

## Reactor, Boiler &amp; Auxiliaries - Course 233

## HEAT TRANSPORT MAINTENANCE COOLING SYSTEM

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## I. PURPOSE OF SYSTEM

This system is used only in stations which utilize a preheater shutdown cooling system (Bruce A and B). It is used when the HT system is in the depressurized state, to remove decay heat from the fuel and maintain a HT temperature of  $\sim 60^{\circ}\text{C}$ , indefinitely. (Shutdown cooling will have already been used to cool the HT  $\text{D}_2\text{O}$  down to  $\sim 60^{\circ}\text{C}$  before maintenance cooling is valved into service.)

The heat removal capacity of the system is typically  $\sim 1\%$  of full power, corresponding to decay heat a few hours after shutdown. Use of this system allows the HT main pumps to be shutdown and the HT system to be depressurized and drained to header level from primary pump on boiler maintenance. Recall that as long as the preheater shutdown cooling system is still in service, the main HT pumps will still be operating and the HT  $\text{D}_2\text{O}$  will therefore still be pressurized.

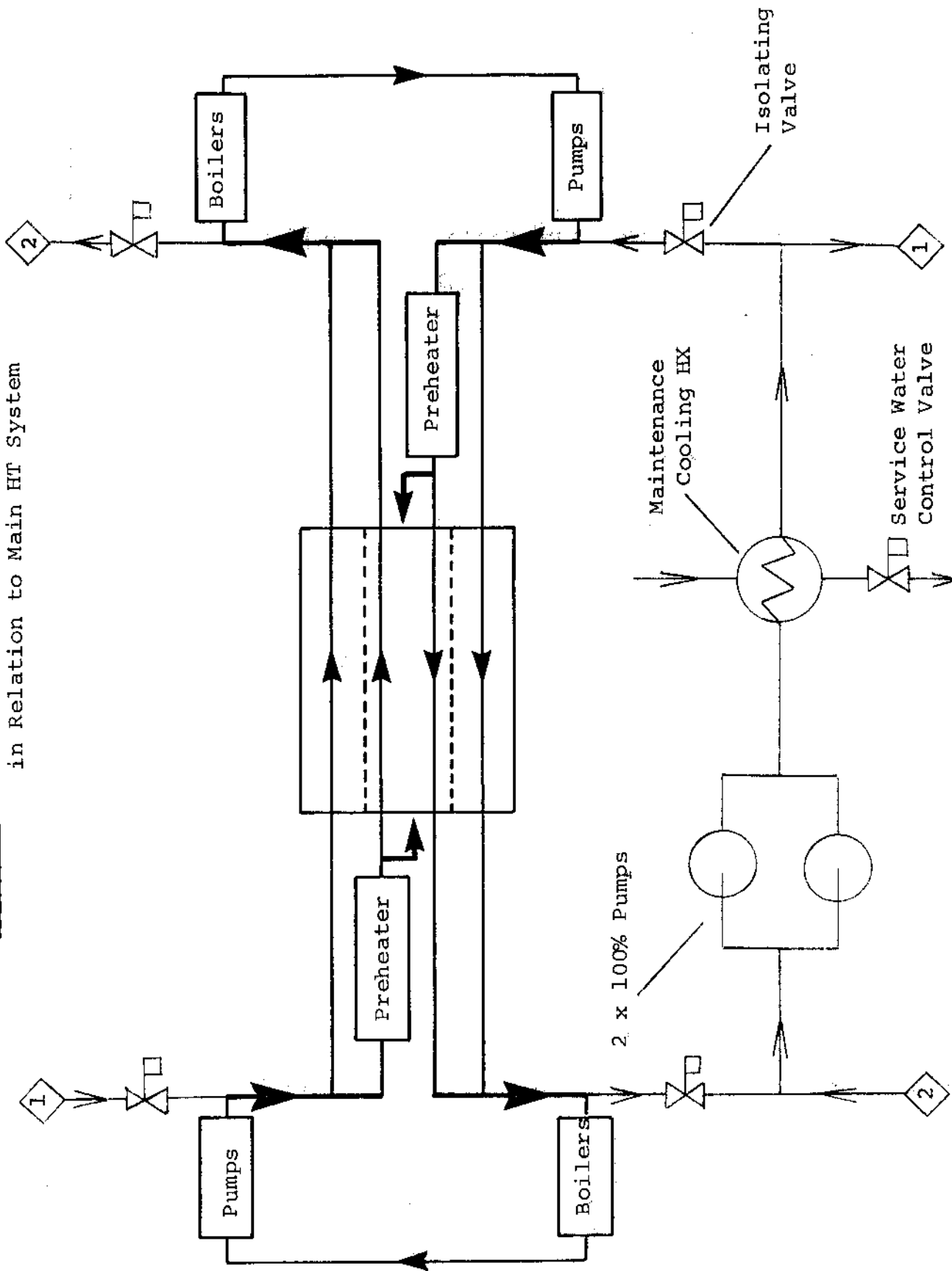
However in case the preheater shutdown cooling system is not available to cool down the HT  $\text{D}_2\text{O}$  to  $\sim 60^{\circ}\text{C}$ , then the maintenance cooling system is designed to be able to cool the HT system from  $\sim 170^{\circ}\text{C}$  and pressurized down to  $\sim 60^{\circ}\text{C}$  and depressurized.

## II. SYSTEM DESCRIPTION

A typical system layout is shown in Figure 1. Note that it is essentially identical to the direct (bypass) shutdown cooling system described in section 30-5. Only a single maintenance cooling loop is used, however, whereas the direct shutdown cooling system employed a separate loop for each bank of main pumps and boilers, see Figure 1, 30-5. To allow for boiler and main pump maintenance, which requires draining HT  $\text{D}_2\text{O}$  to header level, the entire system is below header level

The heat sink for the system is service water, supplied to the maintenance cooling heat exchanger. HT  $\text{D}_2\text{O}$  temperature control is via a control valve on the service water side of the heat exchanger, as shown in Figure 1.

Figure 1 Maintenance Cooling System in Relation to Main HT System



During normal operation, the system is isolated from the main HT system, and is filled with nitrogen gas to minimize corrosion. Prior to use, the system is filled with HT D<sub>2</sub>O, usually from central storage. Adequate venting of the system must be provided, typically to the HT D<sub>2</sub>O collection system whose leakoff flow gauges will indicate when the system is full.

ASSIGNMENT

1. State why this system is required in addition to the preheater shutdown cooling system on the Bruce reactors.
2. Check with the Bruce station operating manuals to see whether maintenance cooling can be used for a crash cooldown from the hot ~250°C pressurized state.

D.J. Winfield