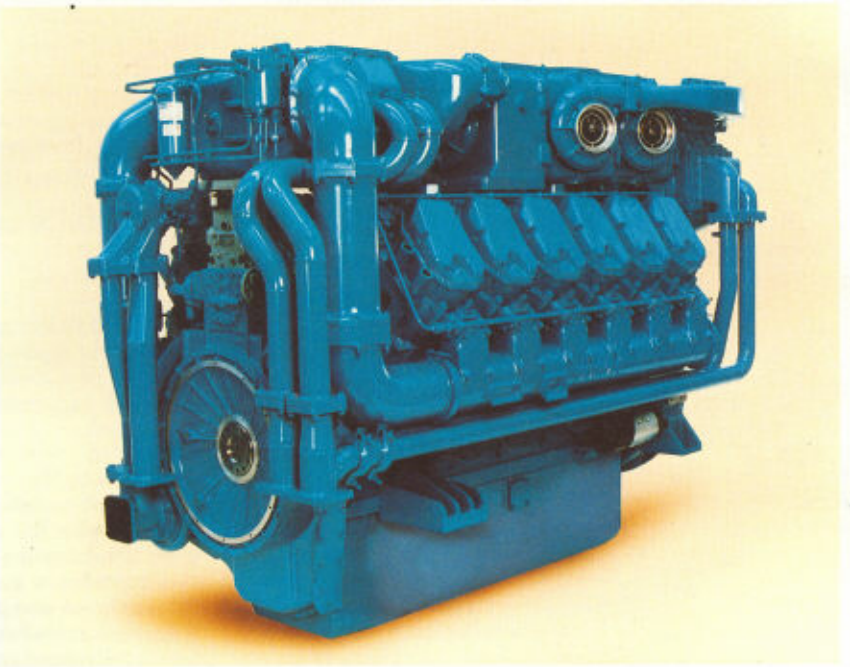
THE PAXMAN 12VP185



GEC ALSTHOM

PAXMAN DIESELS

BASIC TECHNICAL DATA, VARIABLE SPEED ENGINES	
Engine Type	**12VP185**
Number of Cylinders	12
Bore x Stroke	185 x 196mm (7.28 x 7.72 in)
Configuration	90° Vee
Cycle	4 Stroke
Combustion System	Direct Injection
Compression Ratio	13.1:1
Operating Speed Range	650 - 1950 r/min
Maximum Power (High Speed Marine)	2611 kWb (3500 bhp) at 1950 r/min
Idling Speed (Basic Engine)	650 r/min
Mean Piston Speed	11.76 m/s (2315 ft/min) at 1800 r/min
Fuel Feed Pump Lift	2 m
Fuel Type	BS2869 Class A1 to A2 ASTM D975 Number 1D or Number 2D
Lubricating Oil Sump Capacity	Maximum: 218 litres (48 gallons) Minimum: 150 litres (33 gallons)
Maximum Exhaust Back Pressure	25 mm Hg (1 in Hg)
Directional Rotation	Anti-Clockwise looking on Flywheel
Starting	24 Volt Electric Motor as standard
Air Start	Available as an Option
Thread Systems	SI Metric and BSP

General Description

The Paxman 12VP185 engine is a compact, high power to weight ratio, high power density engine giving power up to 2600 kWb at rotational speeds up to 1,950 r/min suitable for marine, power generation, off-highway and rail traction applications. It offers low operating costs through excellent fuel consumption and long life between overhauls. Its two-stage turbocharging system gives the engine excellent torque characteristics and very rapid response throughout its speed range without the complication and cost of sequential turbocharging.

The engine is of 90° Vee form configuration and has a 185 mm bore and 196 mm stroke with a single central camshaft, driving valve gear and unit pump injectors. Component count has been kept to a minimum to maximise reliability and minimise cost. The water-jacketed two-stage turbocharger system is mounted between the cylinder banks to give a low engine profile.

Close attention has been given to the needs of performance, economy of manufacture and simplicity of maintenance throughout the design of the engine.

The main features of the engine are as follows:

Crankcase

The crankcase carries all the main reciprocating, torsional and longitudinal stresses within the engine. It is of robust design to carry the high firing pressures generated in the engine and is made of high strength spheroidal graphite cast iron. The underslung crankshaft is secured by main bearing caps which are drawn internally against the deep-fitting side-faces of the crankcase by high tensile set screws and by hydraulically tensioned main bearing studs. This configuration gives good strength and stiffness characteristics to the bottom end of the crankcase and provides a good solid support for the crankshaft. Generously sized crankcase doors are provided to give access to the connecting rods and crankshaft for in-situ servicing.

Pistons and Liners

The pistons are of a one piece design in high strength nodular cast iron. The design embodies a large oil cooling gallery above the piston ring belt, the oil being supplied by accurately aligned standing jets mounted in the crankcase. The pistons run in liners made of centrifugally cast high grade cast iron. The piston, piston ring and liner combination have been tested rigorously during the development of

the inlet manifolds. From the high-pressure compressors the air passes to the jacket water cooled aftercooler and then to the inlet manifold. This arrangement offers freedom from detonation and close control of the inlet manifold temperature.

Cooling system

Primary Circuit A centrifugal coolant pump, gear driven at the free-end, circulates treated fresh water through the charge air aftercooler, the crankcase jacket, the cylinder heads then to the exhaust manifold casings. The coolant flows unite in the exhaust casings before moving into the turbocharger housing. From there the coolant returns via a single pipe to the coolant thermostat at the free-end where it will either re-circulate the coolant or pass it to the heat exchanger (or radiator), depending on temperature.

Secondary Circuit The oil cooler and charge air intercooler require a supply of cooling water. This is provided by a gear driven centrifugal pump in off-road and power generation applications, which are normally radiator cooled. Marine applications use a self priming pump mounted off the main gear casing at the free-end of the engine. The pump is driven by a polyvee belt from a pulley mounted directly on the free-end of the crankshaft.

Heat Exchanger (marine or cooling tower applications)

The heat exchanger is of plate type using titanium plates for maximum corrosion resistance and ease of maintenance. It is located in close proximity to the circulating pump and thermostat to minimise pipe runs and quantity of coolant within the system.

Radiators

For industrial sets and applications where a self contained power source is required, a range of radiators is available. For ambient temperatures of 40°C and below these can be mounted on the underbase with mechanically driven fans. Above 40°C ambient it mat be necessary to mount the radiator separately and drive the fan by electric motor.

Lubricating Oil system

The engine is of the wet sump type. Oil is circulated by an externally mounted gear type pump supplying high pressure oil through drillings in the crankshaft to the main and big end bearings. As previously described each connecting rod is drilled to service the small end and piston pin. Fixed vertical jets supply cooling oil to the pistons. The turbochargers are supplied with engine oil; no separate lubrication system being required. Filtration is by canister spin-on filters mounted in two groups on the sides of the engine. These groups are so arranged that the engine can run on one bank to allow the canisters to be changed on the opposing bank (a duplex facility). The oil is cooled by a plate type oil cooler similar to the heat exchanger, the temperature being controlled by a bypass thermostat.

Governing

Various types of governing can be fitted depending on application. The basic type is centred on a Regulateurs Europa 1100 Series hydromechanical ballhead type, which can be supplied in several variants to suit particular applications. Digital governing in the form of the Regulateurs Europa Series 22 Viking governor is available where more comprehensive control and protection facilities are needed - see options.

Starting

In standard form the engine will be started by 2 x 24 volt electric motors engaging with a starter ring mounted on the flywheel. A suitable 24 volt alternator can be supplied for battery charging purposes. This is driven from the free-end of the engine. Alternative air or hydraulic start motors are available to suit specific applications - see options.

OPTIONS

Starting

As stated above, in standard form the engine will be started by 2 x 24 volt electric motors engaging with a starter ring mounted on the flywheel. A 24 volt alternator can be supplied for battery charging, driven from the free-end of the engine.

Rail traction applications normally require electric starting at higher voltages and these can be accommodated.

Air motors of either vane or turbine type can be fitted. Starting air pressure at the motor is 6 - 10 bar. For specialised applications hydraulic start motors complete with reservoirs are available

Governing

Marine Propulsion

The standard marine engine is fitted with a Regulateurs Europa Digital Viking 22 controller, a type 2231 hydraulic actuator with ball head back up and an interface panel. In standard form the controller offers a high response rate and extremely close control of engine speed coupled to a range of additional control functions. These include engine start up logic, gearbox interlock, fail to start indication, commissioning of alarm system, overspeed alarm and back up, engine idle signal and tachometer drive. The system can be expanded to include control of acceleration rates, boost fuel limitation, torque control and maximum exhaust temperature control. Shut down facilities are available in the event of low oil pressure, high water temperature and electronic back up for the mechanical overspeed trip.

Power Generation

For single running generator sets the 1100 hydraulic governor with

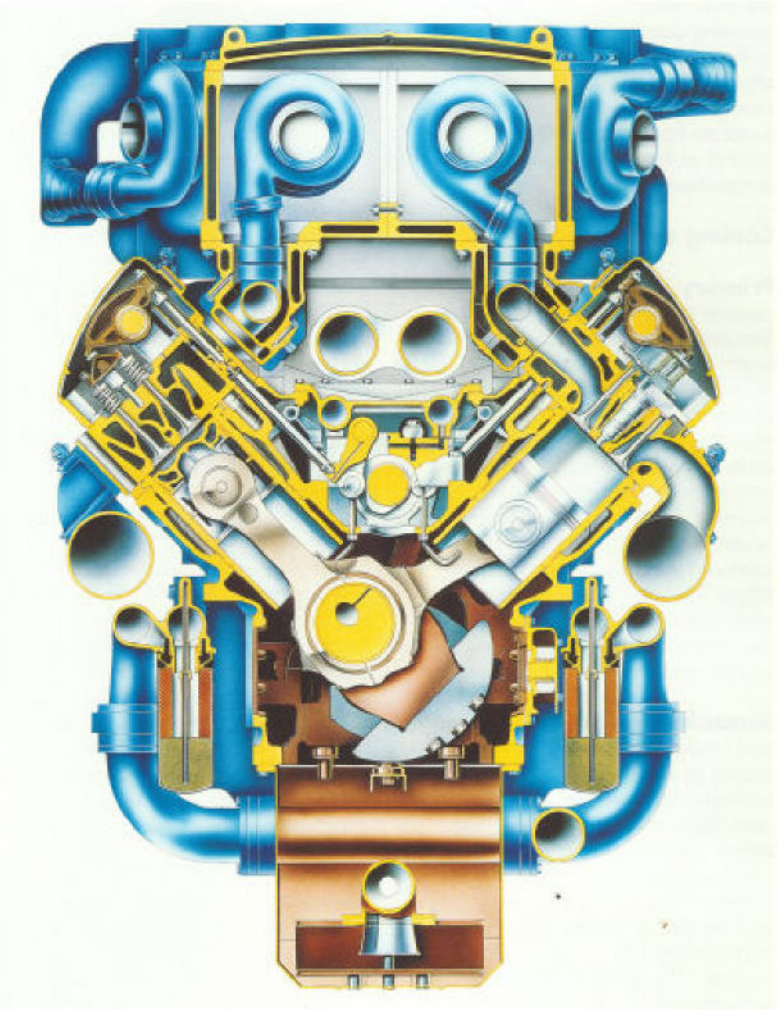
motorised speed control is perfectly adequate. The Digital Viking 22 is used where load anticipation is required to minimise transient speed excursions.

For multi engine power management systems Digital Viking 22 is the normal option with special load share software which gives a choice of master/slave, masterless or droop loading sharing. The governors communicate via their own dedicated RS485 serial link and are able to automatically change mode of control to deal with fault conditions. The system is known as SDM (Self Designating Master) and has been developed to provide a comprehensive package for almost all applications.

Traction
Both hydraulic and electronic options are available for rail traction applications. The latter offers more precise control and facilities for solid state excitation control suitable for interfacing with a range of excitation systems. Both options offer the capacity of considering charge air pressure when setting the load control level.

Off Road Vehicles
The Digital Viking 22 is the standard option with software specially configured to make it an intrinsic part of the vehicles control system. The drivers cable controls interface directly with the governors ECIS.

Monitoring and Control
The engine can be supplied with a built on data acquisition unit, designed to transmit pressure and temperature information, required by Classification Societies, to a local alarm and monitoring panel. The information is fed to a distributed processing unit and then to VDUs mounted at suitable locations. A data logger and event printer are available if required. The various sensors are connected through a standard wiring loom to the data acquisition unit and all system wiring from the unit is by serial link to the



various system components, eliminating the bulk of the hard wiring currently required from the installer.

This system has the capacity to process data from off-engine sources such as bilge alarms, tank levels, smoke and fire alarms, auxiliary engines, liquid transfer systems, cathodic protection and similar ancillary equipment. The information collected being displayed graphically in full colour on the VDUs.

Facilities are available to mount a local instrument panel on the engine, this is equipped with direct reading gauges for the main engine systems including lubricating oil pressure and temperature, water pressure and temperature, fuel pressure, exhaust temperatures and tachometer. Start and stop buttons with key switch for local/remote control are fitted allowing the engine to be started locally for maintenance or in an emergency.

Trend Monitoring
The distributed processing unit in standard form allows up to eight parameters to be displayed

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simultaneously on the VDU screen and graphically illustrates variations for the previous one hour, twenty four hours or seven days. Information so accessed typically includes exhaust temperatures (average), oil temperatures, water temperatures, blow-by and vibration allowing assessment of performance against elapsed time. The memory can be expanded to give longer periods of interrogation.

Engine Mounting System

Feet suitable for marine, rail traction and industrial applications are available. Marine engines are normally mounted on four point anti vibration mounts to limit transmission of noise and vibration to the ship's structure.
Rail traction applications are normally of the diesel electric type with the alternator flange mounted to the engine. This arrangement requires the complete assembly to be supported and feet are available to accommodate 4 or 6 point anti vibration mounts depending on alternator type.
Industrial sets comprising radiator and fan assembly, alternator and engine are built up on a rigid underbase which is mounted on multi point anti vibration mounts; the number being dependent on the total set weight.

Oil and Fuel Filters

In standard form the engine is fitted with simplex fuel and oil filters. These are satisfactory for stand-by industrial applications, short voyage military vessels, off-road vehicles and rail traction. For long voyage vessels, passenger carrying craft and any application where continuous unbroken running is required duplex filters are fitted. Where these filters are necessary two identical groups are mounted one on each side of the engine. The engine will run on either or both groups and the control valves are interlocked to permit one group to be changed without slowing or stopping the engine. The filters are of the canister, spin on, disposable type.

Cold Start Aids

The engine will start without aids down to +5°C. From 0 to 5°C immersion heaters located in the oil sump and water space are used to warm the engine to ensure starting and minimise white smoke formation. From -8 to 0°C these heaters must be supplemented by injecting cold start fluid into the inlet manifold and a pipework system will be fitted to distribute the volatile fluid correctly.

If temperatures lower than -8°C are envisaged it will be necessary to fit a pumped heater unit to raise the engine block to a suitable temperature and some form of space heating may be necessary.

Exhaust System

The engine can be supplied with a 45° or 90° bend for applications where a vertical uptake is not practical. A stainless steel flexible bellows section is available.

Various proprietary silencers are available, these can be of the straight through spark arrestor or snubber type. In cases where noise abatement is critical two silencers in series may be required. Care must be taken not to exceed the maximum back pressure as this will affect engine performance.

Gearboxes

The engine can be supplied with various makes of gearbox and approved matchings between engine speed and shaft speed over a wide range are available. Choice of ratio is flexible due to the excellent torque characteristics of the engine.

Modern gearboxes offer a wide range of options, including co-axial, drop centre, U drives, trolling valves, mounting facilities for CPP oil distribution boxes, power take-off points and facilities for electric, mechanical or pneumatic control. Paxman Diesels will advise customers on the most appropriate configuration for the specific duty. Torsional vibration calculations can be carried out when details of all the driven equipment are available.

Alternators

The engine will accept a range of alternators which can be of single or twin bearing type. The standard flange is SAE00, an adaptor to SAE0 is available. Preferred speeds are 1800 r/min for 60 Hz and 1500 r/min for 50Hz. Paxman Diesels can offer completely engineered sets. Basic engines to agreed specification are available to Original Equipment Manufacturers (OEM) for incorporation into their own designs.

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