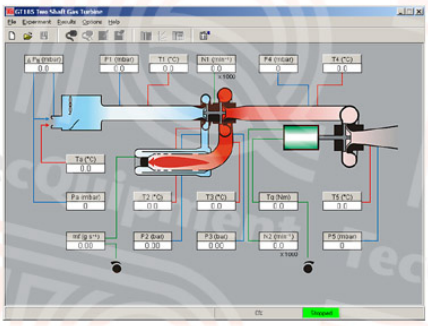
GT185

Two-Shaft Gas Turbine

Allows detailed experiments that show how a two-shaft gas turbine works, and tests its performance



Screenshot from the GT185 ADA software (included)

- Uses industrial parts, powered by kerosene for realistic tests and results
- Fully interlocked starting procedure and automatic shut-down
- Automatic Data Acquisition (ADA) included (supplied with software)
- Direct-coupled (no belts) eddy current dynamometer for accurate loading, speed control and true shaft power measurement
- Supplied with 'Gas Turbine Theory' textbook
- Full schematic instrumentation panel diagram shows students what each part does
- Well proven design - versions installed in universities, technical colleges and military training establishments in 30 countries worldwide

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GT185 Two-Shaft Gas Turbine

Description

A self-contained, fully instrumented, educational two-shaft gas turbine. Powered by kerosene, the experimental abilities of this high-quality apparatus enable comprehensive practical investigations into the principles, and performance of two-shaft gas turbines.

It is a steel frame that holds a gas generator, power turbine, combustion chamber, oil and fuel tanks, pumps, ancillaries and guards. Above these is an instrumentation and control panel with schematic diagram. The clearly labelled front panel with mimic diagram includes the instrument displays, controls and warning lights.

Air passes through an ISA nozzle and air box, into a compressor, then into the combustion chamber. A pump transfers fuel from the fuel tank to spray through a special nozzle into the combustion chamber. A high-energy spark ignites the air and fuel mixture, that flows to a gas generator turbine. The combustion chamber gives excellent combustion, low pressure loss and good flame stability over a wide range of conditions. A fuel flow control valve on the instrumentation and control panel regulates the speed. This design reduces the possibility of overspeed.

Hot gas from the gas generator turbine passes through a short duct to the power turbine. The short duct reduces heat losses to atmosphere. The exhaust gases then discharge to a suitable exhaust system.

The power turbine couples direct to an eddy current dynamometer, so there are no belts to adjust. A load cell on the dynamometer measures torque and a sensor measures the dynamometer speed, to allow calculation of true shaft power. A control on the instrumentation and control panel controls the load of the dynamometer (and therefore speed of the power turbine). The equipment has an oiling system including filters and water-cooled oil.

Starting is semi-automatic and fully interlocked, controlled by a start up and shut down logic system. For protection of the equipment and user, it shuts down the turbines if the user makes an error. It also switches on cooling fans after running.

Digital indicators show shaft speeds, dynamometer torque, pressures, temperatures and mass fuel flow. Analogue indicators show fuel level, fuel pressure, oil temperature, oil pressure and hours run.

This equipment connects to your computer (computer not supplied) and includes specialist, user-friendly data acquisition software. This allows students to display, graph and analyse all relevant variables, and save their results for later analysis. The data acquisition system includes adaptors and leads, and the software is supplied on CD-ROM.

Supplied with the equipment is a detailed textbook that covers the theory and use of gas turbines.

Experiments

A variety of comprehensive investigations into two-shaft turbine performance, including:

Two-shaft gas turbine:

- Specific fuel consumption,
- Thermal efficiency,
- Air standard cycle,
- Work ratio
- Heat balance

Compressor, gas-generator turbine and power turbine:

- Pressure ratio,
- Isentropic efficiencies, polytropic efficiencies, mechanical efficiencies
- Power outputs, power inputs
- Compressor characteristics, power turbine characteristics and all non-dimensional characteristics

Combustion chamber:

- Pressure loss,
- Combustion efficiency,
- Air and fuel ratio

Standard Features

- Supplied with a comprehensive user guide and textbook
- Two-year warranty
- Manufactured in accordance with the latest European Union directives

Recommended Ancillary

A computer with:

Intel® Pentium® (or equivalent) Processor

VGA monitor

CD-ROM drive

Serial Port

10 MB hard disc space

Standard 2 button mouse and keyboard

Microsoft® Windows® 2000, XP, Vista and Windows 7

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Specification

Note: All performance specifications are nominal and determined by local conditions.

Nett dimensions and weight:
1385 mm (width) x 825 mm (depth) x 1721 mm (height) and 360 kg (with no fuel or oil)

Packed dimensions and weight:
3.6 m^3 and 600 kg

Fuel:
Kerosene, specification:

- Specific gravity (or relative density): 0.78
- Net calorific value: 43.6 x 10^6 J/kg
- Flash point: 38 to 66°C
- Freezing point: –38 to 46°C
- Viscosity: 1.4 to 2.5 x 10^{-6} $m^2.s^{-1}$
- Boiling-point (final): 260°C

Lubricating oil:
SAE 10W-40 multigrade turbo diesel oil

Gas generator:
Maximum shaft speed: 90 000 $rev.min^{-1}$

Power Turbine:
Maximum shaft speed: 50 000 $rev.min^{-1}$

Governed continuous speed: 40 000 $rev.min^{-1}$

Maximum raw power: 10 kW at 50 000 $rev.min^{-1}$

Maximum continuous power: 6.5 kW at 40 000 $rev.min^{-1}$

Note: Local operating conditions, such as air and fuel quality will affect the power values.

Digital instruments:
Shaft speeds, Pressures, Temperatures, Fuel flow and Torque

Analogue instruments:
Fuel level and pressure, Oil temperature and pressure, Filter condition, Brake load level and Total hours run

Automatic shut down:
The control system stops apparatus if:

- Ignition fails
- Gas generator is too fast
- Power turbine speed is wrong
- Oil pressure fails
- Water supply fails
- Temperature too high

Exhaust emmisions (typical):

- Carbon dioxide (CO2): 1.8 - 2.9%
- Carbon monoxide, (CO): 240 - 900 ppm
- Nitric oxide, (NO): 11 - 26 ppm
- Nitrogen dioxide, (NO2): 0 - 1 ppm
- Combination of NO and NO2, (NOX): 12 - 26 ppm

Essential Services

Floor space needed:
2000 mm x 2000 mm of solid, level floor

Electrical supply:
230 VAC, 50 Hz a.c. single-phase 17 A, or

220 VAC, 60 Hz a.c. two-phase

Water supply:
At least 18 litres per minute

Exhaust:
At least 100 mm diameter, direct to atmosphere

Vent:
For oil breather pipe - 19 mm

Operating Conditions

Operating environment:
Dry and well-ventilated engine test laboratories

Storage temperature range:
–25°C to +55°C (when packed for transport)

Operating temperature range:
+5°C to +40°C

Operating relative humidity range:
30% to 95% (non-condensing)

Sound Levels

This equipment emits sound levels greater than 90 dB(A)

TecQuipment recommends that you wear ear defenders when you work with or near to this equipment.

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