

TURBINE GAZ A DEUX ARBRES



PEDAGOGICAL APPLICATIONS

- Study of the operation of a gas turbine with two independent propane shaft lines.
- Measurement of flow, pressure, temperature, angular velocity and torque
- Electrical power measurement.
- Efficiency of the different turbines
- Characteristics of the different components: compressor, generator turbine, combustion chamber, power turbine, electric brake
- Yields
- Security

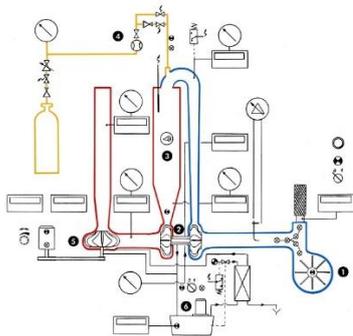
PRINCIPLE OF OPERATION

The TGT1.5K system was developed to allow the study of a two-shaft gas turbine. The fresh air is sucked in by the compressor and sent to the combustion chamber where it will be mixed with the fuel (gas) and ignited. The expansion will drive the generator turbine which is linked to the compressor. The flow of hot gas air is then sent to the working turbine which will generate the mechanical power and drive the electric brake. The assembly is instrumented in order to be able to calculate all the efficiencies and powers of the system. The start of the turbine is automated and assisted by a fan. The machine is completely secured with emergency monitoring and shutdown elements.

The robust design of this equipment makes it perfectly suited for use in schools.

Its anodized aluminum structure on wheels gives it a very high robustness as well as a great flexibility of integration in your premises. The manufacture of this equipment meets the European Machinery Directive

Illustrations



The bench is installed on an aluminium profile structure equipped with four braked-directional castors.

It includes an electrical box with a power disconnecter and a 30mA RCD.

1. Centrifugal fan

- Compression 0.5 to 0.7 bar
- Airflow up to 300m³/h
- Feed filters

2. Turbine generator

- Single-stage centrifugal compressor
 - compression ratio from 1.2 to 3
 - air flow from 100 to 700Kg/h
- Single-stage turbine
 - wedged on the compressor shaft
 - powered by the expansion of gases from the combustion chamber

3. Combustion chamber

- Stainless steel
- Air supply from the compressor
- Propane supply
- Propane air mixture
- Electric arc ignition with high-voltage probes
- Flame detection probe

4. Propane circuit

- Pressure regulator
- Ignition solenoid valve
- Solenoid valve normal run
- Propane flow meter
- Injection nozzle

5. Power turbine

- Powered by the expansion of gases coming from the generating turbine
- Speed reducer
- Servo motor
 - max speed 3750 rpm
 - max power 2 KW

6. Turbine lubrication plant

- Distribution on the two turbine shafts
- Air /oil exchanger for cooling

7. Measurements

- 7 temperature measurements
- 6 pressure measurements
- 2 flow measurements
- 2 turbine rotational speed measurements
- 1 power measurement produced

8. Manual settings

- Propane pressure
- Propane flow
- Turbine speed power

9. Security

- Combustion chamber temperature
- Lubricating oil temperature
- Lubricating oil pressure
- Air pressure inlet combustion chamber
- Turbine cooling circuit water pressure
- Flame detection
- Servo motor
- Variable speed drive defect

Measurements

All measurements are displayed on a 15-inch touch screen. Different display modes:
-on synoptic diagram
-in a table

7 temperature measurements:
-aspirated air
-air after compressor
-air after combustion (turbine inlet N°1)
-air turbine outlet N°1
-air outlet turbine N°2
-Turbine lubricating oil
-fuel (propane)

2 flow measurements:
-fuel flow rate (propane)
- volumetric flow aspirated air

1 power measurement:
- power produced on the output turbine shaft (via the servo motor drive)

7 pressure measurements
-aspirated air
-air after compressor
-air after combustion (turbine inlet N°1)
-air turbine outlet N°1
-air outlet turbine N°2
-Turbine lubricating oil
-fuel (propane)

2 turbine rotational speed measurements
-turbine speed N°1
-turbine speed N°2

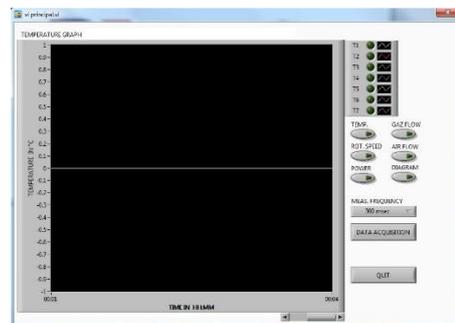
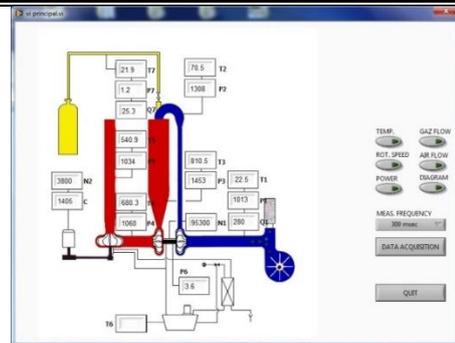
The bench is supplied with a complete data acquisition system including the following features:

- Display of all measured values on the machine (pressure, flow rate, temperature, power)
- plotting the evolution of each piece of data on a real-time graph as a function of time
- plotting the transformation on an entropic diagram
- Saving data to an Excel file.

The acquisition modules are integrated into the machine's electrical box. The connection between a PC and the machine is via WIFI or via a supplied Ethernet cable.

The software provided is intended to run on the latest version of Windows and is free of any license.

The software is developed under the LabVIEW industrial computing interface.



Installation Specifications

- Power supply: 400 Vac – 50 Hz – 20 A
- Type of power supply: 3 phase(s) + Neutral + Earth.
- Water supply: 10 L/min – 2 bar
- Water evacuation: at ground level
- Smoke Evacuation: Diameter 200mm
- Fuel Supply: Propane
- Dimensions: (WxWxH mm): 2700 x 850 x 200027008502000
- Weight (Kg): 780780

Note: As part of an installation of the equipment by our services, all connections to the networks must be less than 2m from the machine

Documentation

- Instruction manual
- Pedagogical manual
- Documentation technique
- Practical work
- Electrical diagram
- Fluidic diagram
- License-free data acquisition software
- CE Certificate of Conformity