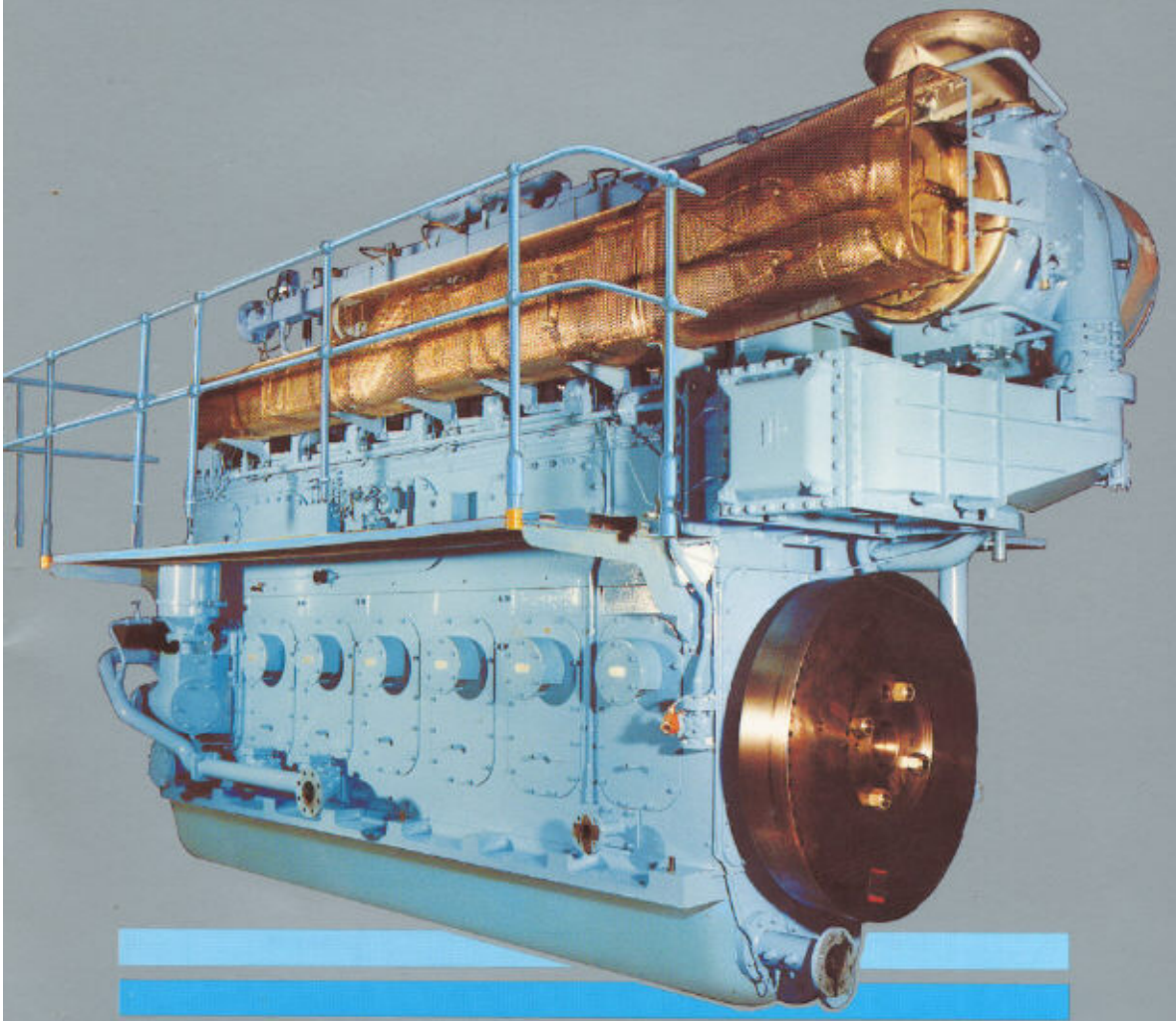
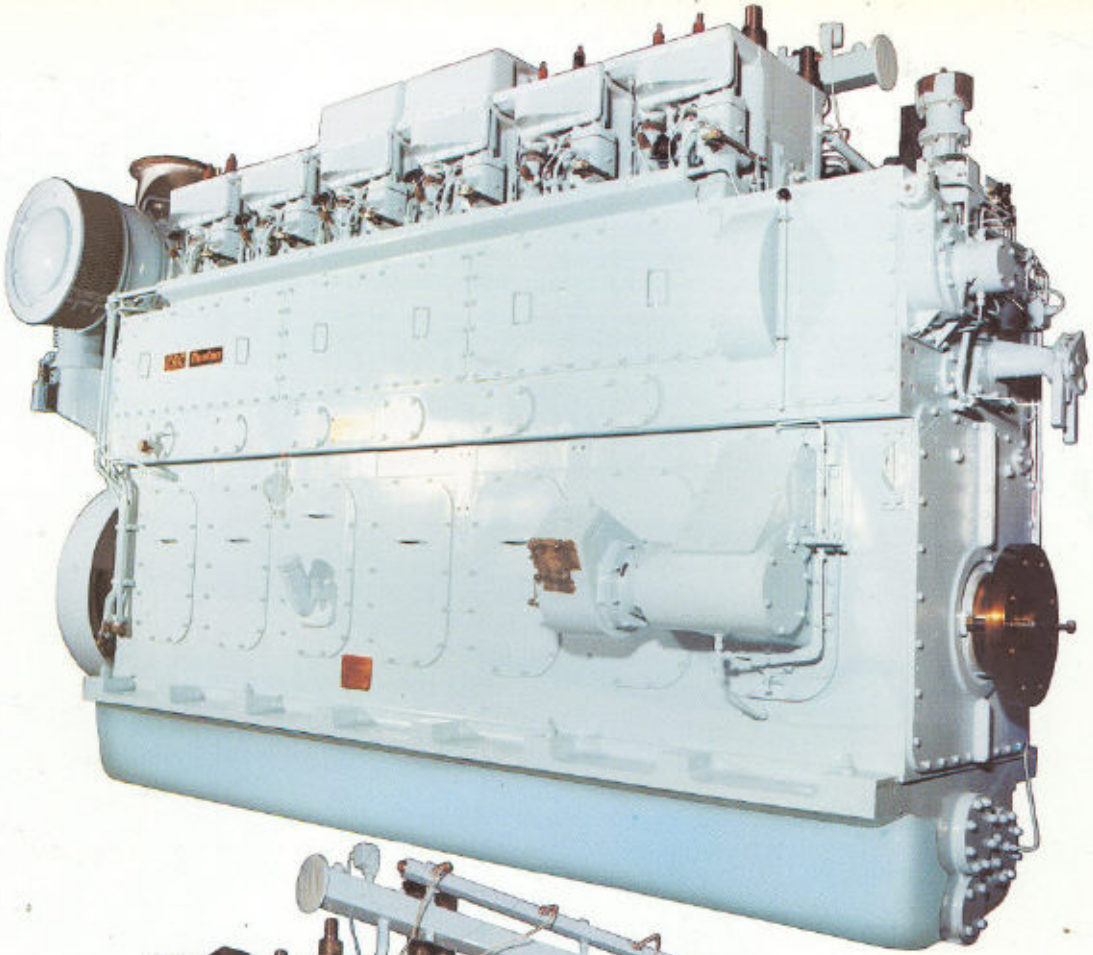
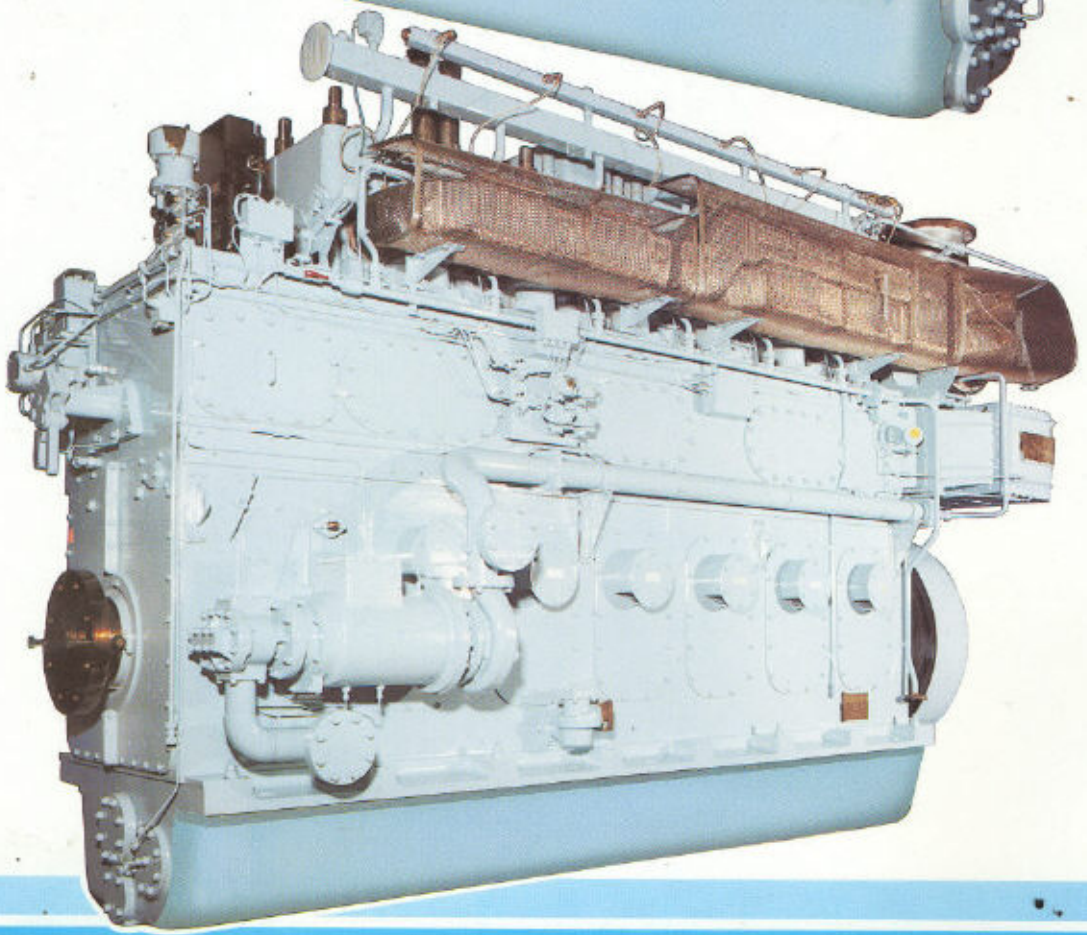
RUSTON AT350 DIESEL ENGINES

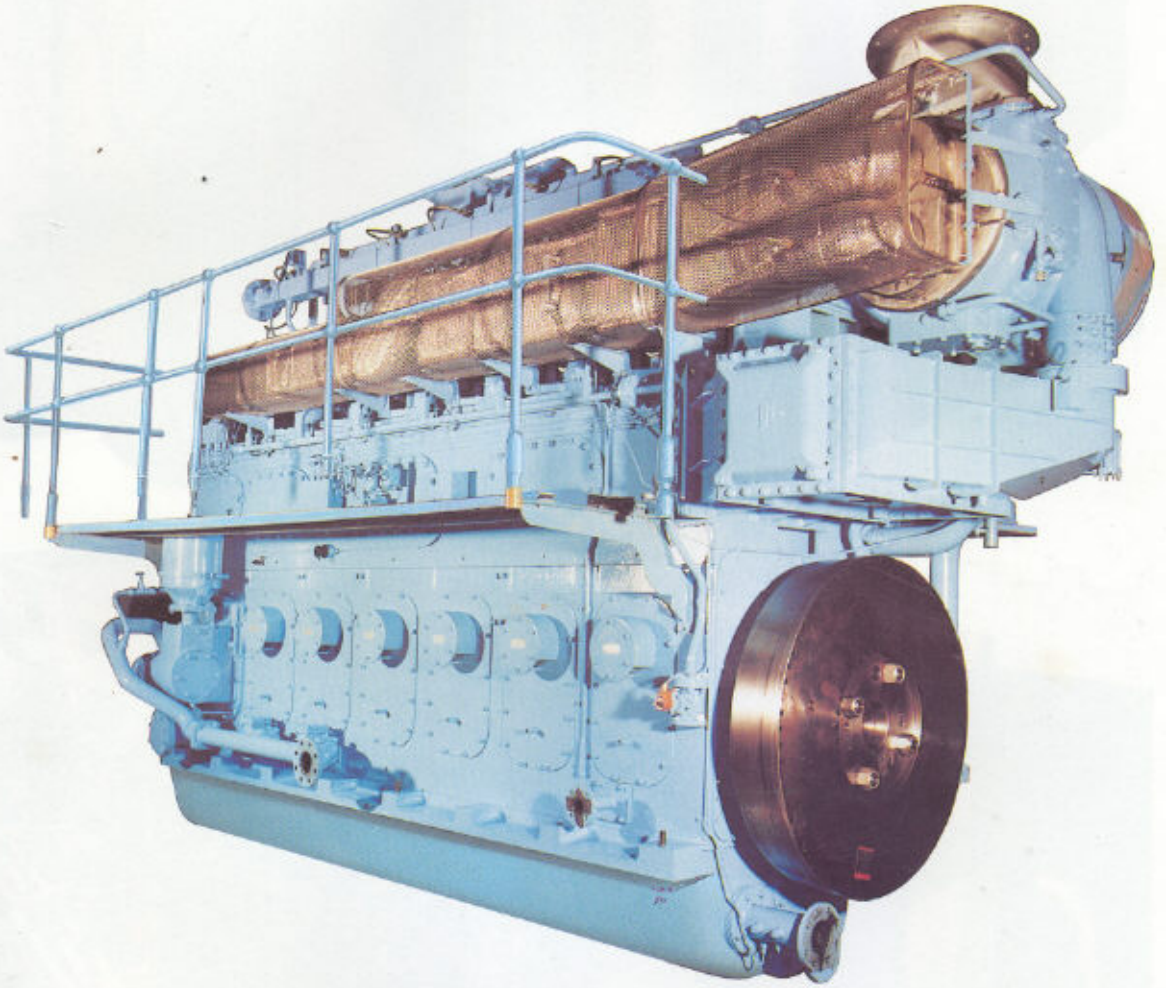






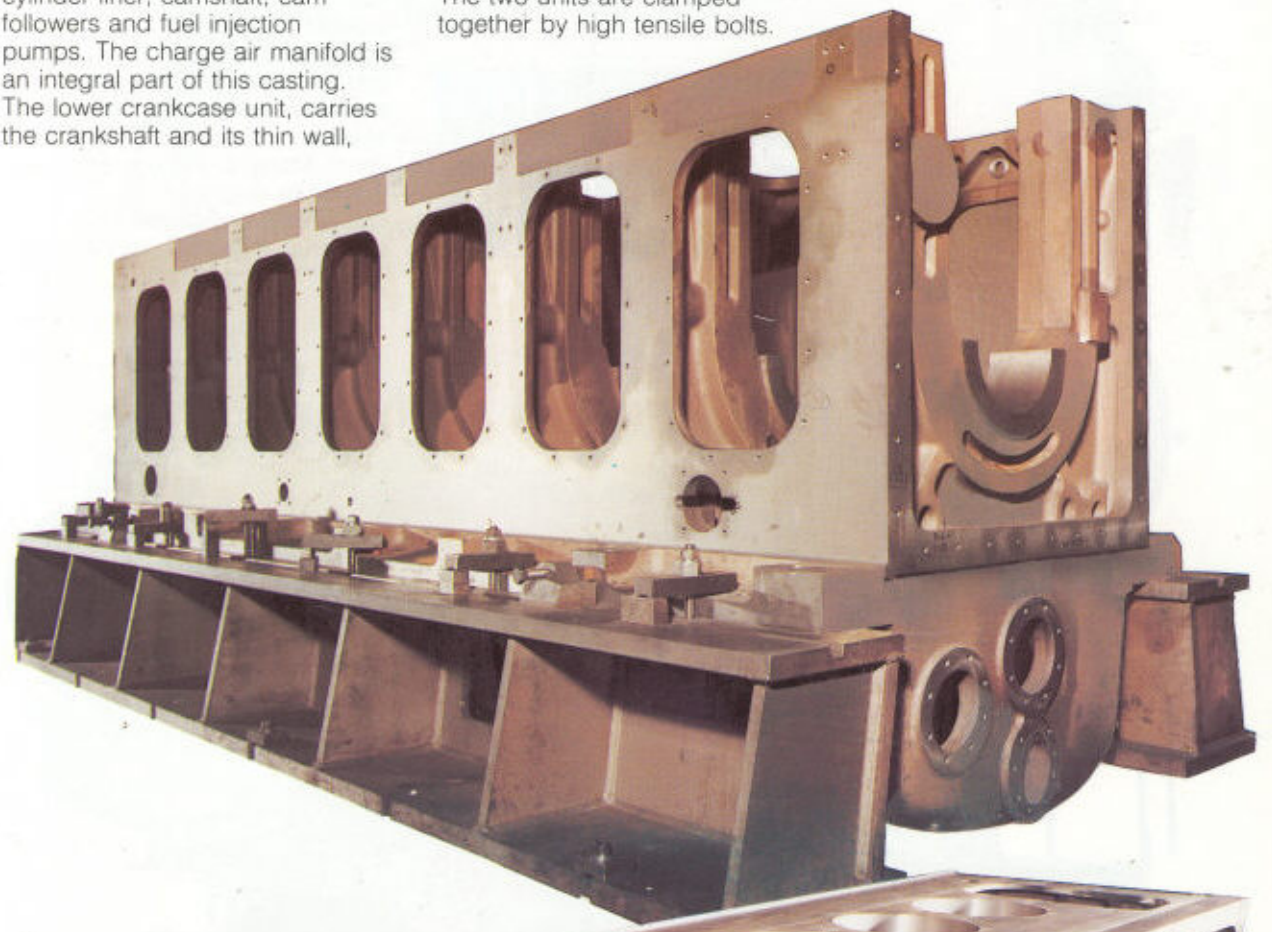
RUSTON AT350

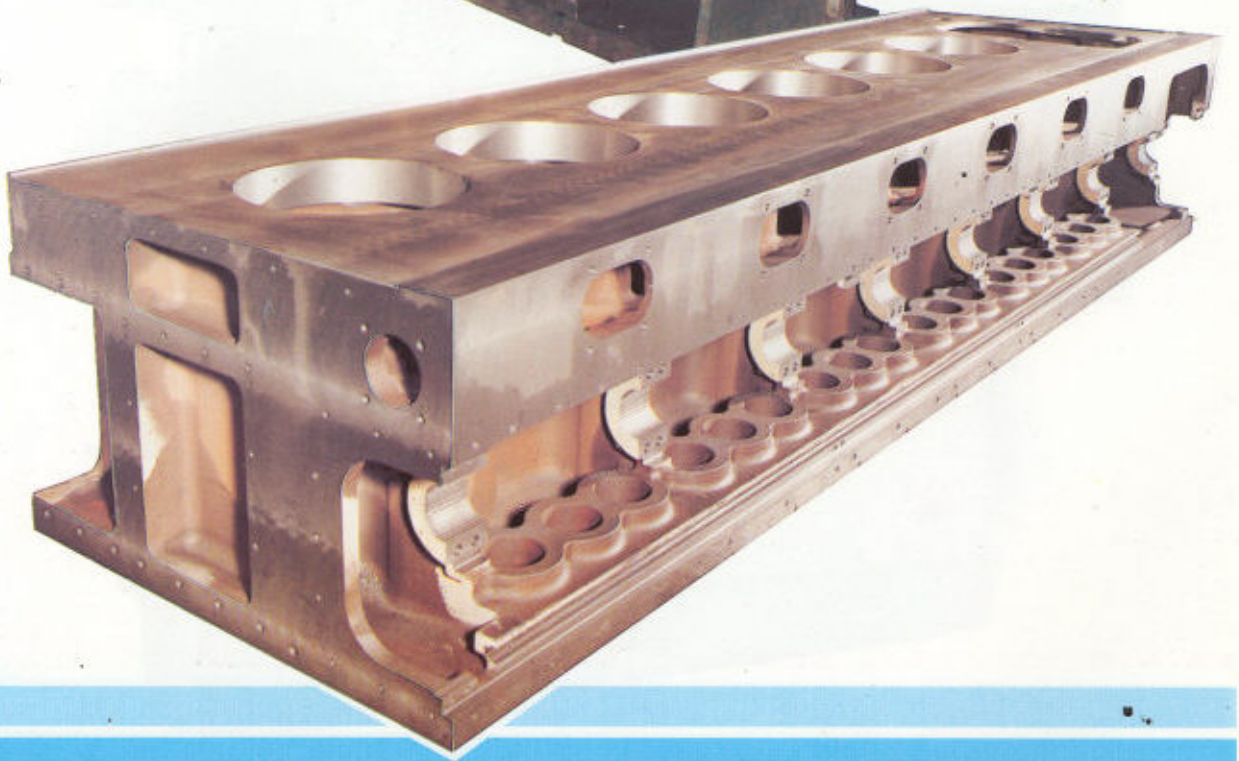
The Ruston AT350 is a development of the successful AT engine with a fundamentally re-designed structure, an increased bore giving higher output and many improved components.
The AT350 with a bore of 350mm and a stroke of 368.3mm provides an output of 3000 to 4500 bhp at a speed of 600 rev/min from a range of 6, 8, and 9 cylinder engines.
The AT350 is available as an industrial or marine engine.



Crankcase, bedplate and cylinder block

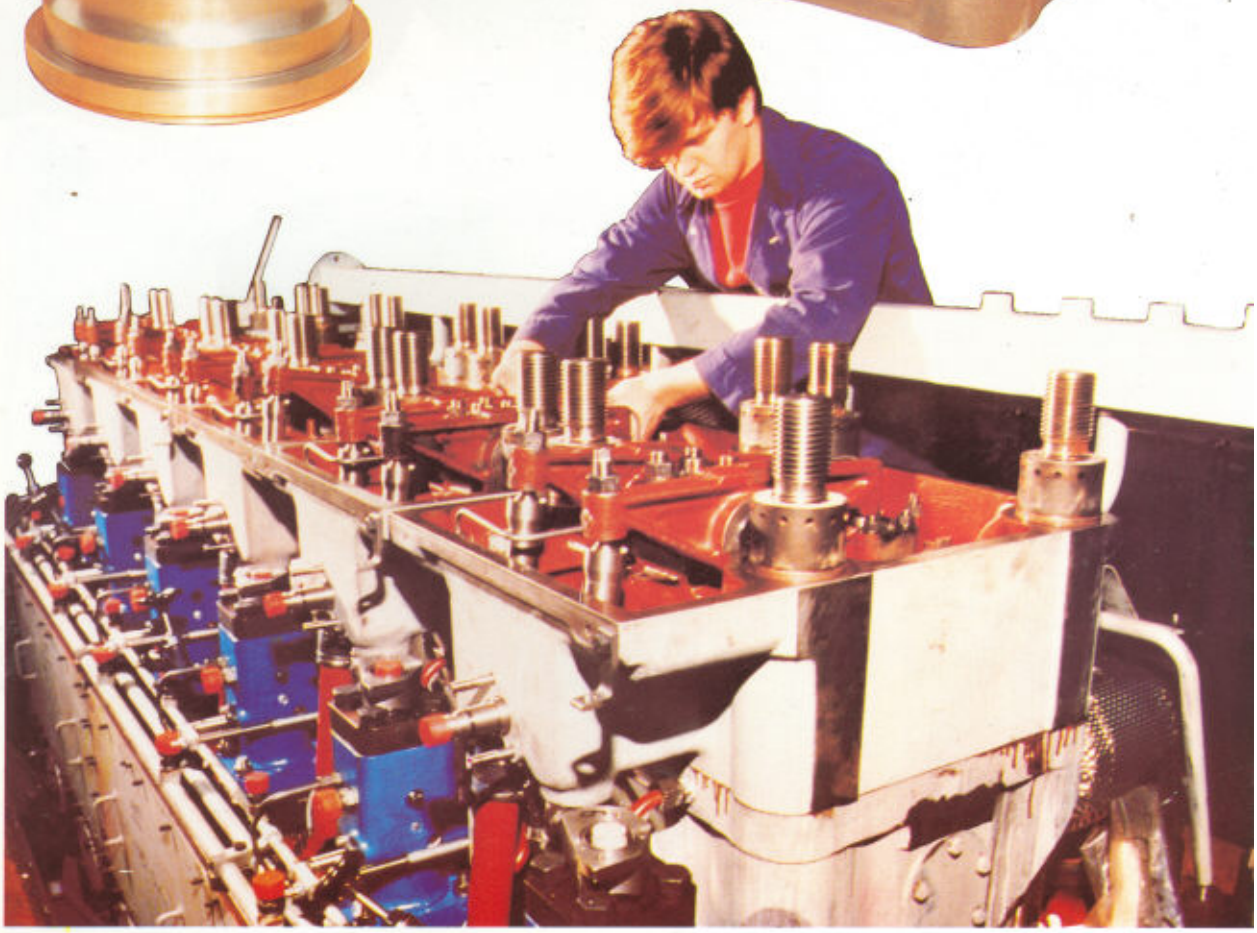
The engine frame consists of two grey iron castings. The upper, cylinder block unit, carries the cylinder liner, camshaft, cam followers and fuel injection pumps. The charge air manifold is an integral part of this casting. The lower crankcase unit, carries the crankshaft and its thin wall, aluminium tin bearings. It is of deep bedplate design with integral sump and mounting girders. Large access doors with explosion relief valves are fitted. The two units are clamped together by high tensile bolts.



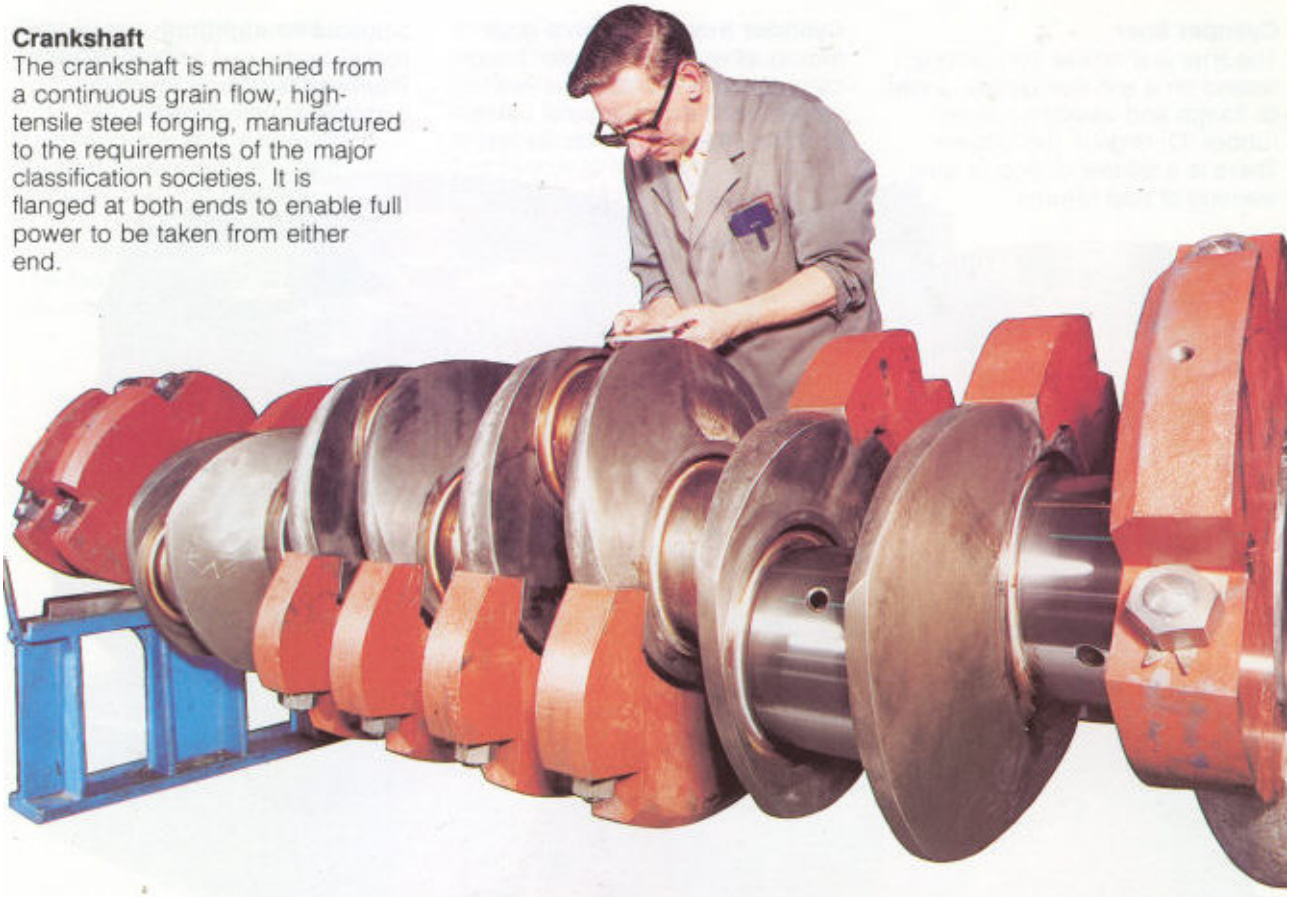


Cylinder liner
The liner is a simple iron casting, seated on a soft iron gasket under its flange and sealed by three rubber 'O' rings at the bottom. There is a tell-tale drilling to give warning of seal failures.

Cylinder head and valve gear
Individual cast iron cylinder heads carry two exhaust and two inlet valves, air start valve, relief valve and fuel injector. The valves are actuated through push rods, rocker levers and bridge pieces. The head is retained by four hydraulically tensioned studs.

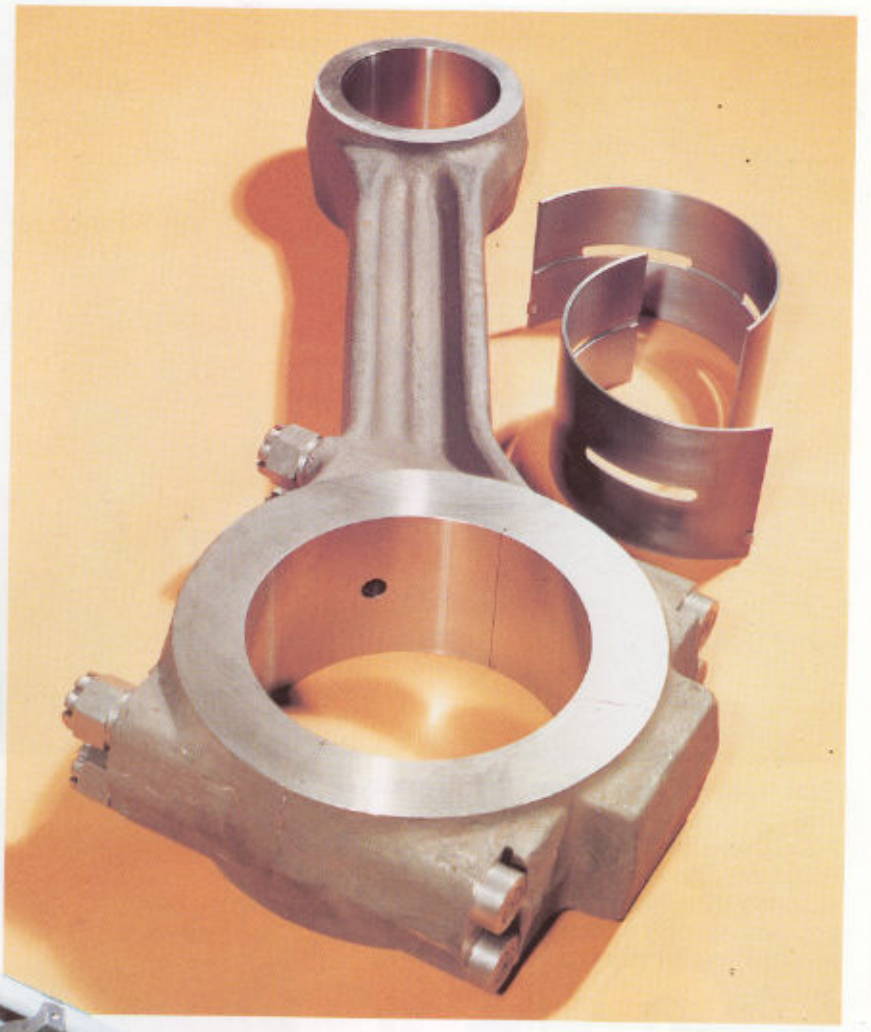


Crankshaft
The crankshaft is machined from a continuous grain flow, high-tensile steel forging, manufactured to the requirements of the major classification societies. It is flanged at both ends to enable full power to be taken from either end.

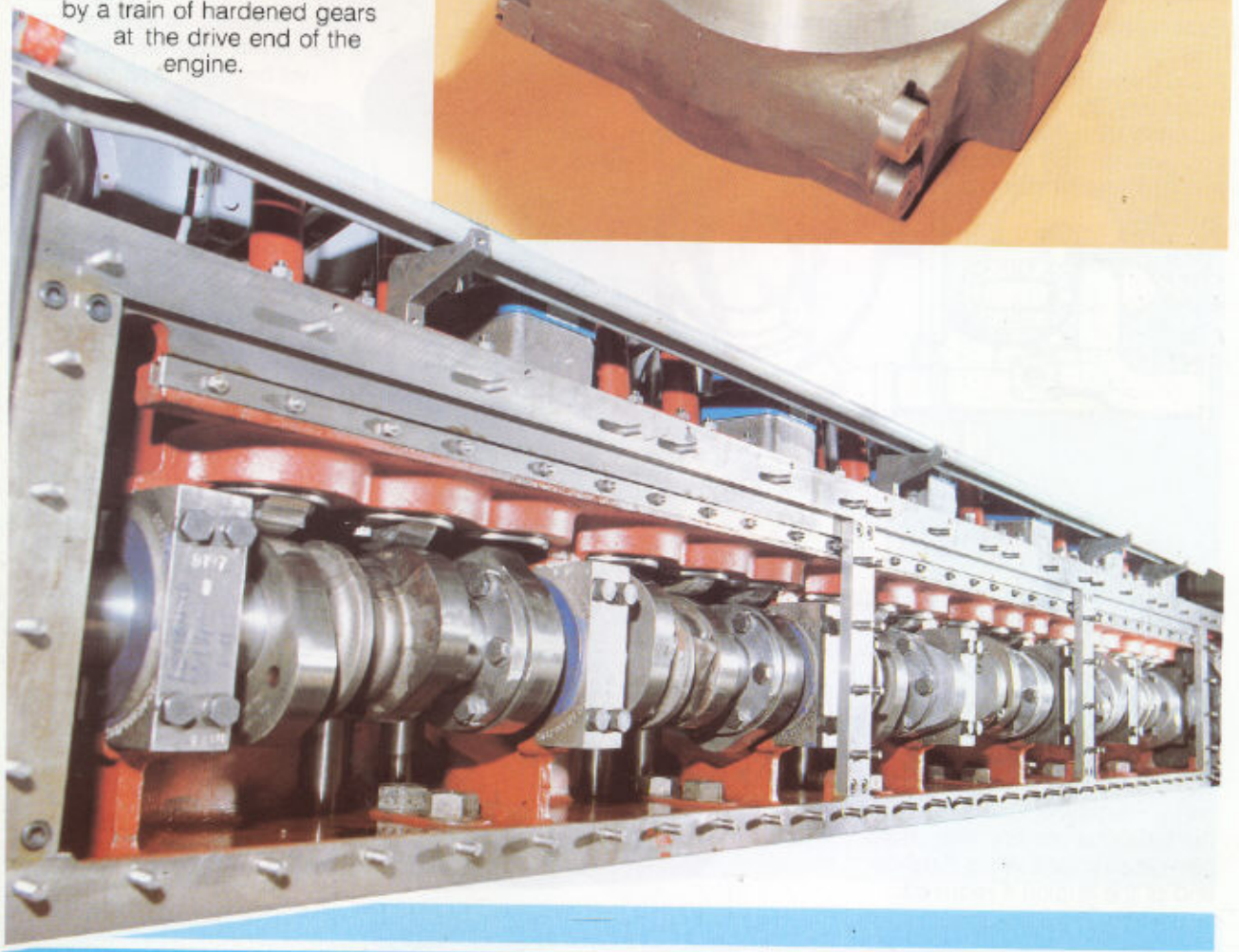


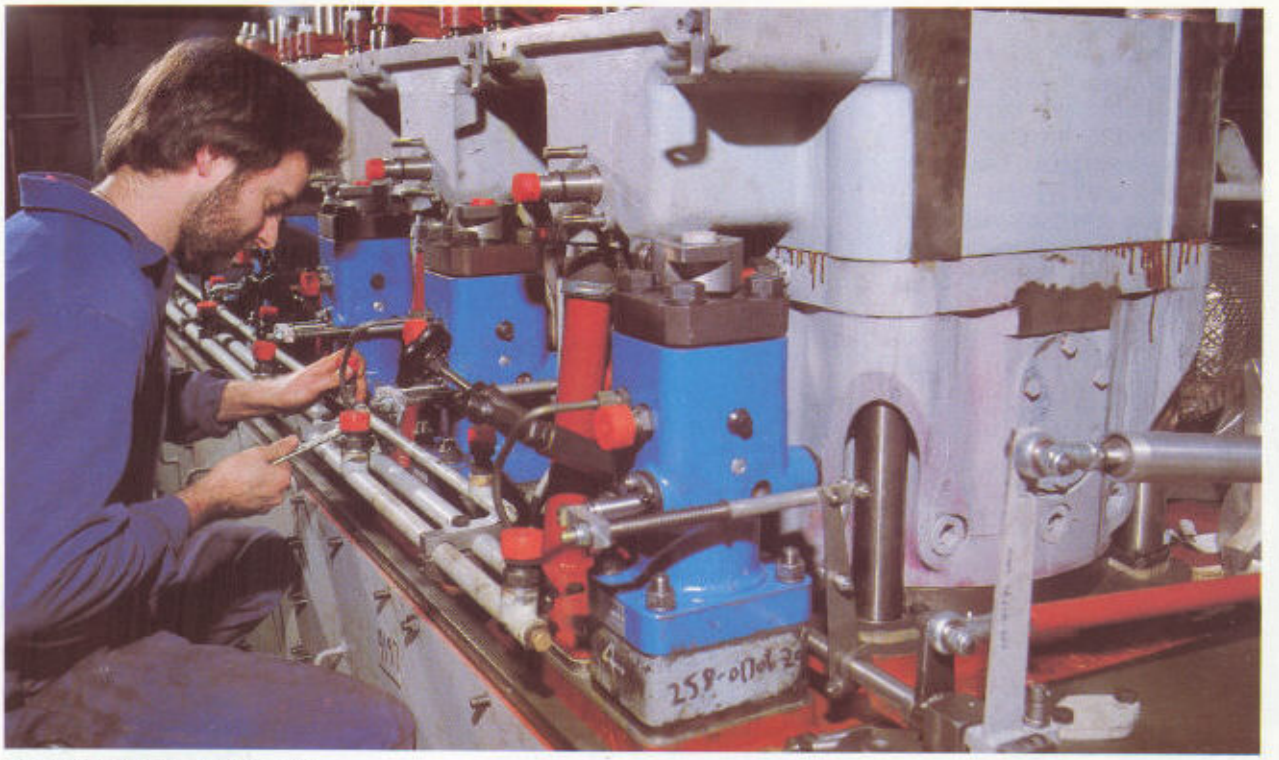
Piston
The piston is on 'monobloc' nodular cast iron design with an internal cooling gallery, fed with oil via a hollow gudgeon pin having radial drillings.

Connecting rod
The connecting rod is a high tensile steel forging with the large end split at an angle, the cap being located by serrations and retained by four bolts. The large end bearing are thin-wall aluminium-tin and the small end bearing is a matched pair of thin wall bushes.

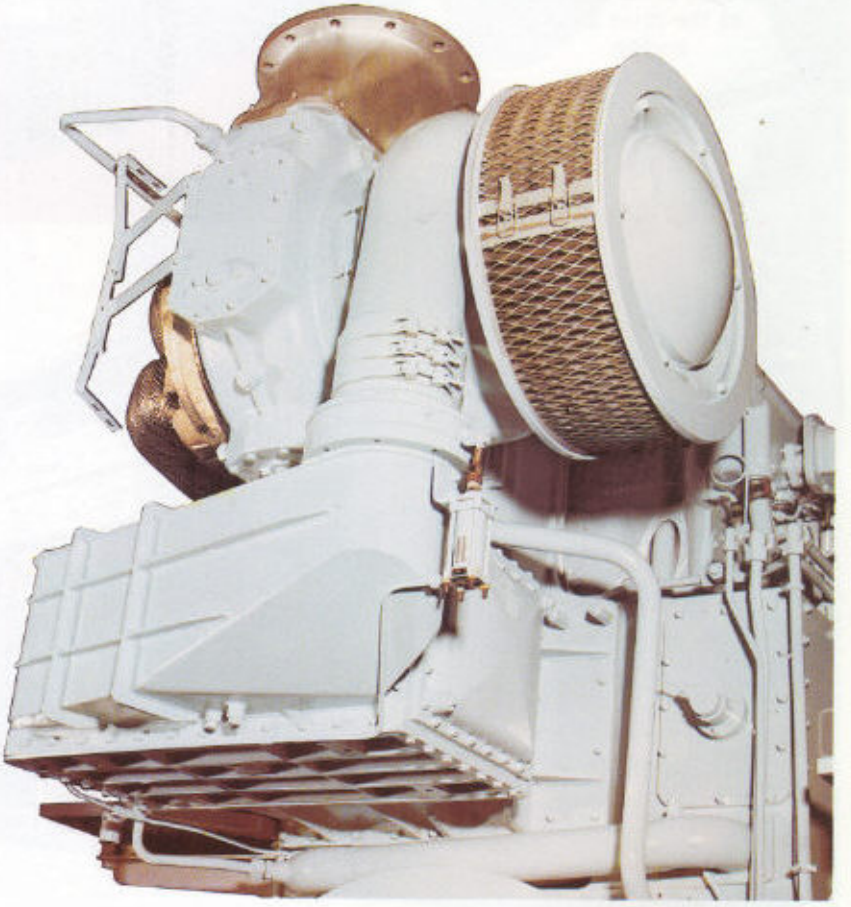


Camshaft and drive
The camshaft is full length with separate valve and fuel cams fastened to it. It is carried in renewable white-metal, thin-wall bearings and is removable from the side of the engine. It is driven by a train of hardened gears at the drive end of the engine.





Fuel injection equipment
The injection pump and injector are suitable for heavy fuel operation. The fuel pump is supplied by a through flow system and any leakage is totally isolated from the engine lubrication system.

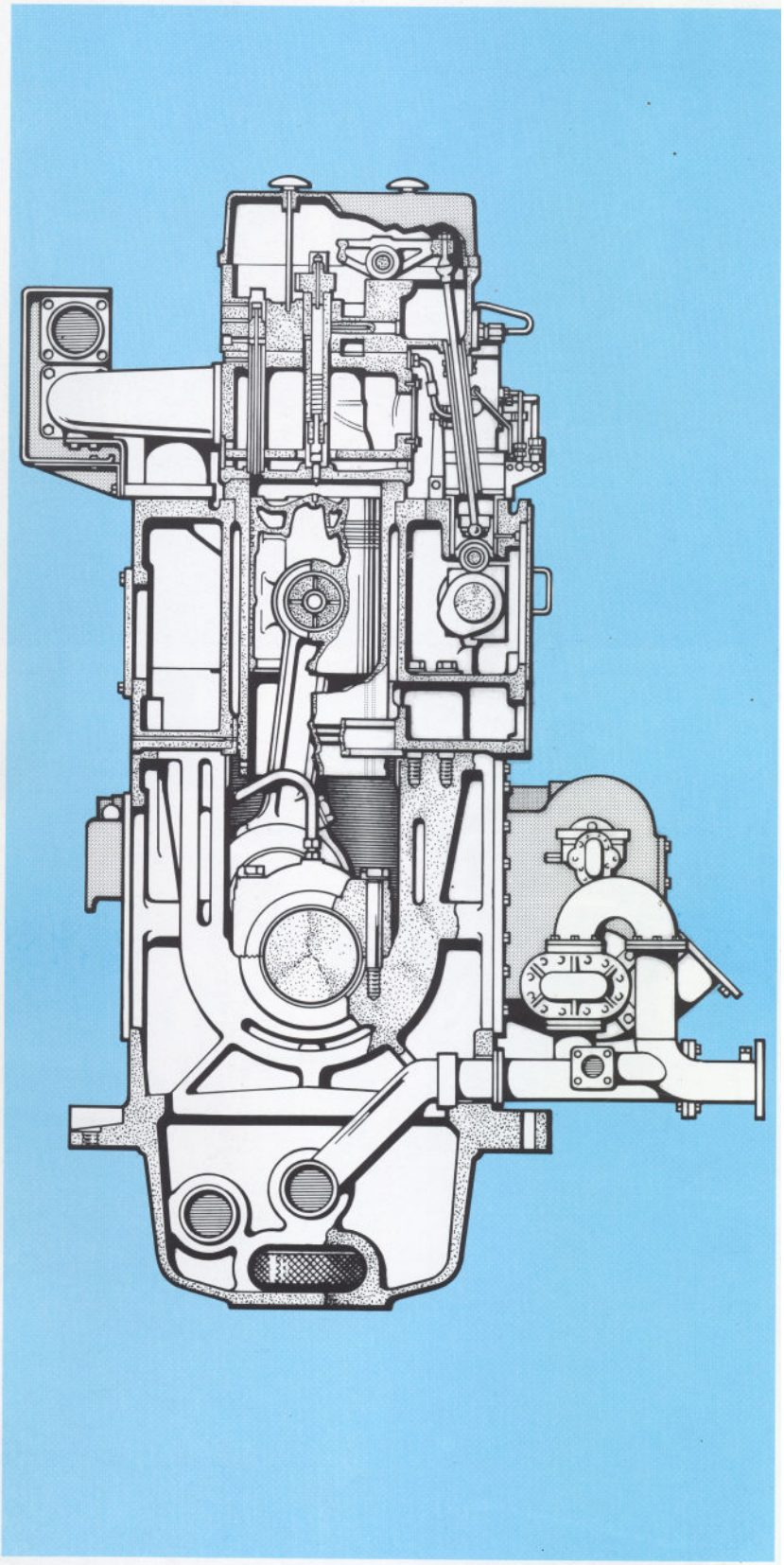


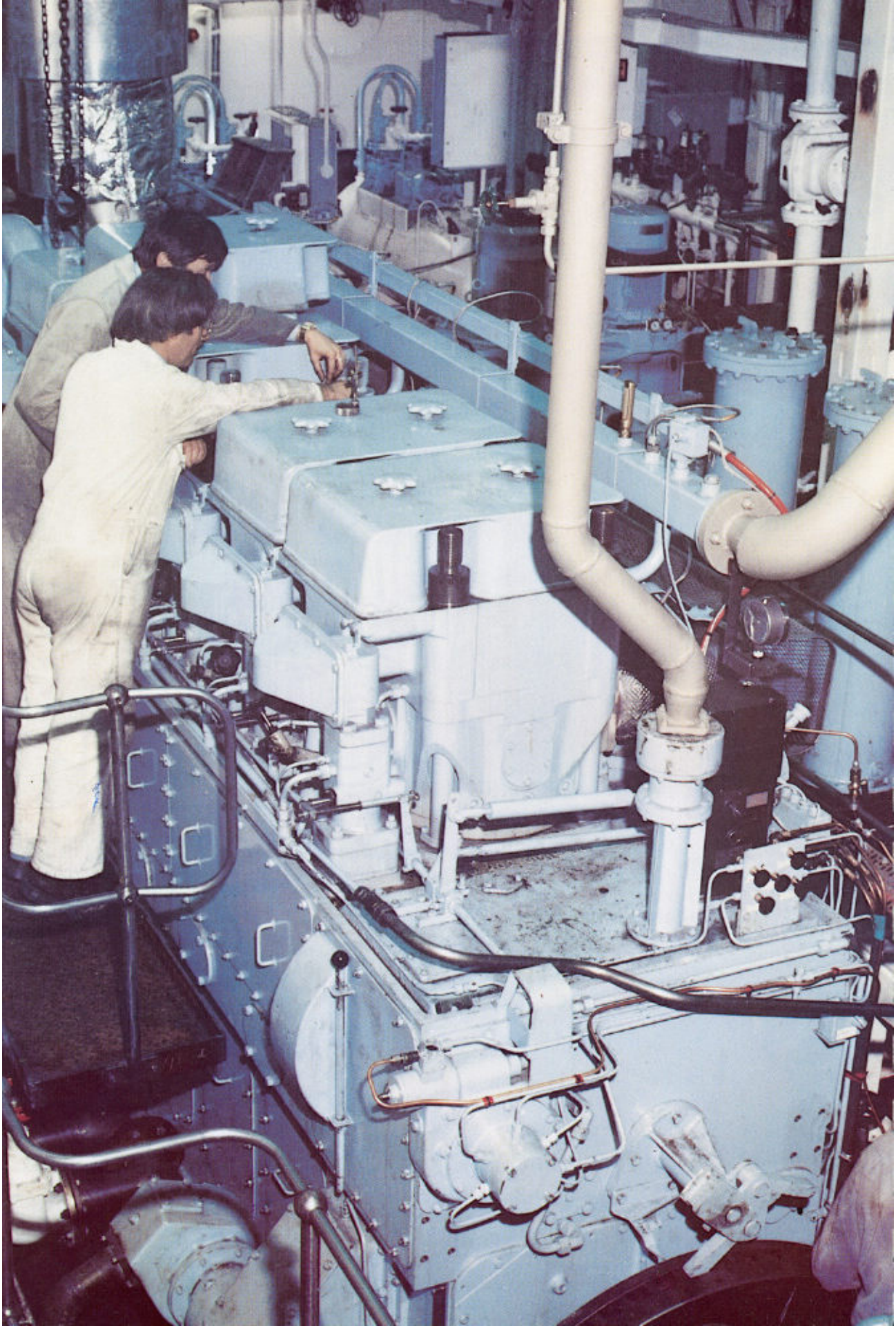
Turbocharger and intercooler
A single turbocharger and intercooler are arranged as standard at the free end of the engine. Napier turbocharger and Serck intercoolers are usually fitted but other proprietory makes can be supplied. Alternatively, the turbocharger and intercooler can be arranged at the flywheel end of the engine if required.

Auxilaries drive
The engine auxilaries are driven through a train of hardened steel spur gears meshing with a separate split gear on the camshaft, adjacent to the gear which drives the camshaft drive train. The gearcase is mounted on the front of the crankcase at the flywheel end and provision is made for driving one jacket water pump, one raw or seawater pump, these pumps being of the centrifugal type, a gear type lubricating oil pump and a gear type fuel feed pump.

Governor
The engine governor is mounted on top of the cylinder block and driven by skew gears and vertical shaft from the crankshaft. This arrangement gives a steady drive and simple connection to the fuel pump racks.

Starting
Starting is by air injection to the cylinders. The start valves are of the servo type actuated by pneumatic signals from a camshaft driven distributor.





Left. One of two Ruston AT350 engines in the suction hopper dredger, 'Mersey Venture' shown above, built by Appledore Shipbuilders Ltd for The Mersey Docks and Harbour Company Ltd.

'Pacific Sandpiper', an irradiated nuclear fuel carrier, is powered by two Ruston 6AT350 engines. The vessel is owned by British Nuclear Transport Ltd and operated by James Fisher and Sons Ltd.

RUSTON AT350

Marine propulsion & auxiliary

Technical Data

Engine type AT350

Description Turbocharged and charge cooled diesel

Cycle 4 stroke

Bore 350mm (13.78in)

Stroke 368mm (14.50in)

Compression ratio 12.4

Mean piston speed 7.37m/s (1450ft/min) at 600 rev/min

Standard rotation Counter clockwise looking on the drive end of the crankshaft

Number of Cylinders		**6**	**8**	**9**
Cylinder configuration		In line	In line	In line
Dry weight (with flywheel)	kg lb	28500 58400	31700 69900	34150 75300
Oil sump capacity	l gal	773 170	1000 220	1091 240
Length	mm in	5240 206	5920 233	6260 247
Width	mm in	1500 59	1500 59	1500 59
Height	mm in	2930 116	2930 116	2930 116

Standard Equipment

Flywheel
Air filter/silencer mounted on turbocharger
Air in cylinder starting
Crankcase explosion relief valves
Water to air charge air coolers
Jacket water cooler
Lubricating oil cooler
Speed governor-type RE1100
Lubricating oil pressure relief valve
Lubricating oil filter —
  simplex type for gen. sets
  duplex type for propulsion
Lubricating oil pressure pump engine driven
Fuel oil filter — duplex type
Fuel boost pump-motor driven
Pre-start lubricating oil priming pump
Engine cooling water pump — engine driven
Electric tachometer
Engine-mounted instrument panel
Remote exhaust temperature indicator
Charge air temperature alarm
Jacket water temperature alarm and shut down
Lubricating oil pressure alarm and shut down
Lagged exhaust manifold
Cylinder pressure relief valve/Compression release valve and indicator (0 kill type)
Exhaust silencer — non-spark arrester type
Exhaust uptake adaptor and bellows
Hand barring gear
Tools for routine maintenance

Optional Equipment

Auto starting
Reverse direction of rotation
Alternative type of speed governor
Power take off from free end of crankshaft
Sea water/secondary water pump — engine driven
Fuel boost pump-engine driven
Overload switch
Fuel limiter
Residual fuel build
Centrifugal bypass lubricating oil filter
Alternative exhaust silencer — eg spark arrester/improved attenuation
Turbocharger mounted at drive end
Handed engine control
Motorised barring gear
Tools for engine overhaul

Marine unrestricted service power

Engine	**Speed**	**Brake power**		**Electrical***
	rev/min	kW	hp	kW
6AT350	600	2240	3000	2140
8AT350	600	2985	4000	2850
9AT350	600	3355	4500	3200

*Electrical power output will depend on actual generator efficiency

Specific fuel consumption

Percent full load	**110**	**100**	**75**	**50**	**25**	**110**	**100**	**75**	**50**	**25**
Speed rev/min	kg/kW-h (brake)					lb/bhp-h				
600	.204	.202	.201	.209	.228	.335	.332	.330	.343	.375
Tolerance	+ 5%					+ 5%				
L.C.V. of fuel	42000 kJ/kg					18060 Btu/16				

Fuel specification
Distillate. BSMA100. Class M1, M2 or equivalent specification.

Residual. BSMA, 100 Class M4-M7 or equivalent specification having visosities of 15, 25, 45, 75 cSt at 80° C (300, 600, 1500, 3500 Redwood No. 1 at 100° F).

General performance data*

ENGINE TYPE		6AT350	8AT350	9AT350
Engine speed	rev/min	600	600	600
BMEP	bar lbf/in²	21.05 305.2	21.05 305.2	21.05 305.2
Mechanical efficiency	%	91.1	91.1	91.1
Brake thermal efficiency	%	42.5	42.5	42.5
Maximum cylinder pressure	bar lbf/in²	138 2000	138 2000	138 2000
Compression pressure	bar lbf/in²	91.0 1320	91.0 1320	91.0 1320
Charge air pressure	bar lbf/in²	1.9 27.6	1.9 27.6	1.9 27.6
Air flow rate	kg/s lb/s	4.68 10.31	6.24 13.75	7.02 15.47
Exhaust gas flow rate	kg/s lb/s	4.80 10.59	6.40 14.12	7.20 15.88
Charge air temperature	°C °F	63 145	63 145	63 145
Exhaust gas temperature — turbine inlet	°C °F	560 1040	560 1040	560 1040
Exhaust gas temperature — turbine outlet	°C °F	385 725	385 725	385 725
Fuel injection pressure	bar lbf/in²	1105 16000	1105 16000	1105 16000
Lubricating oil consumption	l/h pint/h	3.3 5.8	4.4 7.75	5.0 8.8

Heat dissipation and flow data†

ENGINE TYPE		6AT350	8AT350	9AT350
Engine speed	rev/min	600	600	600
Heat dissipation to charge air cooler	kW Btu/h×10³	670 2286	893 3047	1005 3429
Secondary water flow through charge air cooler	m³/h gal/h	68.0 15000	86.4 19000	89.1 19600
Heat dissipation to jacket water	kW Btu/h×10³	616 2100	821 2800	924 3154
Jacket water flow rate	m³/h gal/h	68.0 15000	86.4 19000	99.1 21800
Jacket water temperature into cooler	°C °F	82 180	82 180	82 180
Heat dissipation to lubrication oil cooler	kW Btu/h×10³	291 992	388 1323	436 1489
Lubricating oil flow rate through cooler	m³/h gal/h	41.4 9100	59.6 13100	59.6 13100
Lubricating oil temperature into cooler†	°C °F	82 180	82 180	82 180
Heat to radiation (lagged exhaust manifold)	kW Btu/h×10³	62 212	83 283	93 318

* At marine unrestricted service conditions of 45° C air intake and 32° C charge cooler water temperature.
† Cooler design temperature — nominal setting of thermostatic valve is 77° C (170° F)
** Based on clean deep-sea water and Al-brass tubes

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