via color monitors) for monitoring of propulsion plants and additional measuring points and control functions in general ship´s area
- upon request

B Additional and Alternative Equipment

PAINTWORK

Alternative to Item A.14

B.70 Paint finish "grey silver",
single-component varnish, single color
(RAL 7001)

B.71 Paint finish "signal white",
single-component varnish, single color
(RAL 9003)

B.72 Paint finish "gold metallic",
single-component varnish, metallic-effect paint, single color (RAL 462)

SPARE PARTS

B.80 Shipboard spare parts kit
To manufacturer's recommendation, for engine, gearbox, monitoring system and remote control
- small kit -
(1 x per ship)

TOOLS

B.90 Shipboard tool kit
To manufacturer's recommendation, for engine, gearbox, monitoring system and remote control
- small kit -
(1x per ship)

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