



General Plant Description

Chapter 1.0
B&W Cross-Training Course
R-326C

OBJECTIVES

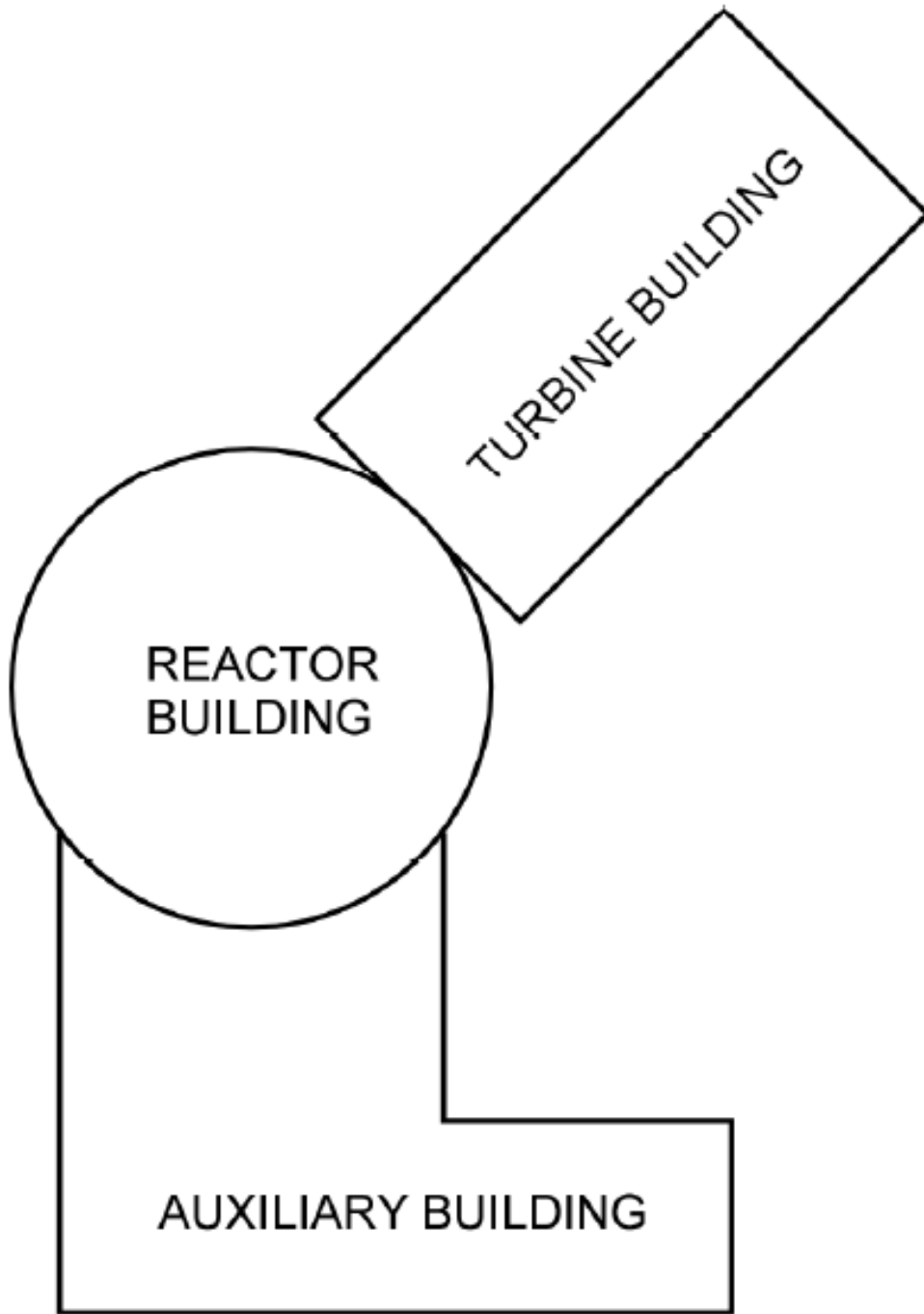
1. Identify the major components included in the primary and secondary cycles.
2. Describe what is meant by the integrated control system.
3. Describe how reactor coolant temperature and secondary system pressure change with load.

General Description

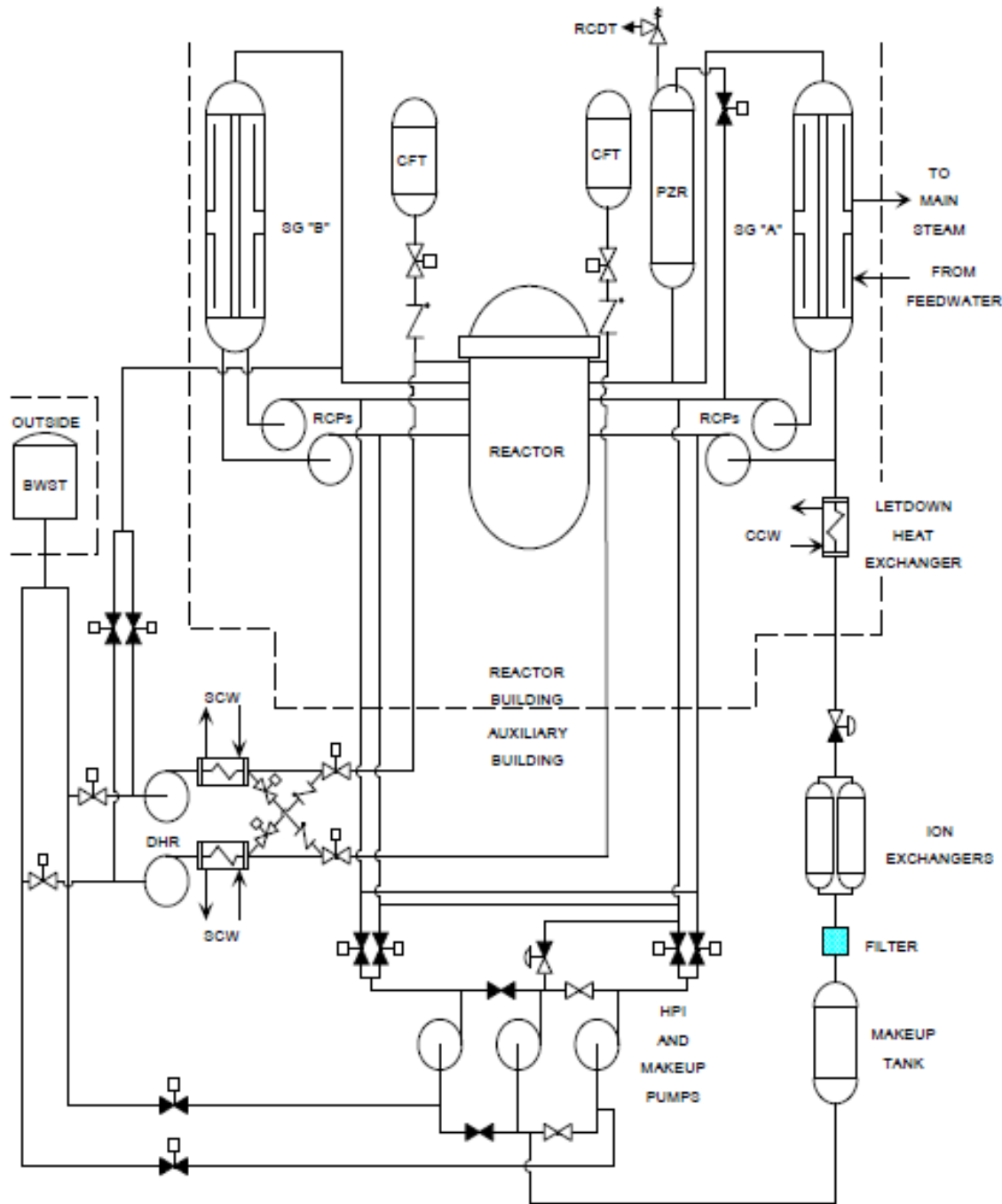
- Light-water PWR, dual-cycle plant.
- Dual cycle keeps potentially radioactive coolant separate from the main turbine, condenser, and other secondary plant components.
- Babcock & Wilcox reactors:
 - ANO U-1
 - Crystal River U-3
 - Oconee 1, 2 & 3
 - TMI U-1
 - Davis-Besse

Primary Cycle ⁽¹⁾

- Reactor, Two loops, Pressurizer (PZR).
 - Operating plants have 177 fuel assemblies.
 - TTC U-3 (i.e., WNP-1) is 205 FA plant.
 - Bellefonte is a 205 FA plant.
- Each loop consists of one hot leg, one OTSG, two cold legs, & two RCPs (1 per cold leg).
 - Operating plants are either raised loop or lowered loop.



Partial Layout
Fig. 1-1



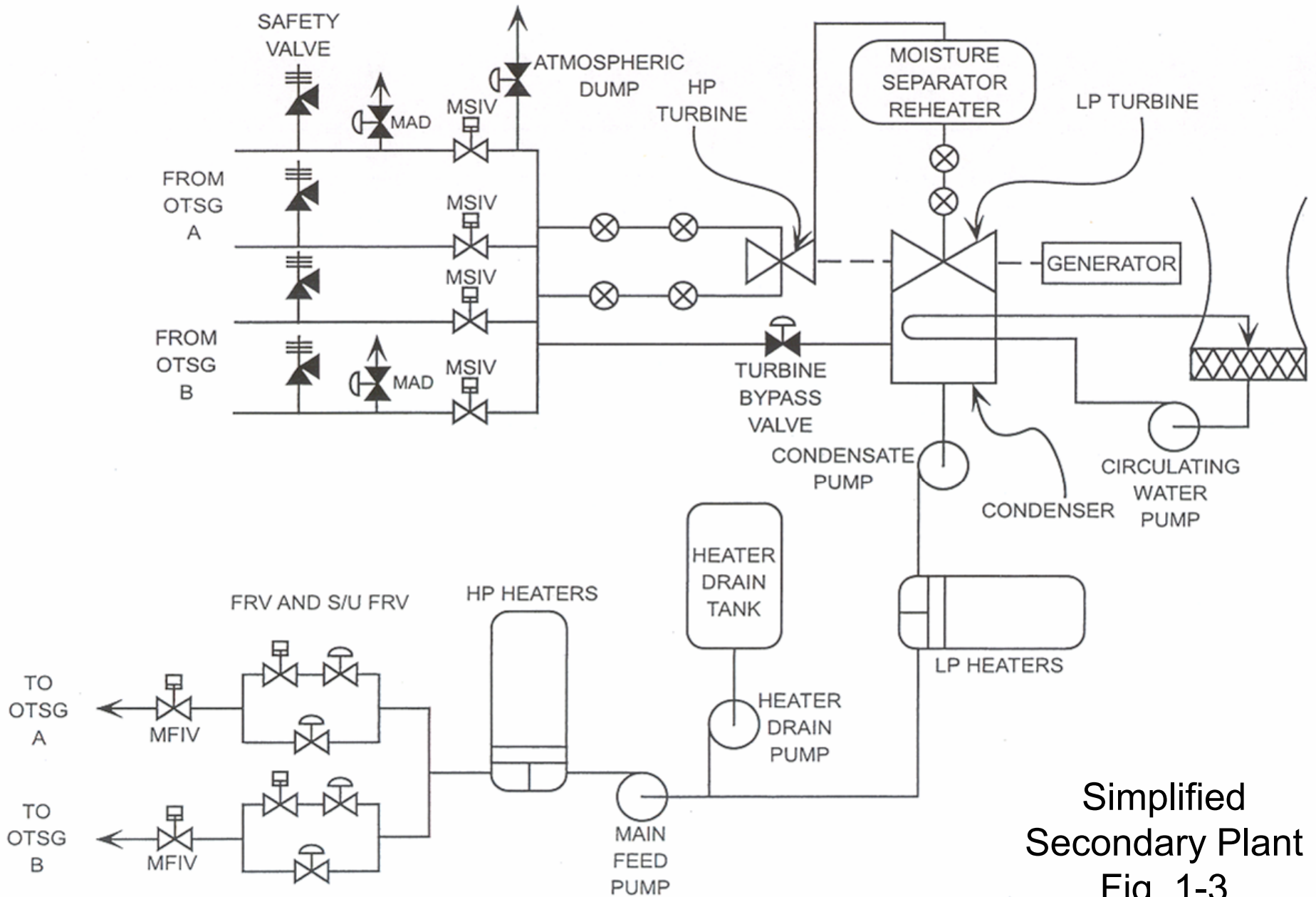
Simplified Plant
Composite Flow
Diagram
Fig. 1-2

Primary Cycle ⁽²⁾

- Once Through Steam Generator (OTSG)
 - Hot RCS leaves vessel and enters top of OTSG.
 - Energy inside tubes transferred to secondary coolant to produce steam.
 - Flow splits into two cold legs at bottom of OTSG.
 - One RCP per cold leg returns coolant to vessel.

Secondary Cycle

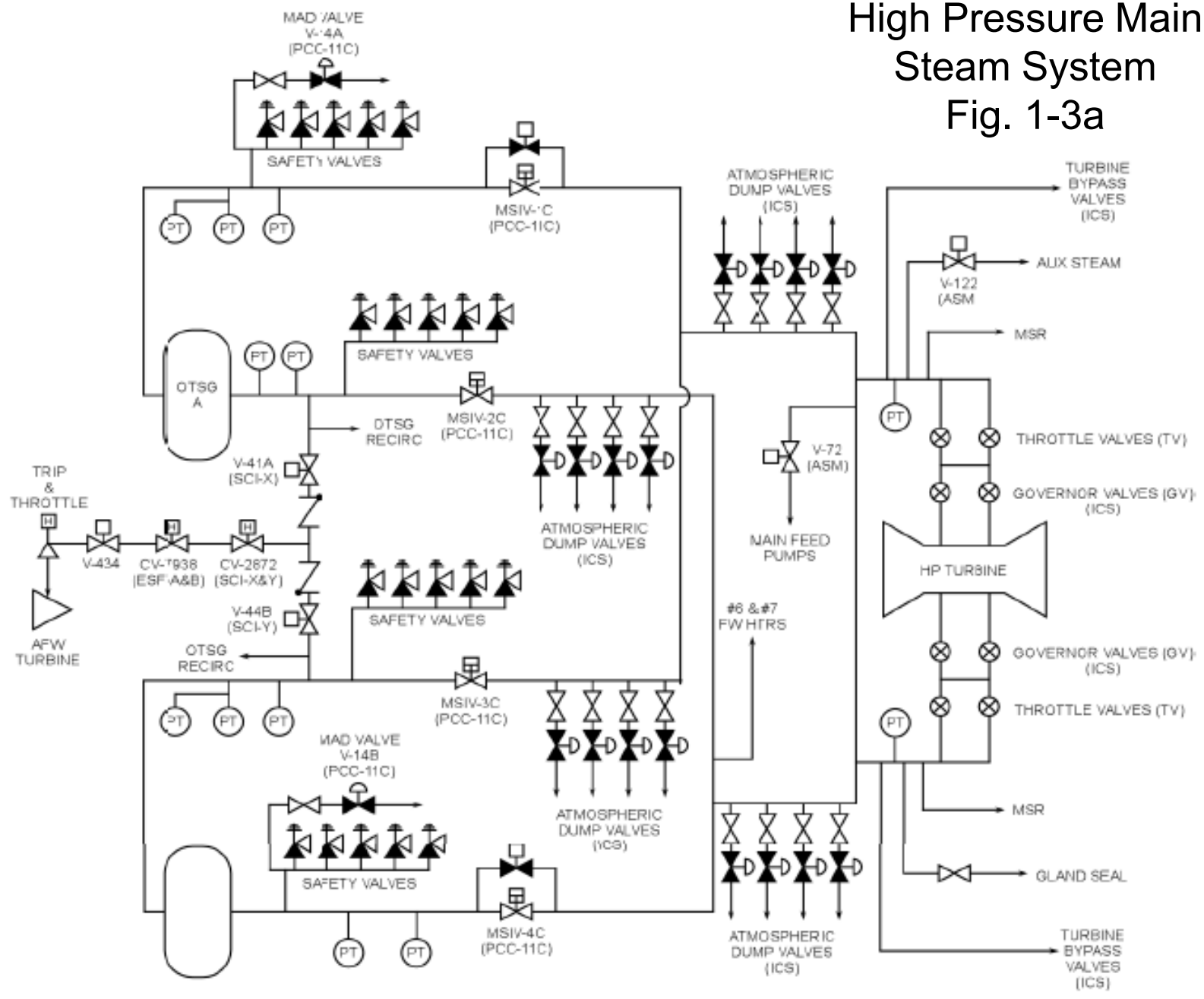
- Steam cycle basically the same as any PWR.
- Feedwater is boiled & superheated as it picks up heat from RCS in OTSG.
- OTSG does not have moisture separators because steam is superheated.
- Steam flow is not measured.
- AFW (or EFW) has separate penetration.

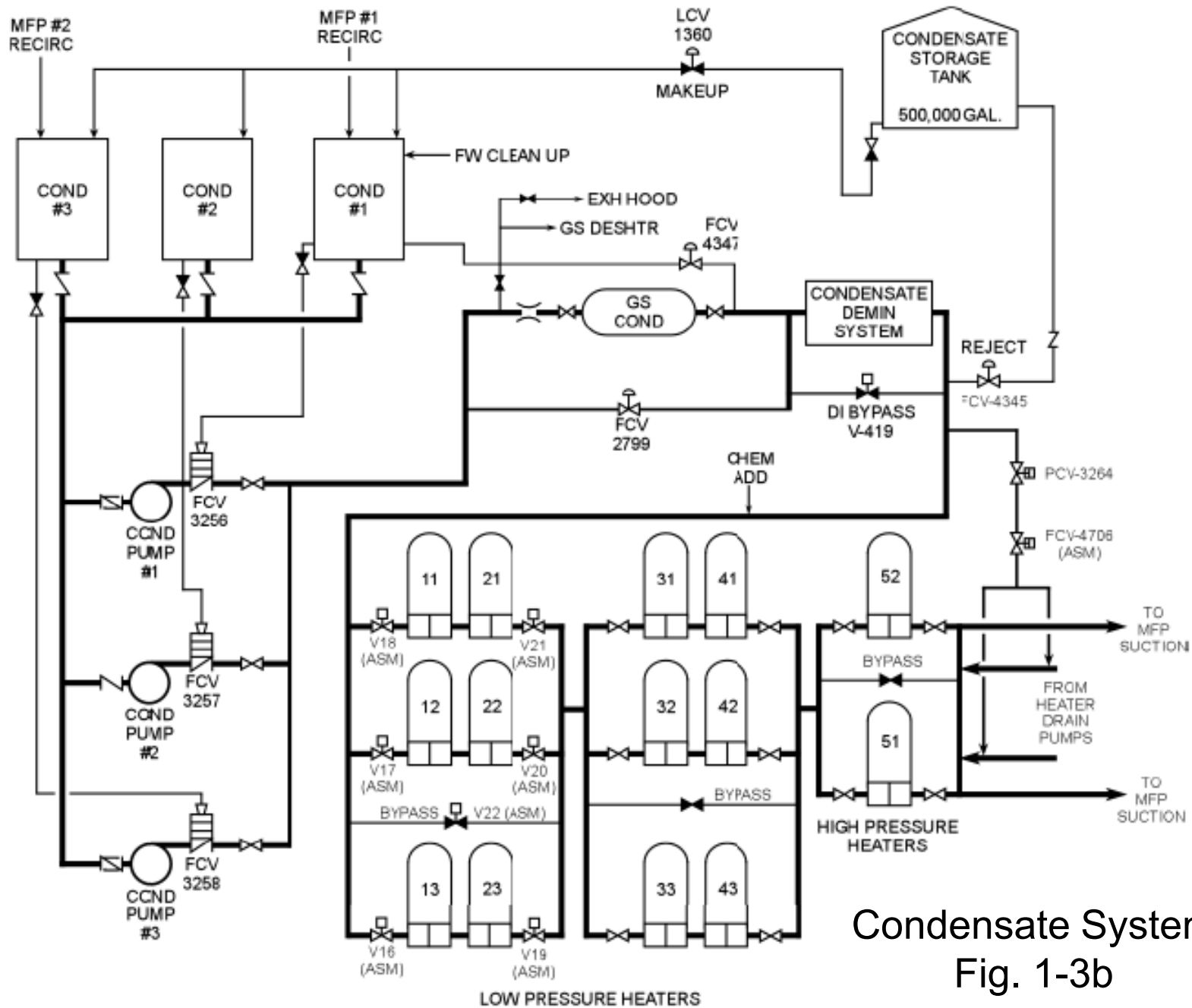


Simplified
Secondary Plant
Fig. 1-3

High Pressure Main Steam System

Fig. 1-3a

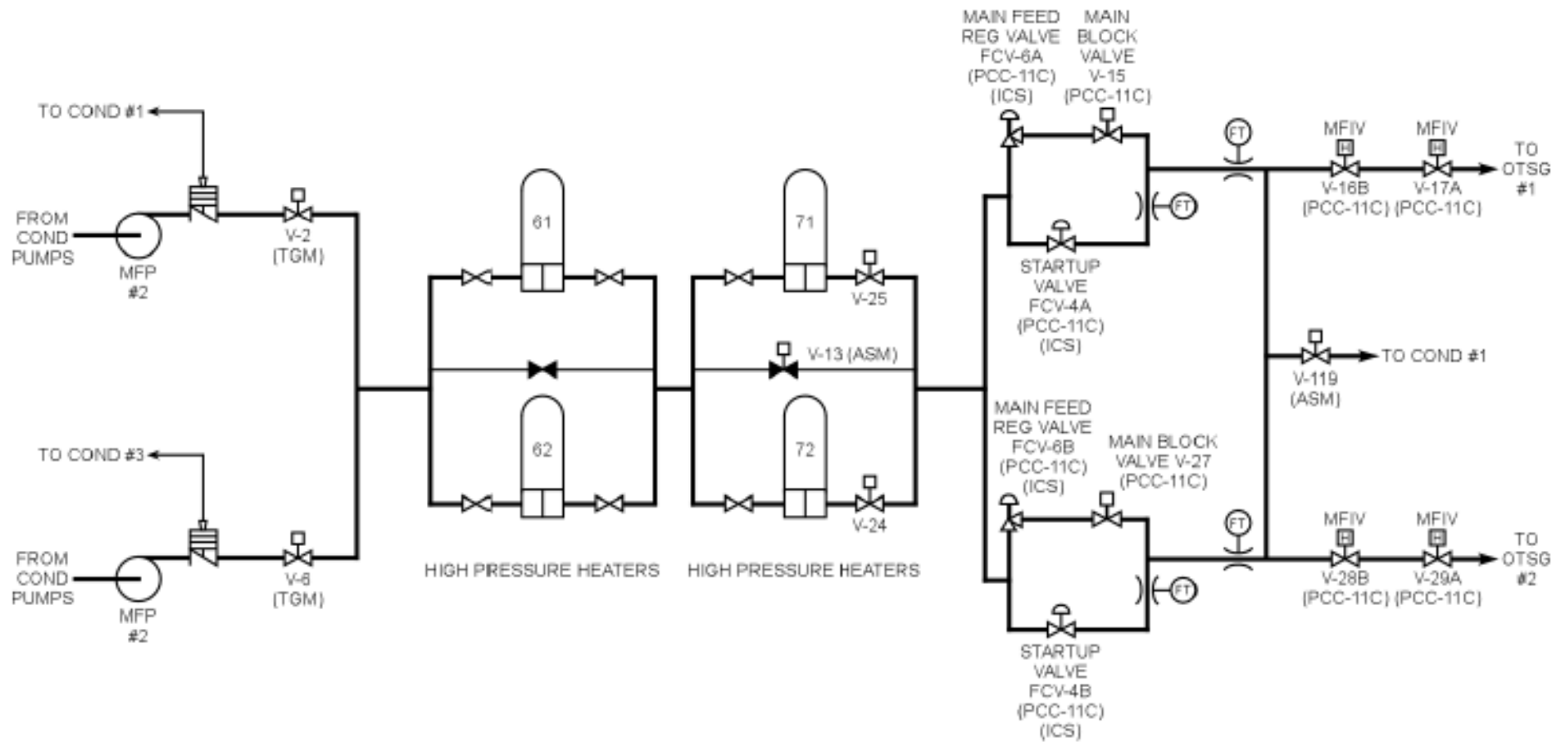




Condensate System
Fig. 1-3b

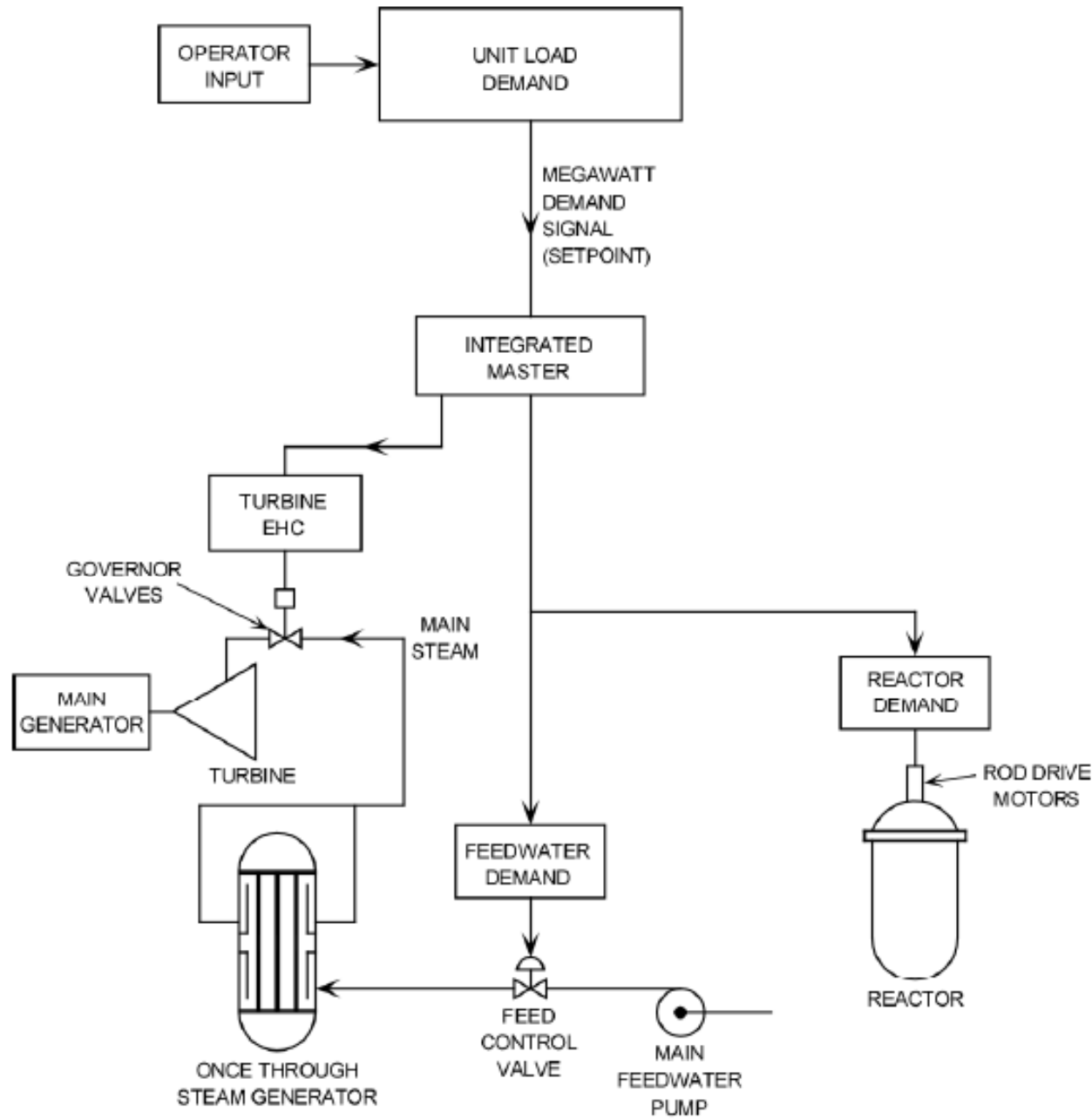
Feedwater System

Fig. 1-3c



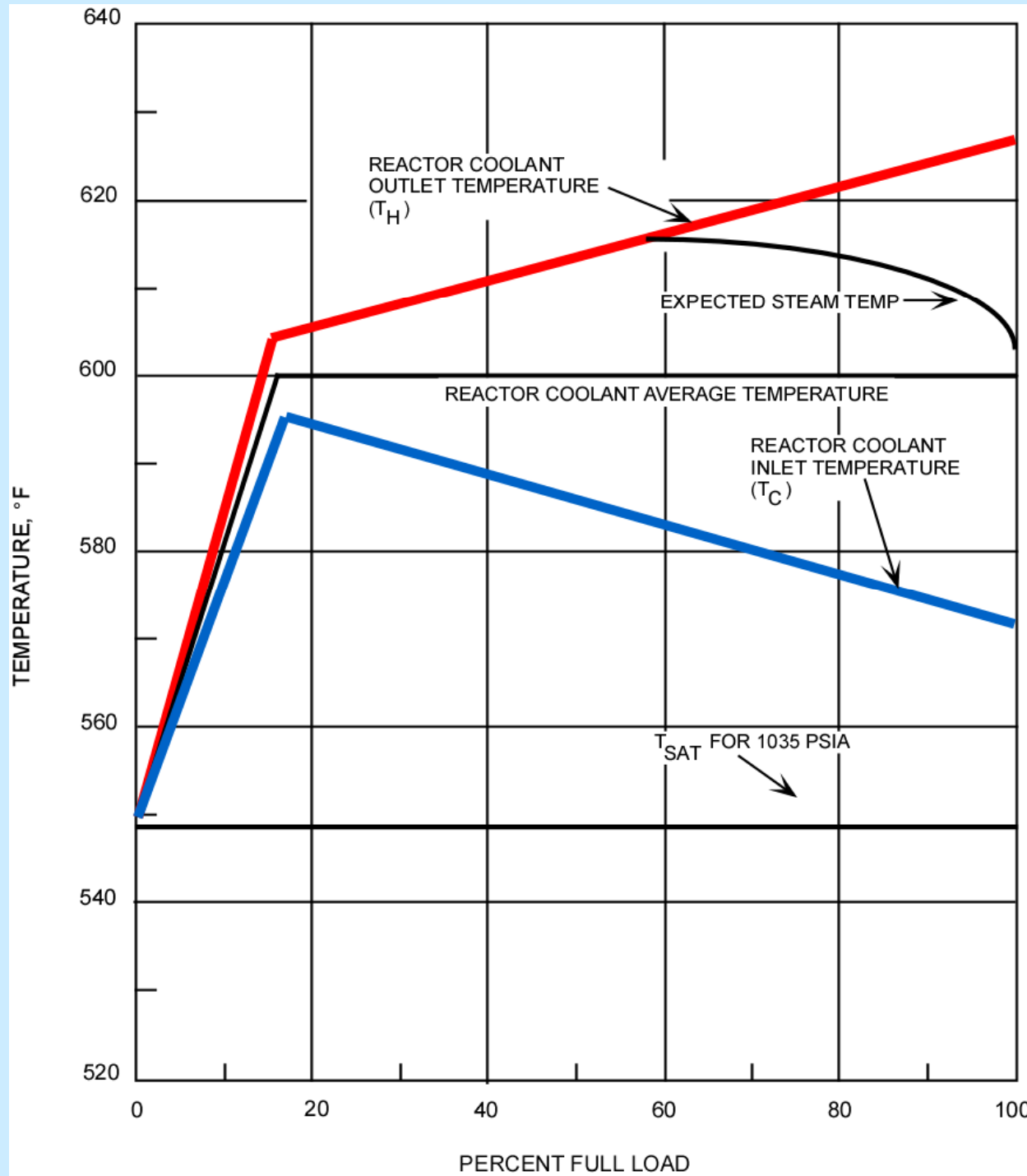
Tave and Steam Pressure Control

- Constant Tave 15% - 100% (601° F) [205 FA] maintained by the Integrated Control System (ICS).
 - 0% - 15% Tave is operator controlled (551 – 601)
 - 177 FA plants:
 - 15% - 100% (Tave = 579° F) (DB - 582° F)
 - 0% - 15% (Tave is 532 - 579° F) (DB – 532-582° F)
- Constant steam header pressure.
 - 1035 psia (205 FA) (~900 psia – 177 FA)
 - Maintained constant by ICS.



Basic Integrated Control System
Fig. 1-4

Reactor Coolant
and Steam
Temperature vs.
Load
Fig. 1-5



Integrated Control System (ICS)

- Provides simultaneous control of:
 - Turbine load (MWe)
 - Turbine bypass valves & atmospheric dump valves.
 - Feedwater control valves
 - MFP speed
 - Control rod position
- Allows plant to automatically maneuver from 15% - 100%.
 - Up to 5% per min.

ICS

- Basic function is to match generated MWe w/ demanded MWe.
- Ensures that heat generation & heat removal are matched with appropriate parameter values.
- Many “adjusting” features:
 - RCS can be operated with unequal loop flows.
 - OTSGs do not have moisture separation equipment and must superheat steam sufficiently.