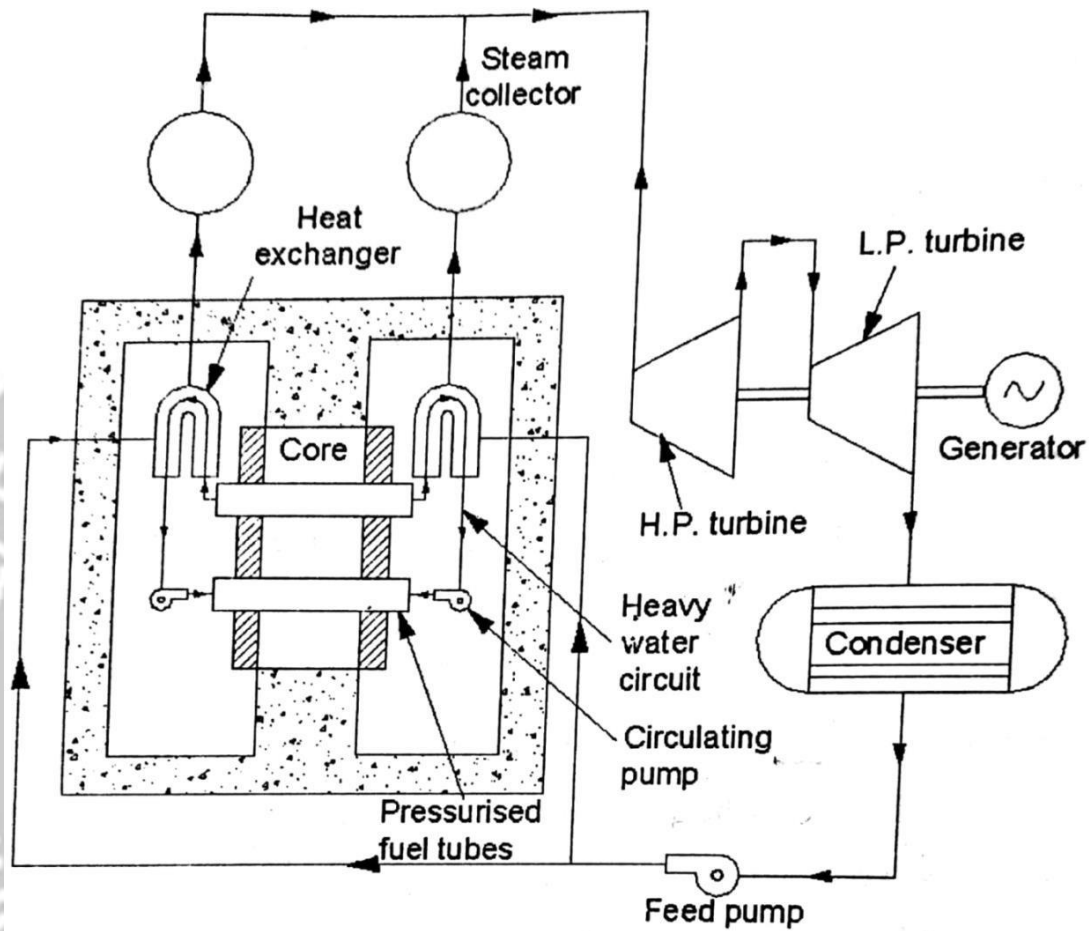


ME8792-POWER PLANT ENGINEERING
UNIT III-NUCLEAR POWER PLANTS
3.3-CANADA DEUTERIUM-URANIUM REACTOR (CANDU)

CANDU REACTOR

CANDU is a thermal nuclear power reactor in which heavy water (99.8% deuterium oxide D₂O) is the moderator and coolant as well as the neutron reflector. This reactor was developed in Canada and is being extensively used in that country. A few CANDU reactors are operating or under construction in some other countries as well.

In this type of reactor the natural uranium (0.7% U⁽²³⁵⁾) is used as fuel and heavy water as moderator. These reactors are more economical to those countries which do not produce enriched uranium as the enrichment of uranium is very costly.



CANDU reactor

CANDU (heavy water) reactor, differs basically from light-water reactors (LWRs) in that in the latter the same water serves on both moderator and coolant, whereas in the CANDU reactor the moderator and coolant are kept separate. Consequently unlike the pressure vessel of a LWR, the CANDU reactor vessel, which contains the relatively cool heavy water moderator, does not have to WITHSTAND a high pressure. Only the heavy water coolant circuit has to be pressurized to inhibit boiling reactor core.

There are two coolant outlet (and two inlet) headers, one at each end of the reactor vessel, corresponding to the opposite directions of coolant flow through the core. Each

inlet (and outlet) header is connected to a separate steam generator and pump loop. A single pressuriser (of the type in pressurised water reactors) maintains an essentially

constant coolant system pressure. The reactor vessel and the steam generator system are enclosed by a concrete containment structure. A water spray in the containment would condense the steam and reduce the pressure that would result from a large break in the coolant circuit.

Advantages of CANDU reactor

1. Heavy water is used as moderator, which has higher multiplication factor and low fuel consumption.
2. Enriched fuel is not required.
3. The cost of the vessel is less as it has not to withstand a high pressure.
4. Less time is needed (as compared to PWR and BWR) to construct the reactor.
5. The moderator can be kept at low temperature which increases its effectiveness in slowing down neutrons.

Disadvantages of CANDU reactor

1. It requires a very high standard of design, manufacture and maintenance
2. The cost of heavy water is very high.
3. There are leakage problems.
4. The size of the reactor is extremely large as power density is low as compared with PWR and BWR.

BREEDER

Breeder reactors could, in principle, extract almost all of the energy contained in uranium or thorium, decreasing fuel requirements by a factor of 100 compared to widely used once-through light water reactors, which extract less than 1% of the energy in the uranium mined from the earth. The high fuel-efficiency of breeder reactors could greatly reduce concerns about fuel supply or energy used in mining.