For projects only
Technical information for detailed design
ask engine supplier for confirmation.

SPECIFICATION

FOR

K 45 GF

TWO-STROKE, SINGLE-ACTING, CROSSHEAD, MARINE

DIESEL ENGINE

B&W
MOTOR

1975

EDITION 1

BURMEISTER & WAIN ENGINEERING COMPANY LIMITED

BURMEISTER & WAIN

LIST OF CORRECTIONS FOR SPECIFICATION **K45 GF**

Basis 19.75. edition 1 page 1 (1)

Date	Page	Description
22/3-76	M1	Fuel oil consumption 155 g/BHPh at a lower calorific value 10,250 kcal/kg at CSR to be altered to 158 g. Guaranteed consumption 158 +3% g/BHPh at CSR. Curve page M9 to be corrected correspondingly.
18/5-76	K2	The following manometers are included in the standard delivery extent: Pressure drop across blower filter. Lub.oil camshaft inlet. Scavenging air receiver. Starting air. See drgs. 663197-8.2, 663196-6.4 and 667761-9.4.

SPECIFICATION

FOR

K 45 GF

TWO-STROKE, SINGLE-ACTING, CROSSHEAD, MARINE

DIESEL ENGINE

B&W
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BURMEISTER & WAIN ENGINEERING COMPANY LIMITED

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H. Recommendation for Main Engine Installation

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A. GENERAL

GENERAL INFORMATION

1 Name of Plant, Building No. _____

2 The engine is of the 2-stroke, single-acting crosshead type

3 Direct reversible engine

4 Starboard engine

5 The engine is designed for operation on heavy fuel oil having a viscosity of up to 3500 sec.Redwood 1 at 100°F (350 cSt at 50°C).

6 Cylinder number: _____

Type _____

Cyl. diameter: _____

Stroke: _____

_____ IHP

Nominal power at _____ BHP

CSR mean pressure _____ RPM

p_e = _____ kp/cm^2

_____ IHP

Nominal power at _____ BHP

MCR mean pressure _____ RPM

p_e = _____ kp/cm^2

_____ BHP

OR per engine _____ RPM

Above ratings are valid at sea level and up to tropical conditions, i.e. sea water temperature 32°C and barometric pressure 760 mm Hg.

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7 The direction of rotation for "Ahead" is so that the top of the crankshaft turns to the starboard.
Numbering of the cylinders is from "fore" to "aft".

8 Classification Society and other regulations: _____

_____

_____

_____

_____

_____

9 Name plates, one language: _____

10 Voltage 3 phase: 440 V 60 c/s
1 phase: 220 V 60 c/s

11 Emergency supply for manoeuvring system: 24 V DC

12 Instrument scale: Metric

13 Weight: The maximum weight of the pieces for dispatch is: _____

14 Drawings and instructions: The following will be delivered:
3 set blueprints of installation drawings mentioned on page H5-H and
4 set instruction books for attendance of the machinery.

Language: _____

The material mentioned in point 14 is for the owner and his staff only and must not in any form be handed over to a third party.

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STANDARD DELIVERY EXTENT

The delivery extent will comprise ..... main engine(s) of the B&W standard design as described in paragraphs B,K and M,and with spare parts as required by the classification societies (see page S2) and special tools (see page T2).

SUPPLEMENTARY EQUIPMENT

If wanted,the following equipment can be supplied at an additional price: (mark)

☐ Fire extinguishing in scavenging box

- ☐ CO_2
- ☐ Water mist
- ☐ Steam

☐ B&W gallery arrangement
Platforms,railings and stanchions

☐ Emergency blower
For operation in case of a total turbocharger break down. See page M2.

☐ Auxiliary blower and non-return valves in scavenging air pipes.
For C.P. propeller plant and for running less than 30% of nominal RPM at CSR. see page M3.

☐ B&W Bridge Manoeuvring System.
Type B&W-BMS-R100.

☐ STL Bridge Manoeuvring System
Type B&W/STL-DMS 990

☐ Engine designed for C.P. Propeller running.
(Incl. aux. blower). See page K23.

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Supplementary equipment continued:

☐ Crane beam placed below centre man.side gallery brackets

☐ Supplementary equipment mentioned below:

_____

_____

_____

_____

_____

_____

_____

_____

NB: Other supplementary equipment on pages A6, A7, A8, A9

CHANGES OF DESIGN AND DELIVERY

Price changes (mark)

☐ Anticlockwise rotation cancels point 7 page A2

☐ Port engine cancels point 4 page A1

☐ Non-reversible cancels point 3 page A1

It is recommended in connection with outside salt cooling water pipes of MK (aluminium brass) to use:

☐ End covers made of brass instead of standard epoxy coated cast iron covers.

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☐ Crosshead bearings with cast-in white metal page B5

☐ Two-piece stay bolts (space conditions)

☐ Other voltage and frequency cancels point 10 page A2

3 phase ____ V ____ c/s

1 phase ____ V ____ c/s

☐ Special balancing of inertia forces and couples page M6

☐ Engine made for ice class requirements

☐ Other changes mentioned below:

_____

_____

_____

_____

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_____

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AUXILIARY EQUIPMENT

The below-mentioned auxiliary equipment can be delivered by the engine builder at an additional price:

☐ Holding-down bolts (bolt,spacer pipe,2 nuts.)

☐ Holding-down bolts (bolt,spacer pipe,1 nut,1 nut with sperical face,sperical washer.)

☐ End chock bolts

☐ Side chocks liners (wedges)

☐ Fuel oil filter

☐ Other auxiliary equipment:

_____

_____

_____

_____

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_____

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_____

_____

_____

_____

SUPPLEMENTARY SIGNAL EQUIPMENT

The following signal equipment can be delivered by the engine builder at an additional price. For the standard extent of signal equipment see paragraph K.

- ☐ Alarm panel for the below specified signal equipment
- ☐ Thrust shaft displacement
- ☐ Scavenging air space temperature each cyl.
- ☐ Cylinder lubricators, flow & level
- ☐ Thrust bearing segment temperature hole for special feeler, make: _____
- ☐ Remote tachometer pointer instruments for main engine for mounting on bridge, qty.: _____
- ☐ Fresh cooling water temperature, outlet from each cyl.
- ☐ Turbocharger too large vibration, one for each charger
- ☐ Oil mist detector (crankcase)
- ☐ Thermonitor for exhaust gas (scanner)
- ☐ Fuel oil after filter, temperature
- ☐ Feeler for exhaust valve movement/cyl.
- ☐ Other signal equipment mentioned below:

_____

_____

_____

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ADDITIONAL SPARE PARTS

The delivery extent of spare parts is laid down by the classification societies, see page S2. Additional spare parts can be delivered at an additional price.

☐ B&W recommended additional spare parts (see page S2 and S3)

☐ Other spare parts as mentioned below:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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ADDITIONAL or CHANGED TOOLS

Special tools are delivered as mentioned on page T2. Other tools can be delivered, see below:

☐ Air cooler pneumatic tackle each cooler
(Hand tackles to be replaced by the mentioned tackles)

☐ Hydraulic jack for end chocks bolt
(Jack, spacer ring and high-pressure steel pipe)

☐ Hydraulic jack for holding-down bolt
(Jack and spacer ring)

☐ Other tools as mentioned below:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

DESCRIPTION

Bedplate and Main Bearing

For 5 and 6 cyl. engines the bedplate is made in one. For 7-12 cyl. it consists of 2 parts assembled in the chain drive. The aft part contains the thrust bearing. The bedplate is made of cast iron and made for long, elastic holding-down bolts tightened by hydraulic tool. The holding-down bolts can be delivered.

The oil pan is made of steel plate and bolted to the bedplate bottom. The oil pan collects the return oil from the forced lubricating- and cooling oil system. The oil pan is provided with an oil outlet at the aft end.

The main bearings consists of steel shells lined with white metal. The bottom shell can be means of hydraulic tools for lifting the crankshaft and a hook-spanner be turned out and in. The shells are fixed with cover and long, elastic studs. The nuts are provided with Penn-securing.

Thrust Bearing

The thrust bearing is of the B&W-Michell type. Primarily, it consists of a steel forged thrust shaft, a bearing support, and segments of cast iron with white metal. The thrust shaft is connected to the crankshaft and the intermediate shaft with fitted bolts.
The intermediate shaft is not included in the delivery extent of the engine builder.

The thrust shaft has a collar for transfer of the "thrust" through the segments to the bedplate.
The thrust bearing is closed against the crankcase, and it is provided with a relief valve.
Lubrication of the thrust bearing takes place from the Engine's system oil. At the bottom of the bearing there is an oil sump with outlet to the oil pan.

Frame Section, Cylinder Liner and Stuffing Box

The frame section consists for the 5 cyl. engine of one part with the chain drive located aft. For cylinder number 6-12 it consists of 2 parts assembled at the chain drive.

The frame section is made of cast iron. Furthermore, it forms the lower part of the cooling water space together with the cylinder liner and the scavenging air space.

The frame section is provided with inspection covers and relief valves on the rear side. For each cylinder there is on the manoeuvring side a large, hinged door giving easy access to the crankcase, and each scavenging air space is provided with a cleaning cover. The double bottom between the crankcase and the scavenging air space and also the stay bolt pipes are water cooled. The frame section supports a telescope pipe for piston cooling oil inlet and a slotted pipe for cooling oil outlet each cylinder.

The frame section is attached to the bedplate with bolts.

The stay bolts are in one part. To prevent transversal oscillations the stay bolts are supported by bracing screws. The stay bolts are tightened hydraulically.

Housings for roller guides, lubricators, and gallery brackets are suspended on the frame section. Between the crankcase and the scavenging air space there is a piston rod stuffing box. The stuffing box is provided with sealing rings for scavenging air and oil scraper rings preventing oil from coming up into the scavenging air space.

The cylinder liner is made of alloyed cast iron and is suspended in the frame section with a low situated flange. The uppermost part of the liner is surrounded by a cast iron cooling jacket. The cylinder liner has scavenging ports and drillings for cylinder lubrication.

Cylinder Cover

The cylinder cover is made in one piece of forged steel and has drillings for cooling water. It has a central bore for exhaust valve and bores for fuel valves, safety valve, starting valve, and indicator valve.
The cylinder cover is attached to the frame section with studs tightened by torque spanner.

Exhaust Valve and Valve Gear

The exhaust valve consists of a valve housing and a valve spindle. The valve housing is of cast iron and arranged for water cooling. The housing is provided with a bottom piece of steel with "Stellite" welded onto the seat. The spindle is made of heat resistant steel with "Stellite" welded onto the seat. The housing is provided with spindle guide. The exhaust valve is tightened to the cylinder cover with studs and nuts tightened by pneumatic tools. The exhaust valve is opened hydraulically and closed by a set of helical springs. The hydraulic system consists of a piston pump mounted on the roller guide housing, a high-pressure pipe, and a working cylinder on the exhaust valve. The piston pump is activated by a cam on the camshaft.

Fuel-, Starting-, Safety- and Indicator Valve

In the cylinder cover there are 2 fuel valves, 1 starting valve, 1 safety valve, and 1 indicator valve.
The fuel valve opening is controlled by the fuel oil pressure and it is closed by a spring. An automatic vent slide allows circulation of fuel oil through the valve and high-pressure pipes and prevents the compression chamber from being filled up with fuel oil in case of possible sticking spindle and stopped engine. Oil from venting and other drains is led away in a closed system.

The starting valve is opened by control air from the starting air distributor and closed by a spring.

The safety valve is spring loaded.

The indicator valve is placed near the indicator gear.

Crankshaft

The crankshaft is for 5 cyl. engines made in one part, while it for 6-12 cyl. engines is made in two parts assembled at the chain drive with fitted bolts. All crankshafts are semi-built. For 5-10 cyl. engines the throws are of cast steel while they are of forged steel for 11-12 cyl. engines. The main bearing pins are forged.
The crankshaft has in the aft end a flange for assembling with the thrust shaft. The crankshaft has no balance weights as the balancing takes place by boring of the crank pins.

Connecting Rod

The connecting rod is of forged steel. It has a Tee-shaped base on which the crank bearing is attached with hydraulic tightened bolts and nuts with Penn-securing. The top is square shaped on which the crosshead bearings are attached with hydraulic tightened studs and nuts with Penn-securing.
The bearing parts are mutually assembled with bolts and nuts tightened by hydraulic jacks.

The lubrication of crank bearing takes place through a central drilling in the connecting rod.
The crank bearing is steel cast in two parts lined with white metal. The bearing clearance is adjusted with shims.
The crosshead bearings are of cast steel in two parts and provided with bearing shells.

Piston - Piston Rod - Crosshead

The piston consists of piston crown, piston skirt, and cooling insert for oil cooling. The piston crown is made of heat-resisting steel and is provided with 5 ring grooves which are hard-chrome plated on both lands. The piston skirt is of cast iron. The piston rings are right and left angle cut and of the same height.

The piston rod is of forged steel. It is fixed to the cross-head with a hydraulic tightened stud. The piston rod has a central bore which in connection with a cooling oil pipe and the cooling insert forms inlet and outlet for cooling oil.

The crosshead is of forged steel and is provided with steel cast guide shoes with white metal on the running surfaces.
A bracket for oil inlet from the telescope pipe and a bracket for oil outlet to slit pipe are mounted on the crosshead.

Fuel Pump and Fuel Oil High-Pressure Pipes

The fuel pumps consist of a pump housing of nodular cast iron and a central placed pump cylinder and plunger of nitrated steel. There is one pump for each cylinder.
In order to prevent fuel oil from being mixed into the separate lubr. system on the camshaft, the pump is provided with a sealing device.
The pump gear is activated by the fuel cam, and the injected volume is controlled by turning the plunger by a toothed bar connected to the regulation mechanism.
Adjustment of the pump lead is made with shims between top cover and pump cylinder.

The fuel oil high-pressure pipes have protecting hoses.
The fuel oil system is provided with a device setting the fuel index in "0" position in case of leakage from the high-pressure pipes.

Camshaft and Cams

The camshaft is divided into sections for each cylinder. The individual sections consist of a shaft piece with 1 exhaust cam, 1 fuel cam, 1 indicator cam, and coupling parts.
The exhaust- and fuel cams are of steel with a hardened roller race, and are shrunk on the shaft. They can be adjusted and dismounted hydraulically.
The indicator cams, which are of cast iron, are tightened to the shaft.
The coupling parts are shrunk on the shaft and can be adjusted and dismounted hydraulically.
The camshaft is embedded in the camshaft frame, which is separated only at the chain drive.
The camshaft bearings consist of 2 mutually interchangeable bearing shells, which are mounted in casings.

Chain Drive and Reversing

The camshaft is driven from the crankshaft by 2 off 3 inches chains. The chain drive is provided with a chain tightener and guidebars support the long chain strands.
The camshaft is provided with a hydraulic actuated reversing gear turning the camshaft to the position corresponding to the crankshaft's direction of rotation.
Starting air distributor, governor, and cylinder lubricators are driven by separate chains from the intermediate wheel.

Governor

The engine RPM is controlled by a hydraulic governor.

Cylinder Lubricators

The cylinder lubricators are mounted at the end of the cylinder frame. The lubricators have built-in adjustment of the oil quantity. They are of the "Sight Feed Lubricator" type and each lubr. point has a glass. The oil is led to the lubricator through a pipe system from an elevated tank. A heating element is built into the lubricator.
The elevated tank and the pipes not mounted on the engine are not included in the delivery extent of the engine builder.

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Manoeuvring System
(Without Bridge Control)

The engine is provided with an el.pneumatic manoeuvring- and regulation system. This system transmits orders from the separate manoeuvring stand to the engine. The system consists of two sub-systems, one for regulation and one for reversing.

The regulation system is able to start, stop and regulate the engine. The speed control handle in the manoeuvring stand activates a control valve, which gives a pneumatic speed-setting signal to the governor dependent of the desired number of revolutions, an el-switch for the starting and stop functions. At a shut down function the stop cylinder is activated by a solenoid valve independent of the speed control handle.
The reversing system contains two el-switches (ahead and astern) mounted in the engine telegraph and activated by the telegraph handle. These switches are connected to the reversing solenoid valves on the engine. These solenoid valves actuate the reversing cylinder at the starting air distributor and the pressure riser for reversing of camshaft.

The reversing takes place by moving the telegraph handle from "Ahead" to "Astern".
The control air then moves the starting air distributor and through the pressure riser the reversing gear to the "Astern" position.
A functional description is given on page K10-K11.
The telegraph is not included in the standard delivery extent of the engine builder.

Turning Gear and Turning Wheel

The turning wheel acts as a worm wheel and is fitted to the thrust shaft. This wheel is driven by a worm shaft on the turning gear, which is mounted on the bedplate. The turning gear is driven by an electric motor with built-in gear and brake. Further the gear is provided with a blocking device that prevents the main engine from starting when the turning gear is engaged. Engagement and disengagement of the turning gear is done by tilting the gear itself.
Starter, push-button, and cable are not included in the delivery extent of the engine builder.

Exhaust Turbocharger - BBC type

Type)
Quantity) See "Neces. Caps. of Aux. Machinery, etc."

The intake silencer of the turbocharger is provided with exchangeable air filter sections.
The turbocharger is provided with self-lubricated roller bearings.
The turbocharger is provided with a connection for tachometer and prepared for signal equipment to indicate possible too large vibration of the turbocharger.
For water cleaning of the turbine blades and the nozzle during operation there are connecting branches in the exhaust bends immediately before the protection grid. Further there is a possibility of water cleaning the air side of the turbocharger.

Air Cooler

Type)
Quantity) See "Necess. Caps. of Aux. Machinery, etc."

The air cooler is provided with cooling elements to be cleaned separately on the spot.

Gallery Brackets

The engine is provided with gallery brackets placed in such a height that the best possible overhaul- and inspection conditions are obtained. Main pipes of the engine are suspended in the gallery brackets.

Scavenging Air System

The air intake to the turbocharger takes place direct from the engine room through the intake silencer of the turbocharger. From the turbocharger the air is led via charging air pipe, air cooler and scavenging air pipe to the scavenging ports of the cylinder liner. The charging air pipe between turbocharger and air cooler is provided with a compensator.

Exhaust Gas System

From the exhaust valves the gas is via exhaust bends led to the turbocharger, through the outlet pipe and out in the exhaust pipe system. The outlet pipe flange is delivered bored according to the dimension stated. The exhaust bends are provided with compensators and with a protection grid before each turbocharger inlet.

For quick assembling and dismantling of the joints between the exhaust bends and the exhaust valves a clamping band is fitted.

The exhaust bends and the outlet pipe are provided with insulation covered by a galvanized steel plate.

The exhaust pipe system from outlet pipe is not included in the delivery extent.

Piping Arrangements

The engine is delivered with piping arrangements for the following:

Starting air
Fuel oil
Piston cooling oil
Main lubr. oil
Camshaft lubr. oil
Cylinder lubr. oil
Fresh cooling water
Different drains

The systems are made of seamless steel pipes.

All pipe connections are provided with blind flanges to be bored by the yard according to the actual outside pipe dimensions.

The pipes are provided with sockets for standard instruments and signal equipment and further with a number of sockets for supplementary signal equipment and supplementary remote instruments.

Starting Air System

The starting air system contains a main starting valve (two ball valves with actuators), a non-return valve, a starting air distributor, and starting valves. The main starting valve is combined with the manoeuvring system, which controls start and "Slow turning" of the engine.
The "Slow turning" function is actuated manually from the manoeuvring stand. Slow turning is only carried out automatically if the plant is provided with bridge manoeuvring system.
The starting air distributor regulates the control air to the starting valves so that these supply the engine with starting air in the firing order.
The starting air distributor is of the "rotor-type". The rotor has three positions in axial direction: Inactive, Ahead and Astern.

Standard Testbed Trial

The testbed trial of the engine is made on diesel or gas oil and begins by running the engine at about 25% CSR during 1/2 hour and 1 hour at the same rating for bearing control.

The engine rating is then stepwise increased according to the propeller curve. 100% CSR is obtained after about 8 to 20 hours.

After this trial the engine is running 1/2 hour at 25%, 50%, 75%, and 100% CSR, and observations (temperature, etc.) are taken at each load.

The delivery test trial begins by running the engine 4 hours at CSR, then 2 hours at MCR, and at last 1/2 hour at OR.

During this trial complete observations are taken and fuel oil consumptions are measured twice at CSR running and once at MCR and OR running.

Information about torsional vibrations

The engine builder carries out calculations of torsional vibrations in the shafting system according to the requirements of the classification societies.

Necessary information for the calculation is: intermediate- and propeller shaft dimensions, bearing supports and their arrangement and dimensions of the propeller. If the shafting arrangement is provided with other components having an influence on torsional vibrations, e.g. coupling data for these would be necessary information. The information should be in the engine builder's possession in due time.

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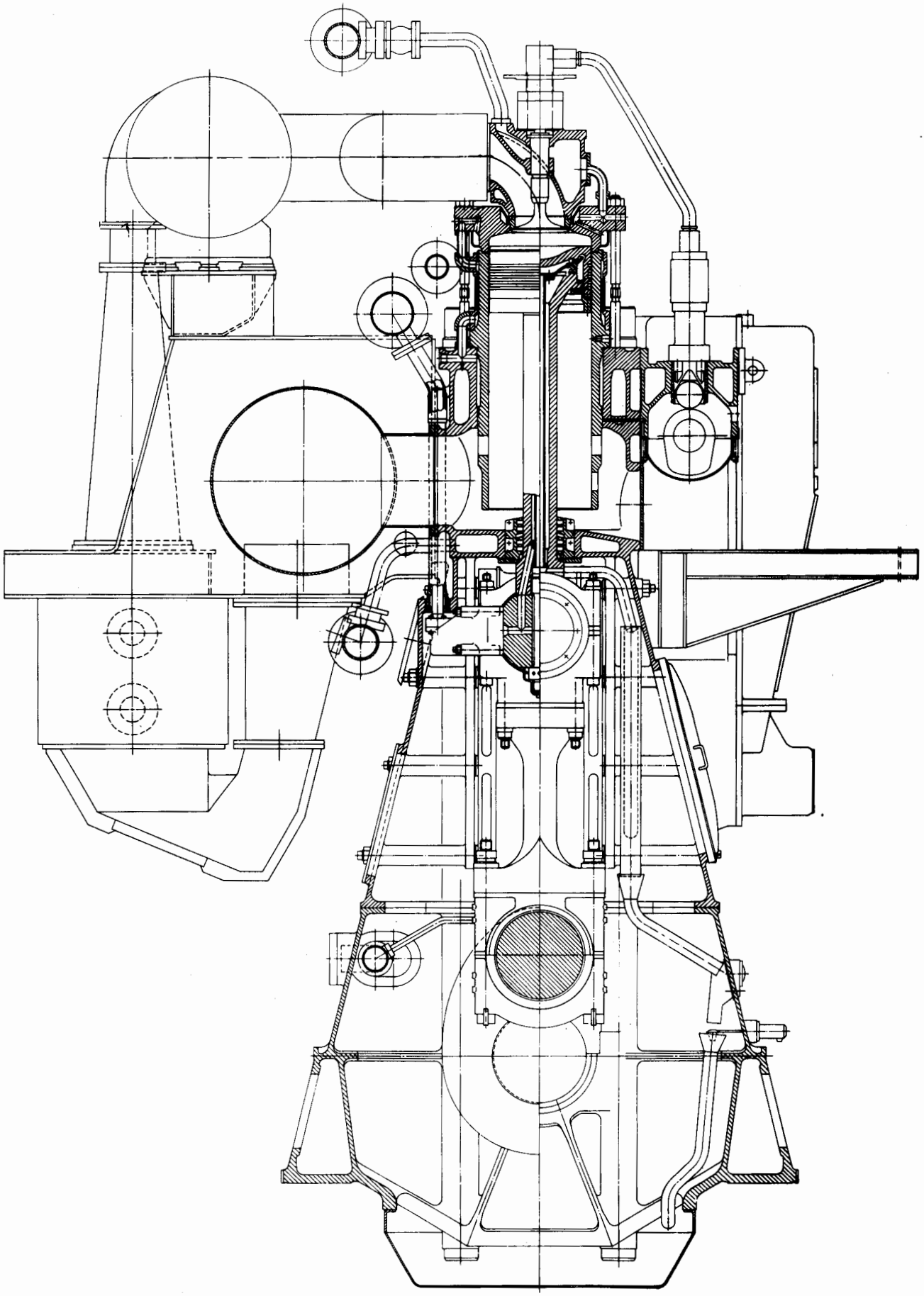

CROSS SECTION THROUGH ENGINE

Drwg. No. 668657-2.3

PACKINGS FOR K-GF ENGINES

On erection of main engine in workshop
the following packing materials are used

Packings	Thick-ness mm	Application	Supplier
Klinger Oilit	1,0	Is used for flange connections for water, lubricating oil and fuel oil	Rich. Klinger A.G. Gumpoldskirchen bei Wien Austria
REINZ REPA	1,0 2,0	Is used for flange connections for starting air Is used for fuel oil between flange and fuel pump	Reinz Dichtungsgesell shaft M.B.H. Neu-Ulm/Donau Western Germany
Copper-asbestosrings	1,5 2,5	Is used between connections where the packing surfaces are turned in relation to each other during tightening-up, for instance unions and plug screws. Refer to our standard sheet N14AC	Victor-Royal A/S Gammelmosevej 46-48 Gentofte, Denmark
Rings of synthetic rubber Technical data: Resistent to:Fuel oil Temperature: 130°C Hardness: 70° Shore Make or similar:Skega Material: Viton		Fuel oil system Maximum setting 8% measured according to DIN 53517 B, at 175°C for 24 hours, with 25% compression and measured on O-Ring 2,4x17,3 mm indside diameter as test specimen	Ferd. Johansen Frederikssunds-vej 276 2760 Brønshøj
Silicone rubberrings Technical data: Hardness: 60° shore Max. temp. 250°C Elongation: 100-500% Oil resistant		Rings of quality Klinger 602, shore hardness 60 are used for the connection between coo-ling jacket and cylinder liner	Wetzell Gummiwerke 32- Hilsesheim Postfach 10 Germany (supply from above compagny, oil resi-stant, except for heavy fuel oil)
Viton		Piston Piston rod	Simrit A/S Sandager 8, 2600 Glostrup Denmark

SEALINGS FOR K - ENGINES

On erection of main engine in workshop the following sealing material are used

Sealing Materials	Application	Supplier
SECOMASTIC KM 366	This sealing material is used as flexible filling between joints with a relatively coarse surface, such as guards between frames (crank housing doors) either together with asbestos cord or alone. It is mainly used as a substitute for packing during test running in workshop.	Secomastic Ltd. Brackness, Berkshire Great Britain
Permatex No. 1 Permatex No. 2	This sealing material is used in case of mounting at high temperature, pressure, or vibrations. Especially for repair of gaskets and fittings, for smoothing of oblique or uneven faces, far sealing af damaged threads and as replacement of gaskets which are unobtainable. Temperature - 60 °C to + 260°C This sealing material is used between joints which are dismantled after test running and further joints to be dismantled regularly or on places where vibratians necessitate flexible fitting, for instance: 1) between frame and bedplate 2) between savenging box and frame top 3) between flange joints of various guards 4) between flange joints of various covers with machined faces 5) between joints on engine parts where good sealing for oil is required	John Prior Comp.inc One World Trade Center Suite 2017 NY10048 U.S.A Telex nr. 42 19 56
Never seez Type NS 160 in the form of a paste	This sealing material is preferably used at the thread and flanged connections of the exhaust bends, which are often disconnected, further it is used in cylinder-cover at stuffing box far safety valve.	A/S Rudnicki & Engholm Howitzvej 23 2000 Kbh. F Denmark
PAXA asbestors compound	1. Together with serwing thread between cylinder and cooling jacket 2. Together with 1/8" asbestas cord at flange joints an outlet pipe from turbacharger	M.B. Cohn Bredgade 76 Copenhagen K Denmark
OSOTITE Liquid Jainting	These sealing materials are used between machined flange joints that are not dismantled after test running in workshop. Further, they are used as binding materials for asbestos cord, for instance at flange joints between scavenging air pipe and scavenging box. Together with 1/4" or 3/16" asbestos cord at flange joints between bedplate and oil pan.	Slick Brands Ltd. Waddon, Craydon Great Britain

PAINTING OF MAIN ENGINE

Components to be painted before shipment from workshop		Priming paint	Number of coating	Make or Similar	Remarks
Crank-shaft	Crankthrows and webs	RUST-BAN PH. 6297 Aluminium	2	ESSO Chemical	**Detached crankthrows for customers to be painted twice**
Inside fixed components	Frames	White acid and oilproof enamel	2	"Hempel" cyl.paint no.1000	
	Frame doors		2		
	Bedplate		2		
	Oil pan		2		
	Main bearing cover		2		
	Cyl. liner on surface of cooling space	Black Apexior TK59	1	British Paints Limited Newcastle Upon Tyne 2 England	Counteracts corrosion
	Cooling jackets on surface of cooling space		1		
	Cyl. liner on conical surfaces	Black Apexior TK59 with 50% graphite added	1		Counteracts corrosion facilitates dismantling
	Cyl. cover on conical surfaces		1		
Outside fixed components	**Bedplate and endframes**	Grey alkyd	2	Sadolin & Holmblad Machinery-paint Serie no: 510-4202	
	Flanges on frames		2		
	Frame doors		2		
	Intermediate frame		2		
	Scav.box and cooling jacket		2		
	Bracket and valve lever		2		
	Gallery brackets	Red lead	1	Dyrup og Co Anti-rust paint No: 5580	
	Oil pan		1		
	Gallery plates	Clear alkyd varnish	1	No: 20/4427 "International"	
	Exhaust pipe	Aluminium paint Pyrofix	1	Sadolin & Holmblad	
Tools	Tools	Chromeorange alkyd	2	Sadolin nr 35 Dyrup nr 30	Painted on all unmachined surfaces
Tool-panels	Toolpanels	Grey alkyd	2	Sadolin nr 40	

RECOMMENDATION FOR MAIN ENGINE INSTALLATION

Components mentioned in this paragraph are not included in the standard delivery extent of the engine builder.
As stated on page A6 some of the components can be delivered.

Minimum required Space for the Engine

See page H7.

Disassembling of the Engine

The division of the engine takes place in consideration of the crane capacity and the gateway of B&W workshop. Maximum lifting capacity in the workshop is 200 t while the lifting capacity in connection with the workshop is 150 t.

The disassembling stated is only intended as a guide as transport medium, -way, and the lifting capacity of the yard may cause other divisions.

The following parts are sent separately:

- Piston with rod and stuffing box
- Connecting rod, crosshead and guide shoe
- Crank bearing
- Fuel pump
- Cylinder cover
- Turbochargers, coolers,
- scavenging air pipe -
- gallery brackets.

The entablature of the engine can be divided between:

- Bedplate and frame section
- Fore and aft part

The crankshaft can be divided at the chain drive and it can be taken out of the bedplate.

List of Weights

For determining the degree of disassembling of the engine for shipment and installation according to actual crane capacity, see list of weights of the larger parts on page H8.
The maximum weight should be noted on page A2.

Inclination of Engine

Maximum permissible inclination from horizontal position including trim for the engine is: Aft 5^{o}, Fore 0.6^{o}.
The inclination "fore" can be raised to 5^{o} provided some alterations of the standard engine.

Installation of the Engine in the Ship

The engine should be installed according to the directions given on the following pages:

Arrangement of holding-down bolts	page H9
Engine seating	page H10
Side chocks	page H11
End chocks	page H12

Top Bracing

As K45GF is an engine with a low height, top bracing is unnecessary provided that the hull and engine foundations have a sufficient rigidness, and only in cases of ships having low and wide bottoms can top bracing be expected to come into question.
In such cases the engine builder recommends top bracing of the B&W friction design to reduce possible vibrations on top of engine or in ship. The top bracing increases the resonance frequency of the system: engine, ship's bottom, ship's side, etc. The top bracing is made by the yard to B&W instructions, which can be seen on the pages:

Proposal for Top Bracing	page H13
Links for Top Bracing	page H14

Centre of Gravity

Centre of gravity of the engine can be found on page H15.

Dimensions of:

Large Spare Parts

To give possibility for appropriate arrangement of the large spare parts in the engine room, a list of large spare parts dimensions can be found on page H16.

Tools

Can be found on page T4-T5-T6-T7

Connections

The necessary connections for the engine can be found on the following pages:

Dimensions of exhaust pipe system	page H17-H18
External pipe connection	page H19-H20
List of flanges	page H21
Lub.oil bottom tank	page H22

Water and Oil Standard Diagrams

On the following pages diagrams can be found for:

Starting air and drainage for scavenging air receiver	page H23
Lubricating oil	page H24-H25
" " for camshaft	page H26
" " for main pipes	page H27
Fuel oil	page H28
Fuel oil details	page H29
Sea cooling water system	page H30
Fresh " " "	page H31

The fresh water expansion tank should have a volume of 1.0 m^3.

Electrical Standard Diagrams

To obtain an easy and safe turning, the starter for the turning gear should be dimensioned:

1. Reversible
2. 2.5 x nominal moment for max. 10 sec.

The following diagram is available:

Cyl. lubricator alarm cut out	page H32

Auxiliaries and Accessories

The minimum capacity for pumps, coolers, preheater for fuel oil and starting air are stated on page H32: "Neces. Caps. of Aux. Machinery, etc."

The values stated for starting air have been determined so that the starting air receivers have air for 16 starts and that the compressor capacity can raise the air pressure from 1 kp/cm^2 to 30 kp/cm^2 in 1 hour.

The maximum mesh for filters must be:

Lubricating oil filter	(50 µ Camshaft lub.oil system
	(50 µ Main lub.oil system
Fuel oil filter	50 µ

The fuel oil filter must be resistant to fuel oil at 135°C.

We recommend the following capacities for purifiers:

Fuel oil	0.22 l/BHP/h	Diesel or gas oil	x)
Lub.oil	0.11 l/BHP/h		

x) Heavy fuel oil requires increased capacity according to the manufacturer of purifiers.

The lub.oil system for the camshaft, which also supplies the hydraulic actuated exhaust valves must be made with automatic start of the spare pump followed by an alarm to secure the above-mentioned functions.

Crane Capacity

For lift see "Engine Datasheet and Load Diagram", page M4. The minimum lifting capacity of the engine room crane must be 1.6 tons to be able to lift the heaviest assembled units during overhaul of the engine.

Above-mentioned lifting capacity is in accordance with "Fédération Europeenne de la Manutention" (FEM) group II, DIN 15020 Entwurf Oct. 1969, which requirements the crane must fulfil.

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List of installation drawings

Signature of schematic drawing
Diagrammatic arr. of:
- Lub.oil pipes w. by-pass filter
- Lub.oil pipes with separator
- Main lub.oil pipes
- Lub.oil for camshaft
- Control tank
- Purification of drain oil from piston rod stuffing boxes
- Cooling water pipes SW
- Cooling water pipes FW
- Starting air pipes
- Fuel oil pipes
- Vent pipe w. drain cowl

Arr. of lub.oil drain
Cleaning of lub.oil system
De-aerating tank
Basic dimension of exhaust pipes
Dimension of exhaust pipes
Proposal of bracing of exhaust pipes
Proposal of top bracing
Link for top bracing
Instruction for obs. of top bracing with friction shims
Necessary capacity list
Required space for the engine
Arr. for torsiograph during TT
External pipe connection
List of flanges
External dimensions of platforms
Fire extinguishing
Arrangement of turning gear
Profile of engine seating
Assembly dwg. for holding-down bolt
Holding-down bolt
Nuts for holding-down bolts

BURMEISTER & WAIN

List of installation drawings (continued)

Distance pipe
Assembly dwg. holding-down bolt
Nut with spherical face
Spherical washer
Protecting cap for holding-down bolts
Supporting chocks
Sec. of supporting chocks on tanktop with pads
Side chocks
Liner for side chocks starboard
Liner for side chock ports
End chocks
Stud with spherical washers and nut for end chocks
Stud for end chocks
Nuts for end chock studs
Spherical washers
Protecting cap for studs
Liner for end chocks
Arr. of holding-down bolts

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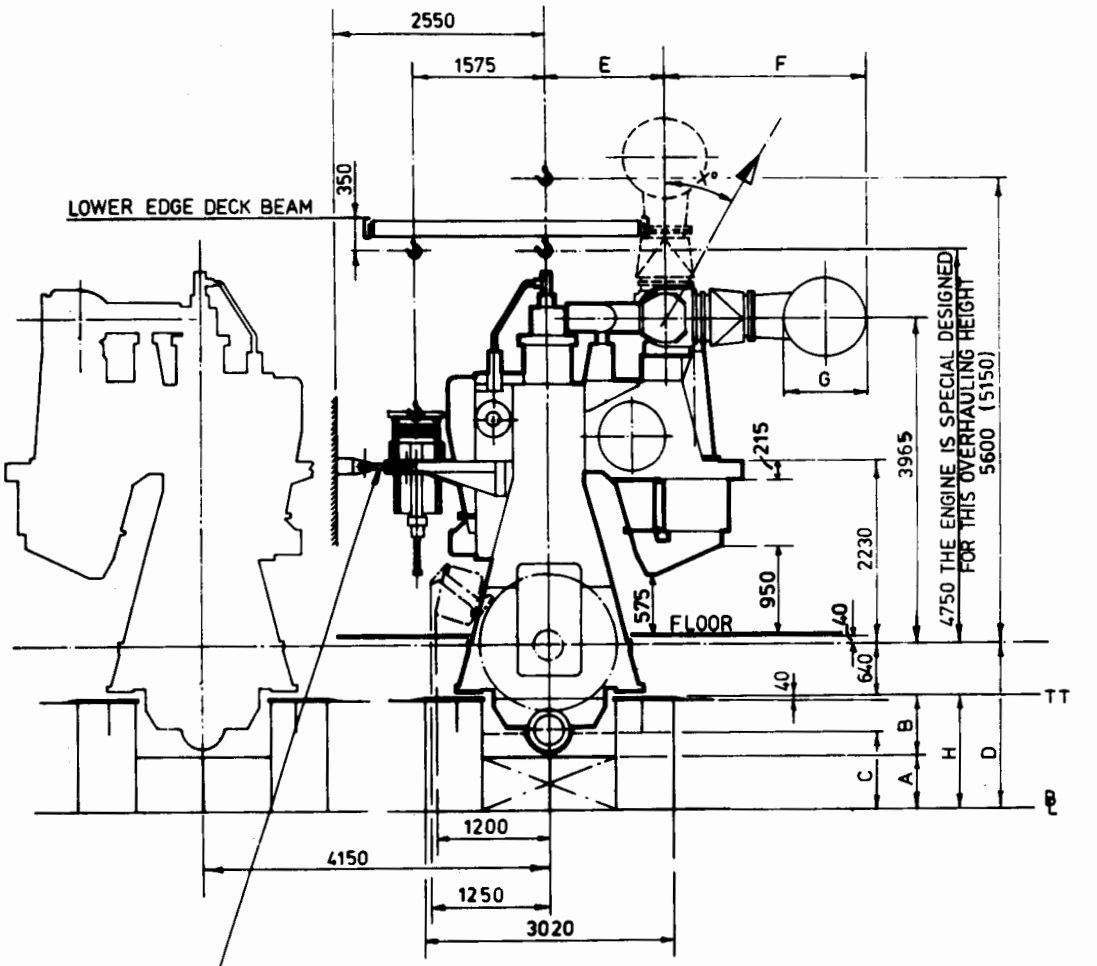

INSTALLATION DIMENSIONS

CYL.NUMBERS	5	6	7	8	9	10	11	12
A*	600	600	600	600	600	600	600	600
B	770	770	770	770	830	830	830	830
C**	910	910	910	910	970	970	970	970
D	2010	2010	2010	2010	2070	2070	2070	2070
E	1450	1450	1460	1460	1450	1450	1460	1450
F	2285	2160	2335	2360	2260	2410	2410	2310
G***	700	700	800	850	900	950	950	1000
X°	I	I	II	II	I	I	II	I
H	ACCORDING TO CLASSIFICATION SOCIETIES' REQUIREMENTS							

I : 0°-30°-60°-90°

II : 0°-15°-30°-45°-60°-75°-90°

*) HEIGHT OF LUB. OIL TANK BELOW OIL OUTLET

**) — - — - — —— OIL TRAY

***) LARGEST DIAMETER

THE DIMENSIONS INDICATED ARE NORMALLY MINIMUM AND IF THEY CANNOT BE OBSERVED, PLEASE CONTACT BURMEISTER & WAIN HEAD OFFICE.

MAX. RAKE OF THE ENGINE (INCL. TRIM OF SHIP) 1/4° TOWARDS "FORE" AND 5° TOWARDS "AFT".

NORMAL MIN. REQUIRED SPACE FOR THE ENGINE

Drwg. No. 50B0435

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

Weights for installation — All weights are in kilogram and are approximate

Total heavist part	No. of cyl. 5	6	7	8	9	10	11	12
Crankshaft	14200	16700 8200	19200 10300	21600 10400	24100 15200	26600 13100	29000 14000	31500 14400
Bedplate compl.	14700	16500	20000 9300	21800 10900	23700 12400	25500 12600	27400 12600	29200 14300
Frame compl.	21900	25500 13700	29100 17200	32400 17200	36400 24500	39600 20800	43300 24500	46700 24500
Camshaft frame	3200 750	3900 800	4500 1000	5200 1100	5800 1450	6500 1350	7100 1450	7800 1600

Cooling Jacket	Thrust shaft	Cooler LK 124	Cooler LK 165
65	2800	1150	1375
Turbocharger			
VTR 321	VTR401		
760	1500		

Weights for overhaul excl. lifting tool/cyl.

Cyl. Cover compl.	Cyl. cover	Guideshoes 2 x 1	Crank Bearing 2/2
635	335	125	150
Exhaust valve compl. seat/spindel	Piston complete Piston Crown	Crosshead Bearing 2 x 2/2	Connecting Rod excl. Bearing
285 10/25	390 95	210	265
Cyl. liner	Crosshead excl. guideshoes	Main Bearing 2/2	Fuel pump
575	345	45	90

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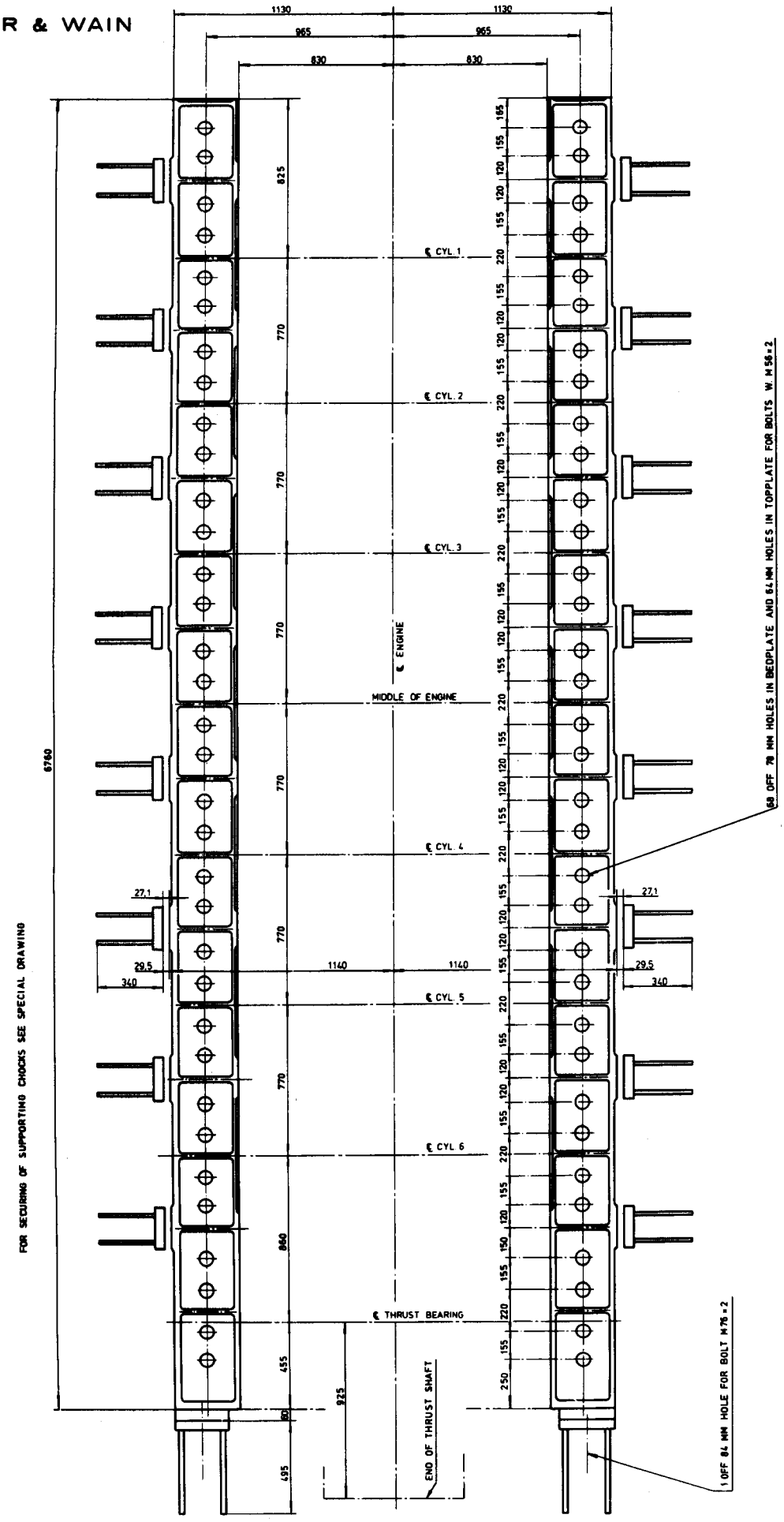
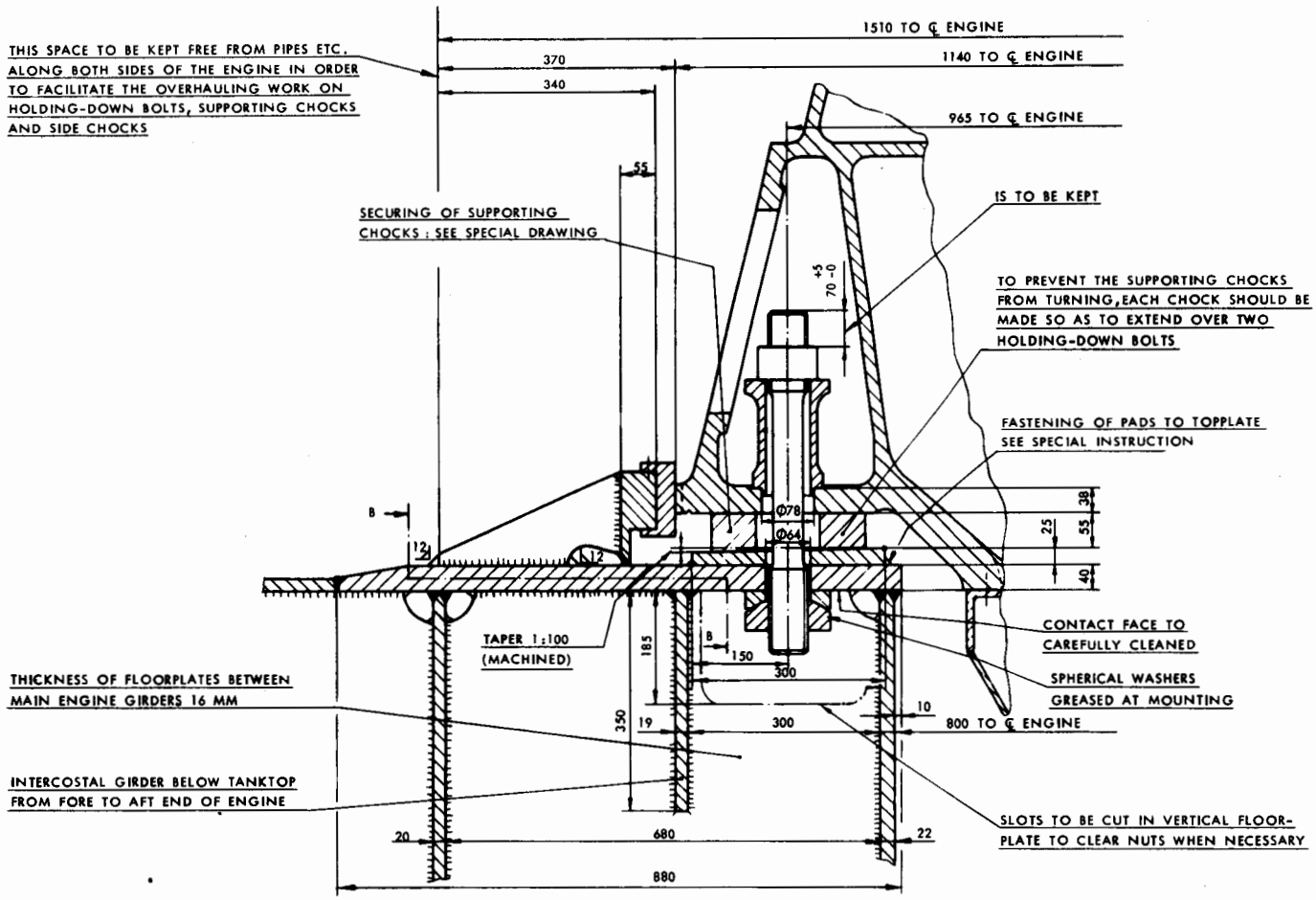


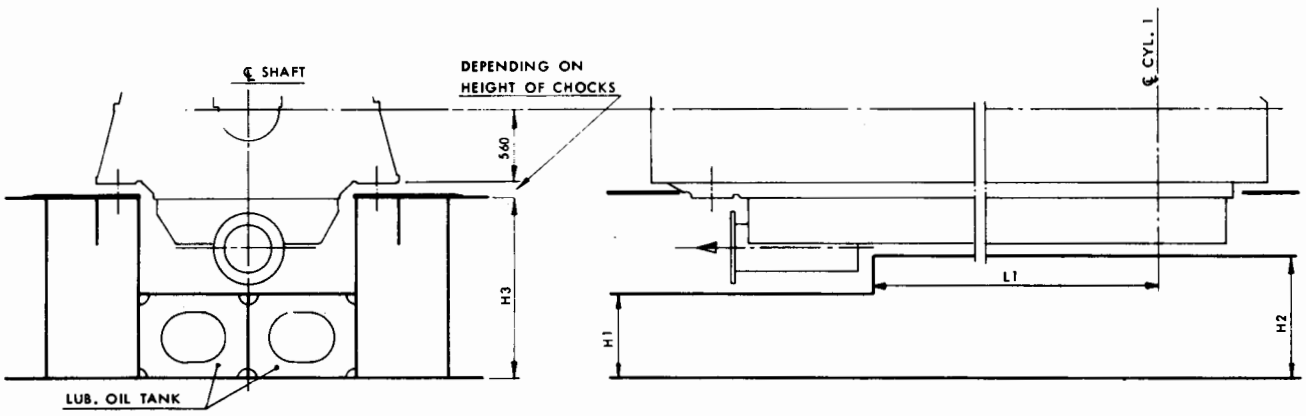
6K45GF

ARRANGEMENT OF HOLDING-DOWN BOLTS

Drwg. No. 23A4654

BURMEISTER & WAIN





FOR HEIGHTS H1, H2, H3, AND LENGTH L1, SEE DRAWING OF ARR. OF LUBR. OIL TANK FOR THE APPROPRIATE CYL. NO.

FOR MEASUREMENTS OF THE PARTS CONSTITUTING THE HOLDING-DOWN BOLT, SIDE-AND END CHOCKS CONNECTIONS, SEE SPECIAL DRAWINGS

FOR LOCATION OF HOLDING-DOWN BOLTS AND OF PADS, SEE SPECIAL ARRANGEMENT DRAWINGS

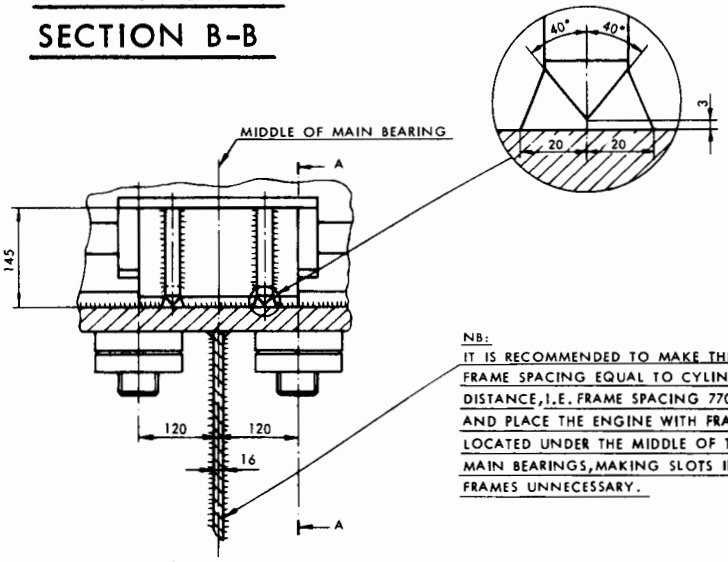
ALL WORKMANSHIP EQUAL TO BOILER SHOP STANDARD

ENGINE SEATING

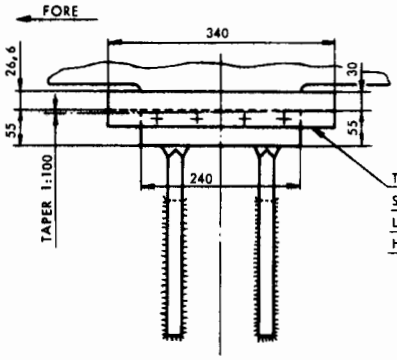
Drwg. No. 26A1729

BURMEISTER & WAIN

SIDE CHOCKS
SECTION B-B



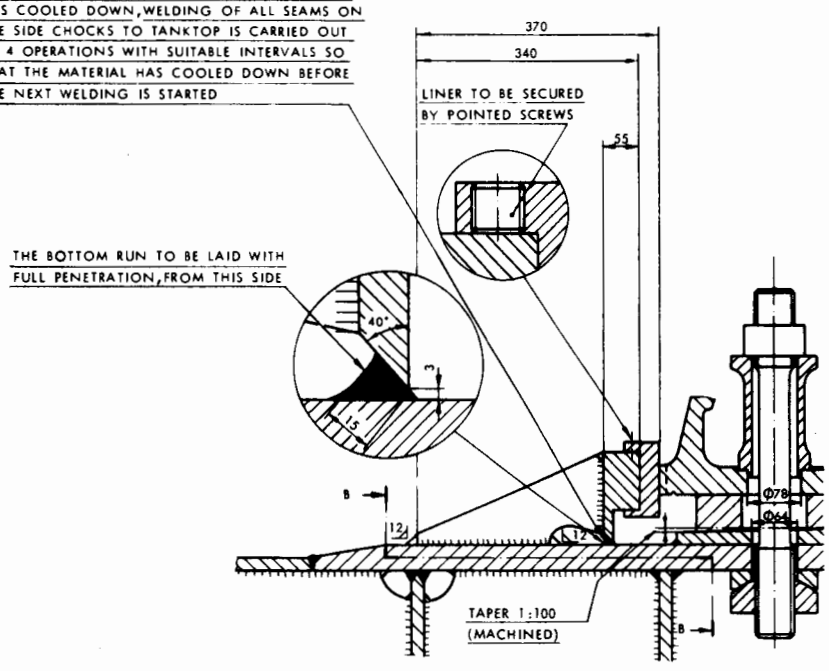
NB:
IT IS RECOMMENDED TO MAKE THE FRAME SPACING EQUAL TO CYLINDER DISTANCE, I.E. FRAME SPACING 770 MM AND PLACE THE ENGINE WITH FRAMES LOCATED UNDER THE MIDDLE OF THE MAIN BEARINGS, MAKING SLOTS IN THE FRAMES UNNECESSARY.



THE LINERS ARE MOUNTED FROM AFT ON BOTH SIDES OF THE ENGINE. AFTER ADAPTATION, THE LINERS IN LINE WITH EACH ENGINE FRAME ARE HAMMERED INTO PLACE SIMULTANEOUSLY.

SIDE CHOCKS
SECTION A-A

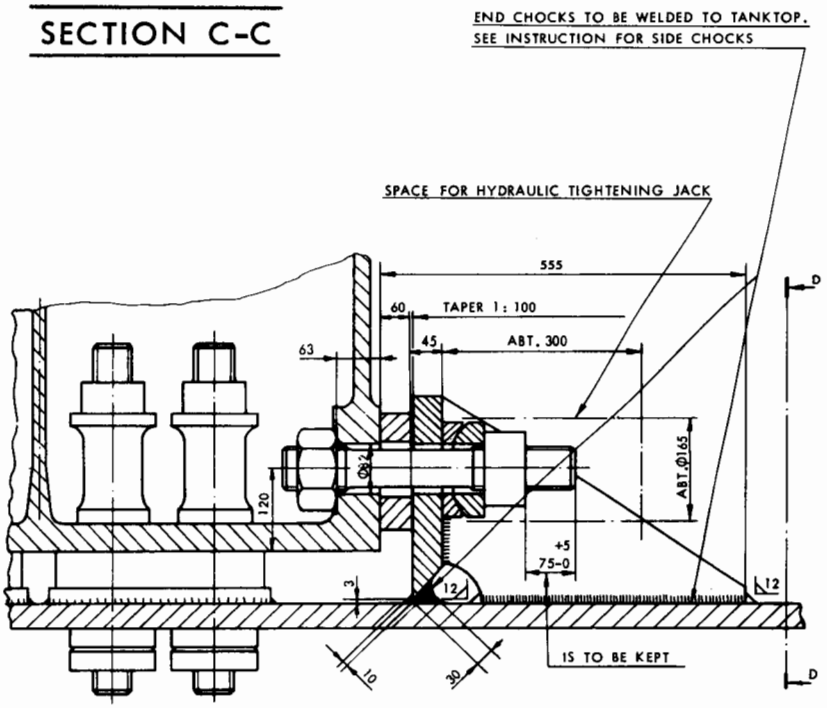
TO AVOID DEFORMATION OF SIDE CHOCKS OWING TO WELDING STRESSES, THE WELDING TO TANKTOP IS CARRIED OUT AS FOLLOWS: THE WELDED AND MACHINED SIDE CHOCK IS TACKWELDED TO TANKTOP. WHEN THE MATERIAL HAS COOLED DOWN, WELDING OF ALL SEAMS ON THE SIDE CHOCKS TO TANKTOP IS CARRIED OUT IN 4 OPERATIONS WITH SUITABLE INTERVALS SO THAT THE MATERIAL HAS COOLED DOWN BEFORE THE NEXT WELDING IS STARTED



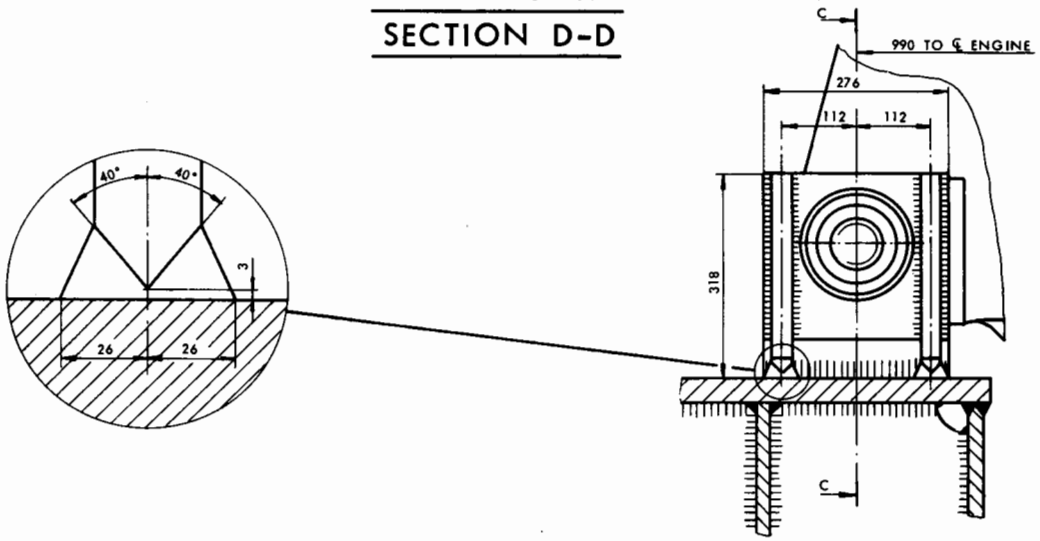
SIDE CHOCKS
Drwg. No. 26A1729

BURMEISTER & WAIN

END CHOCKS
SECTION C-C



END CHOCKS
SECTION D-D

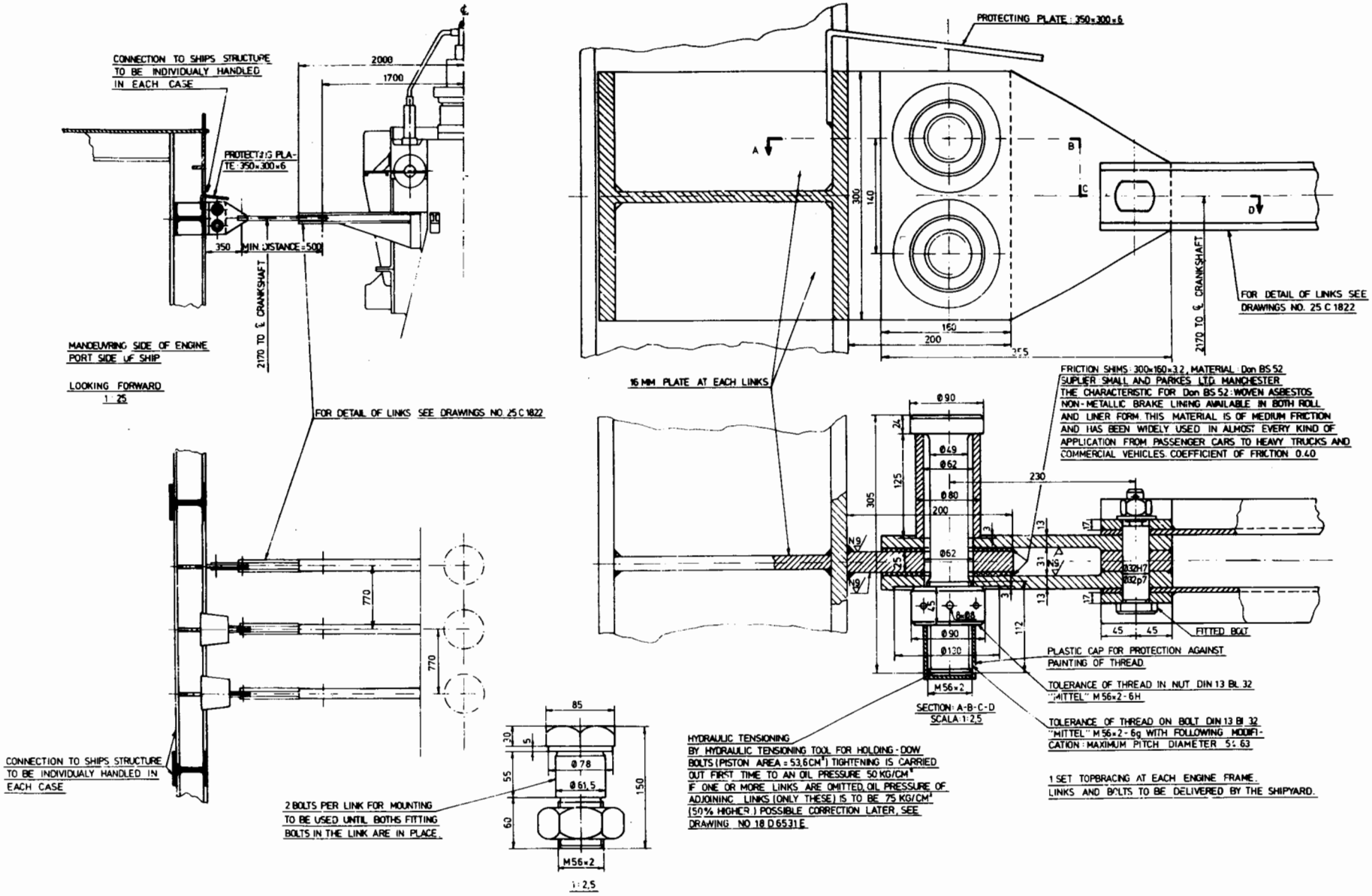


END CHOCKS
Drwg. No. 26A1729

BURMEISTER & WAIN

PROPOSAL FOR TOPBRACING

Drwg. No. 24B6751



H13

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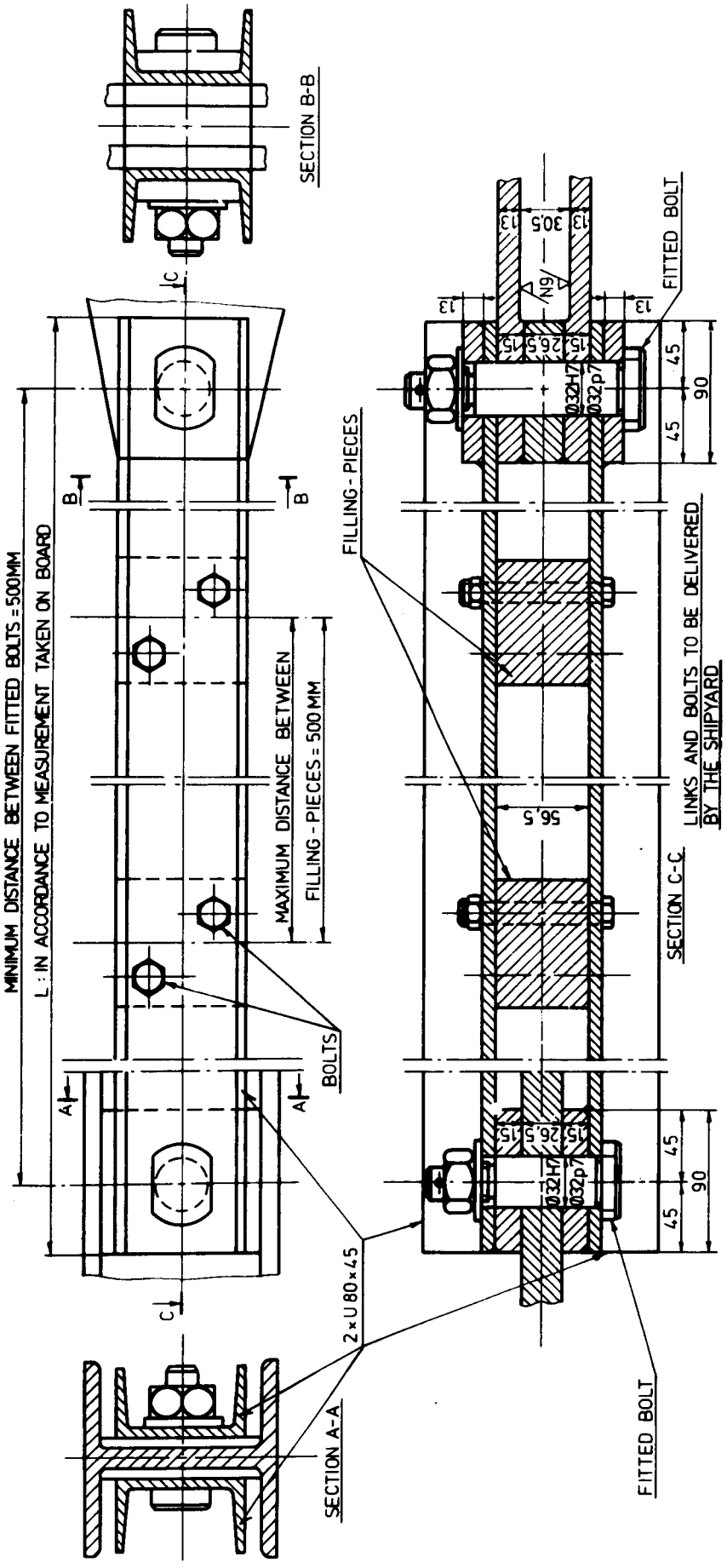
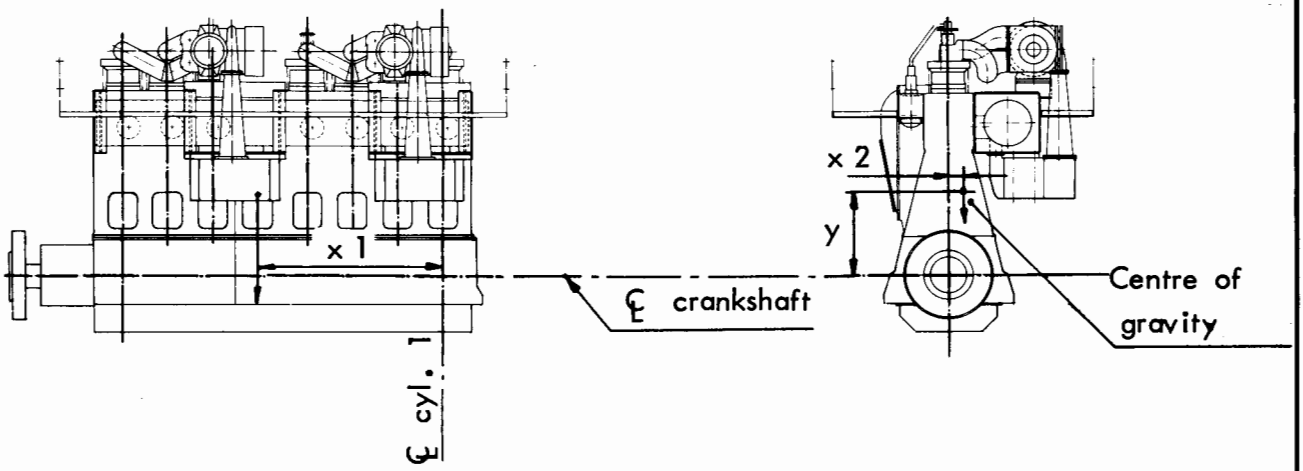


LINKS FOR TOPBRACING

Drwg. No. 25C1822

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm



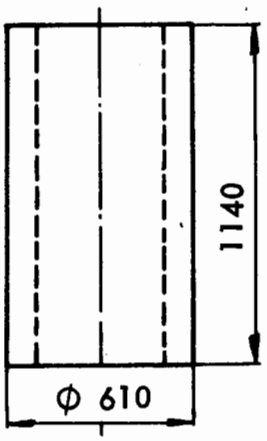
No. of cylinders	5	6	7	8	9	10	11	12	
Distance x 1 mm	2050	2460	2860	3250	3620	4040	4460	4870	
Distance x 2 mm	40	40	50	40	40	60	50	50	
Distance y mm	1340	1340	1360	1365	1380	1360	1385	1380	

With incorporated thrust block included water and oil

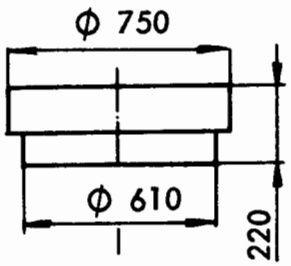
All dimensions are approximate

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

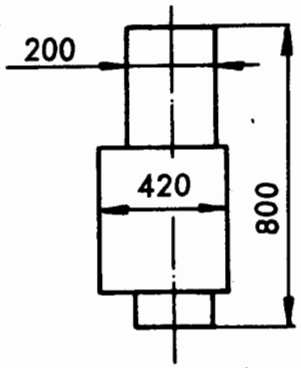
WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm



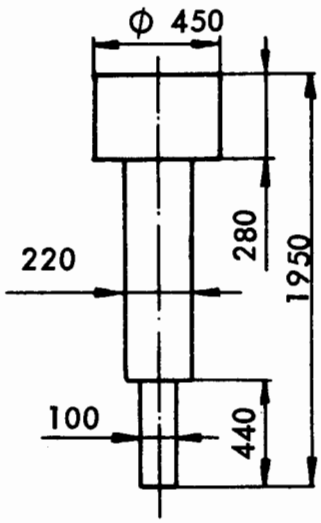
Cylinder Liner



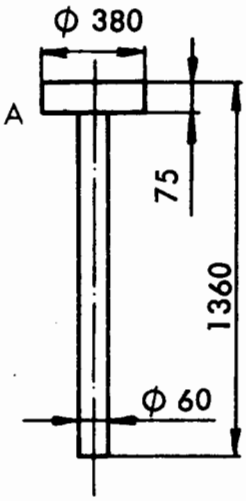
Cylinder Cover



Exhaust Valve



Piston complet
with piston rod

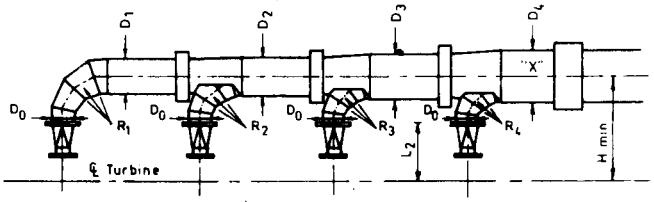


Piston Cooling Insert
(May be dismantled at A)

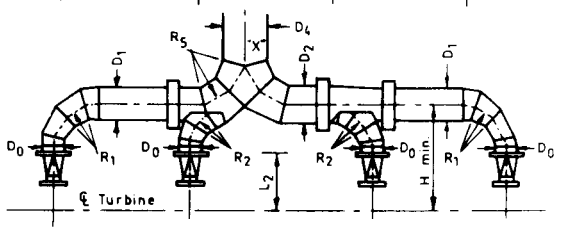
TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE K45GF

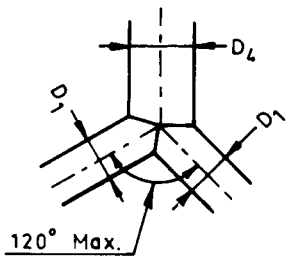
WITH TURBOCHARGER STROKE: 900 mm BORE: 450 mm

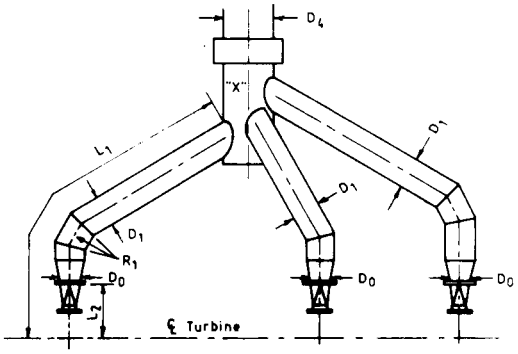
Exhaust Pipe Systems



R_1 = 1,25 D_1 min.
R_2 = 1,15 D_1 min.
R_3 = 1,08 D_1 min.
R_4 = 1,00 D_1 min.
R_5 = 1,25 D_4 min.

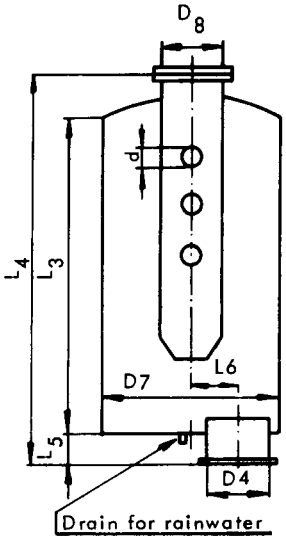






NOTE: The transition from D_0 to D_1 should be gradual, and is to be commenced immediately after the exhaust cone, or the compensator if such is mounted direct on the exhaust cone. The transition may be completed before the bends is commenced.

B&W Type silencer



Separate rain water traps, and, normally, also special spark arrestors are unnecessary with B&W type silencers.

Minimum height for 6,9,12 cyl. engines H = 1810
Minimum height for other engines H = 1935

Height of flange above ℄ blower L_2 = 1050
Maximum lenght measured from ℄ blower L_1 = 4700

L3 = 3000
L4 = 3400
L5 = 150
Volume 5m³

D7 = 1450 Holes = 44

No. of cyl.	Cylinders / Turbine	Diameters of exhaust pipes D0	D1	D2	D3	D4	L6	D8	d
5	2½ 2½	500	700	-	-	700	350	750	125
	3 2	500	700	-	-	700			
6	3 3	500	600	-	-	700	325	800	135
7	4 3	550	700	-	-	800	300	850	145
8	4 4	550	700	-	-	850	275	900	155
	2 2 2 2	550	700	700	700	850			
9	3 3 3	500	600	700	-	900	250	950	165
10	4 3 3	550	700	800	-	950	225	1000	175
	2½ 2½ 2½ 2½	500	700	700	800	950			
11	4 3 4	550	700	800	-	950	200	1050	185
12	3 3 3 3	500	600	700	900	1000	175	1100	190

ALL DIMENSION IN MM UNLESS OTHERWISE STATED

NOTE: The representation of a dimension does not necessarily indicate that an engine of the number of cylinders and turbine arrangement in question exist or is even envisaged.

Liable to change without notice

FOR COEFFICIENTS OF RESISTANCE SEE DRWG NO. 226695

B&W Issued 740829 Head Office Copenhagen

DIMENSIONS OF EXHAUST PIPE SYSTEMS

OSK

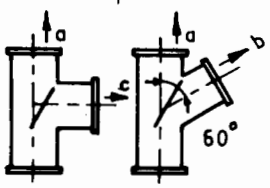
191746

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE

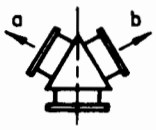
WITH TURBOCHARGER

Change-over Valves

B & W Type Rotary Valve
$\zeta_a = \zeta_b = 0,8$



Change-over valve of type with constant cross-section
ζ_a = 0,6 to 1,2
ζ_b = 40 to 1,5
ζ_c = 1,5 to 2,0



Change-over valve of type with volume
$\zeta_a = \zeta_b$ = about 2,0

Pressure Drops

The basic condition for the dimesnions given in the table is thot the total back pressure in the echaust pipe system is less than 300 mm W.C. . A sotisfactory exhoust pipe system can be constructed when the silencer or exhaust gas boiler hos a resistance h_l about 150 mm W.C. . 150 mm W.C. leaving for chunge over valve of good design and two or three pipe bends in the exhaust pipe system.
Exhaust pipe systems of three types are considered and the normal exhaust pipe diameters (D_4) given in the table, are valid under the conditions stated above.

The given values for ζ must always be referred to the diometer D_4:

$$\zeta \text{ referred to } D_4 = \zeta_d \left(\frac{D_4}{d}\right)^4$$

where $d = \sqrt{\frac{4a}{\pi}}$ = equivalent diameter of element,

a = cross sectional area of element

The resistance of the pipe h_r may, with diameter D_4 given in the table be taken as follows:

$h_r = 75\ \Sigma\zeta_r$ for 6-12 cyl. engines
$h_r = 60\ \Sigma\zeta_r$ for 5 cyl. engines

For 5 cyl. engines, D4 is relatively larger than the normal diameters for other numbers of cylinders, to allow for transient pressure waves.
In the above, $\Sigma\zeta_r$ represents the sum of the coefficients of resistance of the various elements of the system from the point where all branch pipes are joined (marked "X") to the silencer or exhaust gas boiler including pipe bends, change over valve.

h_l = pressure drop across silencer or exhaust gas boiler, measured between input and autput flanges as shown.

The resistance of the pipe after the silencer or boiler h_s may be taken as: -

$$h_s = 50\left(\frac{D_8}{D_s}\right)^4 \cdot \Sigma\zeta_s$$

where D_s is the diameter of the tail pipe and $\Sigma\zeta_s$ is the sum of the coeffficients of resistance af the various elements (spark arrestor, rain water trap, etc.) referred to D_s, ar h_s may be stated by the manufacturer of the elements concerned.

For exhaust pipe systems where the calculated total resistance ($h_r + h_l + h_s$) exceeds 300 mm water column, the normal diameter D4 must be increased by the factor

$$\sqrt[4]{\frac{h_r}{300 - (h_l + h_s)}}$$

NOTE

Apart fram satisfying the conditions as to back pressure given here, the pipe system shauld be examined for resononce pressure vibrations, as such, if they should accur in the neighborhood of the normal service speed, may give rise to distrubances on the bridge ond deck. As the vibrational characteristics af the pipe system depend of the components in a rather complicated manner, it has not been possible to take them into account in these dimensioning rules, and the calculation of these characteristics must be made separately in each individual case.
For this purpase drawings showing the complete exhaust system with all details are necessary.

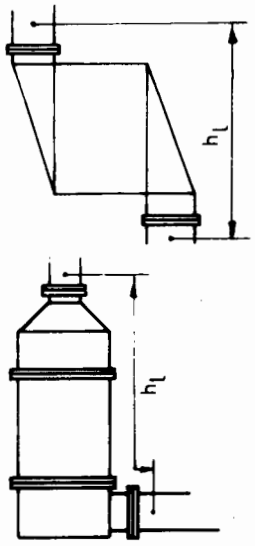
For on agregate or pipe across which the pressure loss for full amount of gas from the engine in question is Δp mm W.C. is

$\Sigma\zeta_r = \frac{\Delta p}{60}$ for 5 cyl. engines referred to D_4

$\Sigma\zeta_r = \frac{\Delta p}{75}$ for 6 - 12 cyl. engines referred to D_4

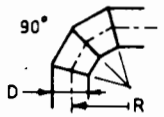
$\Sigma\zeta_r = \frac{\Delta p}{50}$ for 5 - 12 cyl. engines referred to D_8

Exhaust Gas Boilers and other Aggregates

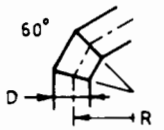


The pressure drop h_l should normally not exceed 150 mm W.C.

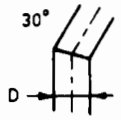
Pipe Bends



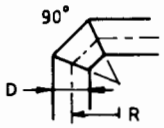
R = D ζ = 0,28
R = 1,5D ζ = 0,20
R = 2D ζ = 0,17



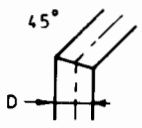
R = D ζ = 0,16
R = 1,5D ζ = 0,12
R = 2D ζ = 0,11



ζ = 0,05



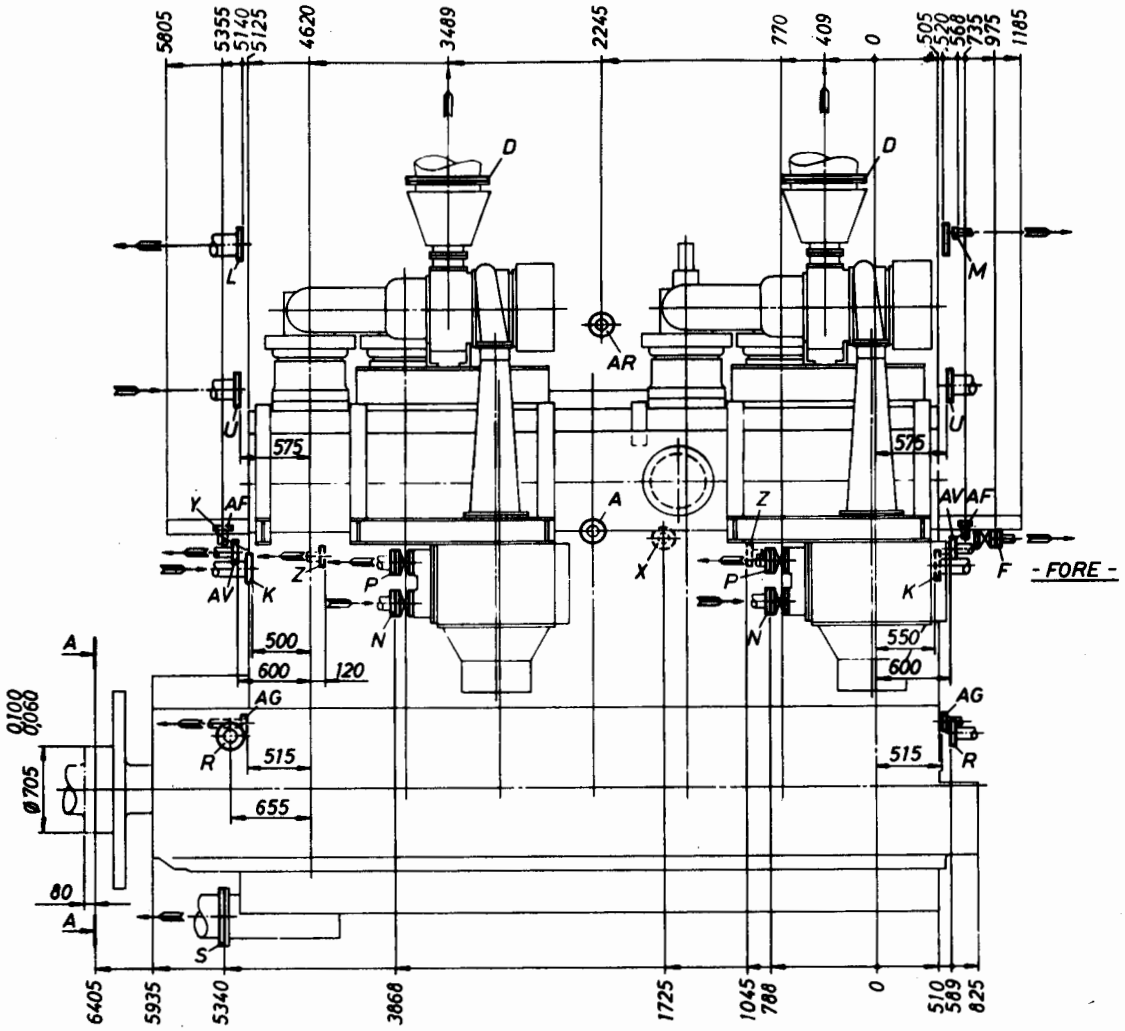
R = D ζ = 0,45
R = 1,5D ζ = 0,35
R = 2D ζ = 0,30



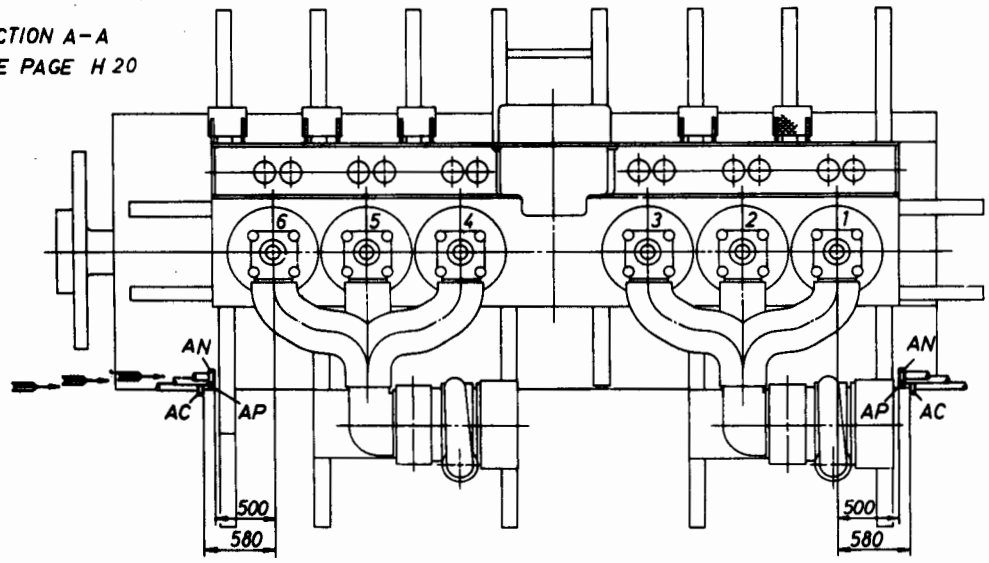
ζ = 0,14

Liable to change without notice

BURMEISTER & WAIN



SECTION A-A
SEE PAGE H 20

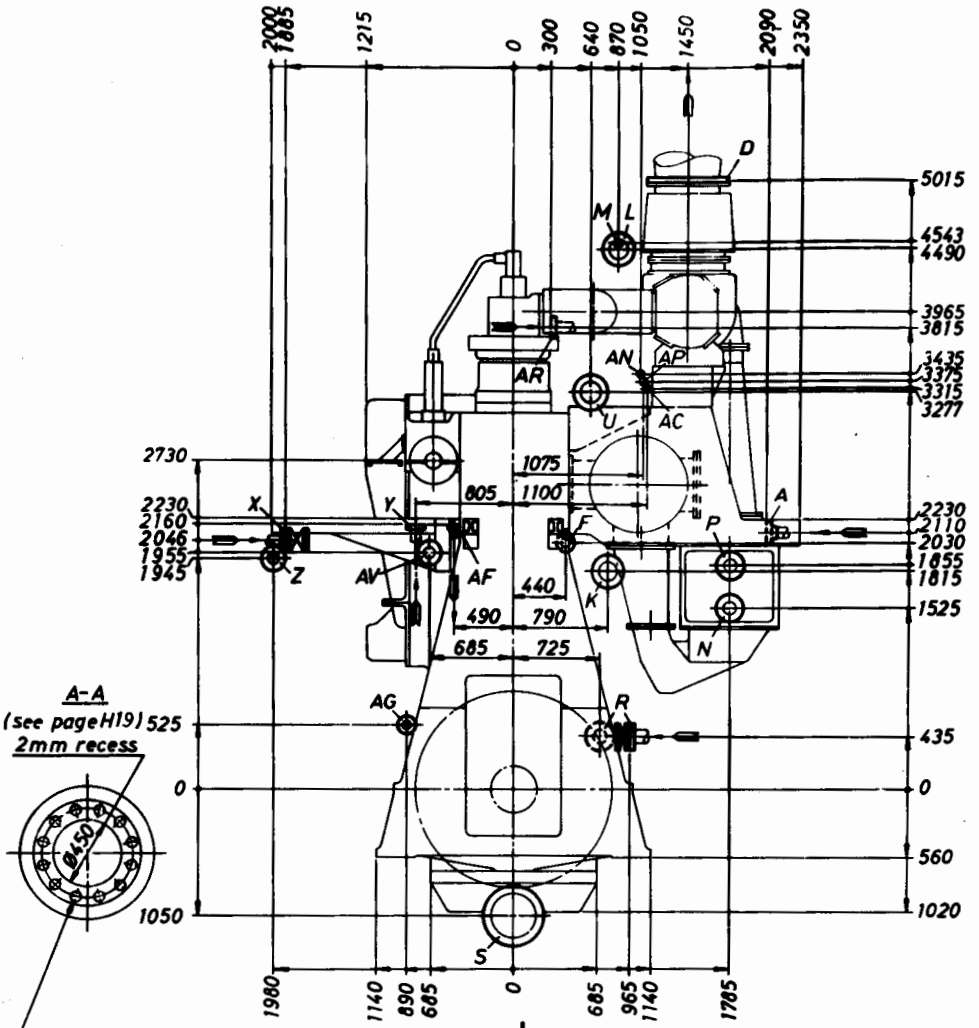


6K45GF

EXTERNAL PIPE CONNECTION

SECT. 1 Drwg. No. 667632-6.4

BURMEISTER & WAIN



12 off holes for 60mm fitted bolt PCD 590mm. These bolts are supplied by B&W provided that the thickness of the forward flange of the intermediate shaft is made 80mm as shown if other thicknesses of this flange is wanted B&W should be notified.

PLEASE NOTE

Our standard equipment does not include platforms, railings and stanchions.

The letters refer to „List of flanges"

The pipes can be connected fore or aft or in the middle as shown.

6K45GF

EXTERNAL PIPE CONNECTION

SECT. 11 Drwg. No. 667632-6.4

BURMEISTER & WAIN

REFE-RENCE	CYL. NO.	FLANGE DIAM.	FLANGE P.C.D.	FLANGE THICKNESS	BOLTS DIAM.	BOLTS NO. OFF	DESCRIPTION
A	5-12	225	180	24	M20	8	STARTING AIR INLET
B							
C							
D	5,10	620	578	20	M20	16	EXHAUST
	6,9,12	620	578	20	M20	16	
	7,8,11	675	630	20	M20	16	
E							
F	5-12	140	100	16	M16	4	FUEL OIL OUTLET
G							
H							
K	5-8	250	210	22	M16	8	COOLING WATER INLET (FRESH)
	9-12	285	240	24	M20	8	
L	5-8	250	210	22	M16	8	COOLING WATER OUTLET (FRESH)
	9-12	285	240	24	M20	8	
M	5-12	ERMETO COUPLING GE 30-SR					COOLING WATER DE-AERATION
N	5-12	220	180	20	M16	8	COOLING WATER INLET TO AIR COOLER (SALT)
P	5-12	220	180	20	M16	8	COOLING WATER OUTLET FROM AIR COOLER (SALT)
R	5-12	220	180	20	M16	8	LUBRICATING OIL INLET (SYSTEM OIL)
S	5-8	505	460	34	M20	16	SYSTEM OIL OUTLET
	9-12	615	565	36	M24	16	
T							
U	5-9	285	240	24	M20	8	COOLING OIL INLET (SYSTEM OIL)
	10-12	315	270	26	M20	8	
V							
X	5-12	165	125	18	M16	4	FUEL OIL INLET
Y	5-12	140	100	16	M16	4	LUBRICATING OIL INLET TO CAMSHAFT
Z	5-12	200	160	18	M16	8	LUBRICATING OIL OUTLET FROM CAMSHAFT
AA							
AB							
AC	5-12	ERMETO UNION G 30-S					LUBRICATING OIL INLET TO CYLINDER LUBRICATORS
AD							
AE							
AF	5-12	ERMETO UNION G 30-S					FUEL OIL TO DRAINTANK (CONNECTION FORE AND AFT)
AG	5-12	140	100	16	M16	4	LUBRICATING OIL FROM STUFFING BOXES FOR PISTON RODS TO DRAINTANK
AH							
AK							
AL							
AM							
AN	5-12	ERMETO UNION G 30-S					WATER INLET FOR CLEANING TURBO-CHARGER
AP	5-12	ERMETO UNION G 30-S					AIR INLET FOR CLEANING TURBO-CHARGER
AR	5-12	165	125	18	M16	4	OIL VAPOUR DISCHARGE
AS							
AT							
AU							
AV	5-12	185	145	18	M16	4	DRAIN FROM SCAVENGING AIR CHAMBER TO CLOSED DRAINTANK
AX							
AY							
AZ							

The main engine will be supplied with blind flanges for all pipe connections from ship. The blind flange is thus to be drilled according to the desired outside pipe dimension.

LIST OF FLANGES

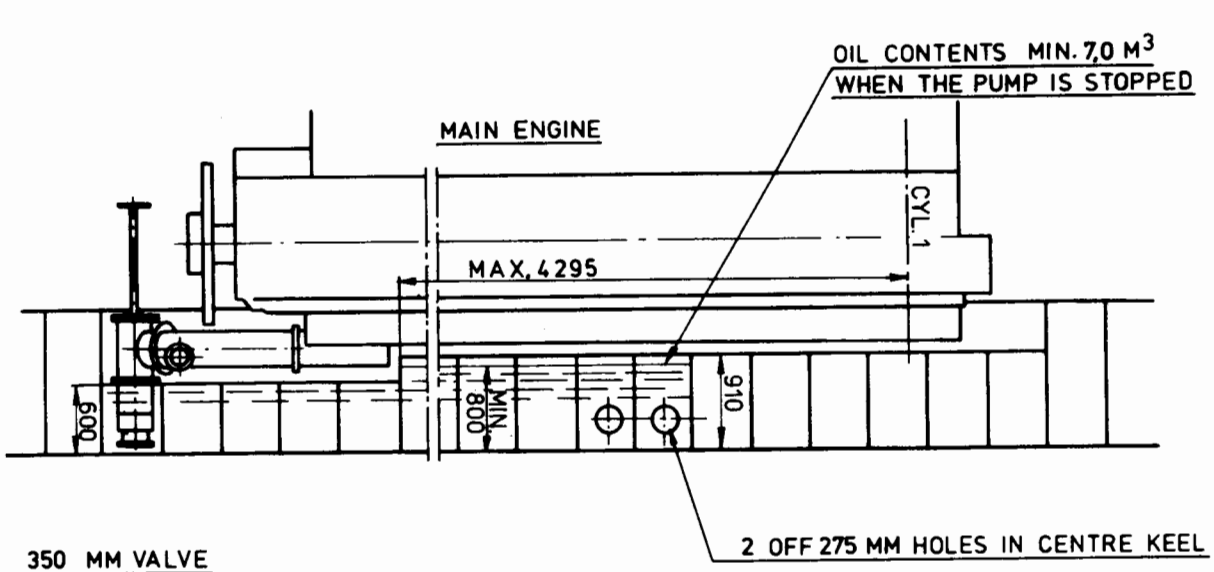
Drwg. No. 667633-8.2

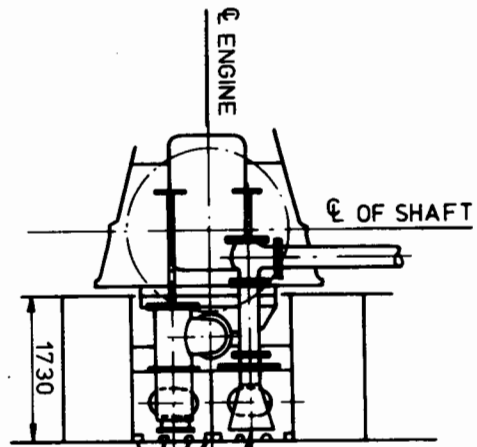
BURMEISTER & WAIN

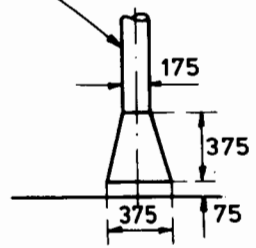
LUB. OIL BOTTOM TANK

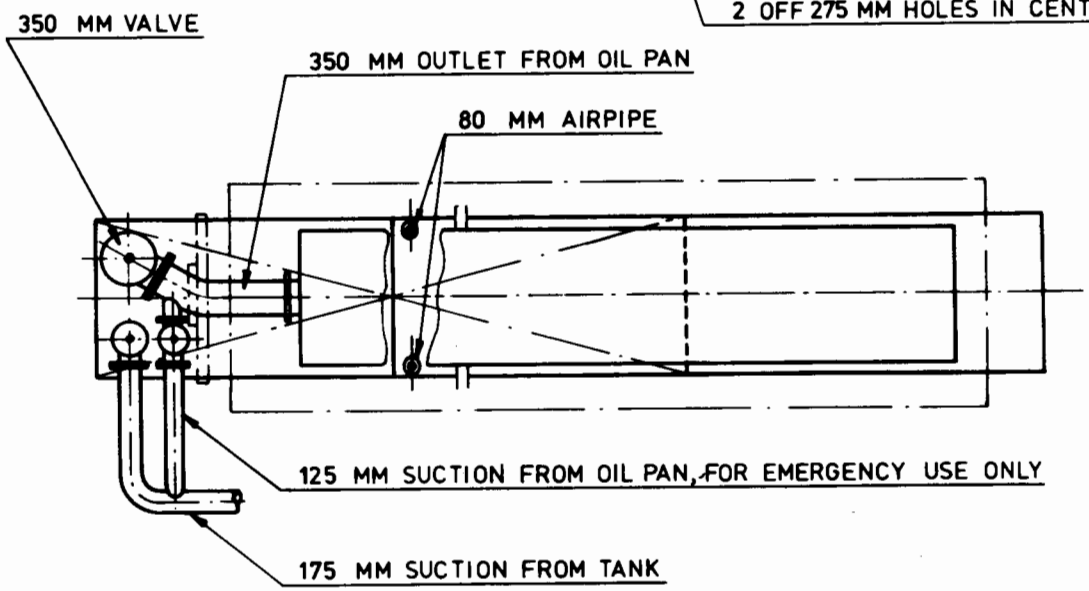
Drwg. No. 20C1334

6K45GF







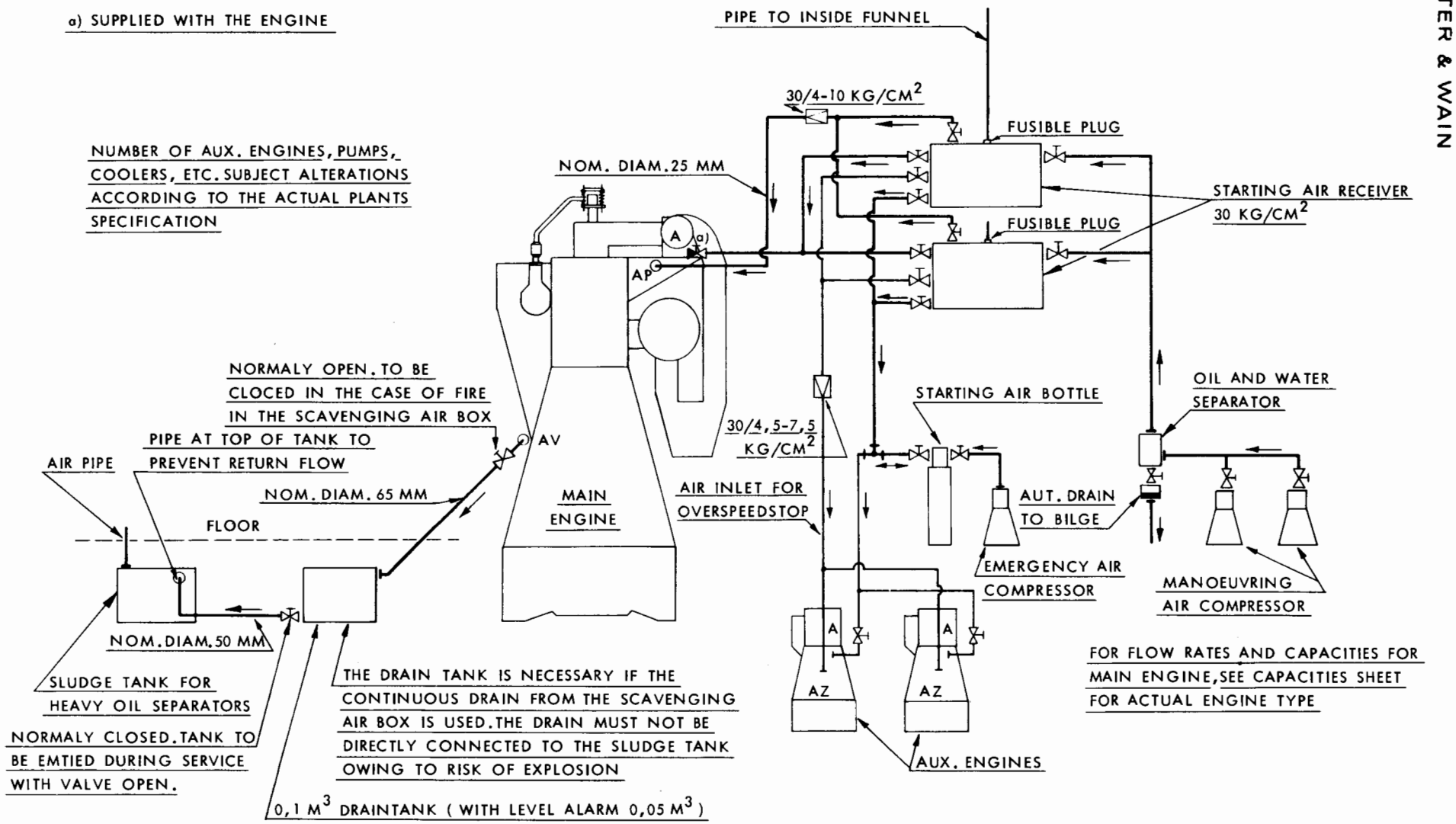


THE DIMENSIONS STATE NOM. INSIDE
PIPE DIAMETER IN M.M.

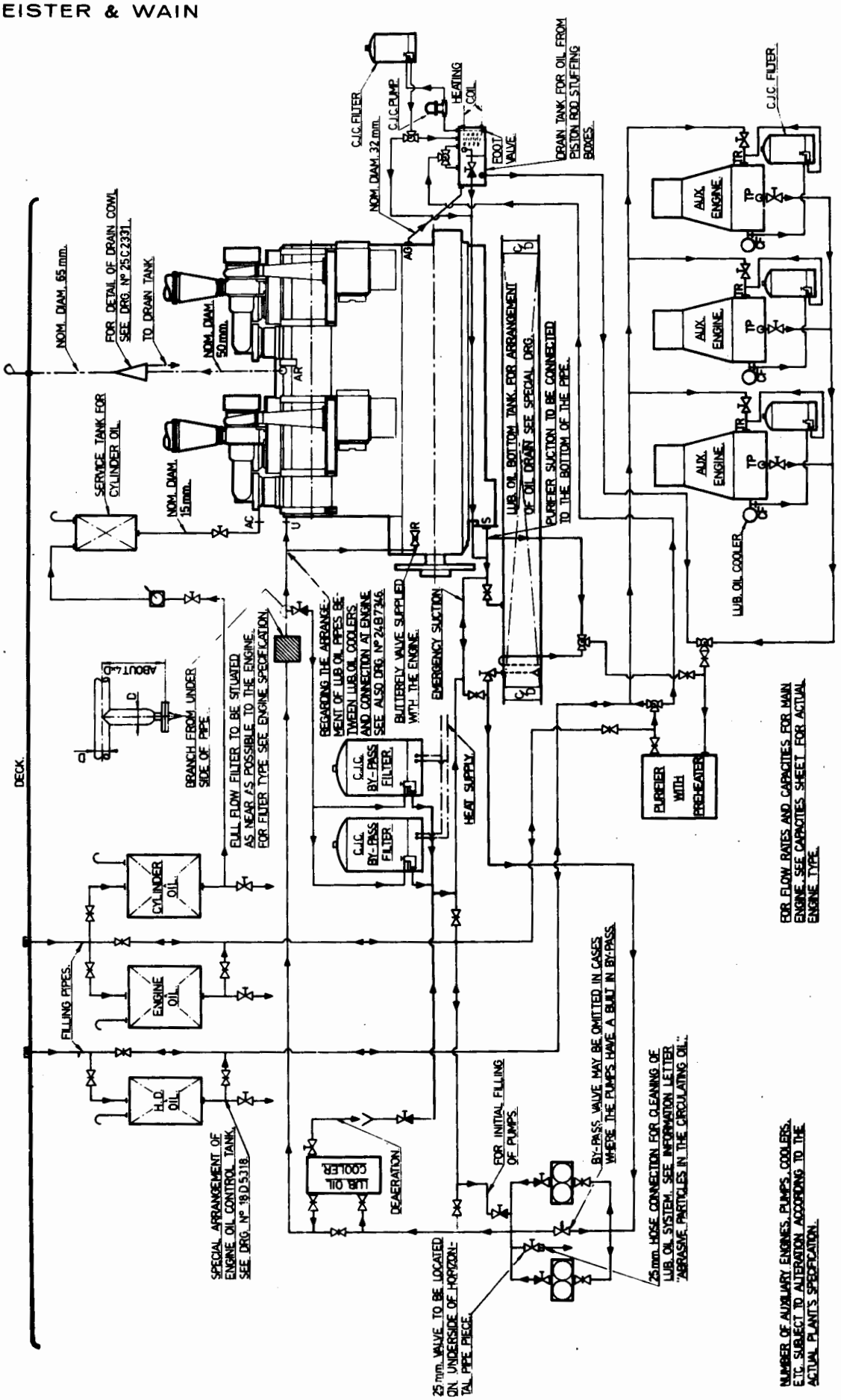
H22

STARTING AIR PIPES

Drwg. No. 25C2913



BURMEISTER & WAIN

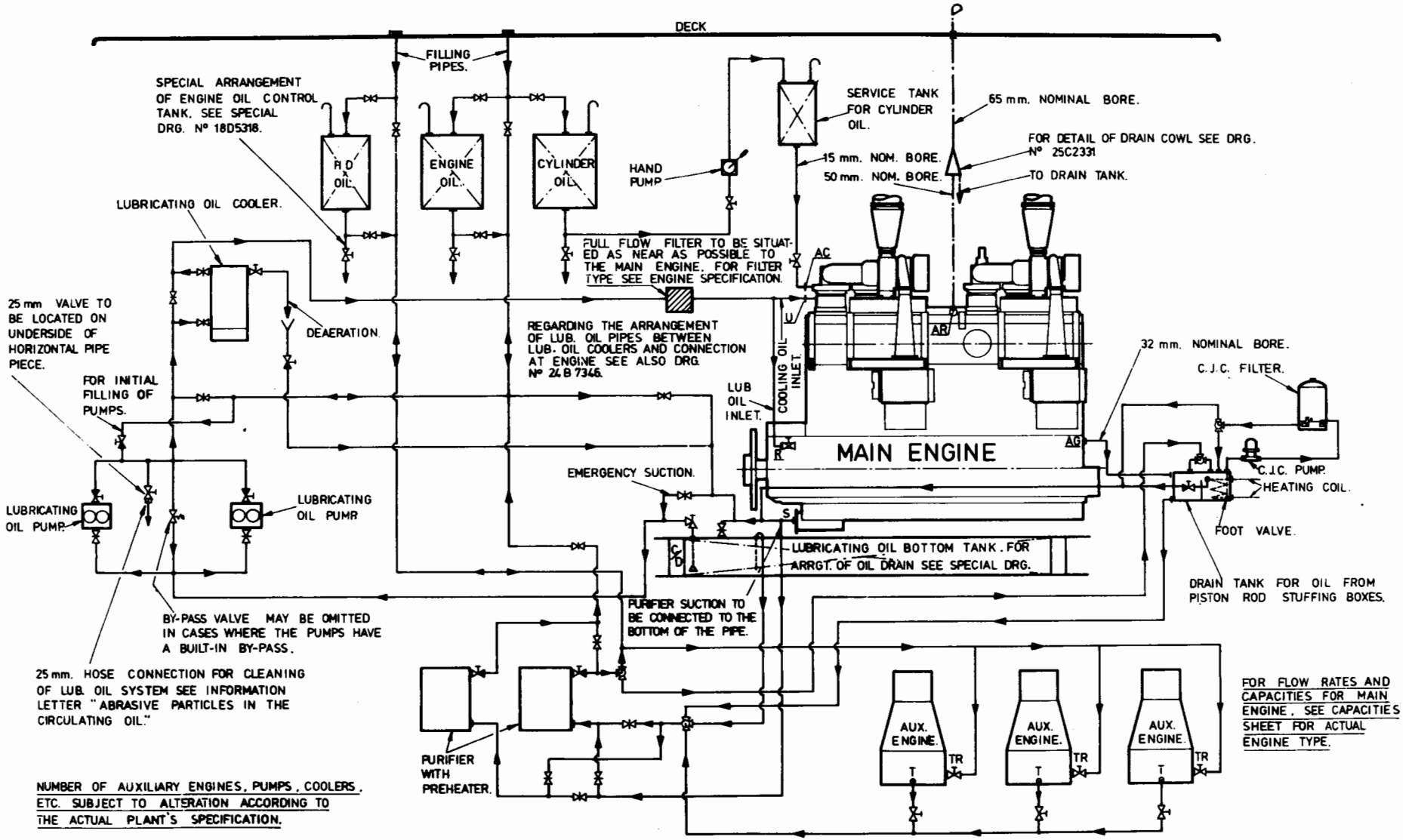


LUB. OIL PIPES

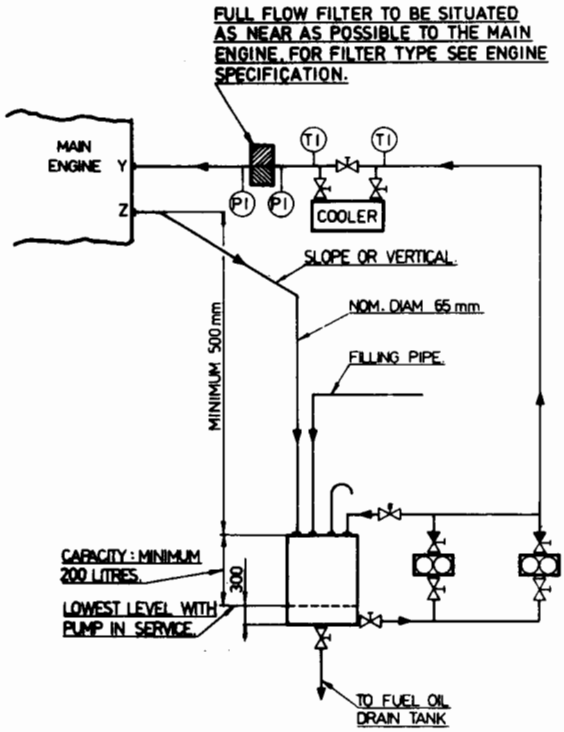
Drwg. No. 21B1226

LUB. OIL PIPES

Drwg. No. 21B1214

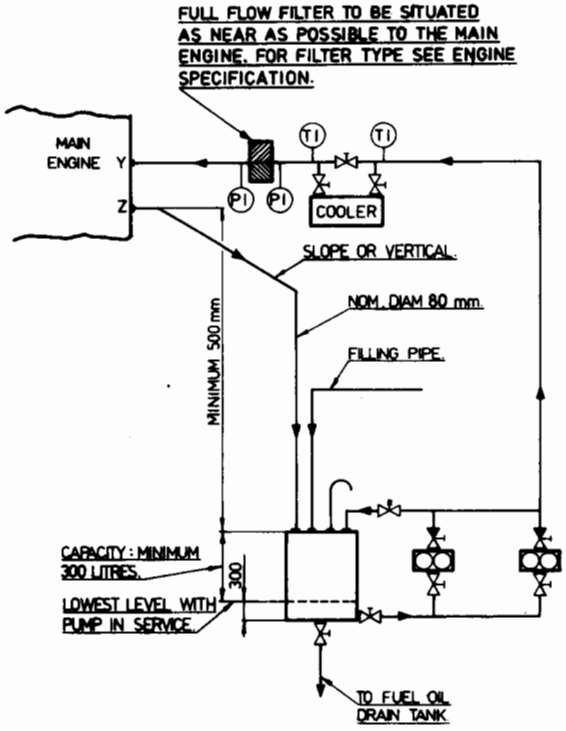


BURMEISTER & WAIN



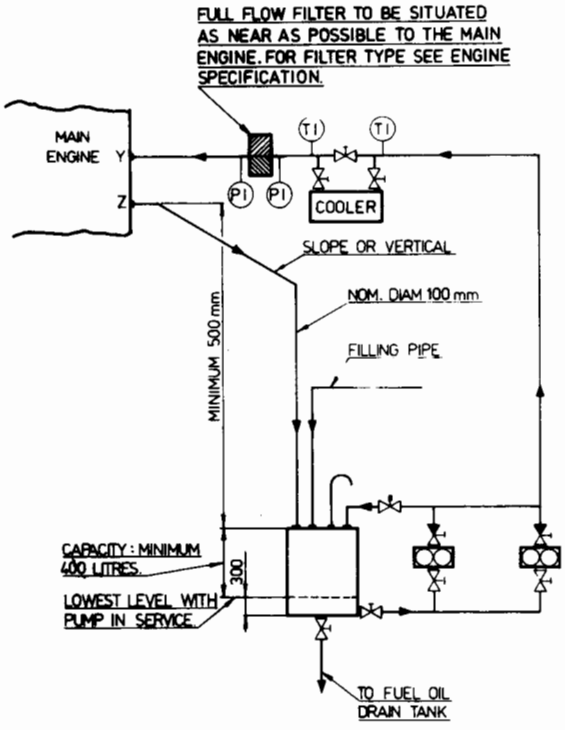
5-6-7K45GF

Drwg. No. 18D5356



8-9-10K45GF

Drwg. No. 18D5357

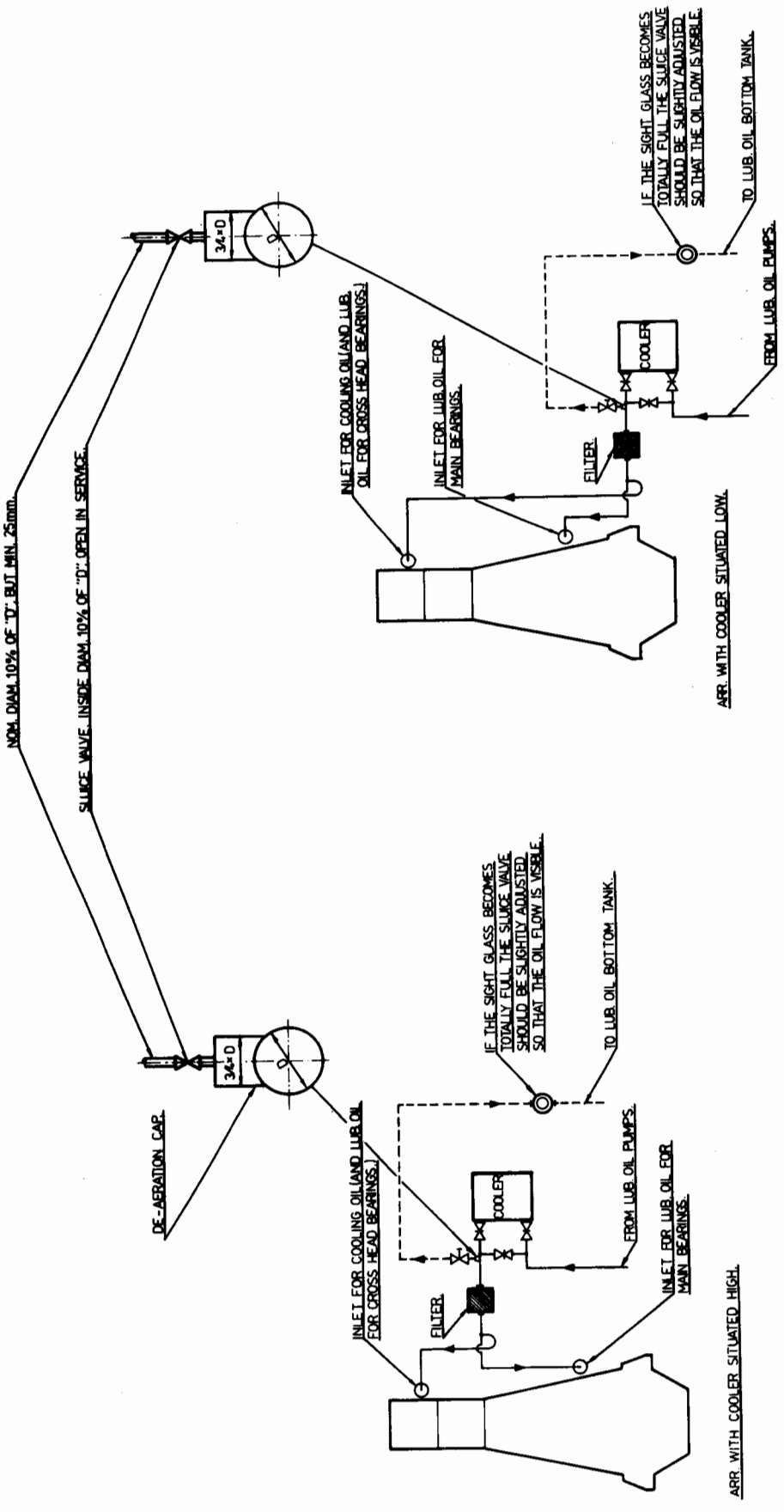


11-12K45GF

Drwg. No. 18D5358

LUB. OIL SYSTEM FOR CAMSHAFT

BURMEISTER & WAIN



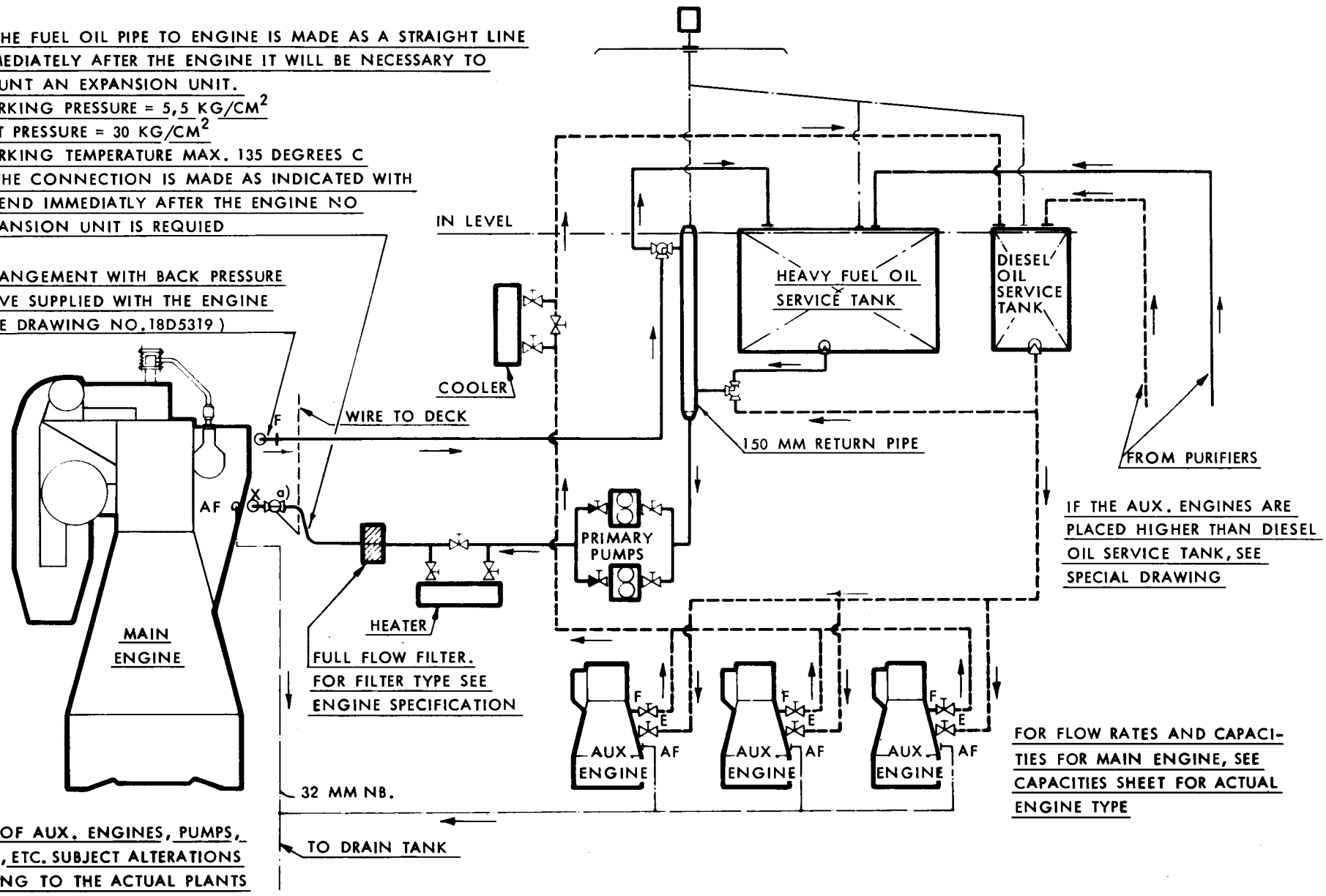
MAIN LUB . OIL PIPE

Drwg. No. 24B7346

a) SUPPLIED WITH THE ENGINE

IF THE FUEL OIL PIPE TO ENGINE IS MADE AS A STRAIGHT LINE IMMEDIATELY AFTER THE ENGINE IT WILL BE NECESSARY TO MOUNT AN EXPANSION UNIT.
WORKING PRESSURE = 5,5 KG/CM^2
TEST PRESSURE = 30 KG/CM^2
WORKING TEMPERATURE MAX. 135 DEGREES C
IF THE CONNECTION IS MADE AS INDICATED WITH A BEND IMMEDIATLY AFTER THE ENGINE NO EXPANSION UNIT IS REQUIED

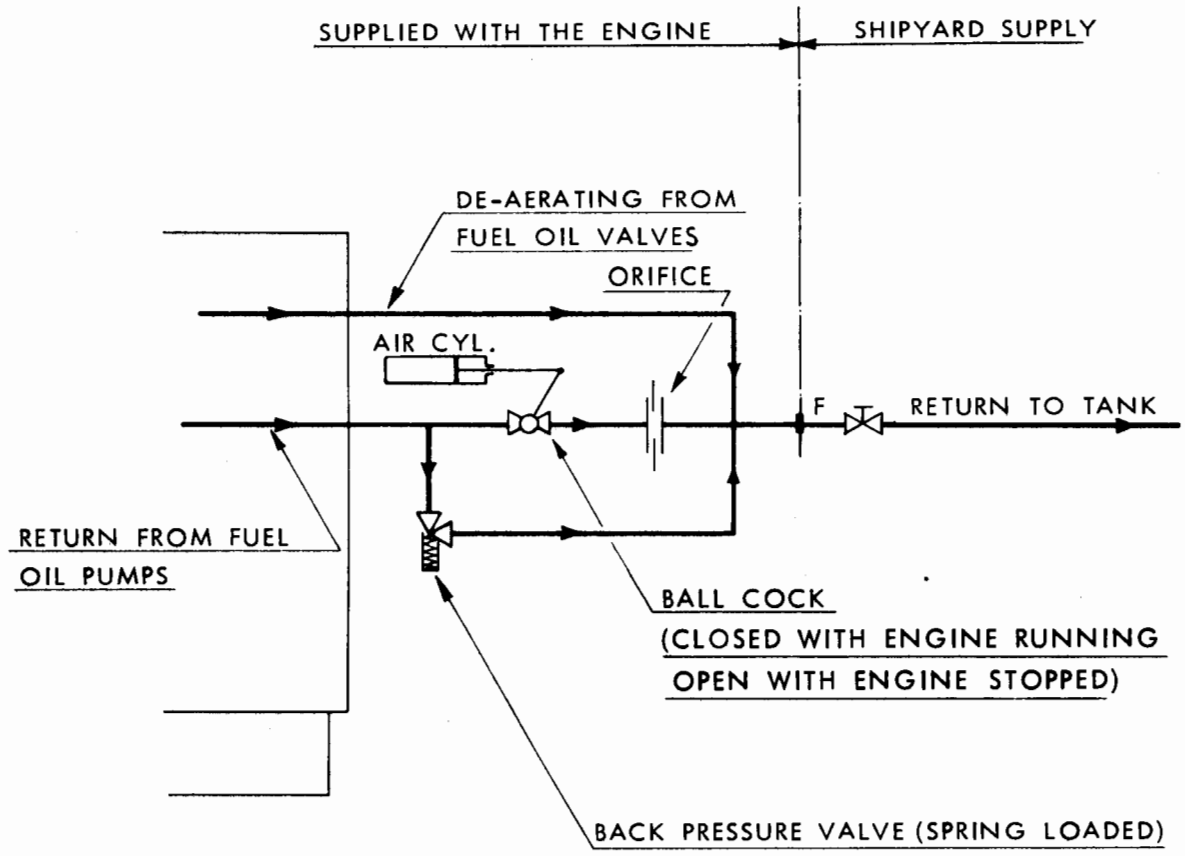
ARRANGEMENT WITH BACK PRESSURE VALVE SUPPLIED WITH THE ENGINE (SEE DRAWING NO. 18D5319)



NUMBER OF AUX. ENGINES, PUMPS, COOLERS, ETC. SUBJECT ALTERATIONS ACCORDING TO THE ACTUAL PLANTS SPECIFICATION

FUEL OIL PIPES
Drwg. No. 25C2917

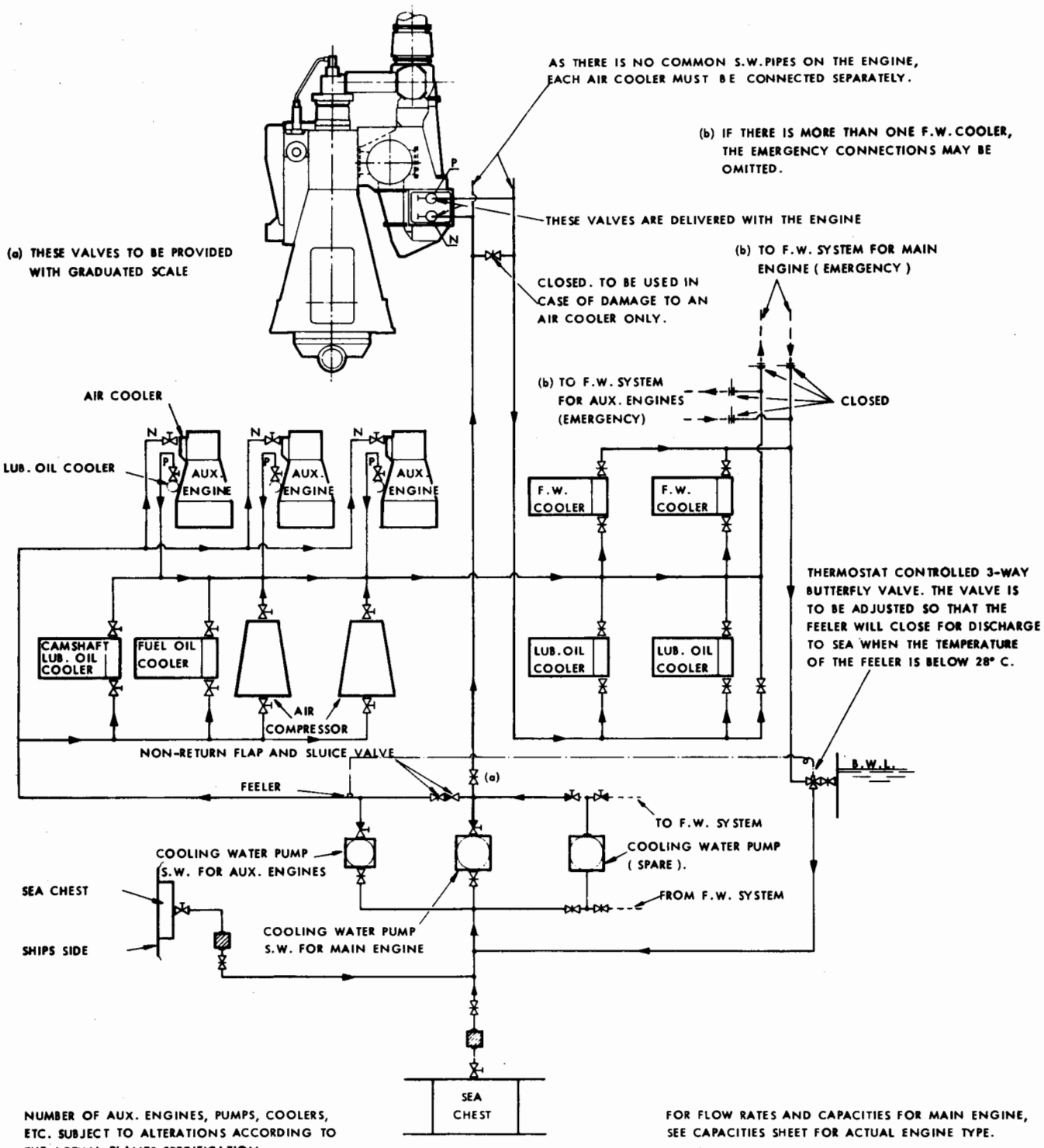
BURMEISTER & WAIN



BACK PRESSURE VALVE IN FUEL OIL SYSTEM

Drwg. No. 18D5717

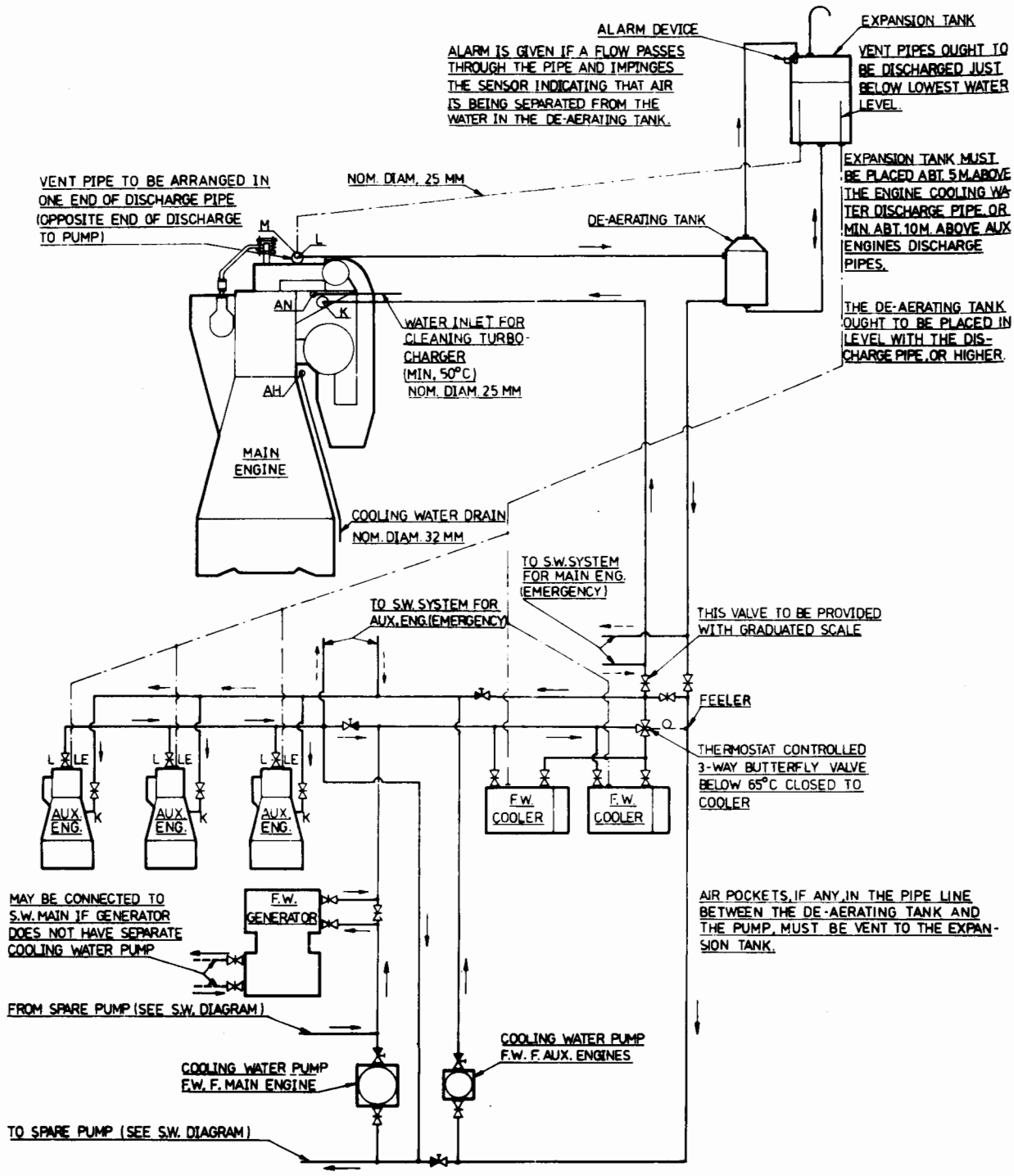
BURMEISTER & WAIN



SEA COOLING WATER PIPES

Drwg. No. 24B7360

BURMEISTER & WAIN



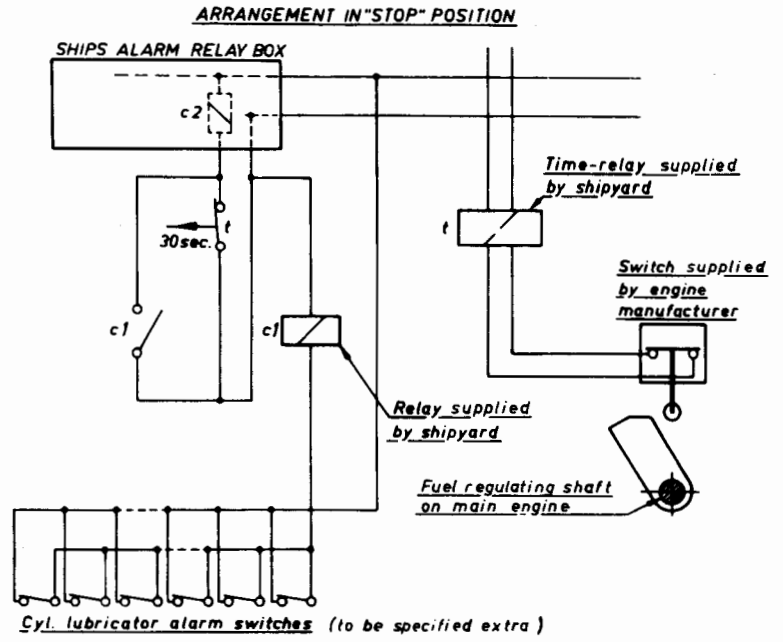
NUMBER OF AUX. ENGINES, PUMPS, COOLERS ETC. SUBJECT TO ALTERATIONS ACCORDING TO THE ACTUAL PLANTS SPECIFICATION.

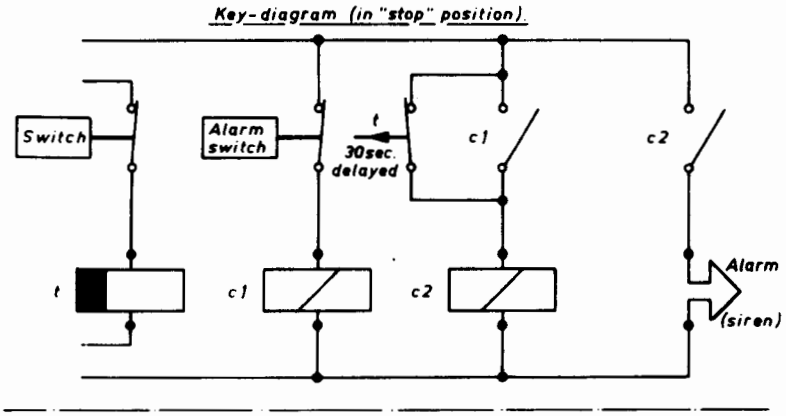
FOR FLOW RATES AND CAPACITIES FOR MAIN ENGINE SEE CAPACITIES SHEET FOR ACTUAL ENGINE TYPE.

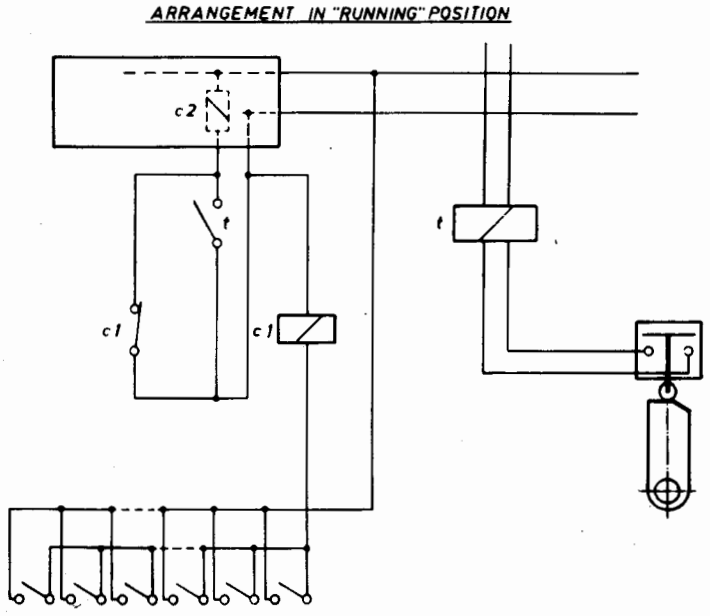
FRESH COOLING WATER PIPES

Drwg. No. 24B7351

BURMEISTER & WAIN







CYL. LUBRICATOR ALARM CUT OUT SWITCH

Drwg. No. 497260-5.0

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE K45GF

WITH TURBOCHARGER STROKE: 900 mm BORE: 450 mm

CSO:	800 BHP/cyl,	860 IHP/cyl. at	220 rpm
MCO:	880 - -	940 - - -	227 -

PUMPS

xx) Fuel oil booster:	0,250	kg/BHPh + 200 kg/h	5,5 kp/cm²	
Cooling and circul.oil:	0		- -	
F.W. and S.W.:	18	m³/h per cyl.	2,0-2,5 - -	Δp F.W. across main engine appr. 12 M.W.C.
Lub. oil for main engine:	22	- - -	3,5 - -	
Lub. oil for camshaft:	0,6	- - -	4,0 - -	
Lub. oil far turbocharger:	0			

xx) COOLERS

Lub. oil

Heat dissipation appr.	73	kcal/BHPh			
Lub. oil quantity:	22	m³/h per cyl.	at 55°C inlet		Δp = max. 5 M.W.C.
S.W. quantity:	15	- - - -	- 41°C -	x)	Δp = max. 2 M.W.C.

Scav. air

Heat dissipation: appr.	175	kcal/BHPh			
S.W. quantity:	15	m³/h per cyl.	at 32°C inlet	x)	Δp = max. 2,5 M.W.C

Fresh water

Heat dissipation: appr.	185	kcal/BHPh			
F.W. quantity:	18	m³/h per cyl.	at 65°C inlet		Δp = max. 2 M.W.C.
S.W. quantity:	18	- - - -	- 44°C inlet		Δp = max. 2 M.W.C.

Lub. oil for turbocharger

Heat dissipation: appr.	0	kcal/h per turbocharger
Lub. oil quantity:	0	m³/h per turbocharger
S.W. quantity:	0	- - - -

Lub. Oil for Camshaft

Heat dissipation: appr.	600	kcal/h per cyl.			
Lub. Oil quantity:	0,6	m³/h - -	at 45°C inlet		Δp = max. 5 M.W.C.
SW -	0,2	- - -	- 32°C -		Δp = max. 2 -

PREHEATER FOR MAIN ENGINE FUEL OIL

3500 sec. Redw. I at 100°F oil to be heated from 70°C to 135°C: appr. 7500 kcal/h per cyl.

EXHAUST BOILER

Gas amount 5700 kg/h per cyl. at 360 °C after turbocharger (at CSO)

AIR CONSUMPTION

(excl. margin for engine room fans) 85 m³/min. per cyl.

STARTING AIR (30 kp/cm²)	5 cyl.	6 cyl.	7 cyl.	8 cyl.	9 cyl.	10 cyl.	11 cyl.	12 cyl.
a) Reversible engine								
Receiver (m³)	3,5	3,5	4	4	4,5	4,5	5	5
Compressor (m³/h)	2x55	2x55	2x60	2x60	2x70	2x70	2x75	2x75
b) Non-reversible engine								
Receiver (m³)	2,5	2,5	2,5	3	3	3	3,5	3,5
Compressor (m³/h)	2x40	2x40	2x40	2x45	2x45	2x45	2x55	2x55

TURBOCHARGER(BBC-VTR)	2x321	2x321	2x401	2x401	3x321	(4x321)	3x401	4x321
AIR COOLER (LK)	2x124	2x124	2x165	2x165	3x124	(4x124)	3x165	4x124
EMERGENCY BLOWER (20 C, 760 mm.Hg. m³/sec.)								

For pipe connection we prescribe the following velocities:

Cooling water max. 3,0 m/sec.
Lub. oil - 1,8 -
Heavy fuel oil - 0,6 -
Light - - - 1,0 -

xx) When calculating the capacity of coolers and fuel oil booster pump the value of BHPh at CSO is used. Margin for running at MCO has been included.

x) Excl. F.W. generator

INSTRUMENTS AND SIGNAL EQUIPMENT

The main engine is delivered with separate manoeuvring stand, instruments, and signal equipment as specified on page K2-K4-K8-K9. For measuring points see page K5 and K6 "Instrumentation". The engine is provided with borings and pipe branches for supplementary signal equipment and remote instruments. For placing of these see page K2, K5 and K6 "Instrumentation" and K3 "Connections for Supplementary Signal equipment". The measuring points for remote pressure gauges are connected with steel pipes to a connection plate mounted near the emergency stand on the engine, see item 28 page K5 and K6. The transducers for remote pressure gauges should be connected to this connection plate.

BURMEISTER & WAIN

Medium	Pos.	No.	BSP
Thermometers:			
Fresh cool. water outlet/turbocharger	1	1	3/4
Fresh cool. water outlet/cyl.	2	1	3/4
Fresh cool. water inlet	3	1	3/4
Sea cool. water inlet/air cooler	4	1	3/4
Sea cool. water outlet/air cooler	5	1	3/4
Lub. oil inlet	6	1	3/4
Piston cool. oil outlet/cyl.	7	1	3/4
Lub. oil camshaft inlet	9	1	3/4
Fuel oil after filter	10	1	3/4
Scavenging air before and after air cooler	11	1	3/4
Scavenging air receiver	12	1	3/4
Exhaust gas after valve	13	1	3/4
Exhaust gas after turbecharger	14	1	3/4
	15		
Manometers:			
Pressure drop across air cooler	16		
Piston cool. oil inlet	17		
Lub. oil inlet	18		
	19		
Pressostats:			
Fresh cool. water pressure drop across engine	20		
Lub.oil camshaft inlet	21		
Piston cool. oil inlet	22		
Lub. oil inlet	23		
	24		
	25		
Thrust bearing control:	26		
Thermometer			
Thermostat			
Lubr. oil control:			
Manometer			
Pressostate			
Flow control:			
Piston cooling oil outlet/cyl.	27		
Connection for pressure gauges in manoeuvring stand, if required	28		

(For positions of items see page K5 and K6)

INSTRUMENTATION

Drwg. No. 663197-8.1

BURMEISTER & WAIN

Medium	Pos.	No.	BSP	If feelers required Min./max. length
Fresh cool. water outlet	30	2	3/4	50/145
Fresh cool. water outlet	31	2	1/2	50/145
Fresh cool. water outlet	32	1	1/4	
Fresh cool. water outlet/TC	33	1	3/4	150
Fresh cool. water outlet/TC	34	1	3/4	67
Fresh cool. water outlet/cyl.	35	1	3/4	150
Fresh cool. water outlet/cyl.	36	1	3/4	67
Fresh cool. water inlet	37	1	3/4	50/145
Fresh cool. water inlet	38	1	1/2	50/145
Fresh cool. water inlet	39	2	1/4	
Piston cool. oil inlet	40	2	1/4	
Piston cool. oil outlet/cyl.	41	1	3/4	60/140
Lub. oil inlet	42	2	3/4	65/180
Lub. oil inlet	43	1	1/2	65/180
Lub. oil camshaft inlet	45	1	3/4	50/150
Lub. oil camshaft inlet	46	2	1/4	
Fuel oil after filter	47	1	3/4	60/100
Fuel oil after filter	48	1	1/2	100/150
Fuel oil after filter	49	1	3/8	
Sea cool. water inlet/AC	50	1	3/4	150/-
Exhaust gas after valve	51	3	3/4	200/250
Exhaust gas after turbocharger	52	2	3/4	150/-
Exhaust gas before turbocharger	53	1	3/4	200/250
Scavenging air receiver	54	4	3/4	125/-
Scavenging air receiver	55	1	3/8	
Scavenging air receiver	56	2	1/4	
Scavenging air before and after cooler	57	4	3/4	170/-
Scavenging air fire/cyl.	58	1	3/4	50/400
Thrust bearing segment	59	1	1/2	130/Ø10
Starting air	60	1	3/8	

TC = Turbocharger AC = AIR Cooler

CONNECTIONS FOR SUPPLEMENTARY SIGNAL EQUIPMENT

Drwg. No. 66 31 96-6.1

BURMEISTER & WAIN

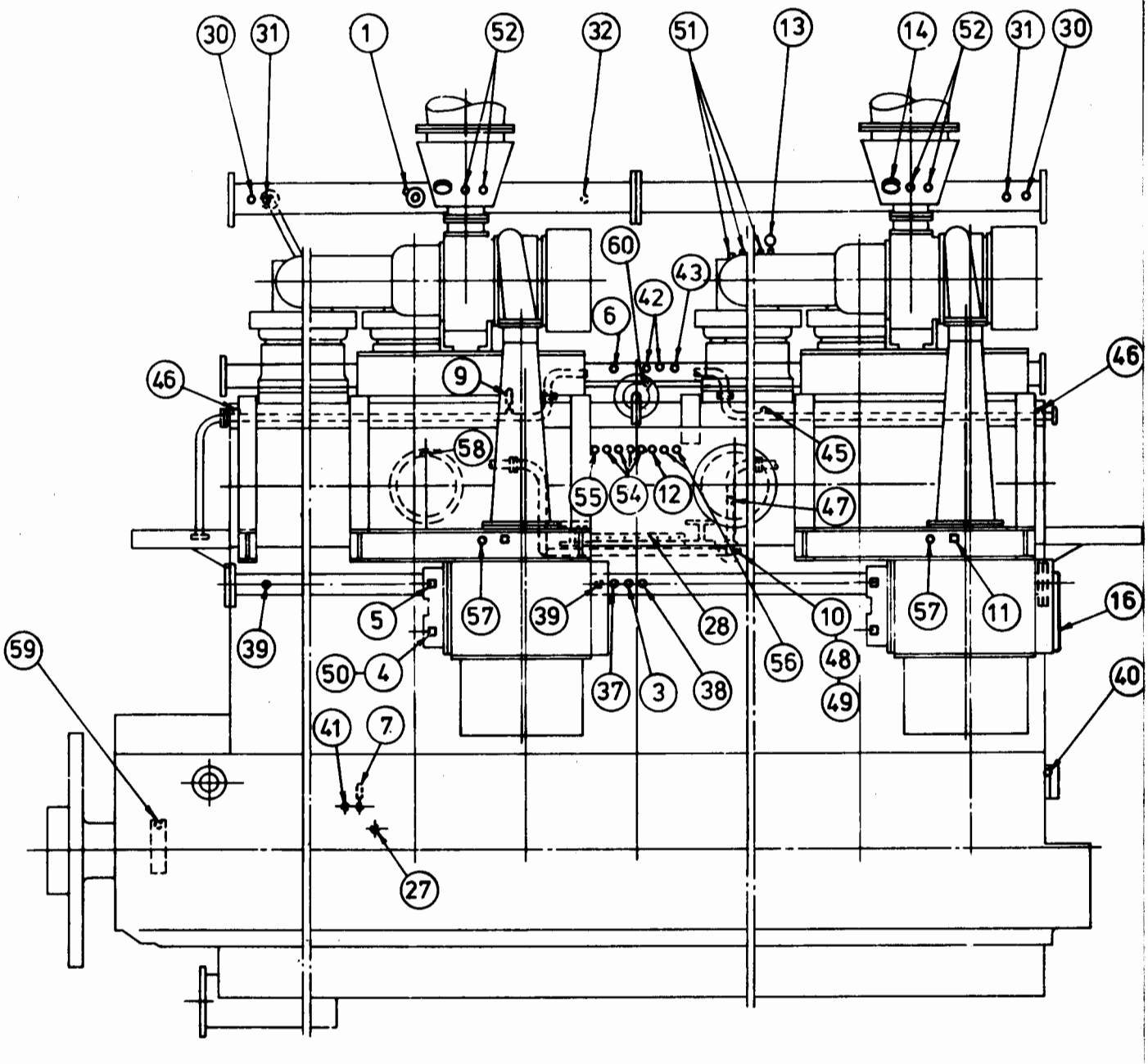
SIGNAL EQUIPMENT on Engine for

T = temperature, high, P = Pressure, low, F = flow, low

Other	Shut down	Alarms	Designation
		1 P	Piston cooling oil inlet
	1	1 P	Main lubr.oil inlet
		1 F	Piston cooling oil, outlet, each cyl.
		1 P	Camshaft lubr.oil inlet
		1ΔP	Fresh cooling water, inlet and outlet
		1 P	Control air
		1 P	Reversing air
	1	1 T	Thrust bearing segment
	1	1	Overspeed
		1	Wrong way
1			Turning gear safety switch

For arrangement of shut-down system see page K15 "Manoeuvring Stand".

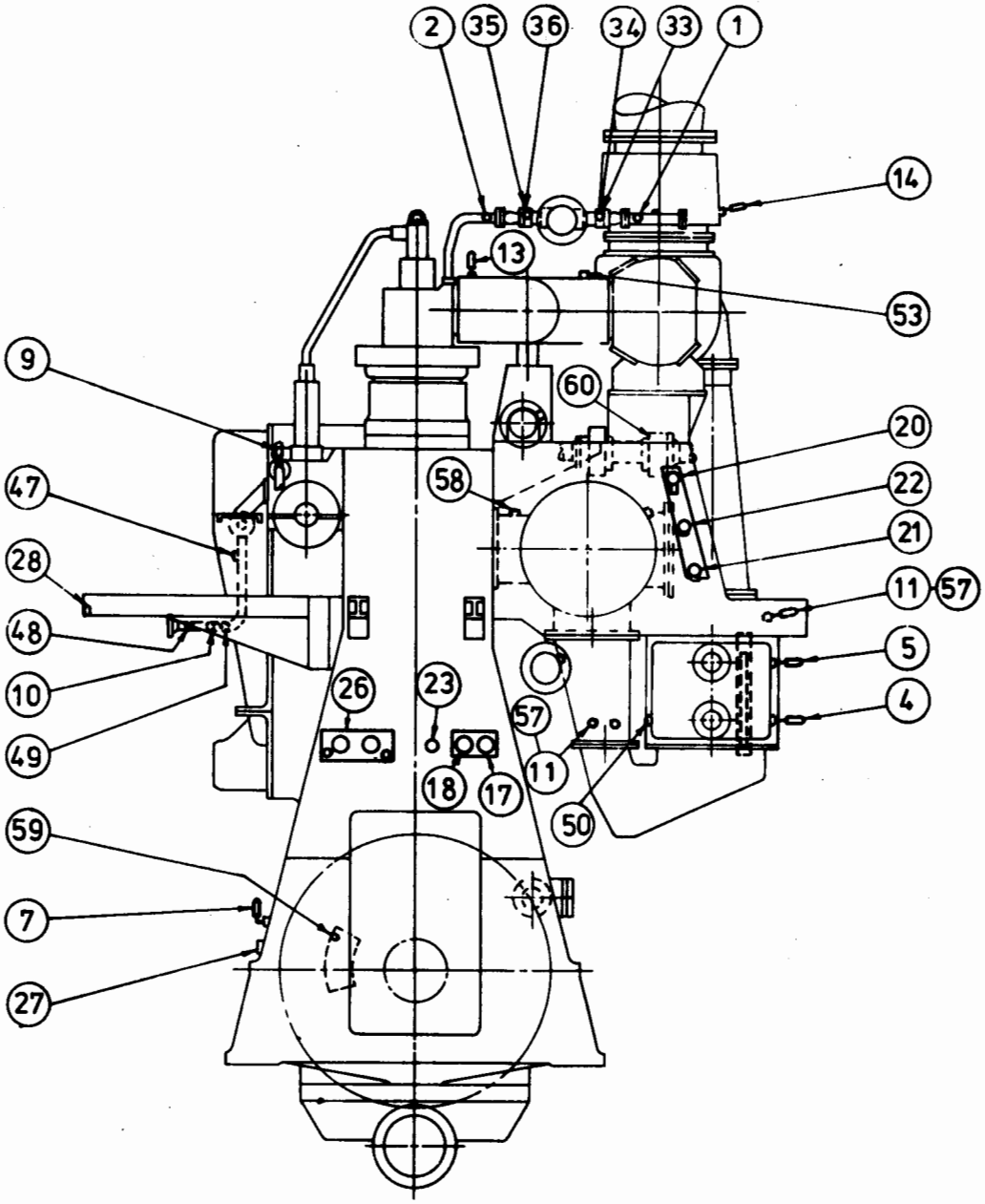
BURMEISTER & WAIN



INSTRUMENTATION SECT I

Drwg. No. 667761-9.1

BURMEISTER & WAIN



INSTRUMENTATION SECT II

Drwg. No. 667761-9.1

MANOEUVRING STAND

The engine is delivered with a separate manoeuvring stand, which is equipped with electrical pressure gauges and thermometers as mentioned on page K8. The only exception is pressure gauges for control air, which are mechanical.

Signals to the pressure gauges are delivered by pressure converters placed in connection with the plate mentioned on page K1 and signals for the thermometers by thermofeelers placed on the measuring points.

Diagram for manoeuvring stand is shown on page K15. On page K16 is given a specification of the telegraph to be used in connection with the pneumatic control system.

The following parts are not included in the delivery extent of the engine builder: Telegraph system and connection between manoeuvring stand and engine and telegraph system.

BURMEISTER & WAIN

To ensure a safe running of the engine the manoeuvring stand is equipped with the following instruments and components:

	Qty.	Designation
Pressure gauges for:	1	Fuel oil before filter
	1	Fuel oil after filter
	1	Starting air
	2	Control air
	1	Fresh cooling water inlet
	1	Sea cooling water inlet
	1	Piston cooling oil inlet
	1	Lubricating oil inlet
	1	Camshaft lubr.oil inlet
	1 x)	Scavenging air
Thermometers for:	1	Fresh cooling water inlet
	1	Lubricating oil inlet
Other instruments:	1	Tachometer for main engine
	1	Tachometer per turbocharger
	1	Reversing indicator
	1	Revolution counter
	1	Clock
Sundries:	1	Alarm cut out switch
	1	Air shut off valve closed lamp
	1	- - - - open lamp
	1	Regulating unit with handle
	1	Safety panel
	1	Relay unit
	1	Power supply for relay unit
	1	Power supply for "ahead", "astern" system
	1	Lamp for emergency system
	2	Lamps for pressurizer
	1	Push-button for slow-turning
	1	Turning gear engagement lamp

x) In case of separated scavenging air receiver (10 & 12 cyl. engines) 2 pressure gauges are to be used.

	Qty.	Designation
Alarm devices:	1	"Wrong way" bell
	1	- - lamp
	1	- - box
	1	Overspeed failure of current (connected to alarm system)

Space is reserved in the manoeuvring stand for mounting of engine telegraph which has to be made according to page K16 "Telegraph Specification for Engines with Pneumatic Regulating Gear".

The telegraph is not included in the delivery extent of the engine builder.

Pneumatic Manoeuvring System (Without Bridge Control)

In the following is given a brief, functional description of the pneumatic manoeuvring system. A more detailed functional description is given on drwg. No. E-4-662839-7 (which can be sent upon request by the engine builder).

For pertaining diagrams see:
Page K13 Diagr. Manoeuvring Arrangement
" K14 Sequence Diagram

Function of the Pneumatic Manoeuvring System

The drawing shows the system in AHEAD and STOP position.

A. Start from Manoeuvring Stand

The telegraph handle is moved in the AHEAD as ordered from bridge. If the engine has been stopped for a long time (t 30 min.), it can be useful to let the engine turn at least one revolution at SLOW-TURNING to be sure that no oil or water is leaked into the cylinders. Slow-turning is obtained by actuating the switch S19 in manoeuvring stand and moving the regulating handle into START position. The solenoid valve pos.12 opens the small ball-valve for starting air by means of valve pos.14. If the pressurizer is in ASTERN position, the valve pos.98 gets a signal and valve pos.87 is moved to AHEAD position.

After the slow-turning is finished a normal start can be carried out by actuating the switch S19 and move the regulating handle back to stop position and then to start position. In this position the solenoid valves pos.4 and 12 are actuated. If the starting air distributor and camshaft are in AHEAD position, signal is given to valve pos.96 for starting air distributor, and valve pos.103 for pre-set speedsetting signal to the governor (abt. 2 kp/cm^2) whose terminal lever turns to a max. position. As the stop cylinder pos.44 is actuated also at start position, the spring rod between governor and regulating shaft is compressed. As valve pos.66 is open and valve pos.61 is in AHEAD position, the internal piston in the starting air distributor is moved to AHEAD position, the engine starts with starting air. At the same time the booster for the governor is actuated.

The booster for governor helps the internal oil pump in the governor to keep the oil pressure during starting period. When the engine has reached the starting level, the regulating handle has to be moved to fuel. Then the stop cylinder is vented, and the engine starts on fuel.

B. Reversing from Manoeuvring Stand (Ahead to Astern)

The engine is to be stopped by moving the regulating handle to stop position and the telegraph handle is moved to ASTERN position. When the RPM has decreased to the reversing level, the regulating handle is moved to START position and the following happen: The ASTERN solenoid valve pos.97 is actuated and reverses the valve pos.87 to ASTERN position. Now the air pressure reverses the valve pos.61 to ASTERN position. This means that the internal piston in the starting air distributor is moved to ASTERN position. At the same time the valve pos.72 is actuated and the pressurizer reverses the camshaft to ASTERN position. When the reversing of the camshaft is fulfilled, the ASTERN switch pos.60 is actuated and the engine starts rotating on starting air in ASTERN direction, and continues on fuel as explained in chapter A.

C. Emergency Control

When the pneumatic or the electrical part of the manoeuvring system breaks down, the necessary manoeuvres can be carried out from emergency stand at the engine.

Preliminaries:

1. Nut P is removed from X to Z. Now the governor is disconnected from the fuel pumps and the emergency handle connected to same.
2. Check that valve pos.52 is in the wanted position (AHEAD or ASTERN).
3. Valve pos.53 is changed-over from NORMAL to EMERGENCY.

Start:

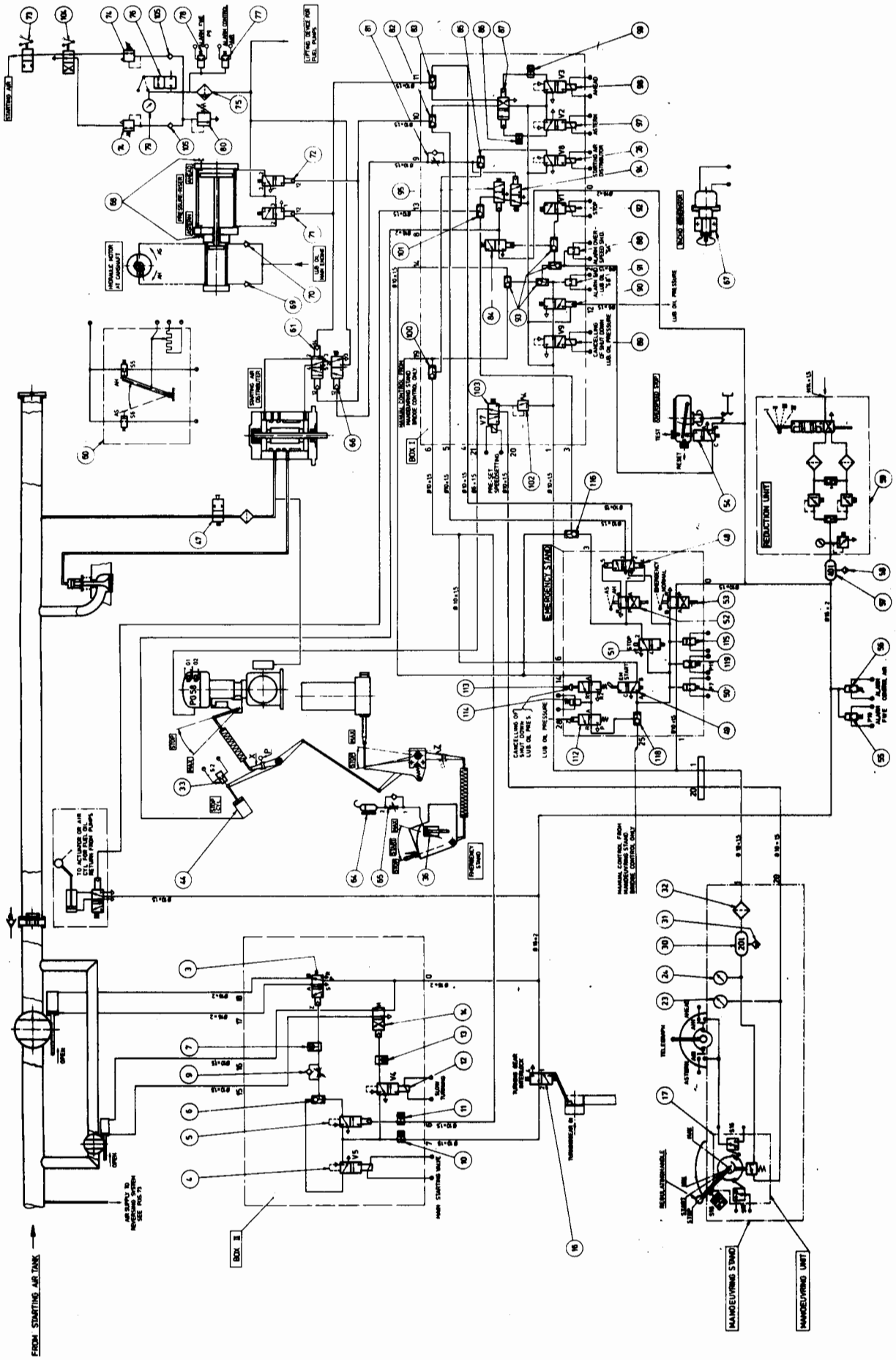
1. Start is carried out by means of the regulating handle in emergency stand. When moving this handle in START position, the valve pos.49 is actuated and air pressure is led to the valve pos.66 which actuates the starting air distributor and valve pos.5 opens the big ball valve for starting air

via valves pos. 6, 9 and 3. At the same time the booster for the governor is actuated.

2. When a sufficient RPM has been reached, the regulating handle is moved to fuel oil and the engine starts.

Reversing: Reversing is carried out by means of valve pos.52.

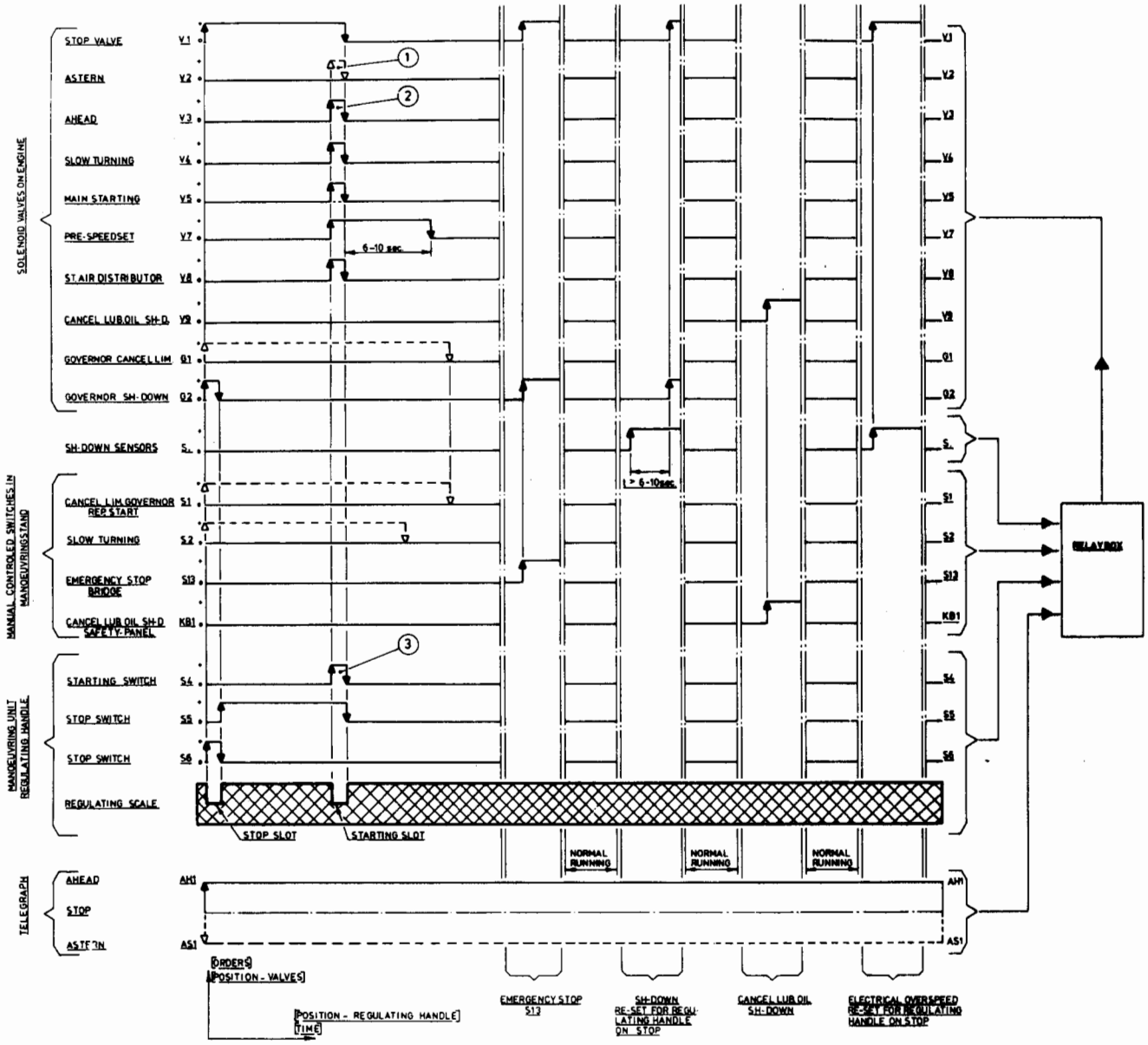
BURMEISTER & WAIN



DIAGR. MANOEUVRING ARRANGEMENT

Drwg. No. 668735-1.3

BURMEISTER & WAIN



(1) Conditions for signal to valve astern : order astern pressureriser in ahead position

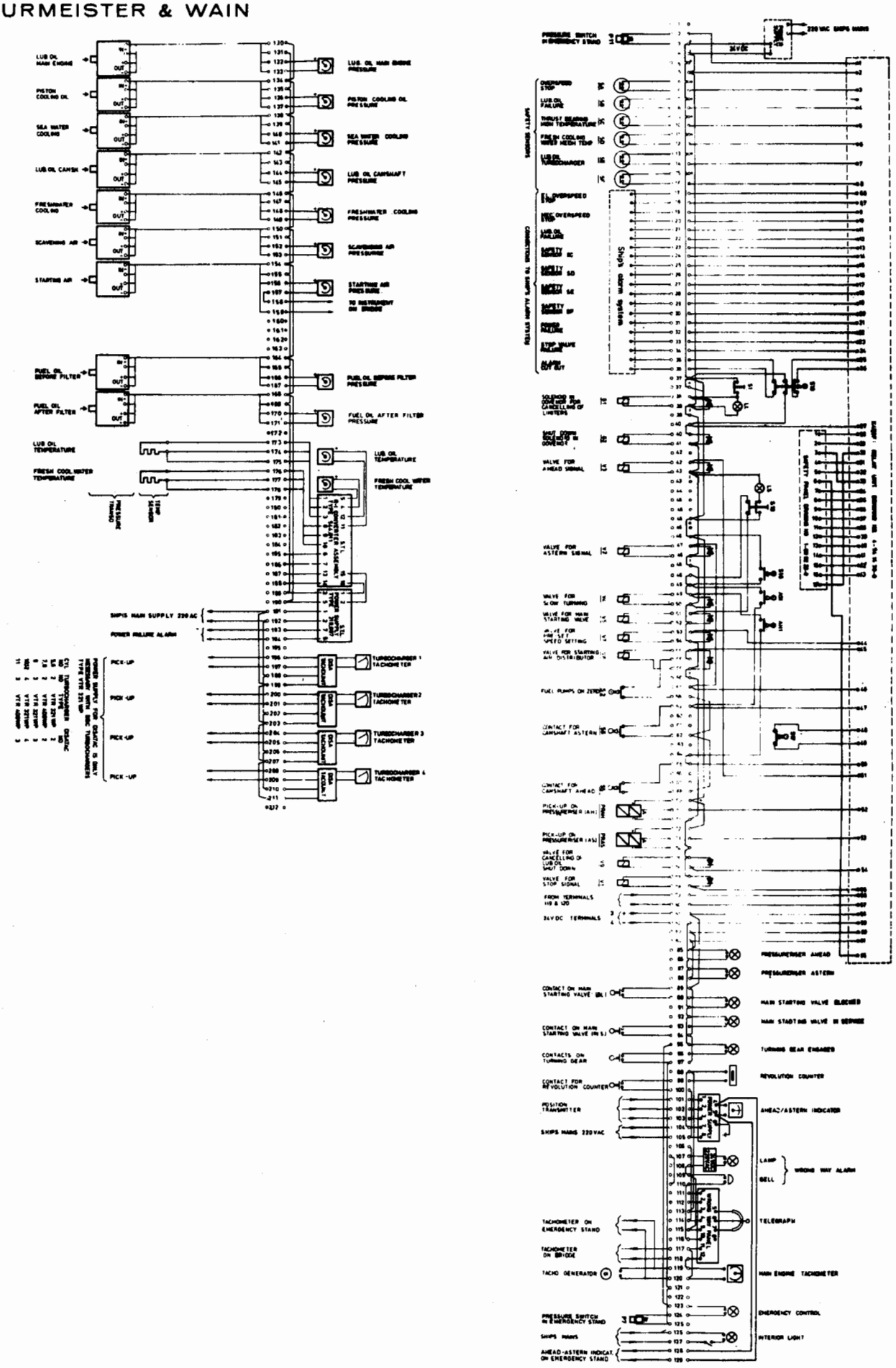
(2) Conditions for signal to valve ahead : order ahead pressureriser in astern position

(3) S4 is only activated at start position when the regulating handle is moved forward

SEQUENCE DIAGRAM

Drwg. No. 540160 - 2.0

BURMEISTER & WAIN



EL DIAGRAM FOR MANOEUVRING STAND

Drwg. No. 668832-1.1

TELEGRAPH SPECIFICATION

This specification does not comprise the equipment normally forming part af the telegraph system. In this case reference is mode to the individual suppliers' specifications, and as far as bridge-controlled plants are concerned: furthermore to our speciol telegraph specification for same. Reference is also mode to the requirements of the Classification Sosieties.

In addition to this equipment the engine room telegraph should include two switches for indication af "AHEAD" and "ASTERN" respectively.

These switches which are shown on Fig. 1. are forming part of a system preventing wrong manaeuvring of the engine. The switches for "AHEAD" and "ASTERN" respectively are to be actuated in all "AHEAD" and "ASTERN" positions corresponding to the normal orders "DEAD SLOW" - "SLOW" - "HALF" and "FULL". Accordingly the switches are not to be actuated in the positions "STOP" - "STAND BY" and "FINISHED WITH ENGINE".

The connections of the switches are to be brought out into a termina! at the telegraph housing. The connection for the "AHEAD" swich shauld be marked 1 and 2, while the connection for the " ASTERN" switch to be marked 3 and 4.

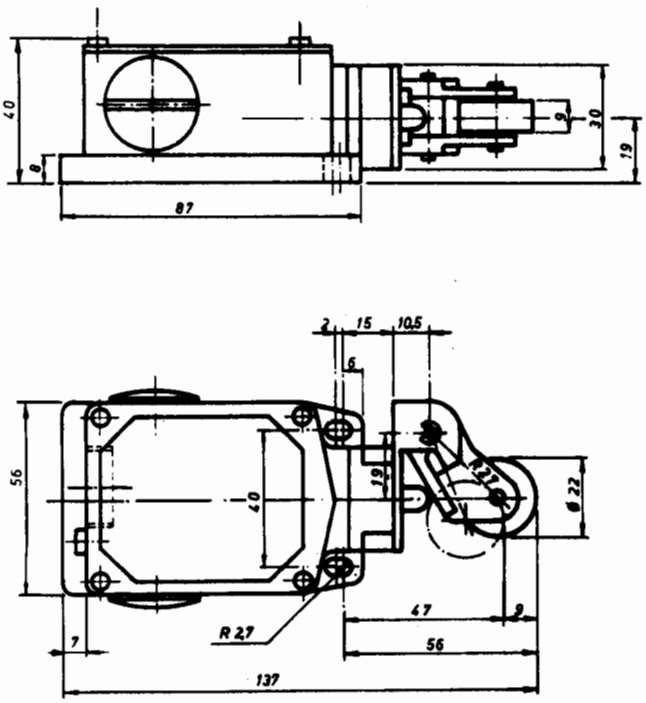


Fig. 1

Make or similar: Siemens.
Type: 3 SE2 100-1
Ambient temperature: - 20° - + 80°C
Insulation: P54 - DIN 40050
Max. Voltage DC : 600 V
Max. Voltage AC : 500 V

BURMEISTER & WAIN

Bridge Manoeuvring System

As stated on page A3 two different bridge manoeuvring systems have been developed for this engine type. One of the systems has been developed by B&W while the other one has been developed by Messrs. S.T. Lyngsø A/S in co-operation with B&W.

The bridge manoeuvring systems have the following type designations:

1. B&W-BMS-R100
2. B&W/STL-DMS990.

1. B&W-BMS-R100

In the following is given a brief, functional description of this system. A more detailed functional description is given on dwg. No. E-4-541459-3. (Which can be sent at request of engine builder).

B&W-BMS-R100 is an el.pneumatic bridge manoeuvring system which makes it possible to run automatically from the bridge respectively from the engine room. The engine's RPM-control, ahead, astern and stop order take place via the telegraph handle. The speed-setting function is pneumatic as a fine-adjustment valve is mounted directly in connection with bridge as well as engine room telegraph. 2 boxes with the necessary pneumatic components and solenoid valves are located on the engine which thus form the basis of controlling the engine.

The electric part of the control system is mounted in a box (1000x800x300), which can be placed in the engine control room.

The main parts of the bridge control system are located as follows:

In the relay box

Relay control, mimic diagram, monitoring equipment, and test panel.

In the manoeuvring stand

Safety panel for shut/slow downs, bridge communication panel, and simplified mimic diagram.

The relay control is mainly built up by means of conventional relays so that maintenance and possible trouble-shooting can be carried out by the engine room staff.

In case of failing function of the electric part of BMS the following alternative operation possibilities are available:

1) Manual control from separate panel mounted in the control room's manoeuvring stand. By this way of operation the engine's RPM is still controlled through the governor.

2) Emergency control from the emergency manoeuvring stand located on the engine. By this way of operation the engine's RPM is controlled without governor.

For pertaining diagrams see:

Page K19 Manoeuvring System (Principle)
" K20 Wiring diagram for manoeuvring stand
" K21 Diagr. Manoeuvring Arrangement
" K22 Sequence diagram.

Spare parts for bridge manoeuvring system:
1 Container with spare parts (See page S3)

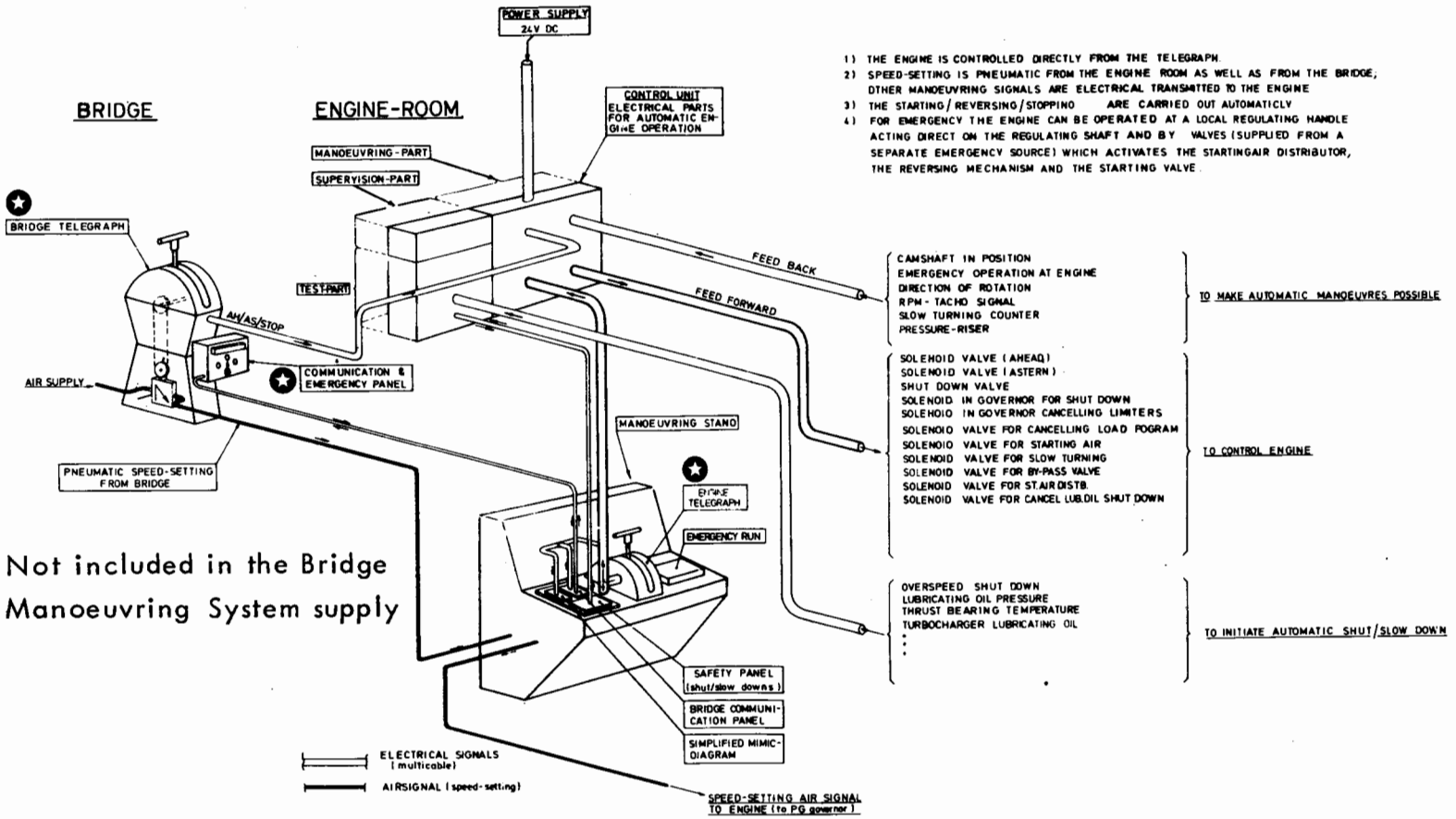
Manual for bridge manoeuvring system:
4 Instruction manual

The following parts are not included in B&W-BMS-R100 delivery extent: Bridge Telegraph, Engine Telegraph, Connection manoeuvring stand-engine-telegraph, alarm systems and cables in connection with thermostats, pressure gauges and other contacting devices. Space is reserved in the manoeuvring stand for mounting of engine telegraph.
The telegraph system has to be made according to "Telegraph Specification" for B&W-BMS-R100. Dwg. No. E-4-696932-9.

2. B&W/STL-DMS990

This bridge manoeuvring system is supplied by S.T. Lyngsø A/S and is described in booklet No. 090.505.
This booklet can be sent at request of engine builder or S.T. Lyngsø A/S.

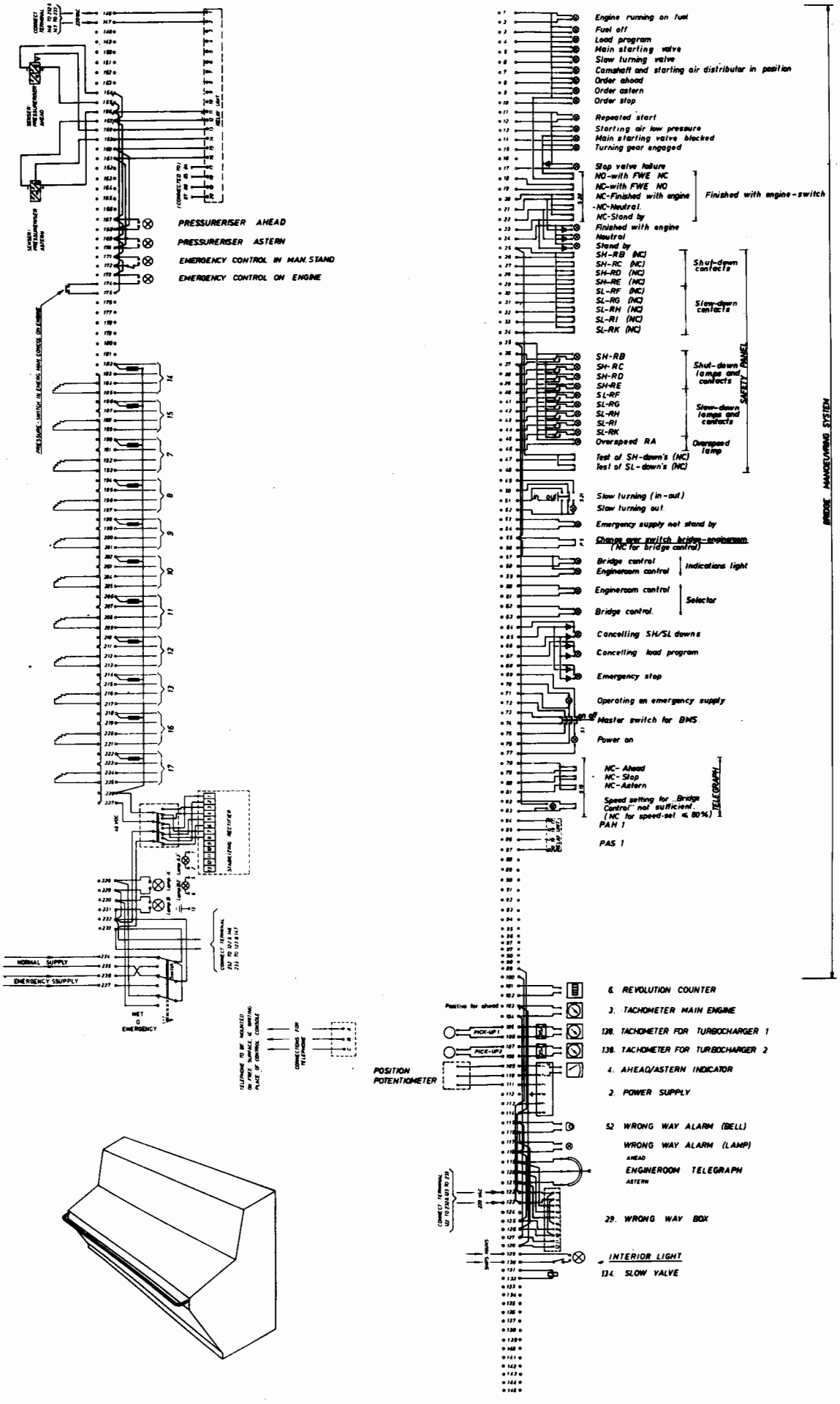
PRINCIPLE OF MANOEUVRING SYSTEM



1) THE ENGINE IS CONTROLLED DIRECTLY FROM THE TELEGRAPH.
2) SPEED-SETTING IS PNEUMATIC FROM THE ENGINE ROOM AS WELL AS FROM THE BRIDGE, OTHER MANOEUVRING SIGNALS ARE ELECTRICAL TRANSMITTED TO THE ENGINE
3) THE STARTING/REVERSING/STOPPING ARE CARRIED OUT AUTOMATICLY
4) FOR EMERGENCY THE ENGINE CAN BE OPERATED AT A LOCAL REGULATING HANDLE ACTING DIRECT ON THE REGULATING SHAFT AND BY VALVES (SUPPLIED FROM A SEPARATE EMERGENCY SOURCE) WHICH ACTIVATES THE STARTINGAIR DISTRIBUTOR, THE REVERSING MECHANISM AND THE STARTING VALVE.

✪ Not included in the Bridge Manoeuvring System supply

BURMEISTER & WAIN

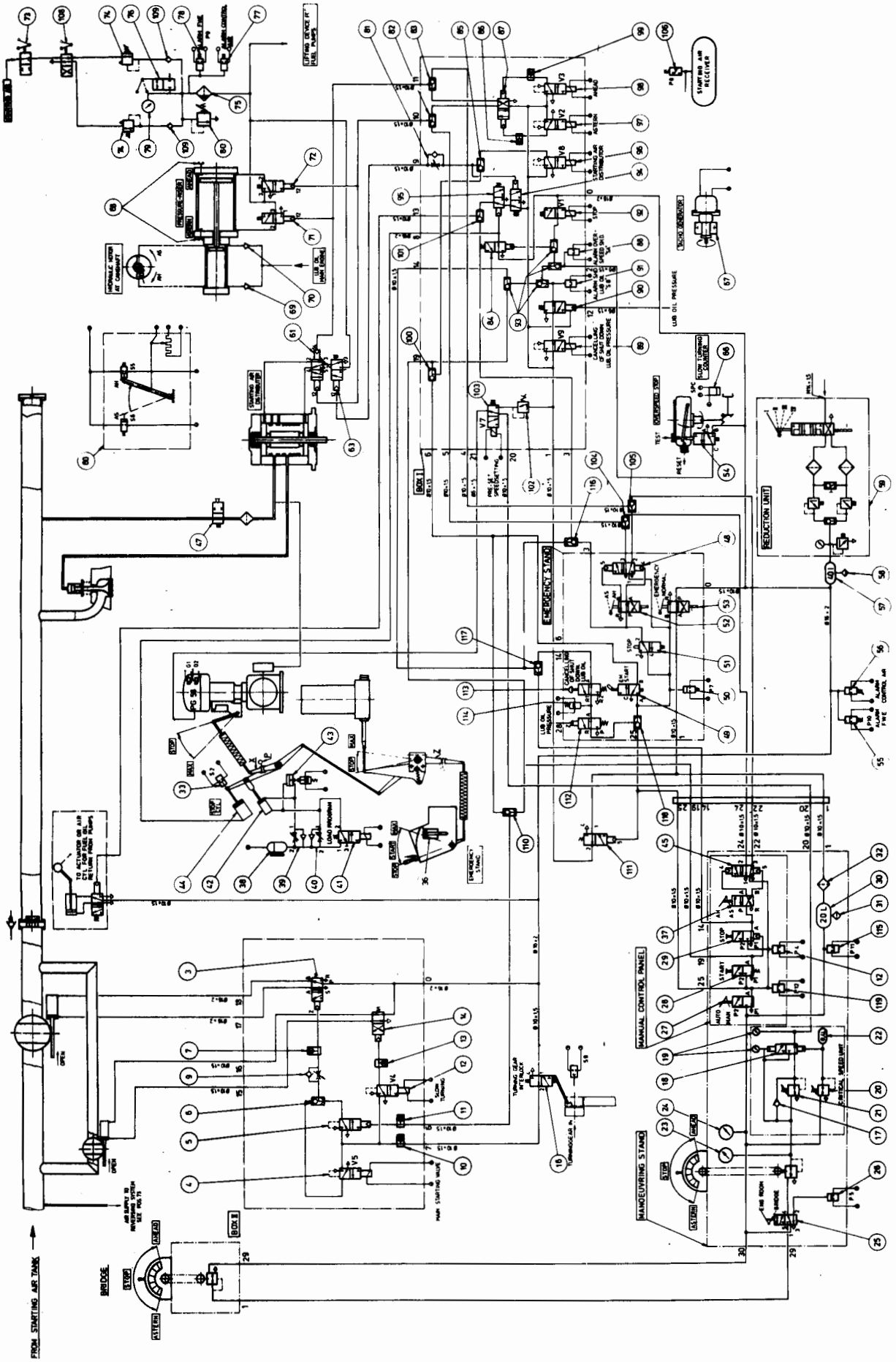


EL DIAGRAM FOR MANOEUVRING STAND

(Bridge Manoeuvring System)

Drwg. No. 695980-2.0

BURMEISTER & WAIN

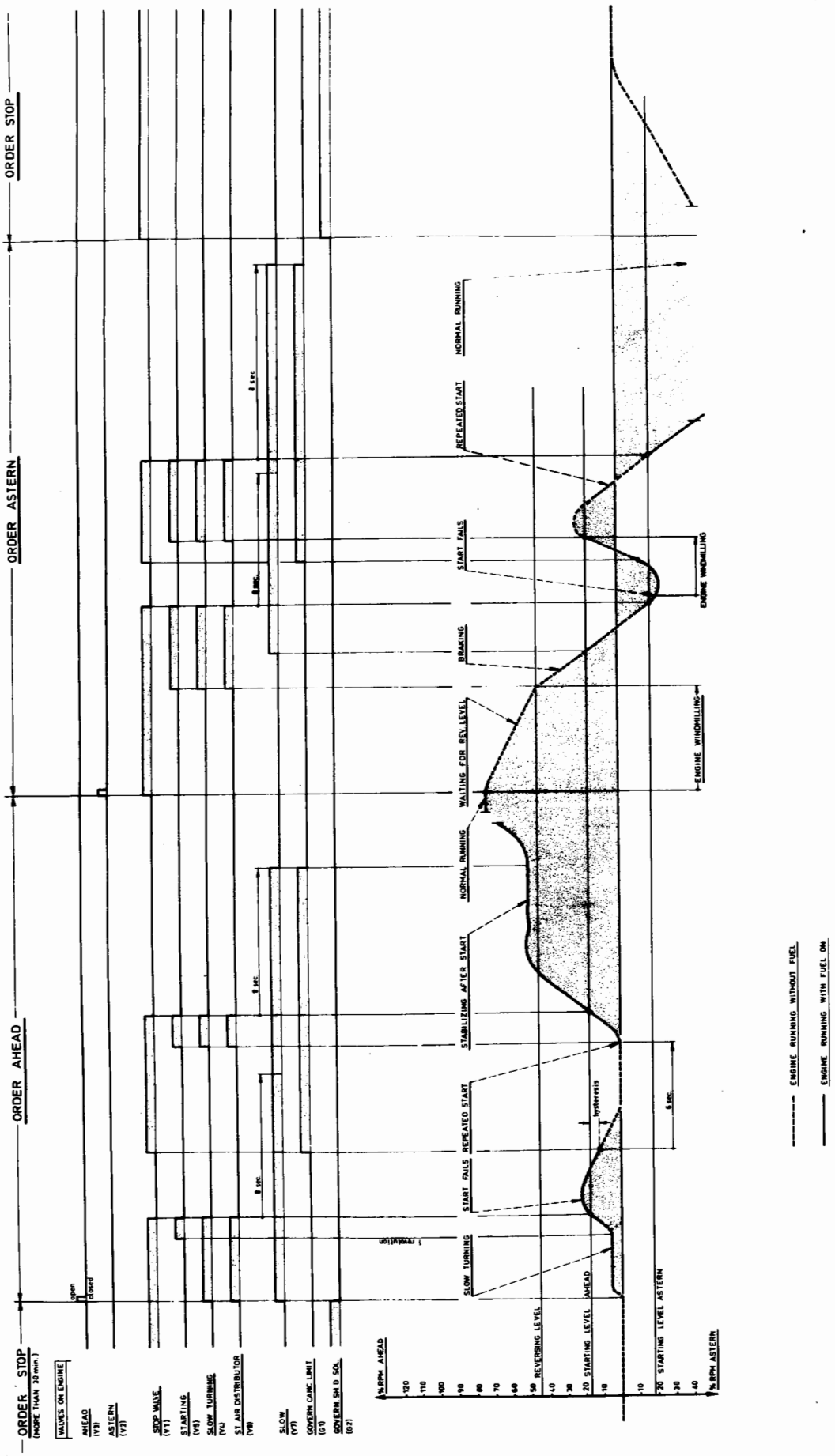


DIAGR. MANOEUVRING ARRANGEMENT

(Bridge Manoeuvring System)

Drwg. No. 668730-2.0

BURMEISTER & WAIN



SEQUENCE DIAGRAM

Drwg. No. 529788-6.0

C.P. Propeller System

An engine ordered to be used in connection with C.P. propeller system is equipped with:

1) Interlock system for blocking of engine if the propeller is not in 0-position when starting the engine.

2) Auxiliary blower(s) 1 for 5-6-7-8-9 cyl. number
2 for 10-11-12 cyl. number
with pressurestat.

3) Starting system from bridge.
Requirement of "Det Norske Veritas" when the engine is provided with aut. stop, for cases other than overspeed and lubr.oil pressure.

4) An index transmitter in connection with the regulating shaft of the engine.
(To be delivered by C.P. propeller supplier).

Periodically unmanned engine room requirement:

5) An extra push-button for stop on bridge. This button should be connected to the shut down coil in the governor.

The C.P. propeller pitch regulating unit is delivered as either

1) a unit to be mounted outside the manoeuvring stand or
2) a component to be mounted inside the manoeuvring stand.
(To be delivered by the C.P. propeller supplier).

The telegraph to be used is the one used for an engine without bridge manoeuvring as specified on page K16.

Periodically Unattended Machinery Space

In addition to B&w bridge manoeuvring system some of the supplementary signal equipment mentioned on page A7 will be necessary to fulfil the requirements of the classification societies for periodically unattended machinery space.Further equipment should be added according to the actual rules.The extent of the rules is given on page K25.

TWO STROKE MAIN MARINE TYPE DIESEL ENGINE K-GF

WITH TURBOCHARGER UNATTENDED MACHINERY SPACE ALARM SENSORS

Germanischer Lloyd | Lloyds Register | Bureau Veritas | Norske Veritas | American Bureau of Shipping

F=FLOAT switch
L=LEVEL -
P=PRESSURE -
T=TEMPERATURE

T(A)=ALTEROSTATE switch
T(d)=THERMONITOR
D =OILMIST detector

GL	LR	NV	BV	ABS		ALARM	POINT OF LOCATION
							FUEL OIL SYSTEM
1	1	1	1	1		P(min)	Fuel oil after Filter
1	1	1	1			T(max)	Fuel oil before Pumps
1	1	1	1	1		T(min)	Fuel oil before Pumps
							LUB. OIL SYSTEM
1	1	1	1	1	standard	P(min)	Piston cooling oil before piston
	1	1				T(max)	Piston cooling oil after piston,pr. cyl.
1	1	1	1	1	standard	F(min)	Piston cooling oil after pistons,pr.cyl.
1	1	1	1	1		T(max)	Lub oil before engine
1			1			T(min)	Lub oil before engine
1						Δ P(max)	Lub oil main Filter automatic
1	1	1	1	1	standard	P(min)	Lub oil before engine and Thrust bearing
1	1	2	1	1	standard	T(Amax)	Thrust bearing, Bearing segment
1	1	1	1	1	standard	P(min)	Lub oil before Camshaft.
			1			T(max)	Lub oil outlet Turbocharger,pr. bearing
1	1	1	1	1		F/L(min)	Cylinder Lubricator(built-in Switches)pr.cyl.
1	1	1	1	1		D	Oilmist detector and Fittings
							COOLING WATER SYSTEM
1	1	1	1	1	standard	ΔP(max)	Freshwater over engine
			1			T(min)	Freshwater before engine
1	1	1	1	1		T(max)	Freshwater after cylinder, pr.cyl.
1		1	1	1		P(min)	Sea water before air coolers
	1					T(min)	Sea water before air coolers
							AIR SYSTEM
1	1	1	1	1		T(mox)	Scavening air - Firealarm, pr.cyl.
1						T(max)	Scavening air temp.
1	1	1	1	1		T(d)	Exhaust gas after cyl. deviation + plung-in units and sensors,pr. cyl.
1	1	1	1	1		P(min)	Starting air before engine
1	1	1	1	1	standard	P(min)	Control air
1	1	1	1	1	standard	P(min)	Reversing air - Manoeuvring air system
							SUNDRIES
1	1	1	1	1	standard	P(min)	Pressure oil after Servo-armplifier

Lioble to chonge without notice

Subject to Class approval

standard — Contacting devices for automatic Shut - down : Overspeed and Main engine and Thrust bearing, too low Luboil pressure together with too high temperature in Thrust bearing segment. Lub oil Turbo-charger.

MAIN ENGINE DATA

Engine Output

See page M4 "Engine Datasheet and Load Diagram".

Running astern the engine can give nearly the same power as for running ahead but normally the propeller can absorb only 80% of full BHP during astern running.

Forces and Moments

See pages:
M5 Description of forces and moments
M6 Inertia Forces and Couples
M7 Guide Force Moments

Water and Oil in Engine

See page M8.

Consumptions

The expected consumptions are shown in below table and on page M9: "Performance Curves".

Name	Consumption
Diesel or gas oil	155 g/BHPh at a lower calorific value 10,250 kcal/kg at CSR
Guaranteed consumption	155 + 3% g/BHPh at CSR
Lub.oil	3 kg/cyl./24h
Fresh cooling water	negligible
Salt cooling water	-
Cyl. lub.oil	7.5 kg/cyl./24h 0.40 g/BHPh

Equipment for Special Service Conditions

Blowers

The blower capacity given below corresponds to ambient conditions of 20°C and 760 mm Hg barometric pressure.

Emergency Blower

Engine with only two turbochargers can, if required, be equipped with an emergency blower.
The blower capacity should be 1.2 m^3/sec. for 5 and 6 cyl. engines and 1.6 m^3/sec. for 7 and 8 cyl. engines. The static delivery pressure should be 1.0 m W.C. Depending on the number of working cylinders, this capacity will be sufficient for running the engine at max. 50% of continuous service RPM in tropical condition with both turbochargers out of action.

Emergency Running without Emergency Blower

For engines without emergency blower one turbocharger must be running. In below table is stated which r.p.m. can be obtained with reduced number of turbochargers running for engines with different cylinder numbers.

Cyl.number	5	6	7		8	9		10		
Working cyl. no.	3	3	3	4	4	3	6	4	5	7
% of nominal RPM at CSR	58	58	51	64	58	41	74	48	58	75

11				12		
3	4	7	8	3	6	9
34	43	71	76	31	58	80

Auxiliary Blower

Auxiliary blower will be necessary in two cases:

a. C.P. propeller
b. Fixed propeller if RPM less than abt. 30% of nominal RPM at CSR is wanted (20-25%).

a. Static delivery pressure 500 mm W.C.

Cyl.	5	6	7	8	9	10	11	12
m^3/sec.	1,5	1,8	2,1	2,4	2,7	3,0	3,3	3,6

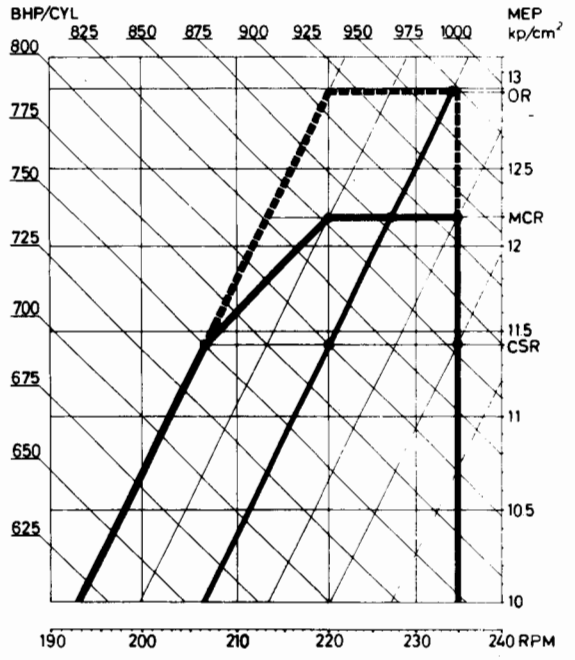
b. Static delivery pressure 300 mm W.C.

Cyl.	5	6	7	8	9	10	11	12
m^3/sec.	1.1	1.3	1.5	1.8	2.0	2.2	2.4	2.6

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

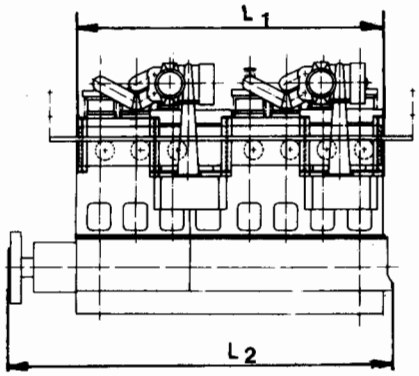
No. of Cyl.	Power Range for Continuous Service Rating MEP = 11,4 kp/cm²						Power Range for Max. Continuous Rating MEP = 12,2 kp/cm²						Engine Net Dimensions		
	RPM = 206		Nominal RPM = 220		RPM = 235		RPM = 220		Nominal RPM = 227		RPM = 235		L_1	L_2	Dry weight
	IHP	BHP	IHP	BHP	IHP	BHP	IHP	BHP	IHP	BHP	IHP	BHP	mm	mm	in 1000 kg
5	4050	3750	4300	4000	4600	4300	4600	4250	4700	4400	4900	4550	4840	6455	94
6	4850	4500	5200	4800	5550	5150	5500	5100	5650	5300	5850	5450	5610	7225	107
7	5650	5250	6050	5600	6450	6000	6400	6000	6600	6150	6850	6350	6380	7995	123
8	6500	6000	6900	6400	7400	6850	7300	6800	7550	7050	7800	7300	7150	8765	136
9	7300	6750	7800	7200	8300	7700	8200	7700	8500	7900	8800	8200	7920	9535	149
10	8100	7500	8600	8000	9200	8500	9200	8500	9400	8800	9800	9100	8690	10305	163
11	8900	8300	9500	8800	10100	9400	10100	9400	10400	9700	10800	10000	9460	11075	177
12	9700	9000	10400	9600	11100	10300	11000	10300	11300	10600	11700	10900	10230	11845	192

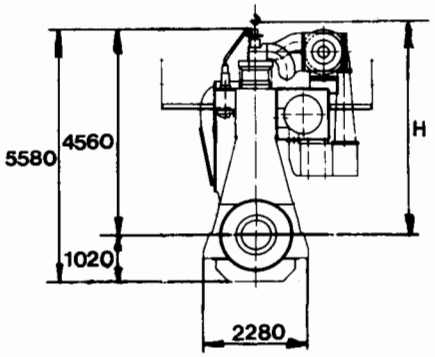


All scales are logarithmic

Overload Rating 13,0 kp/cm2, 970 BHP/cyl. at 234 RPM. IHP and BHP refer to metric horse power i.e. 75 kpm/sec. The above ratings are valid at sea level and up to tropical conditions, i.e. sea water 32° C and barometric pressure 760 mm HG.

Dismantling height to crane hook H = **4750** mm at normal arrangement. May be reduced by special arrangement.





All dimensions and weights are approximate and subject to change without notice.

The three horizontal lines through CSR, MCR and OR in the diagram determine by their length the corresponding power-rpm ranges at the following MEP:
CSR = 11,4 kp/cm², which is the continuous service rating recommended for average service performance with abt. 6 % margin for increase in MEP up to MCR when desirable.
MCR = 12,2 kp/cm², which is the maximum continuous rating for which the engine is designed and approved and is the upper limit of MEP in continuous service.
OR = 13,0 kp/cm², which is the upper limit of MEP

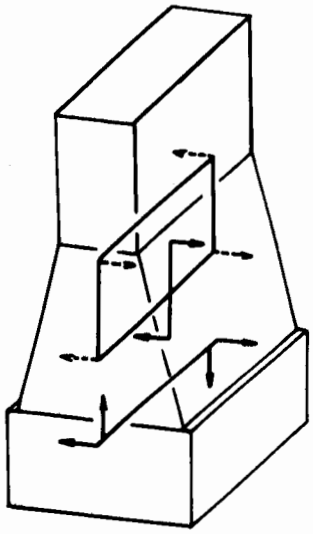
The power-rpm fields for the two continuous ratings are inside the heavy full lines, and the overload field is limited by heavy dotted lines. Outside the field with heavy full lines it is recommended to run for shorter duration only. Nominal power is to be used for testbed trials. Max. RPM line for service, RPM = 235 should not be exceeded save for trial trip when normally about 2 % higher RPM can be allowed. The speed range may in some cases be reduced due to critical vibrations.

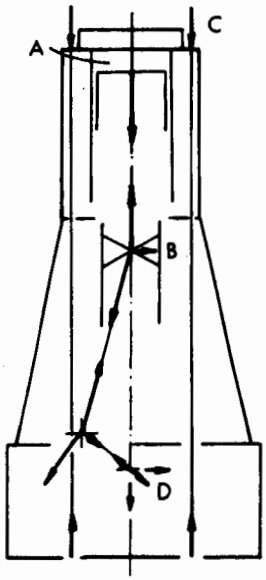
The choice of propeller for new and fully laden ship should be made with a view to foreseen increade in hull resistance, in order to keep the engine working power range within the continuous power field during normal service operation.
The propeller curvers shown correspond to : MEP = $C_1 \times RPM^2$ and BHP = $C_2 \times RPM^3$.

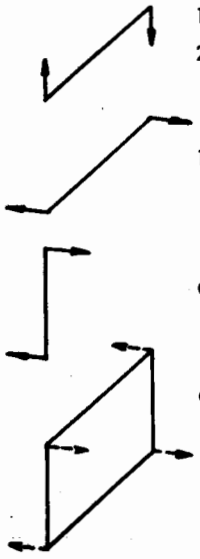
TWO-STROKE, SINGLE-ACTING, CROSSHEAD, MARINE DIESEL ENGINE

WITH TURBOCHARGE

FORCES AND MOMENTS
DESCRIPTION







1.Order Moment , vertical , 1 ~/ Rev.
2.Order Moment „ vertical , 2 ~/ Rev.

1.Order Moment , horizontal 1 ~/ Rev.

Guide Force Moment , H , vertical Z ~/ Rev.

Guide Force Moment , X , horizontal , Z ~/ Rev.

A = Combustion Pressure
B = Guide Force
C = Stay-Bolt Force
D = Main Bearing Force a) Combustion Force
b) Force due to Weight

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

No. of Cyl.	N RPM	Recipr. Masses Per Cyl. Kg	Rot. Masses Per Cyl. Kg	External Forces and Couples			
				1. Order Moment		2. Order	Free Forces
				Horiz. Tm	Vertical Tm	Tm	T
5	220	1260	838	5,4	5,4	36,9	0
6	220	1260	838	0	0	25,7	0
7	220	1260	838	8,4	8,4	4,7	0
8	220	1260	838	1,6	2,8	0	0
9	220	1260	838	10,9	10,9	8,4	0
10	220	1260	838	10,6	10,6	0	0
11	220	1260	700	7,0	6,1	4,6	0
12	220	1260	700	0	0	0	0

Crankshaft : SEMIBUILT

Liable to change without notice

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

Cyl. No.	5	6	7	8	9	10	11	12
H-moment [Tm]	Z=5 11,0	Z=6 7,1	Z=7 3,3	Z=8 1,8	Z=9 1,4	Z=10 1,2	Z=11 1,2	Z=12 1,1
X-moments [Tm]								
Z=1	2,6	0	3,9	1,1	5,3	5,0	3,3	0
Z=2	5,4	3,8	0,8	0	1,3	0	0,8	0
Z=3	6,2	14.8	15,0	14,4	22,8	12,4	1,7	15,7
Z=4	0,8	6,2	21,4	7,1	9,1	0	27,4	13,7
Z=5	0	0	0,8	13,7	6,0	35,4	27,5	0
Z=6	0,3	0	0,4	0	11,7	0	14,9	26,7
Z=7	1,3	0	0	*	0,3	2,5	3,9	0
Z=8	0,6	0,4	*	0	0,1	0	0,2	1,0
Z=9	*	1,0	*	*	0	*	*	1,1
Z=10	0	0,2	0,8	0	*	0	*	0
Z=11	*	0	0,7	0,7	*	*	0	0
Z=12	0,3	0	*	0,2	0,9	0	*	0

Z = ~/ rev. at 220 RPM

* = small

Liable to change without notice

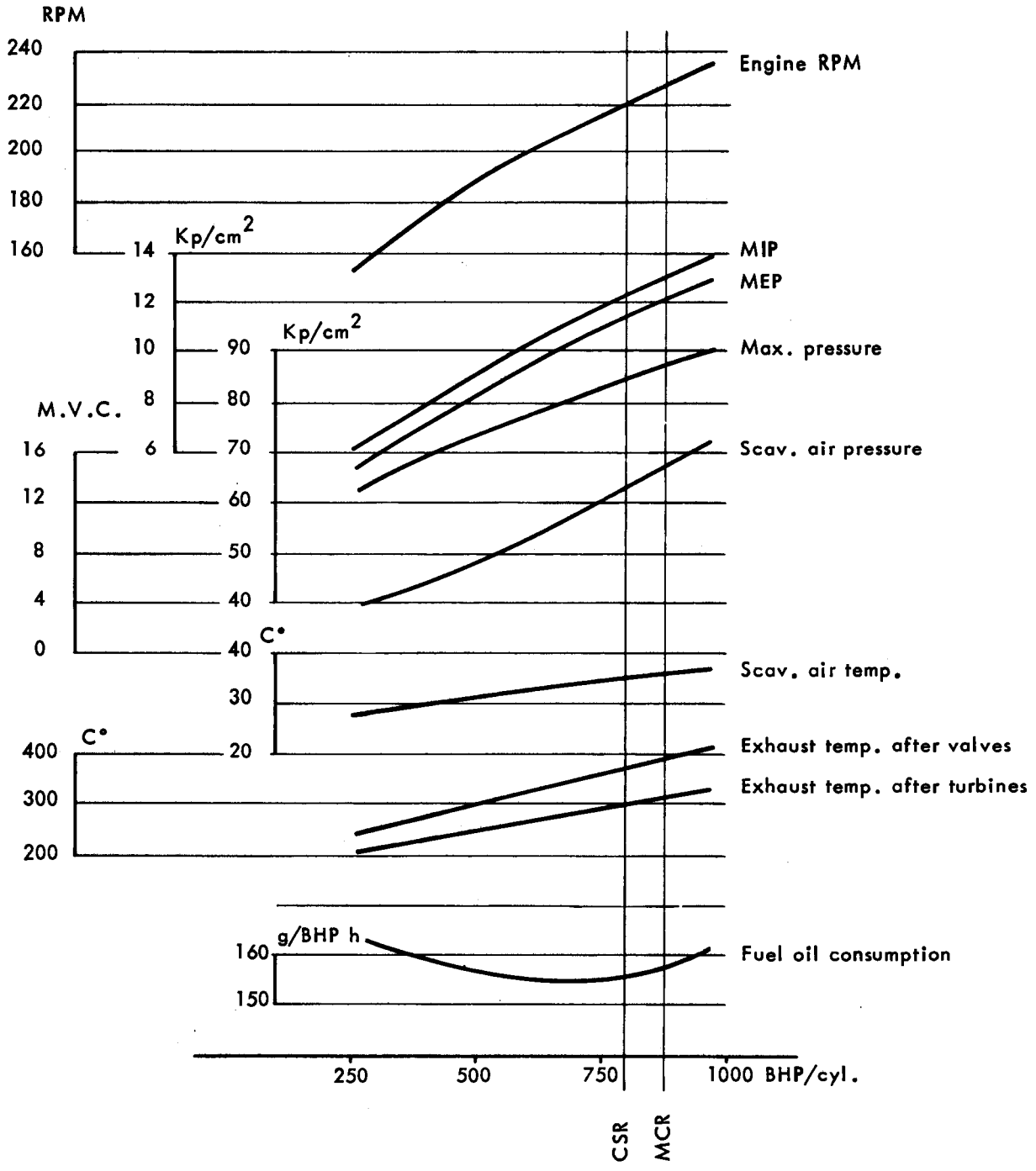
TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K 45 GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

No. of cylinders	Weight of water and oil in engine in service					
	Weight of water			Weight of oil in		
	Fresh kg	Salt kg	Total kg	Engine System kg	Oilpan kg	Total kg
5	1030	400	1430	340	460	800
6	1220	400	1620	390	560	950
7	1450	500	1950	450	650	1100
8	1640	500	2140	520	760	1280
9	1880	600	2480	585	865	1450
10	2170	800	2970	700	980	1680
11	2370	750	3120	760	1100	1860
12	2560	800	3360	830	1220	2050

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm



6-9-12 cyl.

B&W	Issued 750915 Head Office Copenhagen	PERFORMANCE CURVES	OSX	191767

169 10 72

Spare Parts

Spare parts are delivered according to the requirements of the classification societies. The requirements are stated on page S2. Further B&W recommend some additionals, which are stated on page S2 and S3. The additional spare parts can be delivered at an additional price, see page A8

If the fitted bolts between thrust shaft and intermediate shaft have to be removed for pulling the propeller shaft, some of the classification societies require one set of bolts as spares. In this connection see the actual rules. Spare bolts can be supplied at an additional price.

TWO STROKE, SINGLE-ACTING, CROSSHEAD, MARINE DIESEL ENGINE K45GF

WITH TURBOCHARGE — DELIVERY EXTENT OF SPARES

American Bureau of Shipping / **Norske Veritas** / **Bureau Veritas** / **Lloyds Register of Shipping**

Class-requirements	B&W recommend. add.	Class & B&W recommended spares add.	
1	none	1	Main bearing shells in 2/2 with shims.
1 set	-	1 set	Studs, nuts for 1 main bearing
1	-	1	Journal bearing shells in 2/2 with shims for thrust shaft.
1 set	-	1 set	Studs, nuts for 1 journal bearing
1	-	1	Cyl. liner with sealing rings
none	1	1	Non-return valve spring for cyl. lubrication for 1 cylinder
1 (disassembled)	none	1	Cyl. cover complete with fuel, exhaust, starting, safety valve, indicator cock & sealing rings.
1/2 set	1/2 set	1 set	Studs and nuts for 1 cyl. cover
1	none	1	Connecting rod crank bearing in 2/2 with shims, bolts, nuts
2	none	2	Crosshead bearing shells in 2/2 with bolts and nuts
2	-	2	Thrust collars
1	-	1	Piston complete with cool. insert pistan rod, piston rings and stuffing box, studs and nuts
1 set	3 set	4 set	Piston rings for 1 piston
none	2 set	2 set	Sealing and scraper rings for 1 piston rod stuffing box
none	1	1	Piston cooling insert
1	1	2	Telescope pipe with gland
2	none	2	Exhaust valve complete
none	50%	50%	Exhaust valve spindles
-	1	1	Exhaust valve seats
-	1	1	Exhaust valve high pressure pipe
	1 set	1 set	Exhaust valve high press. pipe shims
-	2 set	2 set	Exhaust valve springs for 1 valve
-	2	2	Valve gear piston with rings
-	2	2	Valve gear liner for piston
-	2	2	Valve gear throttle-valve
-	2	2	Valve gear safety valve
-	2	2	Roller guide complete with roller and roller bearing
-	2	2	Roller with roller bearing
-	1	1	Roller guide spring for 1 valve
100%	none	100%	Fuel valve complete
none	+50%	50%	Fuel valve spindle with guide
-	+50%	50%	Fuel valve atomizer
-	+50%	50%	Fuel valve spring

continued

Class-requirements	B&W recommend. add.	Class & B&W recommended spares add.	
1	none	1	Starting valve complete
none	2	2	Starting valve spindle with piston
-	2	2	Starting valve springs
-	5	5	Safety caps with gaskets
-	2	2	Control air flexible pipe
1	none	1	Safety valve complete
none	2	2	Safety valve disc
-	2	2	Safety valve spring
6	none	6	Camshaft chain link
1	-	1	Bearing for camshaft at chain drive, chain tightener and intermediate shaft
1	none	1	Guide ring for above bearing in 2/2
none	2	2	Guide bar for chain
-	1	1	Chain tightener spring
none	1	1	Camshaft exhaust cam
-	1	1	Camshaft fuel pump cam
1	50%	50%	Fuel pump cylinder complete with plunger
none	1 set	1 set	Roller guide springs for 1 pump
1	1	2	High pressure pipe each type
1	2	3	Fuel oil suction valve complete
none	2	2	Fuel oil schock absorber spring
-	1	1	Fuel oil back pressure valve spring
none	+50%	50%	Indicator cocks
-	100%	100%	Indicator cock packings
1 set	none	1 set	Thrust block segment "ahead"
none	+++ 1	1	Turbocharger rotor complete
-	1 set	1 set	Turbocharger roller bearing
none	+++ 1 set	1 set	Manoeuvring gear spare parts
-	1	1	Manoeuvring gear connect. rod spring
-	1	1	Manoeuvring gear lever spring
1	none	1	Cylinder lubricator complete
1	-	1	Cylinder lubricator drive
none	1 set	1 set	Cylinder lubricator spare parts
none	4	4	Gasket material 1 m^2
-	1	1	Gasket compound 1 kg
none	3	3	Thermometer for exhaust gas
-	1	1	Thermometer for cooling water
-	1	1	Thermometer for lub oil

+use odd cylinder number plus one
++add one prerotor for either type of chargers
+++for specification turn page

Liable to change without notice

Manoeuvring gear spare parts

For Westinghouse boxes

1 Solenoid valve, Westinghouse
1 Non-return valve, Westinghouse
1 Non-return valve, Westinghouse

For reductions unit for manoeuvring air

1 Repair set, Westinghouse

For regulating unit in manoeuvring stand

1 Valve, Westinghouse
1 Pressure switch, Westinghouse

For reducing valve for pressure riser

1 Repair set, Nordgren

For filter for pressure riser

1 Repair set, Nordgren

For stop cylinder and starting air distributor

1 Switch
1 Flexible hose

For relay box and safety panel

Div. relays etc.

SPECIAL TOOLS

The engine is delivered with all necessary special tools for overhaul. The extent of the tools is stated on page T2. Most of the tools are arranged on steel plate panels in order to facilitate maintenance, dismantling, and overhaul. These panels are recommended placed where the overhaul is carried out as shown on page T3. On this page is further mentioned the size and weight of the panels.
Proposal for mounting of the tool panels is shown on page T4. Page T5 shows the size and weight of components not arranged on panels.
The extent of special tools may be changed as mentioned on page A9.

Page T3 Tool Panels is missing in this issue of the specification.

TWO STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE K45GF
WITH TURBOCHARGE
MAIN ENGINE SPECIAL TOOLS

SPECIAL TOOLS STEELPLATE PANELS mounted with tools for maintenance, dismantling and overhaul of main engine.

901. CYLINDER COVER
1 Cylinder cover lifting gear
1 Cyl. liner contact face grinder
1 Exhaust valve contact face grinder
1 Fuel valve contact face cutter & grinder
1 Fuel valve extractor
1 Starting valve contact face cutter & grinder

902. PISTON- PISTON ROD and -STUFFING BOX
1 Piston- piston rod and -stuffing box lift. gear
1 Piston overhaul tool
1 Piston ring opener
1 Piston rod stud hydraulic jack
1 Piston-piston rod oil pressure testing tool
1 Stuffing box overhaul tool

903. CYLINDER LINER and CYLINDER FRAME
1 Cylinder liner lifting gear
1 Cylinder liner tilt- and transport gear
1 Cylinder liner measuring tool
1 Cylinder frame cleaning tool

904. CROSSHEAD and CONNECTING ROD
4 Crosshead bracket
1 Crosshead and guide shoe lifting tool
2 Crosshead bearing bolt hydraulic jack
2 Crank bearing bolt hydraulic jack
1 Crank bearing lifting tool
1 Connecting rod lifting tool
2 Guide shoe extractor

905. CRANKSHAFT and MAIN BEARING
1 Main bearing dismantling tool
2 Coupling bolt spanner
1 Crankshaft bridge gauge
1 Thrust block bridge gauge
1 Thrust block incorporated turning dog
1 Relief valve testing tool
1 Pin gauge

906. CAMSHAFT - CHAIN DRIVE and REVERSING
1 Camshaft coupling hydraulic pulling gear
2 Camshaft bearing stud hydraulic jack
1 Camshaft cam adjustment spanner
1 Hydraulic motor lifting tool
1 Chain drive roller bearing tool

1 Chain assembling tool each chain size
1 Chain bursting device each chain size
1 Grease gun
2 Pin gauge
1 Emergency Reversing hydraulic jack

907. STARTING AIR SYSTEM
1 Starting valve seat grinding tool
1 Starting valve overhaul tool

908. EXHAUST VALVE and - VALVE GEAR
1 Exhaust valve seat pneum. grinding machine
1 Exhaust valve spindle & -seat checking template
4 Exhaust valve spring suppressing screws
1 Roller guide lifting tool
1 Roller guide roller bearing extractor
1 Grinding tool for high pressure connections

909. FUEL VALVE and FUEL PUMP
1 Fuel valve overhaul tool
1 Fuel valve pressure & spray control device
1 Fuel pump cyl. and -plunger lifting gear
1 Fuel pump high pressure pipe overhaul tool
1 Fuel pump lead measuring tool

910. EXHAUST TURBOCHARGER SYSTEM
1 Turbocharger overhaul & -rotor cleaning tool
1 Turbocharger gas outlet blanking-off tool
1 Turbocharger rotor cleaning water nozzle & hose
1 Air cooler element cleaning tool

911. SAFETY DEVICES
1 Safety valve pressure testing tool

912. MAIN PARTS ASSEMBLING
2 Staybolt hydraulic jacks

913.1 ACCESSORIES
1 Hydraulic oil pump pneumatic operated
1 Hydraulic oil injector manual operated
3 High pressure hoses & quick couplings in sets
2 Hydraulic jack assembly device
Hydraulic jacks are delivered in wooden boxes

913.2 ORDINARY HAND TOOLS

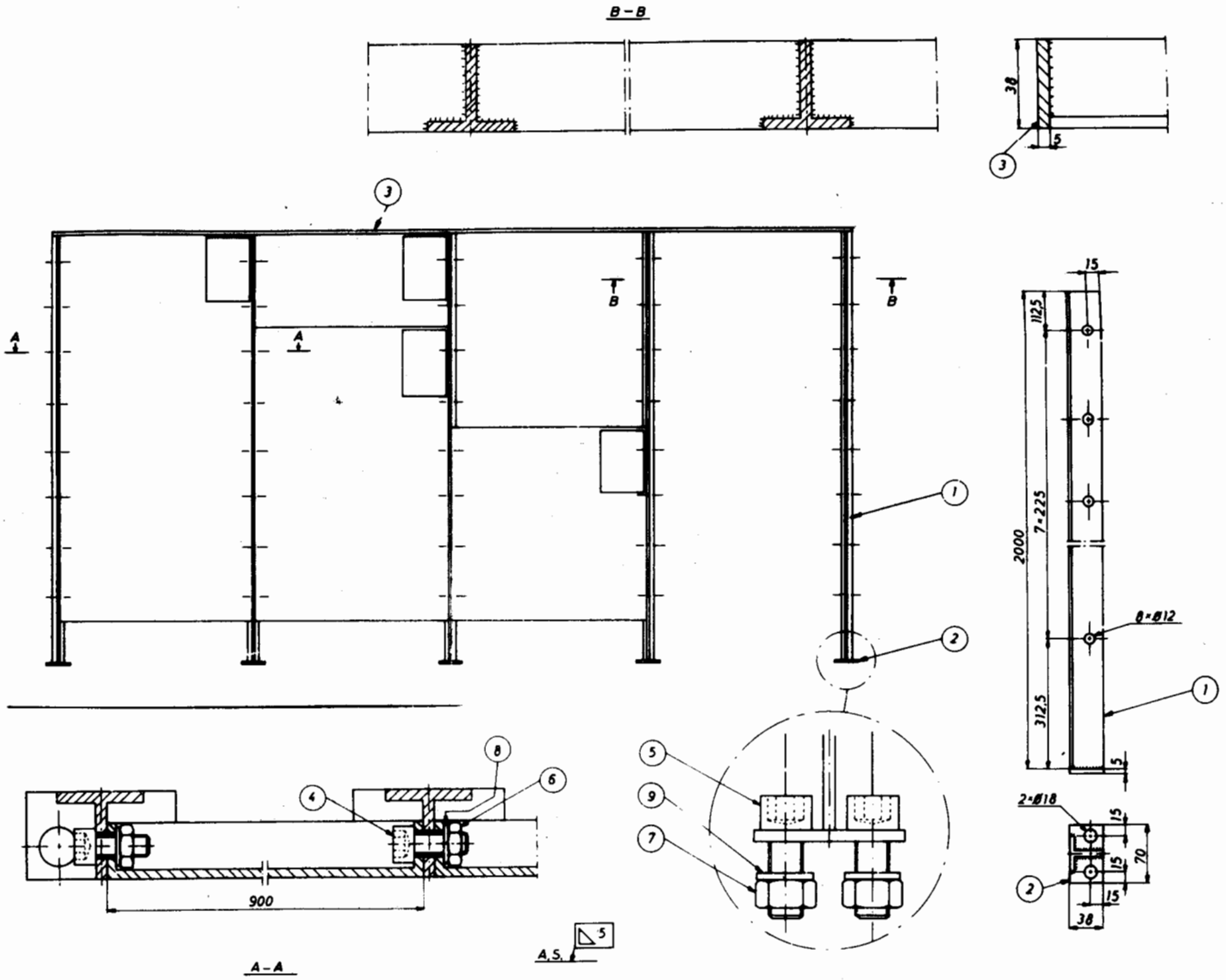
10	Combined ring & fork spanners	10-36 mm
2	Torque spanner	14-65 & 75-200 kpm
1	Fork spanner	65 mm
8	Fork ram spanners	30-65 mm
11	Ring ram spanners	30-85 mm
14	Internal hexagon spanners	1.5-19 mm
2	Adjustable spanners	8"-12"
1	Tool kit in two boxes containing:	
	Ratchet spanner	
	Connecting square	
	Sliding piece handle	
	Universal joint	
	Extensioners	
	Socket spanners	10-41 mm
	Internal hexagon spanners	5-19 mm

913.3 MISCELLANEOUS

5	Wire straps	
3	Pull-lift lifting capacity	750 kg
8	Schackels	
8	Eyebolts	
1	Indicator	
1	Planimeter	
1	Set of feeler blades	
250	Indicator cards	
1	Crankshaft aligment indicator	

Liable to change without notice

BURMEISTER & WAIN



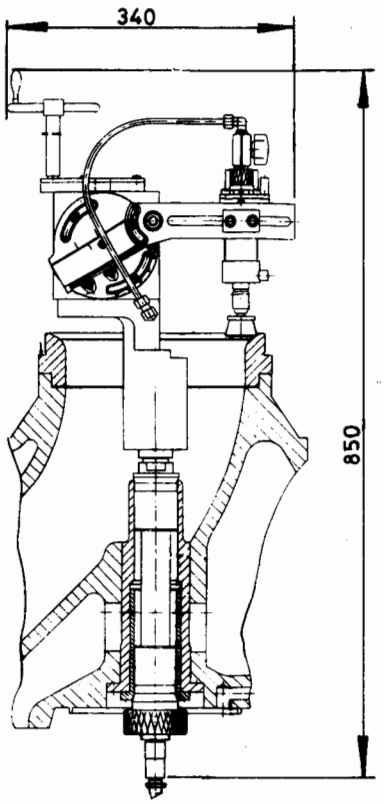
Pos. No. 1.	T-iron	40x40x2000 mm
Pos. No. 2.	Plat iron	38x5x70 mm
Pos. No. 3.	Plat iron	38x5 mm
Pos. No. 4.	Screw M10	L=25 mm
Pos. No. 5.	Screw M16	L=40 mm
Pos. No. 6.	Nut M10	
Pos. No. 7.	Nut M16	
Pos. No. 8.	Spring washer	D= 10/17 mm
Pos. No. 9.	Spring washer	D= 16/26 mm

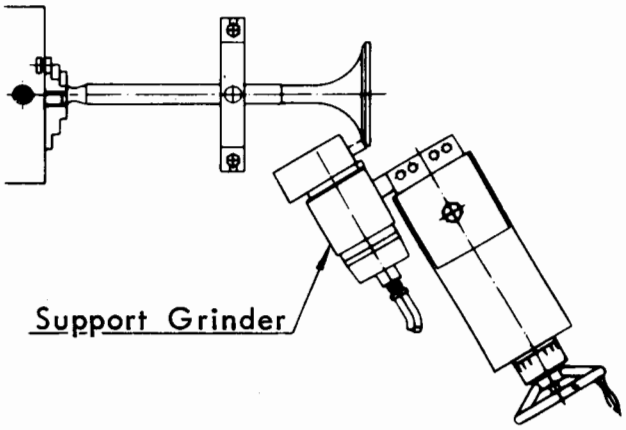
PROPOSAL FOR MOUNTING OF TOOL PANELS

Drwg. No. 49 70 25-8.0

TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm





Grinding Machine, Exhaust Valve Seat
Dim. in wooden box 1145x370x125
Weight 45 kg.

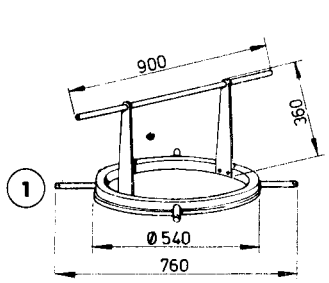
Support Grinder, Exhaust Valve
Dim. in wooden box 440x380x185
Weight 25 kg.

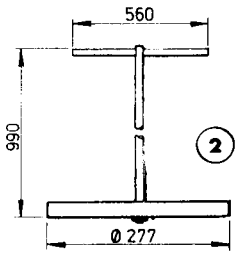
Wooden boxes with hydraulic jacks for :

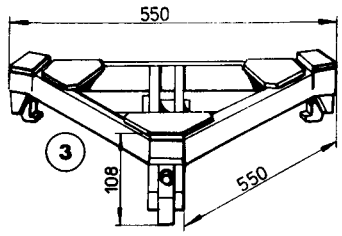
Description	Dimension mm	Weight in kg
Stay bolts	530x450x205	50
Pistion rod studs	450x360x190	30
Connection rod bolts	450x360x190	20
Crosshead bolts	450x360x190	15

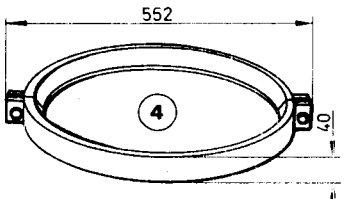
TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

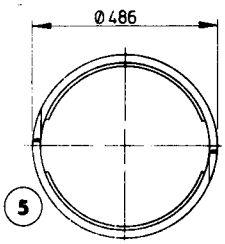
WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm

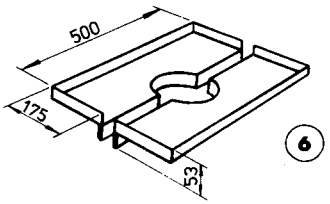


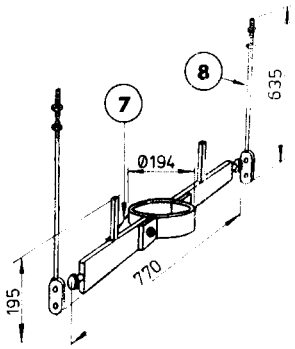


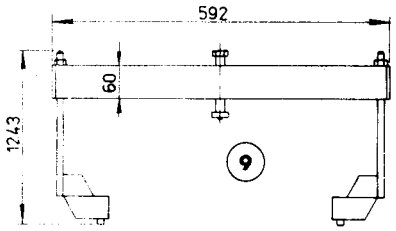


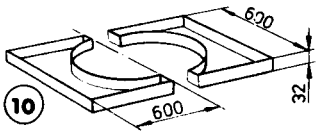


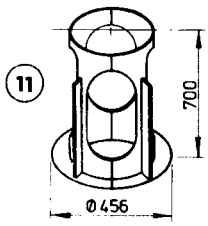








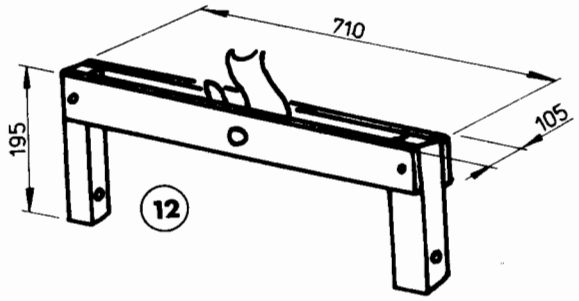


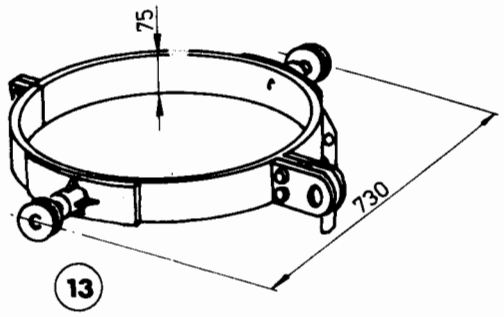


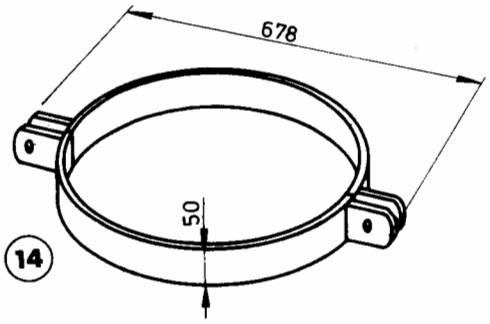
Pos.	No.	Description	Weight in kg.
1	901	Grinding tool	41
2	901	Grinding tool	18
3	902	Lifting tool for piston	25
4	902	Guide ring for piston	9
5	902	Snap ring for piston	6,5
6	902	Table	8
7	902	Collar	21
8	902	Supporting rod	1,6
9	902	Lifting tool for piston	11
10	902	Oil pan	6,5
11	902	Support for piston	38

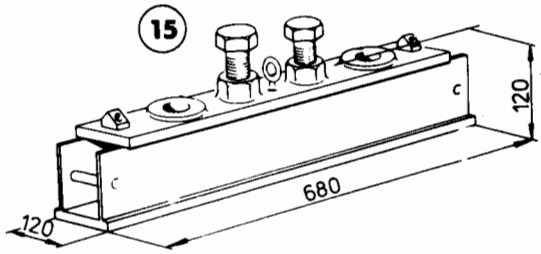
TWO-STROKE, SINGLE-ACTING, CROSSHEAD MARINE DIESEL ENGINE **K45GF**

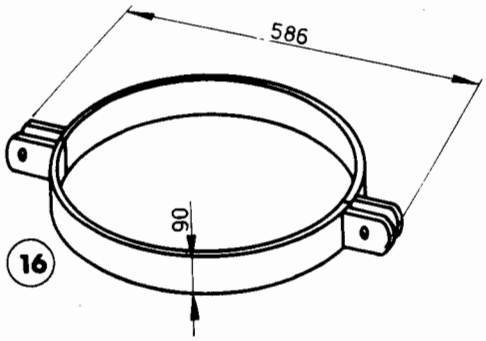
WITH TURBOCHARGE STROKE : 900 mm BORE : 450 mm





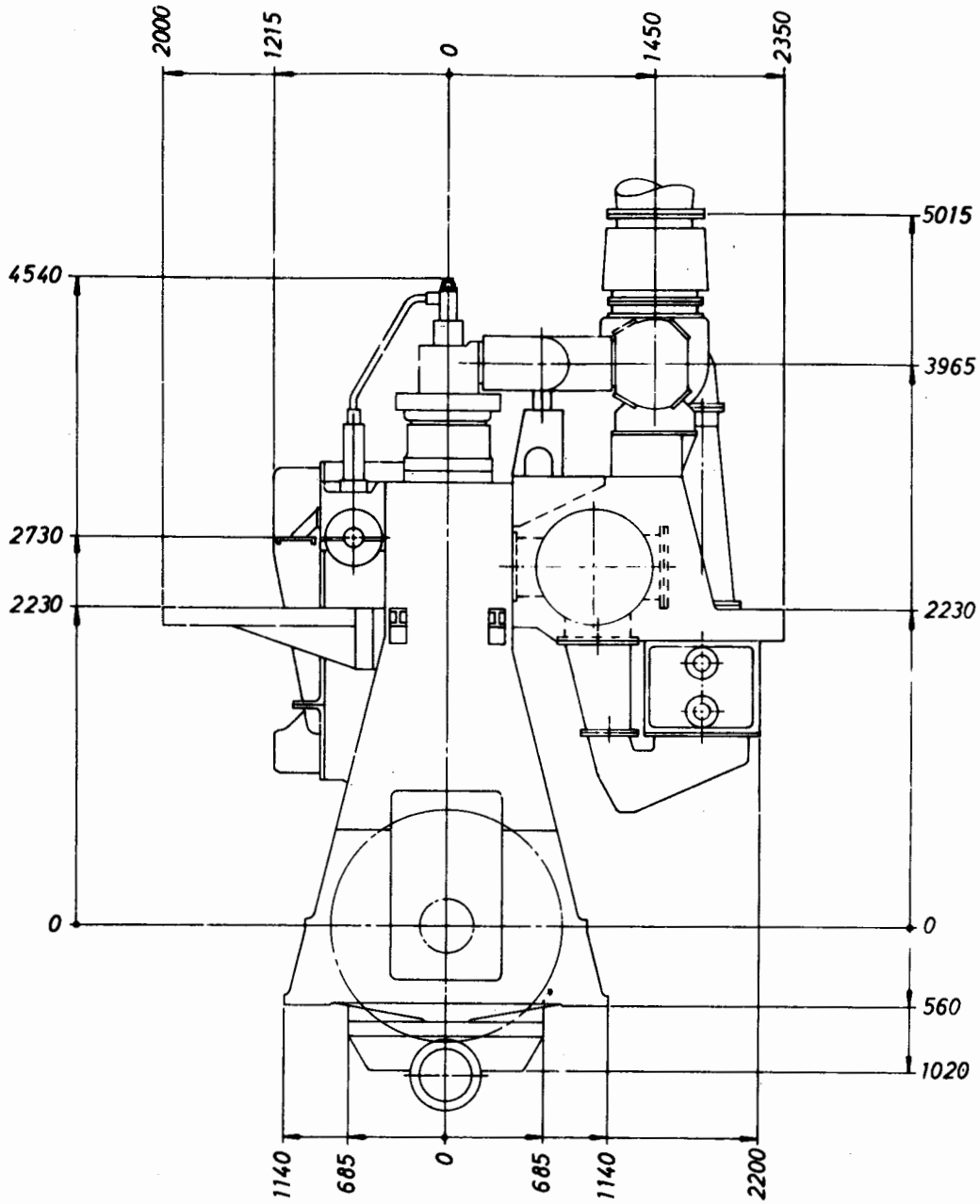






Pos.	No.	Description	Weight in kg.
12	903	Lifting tool for cylinder liner	22
13	903	Collar for cylinder liner	21
14	903	Lifting tool for cylinder liner	15
15	905	Crossbar	23
16	905	Collar	17

BURMEISTER & WAIN



PLEASE NOTE.

Our standard equipment does not include platforms, railings and stanchions.

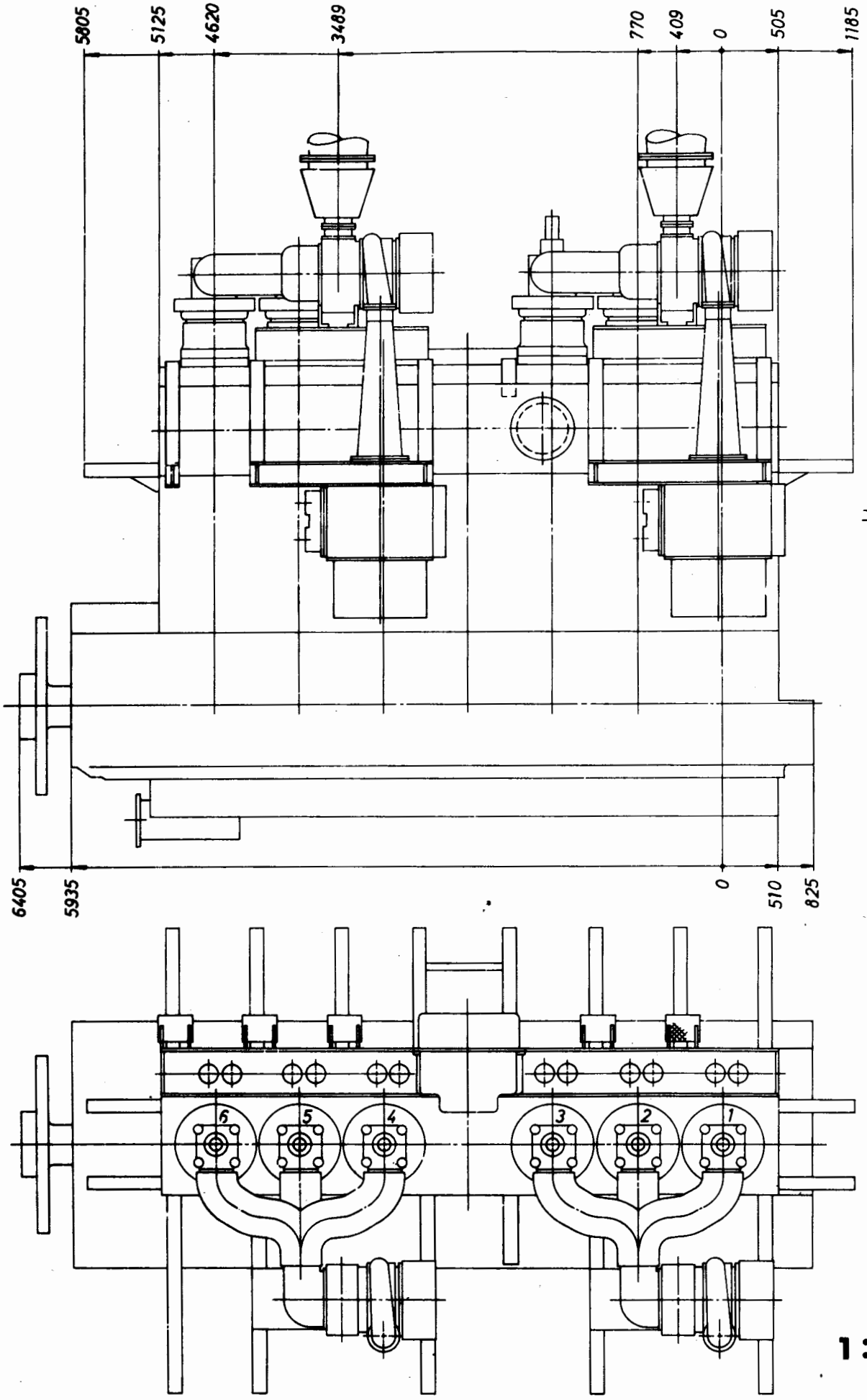
1:50

6K45GF

OUTLINE DRAWING SECT. II.

Drwg. No. 667534-4.1

BURMEISTER & WAIN



1 : 50

6K45GF

OUTLINE DRAWING SECT. I.

Drwg. No. 667534-4.1