Pounder's marine diesel engines and gas turbines

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The gas generator of the GT35 is a two-shaft engine equipped with a 10-stage low pressure compressor, an eight-stage high pressure compressor, seven can-type combustion chambers, a single-stage high pressure turbine and a two-stage low pressure turbine (Figure 31.12). The power turbine, developed in parallel with the gas generator, is a three-stage design. A refinement made in the 1990s enabled the power turbine to operate at variable speed and enhanced its suitability for mechanical drive and marine applications.

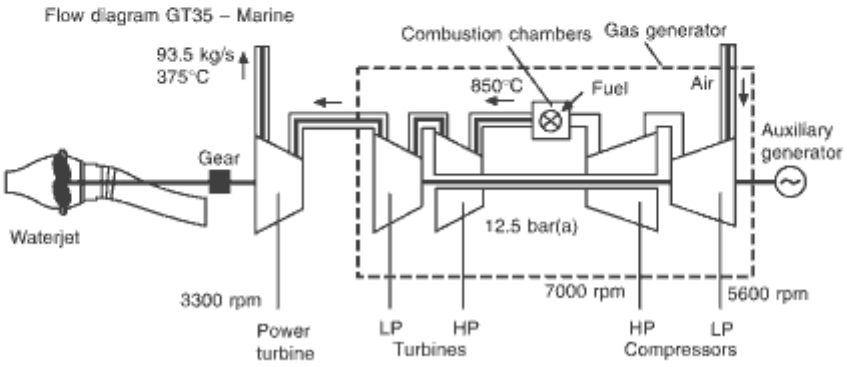
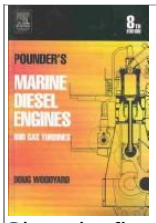


Figure 31.12 Flow diagram of Alstom Power GT35 gas turbine in a marine propulsion installation

Refining the GT35 for marine applications called for the following measures: modifying the lube oil system to allow for vessel movements; modifying the support arrangement to protect the turbine from hull deflections; and modifying the power turbine by introducing a second combined journal and thrust bearing, as well as a modified active tip clearance control mechanism (achieving a self-supported power turbine and thus eliminating the need for a thrust bearing in the gearbox).

High reliability from the marinized GT35 was sought by exploiting as many standard components as possible from the power generation and mechanical drive versions. An extensive re-calculation of low cycle fatigue and creep properties of certain critical elements of the turbine was also undertaken, leading to subsequent redesign of some parts. High availability and maintainability in arduous marine duty were addressed by adapting the installation to the specific vessel, with the aim of reducing the time for unit replacement and facilitating servicing. The maintenance programme was also adapted to operating conditions imposing only short shutdown times for routine inspections and unit change-outs.



are promised by Alstom Power, which inherited the lightweight industrial-based turbine interests of Sweden's ABB Stal. Successful marine service experience on IF30 intermediate fuel is cited for its GT35 turbine, supported by a capability to burn IF180 fuel demonstrated in land-based plants.

The GT35 emerged from a post-war aero engine development programme in Sweden involving Stal Laval and Volvo Flygmotor. Small turbojets were designed and built for testing in the late 1940s/early 1950s but never entered commercial production. Stal Laval saw potential in transforming the engine into an industrial gas turbine for power generation and mechanical drive duties. The first GT35, rated at 9000 kW, was tested in 1955 and installed during the following year in a Swedish power station.

Performance and reliability were subsequently demonstrated in land-based and offshore platform power generating installations. The design has since benefited from two upgradings to attain its present output rating of 17 300 kW at 3450 rev/min for mechanical drive applications, with an efficiency of 33 per cent (Figure 31.11).

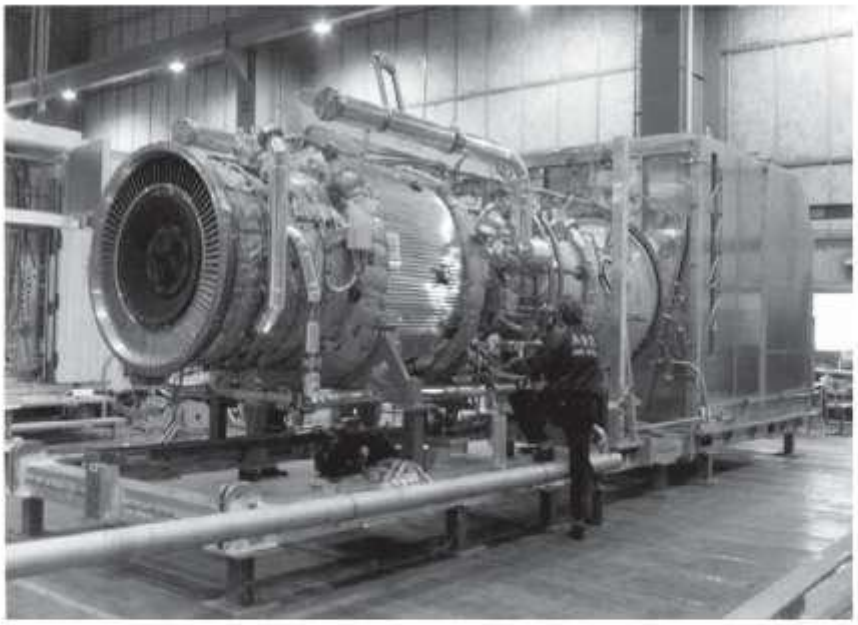


Figure 31.11 One of two 17 000 kW Alstom Power GT35 gas turbines supplied to drive the waterjets of a Stena HSS 900-class fast ferry

Figure 31.13 Seven large can-type combustion chambers (foreground) contribute to the lower grade fuel burning capability of Alstom Power's GT35 turbine

GE MARINE ENGINES

General Electric (GE) introduced its first aero-derivative gas turbine, the LM100, in 1959 and in the same year the LM1500, derived from the successful J79 aircraft engine. The first LM1500 installation, serving the hydrofoil vessel *H.S. Denison*, was followed by over 160 applications in land-based catapults, pipeline pumping systems, marine propulsion and power generation. The mainstay of the US designer's programme, the LM2500, arrived in 1969 and has since benefited from developments which have doubled its initial rating of around 15 000 kW. Other models subsequently joined the LM-series portfolio, which now embraces five simple-cycle designs with maximum power ratings from around 4500 kW to 42 750 kW and thermal efficiencies up to 42 per cent (see table).