84.11 - Turbo-jets, turbo-propellers and other gas turbines (+).

- Turbo-jets :

8411.11 - - Of a thrust not exceeding 25 kN

8411.12 - - Of a thrust exceeding 25 kN

- Turbo-propellers :

8411.21 - - Of a power not exceeding 1,100 kW

8411.22 - - Of a power exceeding 1,100 kW

- Other gas turbines :

8411.81 - - Of a power not exceeding 5,000 kW

8411.82 - - Of a power exceeding 5,000 kW

- Parts :

8411.91 - - Of turbo-jets or turbo-propellers

8411.99 - - Other

This heading covers **turbo-jets, turbo-propellers** and **other gas turbines**.

The turbines of this heading are, in general, internal combustion engines which do not usually require any external source of heat as does, for example, a steam turbine.

(A) TURBO-JETS

A turbo-jet consists of a compressor, a combustion system, a turbine and a nozzle, which is a convergent duct placed in the exhaust pipe. The hot pressurised gas exiting from the turbine is converted to a high velocity gas stream by the nozzle. The reaction of this gas stream acting on the engine provides the motive force which may be used to power aircraft. In its simplest form the compressor and turbine are accommodated on a single shaft. In more complex designs the compressor is made in two parts (a two spool compressor) in which the spool of each part is driven by its own turbine through concentric shafting. Another variation is to add a ducted fan usually at the inlet to the compressor and drive this either by a third turbine or connect it to the first compressor spool. The fan acts in the nature of a ducted propeller, most of its output bypassing the compressor and turbine and joining the exhaust jet to provide extra thrust. This version is sometimes called a "bypass fan jet".

So-called "after-burning" appliances are auxiliary units for mounting in series with certain turbo-jet engines in order to boost their power output for short periods. These appliances have their own fuel supply and utilise the excess oxygen in the gases issuing from the turbo-jet.

(B) TURBO-PROPELLERS

Such engines are similar to turbo-jets, but have a further turbine downstream of the compressor turbine, which is coupled to a conventional propeller such as is used on piston engined aircraft. This latter turbine is sometimes referred to as a "free turbine", meaning that it is not mechanically coupled to the compressor and compressor turbine shaft. Thus most of the hot pressurised gas leaving the compressor turbine is converted into shaft power by the free turbine instead of being expanded in a nozzle as is the case in turbo-jets. In some cases, the gases leaving the free turbine may be expanded in a nozzle to provide auxiliary jet power and assist the propeller.

(C) OTHER GAS TURBINES

This group includes industrial gas-turbine units which are either specifically designed for industrial use or adapt turbo-jets or turbo-propeller units for uses other than providing motive power for aircraft.

There are two types of cycles :

(1) The simple cycle, in which air is ingested and compressed by the compressor, heated in the combustion system and passed through the turbine, finally exhausting to the atmosphere.

(2) The regenerative cycle, in which air is ingested, compressed and passed through the air pipes of a regenerator. The air is pre-heated by the turbine exhaust and is then passed to the combustion system where it is further heated by the addition of fuel. The air/gas mixture passes through the turbine and is exhausted through the hot gas side of the regenerator and finally to the atmosphere.

There are two types of designs :

(a) The single-shaft gas turbine unit, in which the compressor and turbine are built on a single shaft, the turbine providing power to rotate the compressor and to drive rotating machinery through a coupling. This type of drive is most effective for constant speed applications such as electrical power generation.

(b) The two-shaft gas turbine unit, in which the compressor, combustion system and compressor turbine are accommodated in one unit generally called a gas generator, whilst a second turbine on a separate shaft receives the heated and pressurised gas from the exhaust of the gas generator. This second turbine known as the power turbine is coupled to a driven unit, such as a compressor or pump. Two-shaft gas turbines are normally applied where load demand variations require a range of power and rotational speed from the gas turbine.

These gas turbines are used for marine craft and locomotives, for electrical power generation, and for mechanical drives in the oil and gas, pipeline and petrochemical industries.

This group also includes other gas turbines without a combustion chamber, comprising simply a stator and rotor and which use energy from gases provided by other machines or appliances (e.g., gas generators, diesel engines, free-piston generators) and compressed air or other compressed gas turbines.

PARTS

Subject to the general provisions regarding the classification of parts (see the General Explanatory Note to Section XVI), parts of the engines and motors of this heading are also classified here (e.g., gas turbine rotors, combustion chambers and vents for jet engines, parts of turbo-jet engines (stator rings, with or without blades, rotor discs or wheels, with or without fins, blades and fins), fuel feed regulators, fuel nozzles).

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Subheading Explanatory Note.

Subheadings 8411.11 and 8411.12

Thrust is to be taken to mean the product of the exhaust mass flow per second and the difference between the exhaust velocity and the air inlet velocity.