

9(a). Explain the principle of MHD power generation with neat sketch.

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MHD (Magneto Hydrodynamic) power generation is a method of generating electricity by utilizing the principles of magnetohydrodynamics, which involves the interaction between electrically conducting fluids and magnetic fields. Although I cannot provide a sketch directly, I can describe the principle of MHD power generation to you.

The basic principle of MHD power generation can be explained as follows:

1. Working Fluid: The process begins with the selection of a suitable working fluid, typically a high-temperature ionized gas or plasma. This gas is used as a conductor to generate electric power.
2. Combustion Chamber: The working fluid is heated and ionized by combustion. Fuel, such as coal or natural gas, is burned in a combustion chamber, producing high-temperature gases. The heat generated in this process increases the temperature of the gas, causing ionization and the creation of a plasma.
3. Magnetic Field: A strong magnetic field is applied across the path of the ionized gas. The magnetic field is usually generated by powerful magnets positioned around the flow channel of the working fluid.
4. Electrodes: Electrodes are placed at the entry and exit points of the flow channel to capture the electric current generated by the moving

ionized gas.

5. Lorentz Force: As the ionized gas flows through the magnetic field, it experiences a force called the Lorentz force. The Lorentz force is perpendicular to both the direction of the gas flow and the applied magnetic field. This force is created due to the interaction between the moving charged particles in the gas and the magnetic field.

6. Electric Current Generation: The Lorentz force acts as a driving force for the ionized gas and causes it to move perpendicular to the magnetic field lines. This movement of the gas generates an electric current in the direction perpendicular to both the gas flow and the magnetic field. The electrodes capture this electric current and direct it to an external circuit.

7. Power Extraction: The electric current generated in the MHD process is extracted from the system and utilized to produce electricity. It can be connected to a load or grid for power distribution.

The advantage of MHD power generation is that it can potentially achieve high efficiency since there are no mechanical parts involved in the energy conversion process. However, there are technical challenges in maintaining stable and efficient plasma flow, managing the heat and erosion effects on the walls of the channel, and dealing with the complex physics involved in the MHD process.

