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Opinion Article

Improved Efficiency of a Gas Turbine

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DESCRIPTION

A gas turbine is a type of power plant that uses an internal combustion engine to convert natural gas or other liquid fuels into mechanical energy. This energy then powers a generator, which creates electrical energy that is carried through power lines to homes and businesses. A gaseous working fluid is used for this. The mechanical power generated can be used by industrial devices. In a gas turbine, the working fluid flows continuously. Electricity generating gas turbines are those that produce shaft power. A gas turbine is a rotary engine that uses a flow of combustion gases to generate energy. Ambient air is taken into the engine intake, where it is increased in pressure and temperature by an axial or centrifugal compressor (or both) before being fed into the combustion chamber.

Turbine efficiency is defined as the ratio of the turbine's actual work output to the net input energy in the form of fuel. Without a heat recovery system, the efficiency of stand-alone gas turbines can be as low as 35%-40%. This is due to the rotor's blade efficiency, leakage through clearance areas, friction, irreversible turbulence, and other factors. Due to the high temperature of the gas turbine exhaust gas, a heat recovery steam generator can be used to recover energy from the hot gas and use the steam for process. In more operational gas turbines, intake air cooling is considered as an independent process. This method is applicable without any change or modification of main components of the gas turbine.

However Installation of gas turbine equipment is almost independent and are separated from main components of gas turbine cycle, all of these inlet air cooling methods are applicable during designing and installation of a turbine. Power enhancement and efficiency improvement of gas turbine is mainly divided into three general categories:

- Inlet air cooling as a way of increasing power.
- Using outlet hot gas as a means of increasing efficiency and power.
- Energy-saving techniques.

METHODS FOR IMPROVING THERMAL EFFICIENCY OF GAS TURBINE

Reducing the amount of fuel required

The working fluid is preheated using turbine exhaust gases, which reduces the amount of heat delivered. As a result, the amount of fuel given to the combustion chamber is reduced. As a result, the thermal efficiency can be obtained.

Reducing compression work needed

This method is known as “Inter-cooling”. In this method two to three staged inter-cooling are used by employing multi stages compression with inter-cooling between compression processes we can make it approach isothermal compression.

ADVANTAGES

These gas turbines has very high power-to-weight ratio, compared to reciprocating engines, it is smaller than reciprocating engines of the same power rating; it moves in single direction with less vibration than reciprocating engines. These turbines are designed with less number of parts than reciprocating engines. Gas turbine has low operating pressures, lubricating oil cost and consumption, low and lubricating oil cost, consumption, and these turbines are operated with high speed.

DISADVANTAGES

Because of the materials are stronger and more heat resistant, and machining techniques are more complex, gas turbines are substantially more expensive than reciprocating engines of comparable size; delayed response to changes in power settings.

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