Turboexpander wikipedia

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A hydrogen turboexpander-generator or generator-loaded expander for hydrogen gas is an axial flow turbine or radial expander for energy recovery through which a high pressure hydrogen gas is expanded to produce work used to drive an electrical generator. It replaces the control valve or regulator where the pressure drops to the appropriate pressure for the low-pressure network. A turboexpander generator can help recover energy losses and offset electrical requirements and CO2 emissions.

Per stage, 200 bar is handled with up to 15,000 kW power and a maximum expansion ratio of 14, the generator loaded expander for hydrogen gas is fitted with an automatic thrust balance, a dry gas seal, and a programmable logic control with remote monitoring and diagnostics.[1]

Hydrogen turboexpander-generators are used for hydrogen pipeline transport in combination with hydrogen compressors and energy recovery in underground hydrogen storage. A variation is the compressor loaded turboexpanders which are used in the liquefaction of gases such as liquid hydrogen.[2]

Turbomachinery, in mechanical engineering, describes machines that transfer energy between a rotor and a fluid, including both turbines and compressors. While a turbine transfers energy from a fluid to a rotor, a compressor transfers energy from a rotor to a fluid.[1][2] It is an important application of fluid mechanics.[3]

These two types of machines are governed by the same basic relationships including Newton"s second Law of Motion and Euler"s pump and turbine equation for compressible fluids. Centrifugal pumps are also turbomachines that transfer energy from a rotor to a fluid, usually a liquid, while turbines and compressors usually work with a gas.[1]

In general, the two kinds of turbomachines encountered in practice are open and closed turbomachines. Open machines such as propellers, windmills, and unshrouded fans act on an infinite extent of fluid, whereas closed machines operate on a finite quantity of fluid as it passes through a housing or casing.[2]

Turbomachines are also categorized according to the type of flow. When the flow is parallel to the axis of rotation, they are called axial flow machines, and when flow is perpendicular to the axis of rotation, they are referred to as radial (or centrifugal) flow machines. There is also a third category, called mixed flow machines, where both radial and axial flow velocity components are present.[2]

Turbomachines may be further classified into two additional categories: those that absorb energy to increase the fluid pressure, i.e. pumps, fans, and compressors, and those that produce energy such as turbines by expanding flow to lower pressures. Of particular interest are applications which contain pumps, fans, compressors and turbines. These components are essential in almost all mechanical equipment systems, such

as power and refrigeration cycles.[2][5]

Any device that extracts energy from or imparts energy to a continuously moving stream of fluid can be called a turbomachine. Elaborating, a turbomachine is a power or heat generating machine which employs the dynamic action of a rotating element, the rotor; the action of the rotor changes the energy level of the continuously flowing fluid through the machine. Turbines, compressors and fans are all members of this family of machines.[6]

In contrast to positive displacement machines (particularly of the reciprocating type which are low speed machines based on the mechanical and volumetric efficiency considerations), the majority of turbomachines run at comparatively higher speeds without any mechanical problems and volumetric efficiency close to one hundred percent.[7]

Turbomachines can be categorized on the basis of the direction of energy conversion:[1][2]

Turbomachines can be categorized on the basis of the nature of the flow path through the passage of the rotor:[8]