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American National Standard (ANSI)

IEEE Std 805-™ 1984 (Withdrawn 2006)

IEEE Recommended Practice for System Identification in Nuclear Power Plants and Related Facilities

Sponsor

Power Generation Committee
of the
IEEE Power Engineering Society

Withdrawn 3 February 2006

IEEE-SA Standards Board

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Foreword

(This Foreword is not a part of IEEE Std 805-1984, IEEE Recommended Practice for System Identification in Nuclear Power Plants and Related Facilities.)

In April 1979, the Working Group on Unique Identification in Power Plants of the Station Design Subcommittee was formed and charged with the task of producing a series of recommended practices for unique identification in power plants. Later, realizing that this concept provided the same benefits to other types of facilities, the title was extended to include *and related facilities*.

This series of recommended practices, entitled the Energy Industry Identification Systems (ELIS), provides a single source of unique identification of systems, structures, and components for all types of power generation and related facilities with provision for the inclusion of currently established plant system identifier codes. Using this series of recommended practices, which includes principles, a table of component function identifier codes, implementation instructions, and system descriptions for the various types of power plants and related facilities, a user can correlate a system, structure, or component with another organization for purposes of reporting, comparison, or general communication. Numerous economic, safety, and convenience benefits can be derived from this concept. IEEE Std 805 deals with system descriptions and system codes for nuclear power plant systems.

The purpose of this working group was to generate an industry-wide language of communication which users could employ at the interface of their organizations and which would not require them to change a viable identification concept which they were using internally. In the event that the users do not have a viable identification concept of their own, they may choose to employ this concept for their internal applications since it has been successfully applied by several utilities and architect/engineering firms.

If conflicts with other standards are discovered, they will be handled in a revision.

This recommended practice was prepared by the Working Group for Unique Identification in Power Plants and Related Facilities, Station Design Subcommittee of the Power Generation Committee.

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IEEE Recommended Practice for System Identification in Nuclear Power Plants and Related Facilities

1. Scope and Purpose

1.1 Scope

This recommended practice provides a single source of nuclear power plant system descriptions which, along with related recommended practices concerning unique identification principles and definitions, component function identifiers, and implementation instructions, makes up a concept for uniquely identifying systems, structures, and components of light water nuclear power plant projects (electric power generating stations) and related facilities. Fossil, hydro, and other types of power plants are not included in this edition.

1.2 Purpose

The purpose of this series of recommended practices is to present a common language of communication which will permit a user to correlate a system, structure, or component with another organization for the purposes of reporting, comparison, or general communication. It does not require a using organization to change its own internal identification concept, but if the organization chooses to do so it has only to transcode at the interface from their internal language to this common language concept.

The user may choose to adopt this concept for internal organizational use. It represents the accumulated practice of the industry assimilated into one set of practices. A significant feature of this concept is that the unique identification code identifies the function at the component level and not the hardware itself.

2. Discussion

The system descriptions concentrate on system function and include such internal details as is necessary to clearly support the system function description. They are not intended to serve as design input. System diagrams also show connections with major interfacing systems, and major components in these interfacing systems, where appropriate to enhance communication of the system function. The system description grouping, as indicated by the first character of

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the two-alpha-character code, is designed to favor the convenience of plant operation rather than plant design and construction.

The system descriptions and diagrams represent typical systems and are not intended for design purposes. When a system function can be accomplished by significantly different system internal designs, the system description includes a brief identification of major design alternatives to serve as an aid for correlating plant specific system designs with this classification concept. The differences among PWR system nomenclature and system designs were not included in this classification concept because of the functional similarity among the different PWR designs. A single set of system nomenclature and system boundaries has been defined for all PWR designs.

The major differences between PWR and BWR system nomenclature and system internal designs have been preserved in that separate system descriptions and diagrams are provided, where appropriate.

The symbols used in the system diagrams were selected to represent accepted practice as much as possible.

3. References

When the following standards referred to in this recommended practice are superseded by a revision, the latest revision shall apply.

[1] ANSI/IEEE Std 100-1977, IEEE Standard Dictionary of Electrical and Electronics Terms.

[2] IEEE Std 803-1983, IEEE Recommended Practice for Unique Identification in Power Plants and Related Facilities—Principles and Definitions.

[3] IEEE Std 803A-1983, IEEE Recommended Practice for Unique Identification in Power Plants and Related Facilities—Component Function Identifiers.

[4] IEEE Std 804-1983, IEEE Recommended Practice for Unique Identification in Power Plants and Related Facilities—Implementation.

Table 1—EIS System List—Alphabetical by System Code

A — Primary Heat Source Systems Group		
AA	Control Rod Drive System (BWR)	Fig 2
AA	Control Rod Drive System (PWR)	Fig 3
AB	Reactor Coolant System (PWR)	Fig 4
AC	Reactor Core System	
AD	Reactor Recirculation System (BWR)	Fig 5
B — Engineered Safety Systems Group		
BA	Auxiliary/Emergency Feedwater System (PWR)	
BB	Containment Combustible Gas Control System	
BC	Containment Ice Condenser System (PWR) Refrigeration Subsystem	Fig 8
BC	Containment Ice Condenser System (PWR) Ice Condenser Subsystem	Fig 9
BD	Containment Leakage Control System	
BE	Containment Spray System (PWR)	Fig 10
BF	Containment Vacuum Relief System	

Table 1—EIS System List—Alphabetical by System Code (Continued)

BG	High-Pressure Core Spray System (BWR)	Fig 11
BH	Emergency/Standby Gas Treatment System	Fig 12
BI	Essential Service Water System	Fig 13
BJ	High-Pressure Coolant Injection System (BWR)	Fig 14
BK	Containment Fan Cooling System (PWR)	Fig 15
BL	Isolation Condenser System (BWR)	Fig 16
BM	Low Pressure Core Spray System (BWR)	Fig 17
BN	Reactor Core Isolation Cooling System (BWR)	Fig 18
BO	Residual Heat Removal/Low Pressure Coolant Injection System (BWR)	Fig 19
BP	Residual Heat Removal/Low Pressure Safety Injection System (PWR)	Fig 20
BQ	High Pressure Safety Injection System (PWR)	Fig 21
BR	Standby Liquid Control System (BWR)	Fig 22
BS	Ultimate Heat Sink System	
BT	Suppression Pool Makeup System (BWR)	Fig 23
C — Reactor Auxiliaries Systems Group		
CA	Boron Recycle System (PWR)	Fig 24
CB	Chemical and Volume Control/Makeup and Purification System (PWR)	Fig 25(a) and (b)
CC	Closed/Component Cooling Water System	Fig 26
CD	Control Rod Drive Cooling System (PWR)	Fig 27
CE	Reactor Water Cleanup System (BWR)	Fig 28
CF	Reactor Services System	
CG	Suppression Pool Purification System (BWR)	Fig 29
D — Fuel Management Systems Group		
DA	Fuel Pool Cooling and Purification System	
DB	Nuclear Fuel Services System	
DC	Diesel Fuel Oil System	Fig 30
DR	Fuel Oil Receiving Storage, and Transfer System	Fig 31
DF	Nuclear Fuel Transfer System	
E — Electrical Power Systems Group		
EA	Medium-Voltage Power System (601V through 35 kV)	Fig 32
EB	Medium-Voltage Power System—Class 1E	Fig 33
EC	Low-Voltage Power System (600V and less)	Fig 34
ED	Low-Voltage Power System—Class 1E	Fig 35
EE	Instrument and Uninterruptible Power System	Fig 36
EF	Instrument and Uninterruptible Power System—Class 1E	Fig 37
E1	DC Power System	Fig 38
EJ	DC Power System—Class 1E	Fig 39
EK	Emergency Onsite Power Supply System	Fig 40
EL	Main Generator Output Power System	Fig 41
F — Electrical Support Systems Group		
FA	Cable Raceway System	

Table 1—EIS System List—Alphabetical by System Code (Continued)

FB	Cathodic Protection System
FC	Grounding and Lightning Protection System
FD	Heat Tracing System
FE	Heat Tracing System—Class 1E
FF	Normal AC Lighting System
FG	Standby AC Lighting System
FH	Emergency DC Lighting System
FI	Communications System
FJ	Station Generation Telemetry System
FK	Switchyard System
I — Instrumentation and Monitoring Systems Group	
IA	Security System
IB	Annunciator System
IC	Fire Detection System
ID	Computer System
IG	Incore/Excore Monitoring System
IH	Core Vibration Monitoring System
II	Loose Parts Monitoring System
IJ	Leak Monitoring System
IK	Containment Environmental Monitoring System
IL	Radiation Monitoring System
IM	Temperature Monitoring System
IN	Seismic Monitoring System
IO	Performance Monitoring System
IP	Pest Accident Monitoring System
IQ	Sequence of Events Monitoring System
IR	Television System
IS	Environmental/Meteorological Monitoring System (Ex PLT)
IT	Main Turbine Instrumentation System
IU	Display Control System
IV	Vibration Monitoring System
J — Protection and Control Systems Group	
JA	Integrated Control System
JB	Feedwater/Steam Generator Water Level Control System
JC	Plant Protection System
JD	Reactor Power Control System
JE	Engineered Safety Features Actuation System
JG	Solid State Control System/Auxiliary Logic Control System
JI	Turbine Steam Bypass Control System Turbine Supervisory Control System
JK	Feedwater Pump Turbine Instrumentation and Control System
JL	Panels System

Fig 42

Table 1—EIS System List—Alphabetical by System Code (Continued)

JM	Containment Isolation Control System	
K — Water, Chemical, and Drainage Systems Group		
KA	Condensate Storage and Transfer System	Fig 43
KB	Turbine Building Closed Cooling Water System	Fig 44
KC	Demineralized Water Storage and Transfer System	Fig 45
KD	Condensate and Feedwater Chemistry Control System	
KE	Heat Rejection System	Fig 46
KF	Heat Rejection Chemical Treatment System	
KG	Nonessential Service Water System	Fig 47
KH	Water Filtration System	Fig 48
KI	Raw Water Makeup System	
KJ	Makeup Demineralizer System	Fig 49
KK	Potable Water Distribution System	Fig 50
KL	Removable Chemical Cleaning System	
KM	Chilled Water System	
KN	Sampling and Water Quality System	Fig 51
KO	Gland Seal Water Supply System	Fig 52
KP	Fire Protection System (Water)	Fig 53
KQ	Fire Protection System (Chemical)	
L — Service Auxiliaries Systems Group		
LA	Diesel Lube Oil System	
LB	Diesel Cooling Water System	
LC	Diesel Generator Starting Air System	Fig 54
LD	Instrument Air Supply System	
LE	Essential Air System	
LF	Service Air System	Fig 55
LG	Welding Gas System	
LH	Breathing Air System	
LJ	Hydrogen Supply System	
LK	Nitrogen Supply System	Fig 56
LL	Lube Oil System	
LM	Lube Oil Storage and Transfer System	Fig 57
LN	Insulating Oil System	Fig 58
LP	Laboratory Gas System	
LQ	Laboratory Equipment System	
LR	Material and Equipment Handling System	
LS	Plant Shop System	
LT	Record Storage System	
LU	Yard Handling and Maintenance System	
LV	Plant Hot Water System	
LW	Carbon Dioxide (CO ₂) Supply System	

Table 1—EIS System List—Alphabetical by System Code (Continued)

M — Site Facility Buildings and Structures Group		
MA	Administration Building	
MB	Industrial/Sanitary Waste Treatment Building	
MC	Maintenance and Warehouse Building	
MD	Makeup Water Intake Structure	
MF	Service Building	
MG	Wastewater Outfall Structure	
MH	Water Treatment Building	
MJ	Visitors Center	
MK	Essential Service Water Pump Building	
N — Power Generation Buildings and Structures Group		
NA	Control Building/Control Complex	
NB	Emergency Onsite Power Supply Building	
NC	Emergency Operations Facility (Offsite)	
ND	Fuel Building	
NE	Radwaste Building	
NF	Auxiliary Building	
NG	Reactor Building (BWR)	
NH	Reactor Containment Building	
NM	Turbine Building	
NN	Circulating Water Structures	
S — Steam Cycle Systems Group		
SA	Auxiliary Steam System	Fig 59
SB	Main/Reheat Steam System	Fig 60
SD	Condensate System	Fig 61
SE	Steam Extraction System	Fig 62
SF	Condensate Demineralizer System	Fig 63
SG	Condenser System	Fig 64
SH	Condenser Vacuum System	Fig 65
SI	Condenser Tube Cleaning System	Fig 66
SJ	Feedwater System	Fig 67
SK	Feedwater Pump Injection and Miscellaneous System	Fig 68
SL	Feedwater Pump Turbine Lube Oil System	Fig 69
SM	LP Heater Drains and Vents System	Fig 70
SN	HP Heater and MSR Drains and Vents System	Fig 71
T — Power Conversion Systems Group		
TA	Main Turbine System	Fig 72
TB	Main Generator System	
TC	Turbine Steam Seal System	Fig 73
TD	Turbine Lube Oil System	Fig 74

Table 1—EIS System List—Alphabetical by System Code (Continued)

TE	Miscellaneous Turbine Vents System	
TF	Turbine Drains and Miscellaneous Piping System	
TG	Main Turbine Control Fluid System	Fig 75
TH	Main Generator Gas Purge System	
TI	Main Generator Seal Oil System	
TJ	Main Generator Stator Cooling System	Fig 76
TK	Main Generator Hydrogen Cooling System	Fig 77
TL	Main Generator Excitation System	
U — Site Facility Environmental Control Systems Group		
UA	Pumping Station Environmental Control System	
UB	Water Treatment Building Environmental Control System	
UC	Service Building Environmental Control System	
UD	Administration Building Environmental Control System	
UE	Security Building Environmental Control System	
UF	Technical Support Center Environmental Control System	
UG	Emergency Operations Facility Environmental Control System	
UH	Visitors Center Environmental Control System	
V — Power Generation Buildings Environmental Control Systems Group		
VA	Reactor Building Environmental Control System	
VB	Drywell Environmental Control System (BWR)	
VC	Shield Annulus Return and Exhaust System	
VE	Access Corridors Environmental Control System	
VF	Auxiliary Building Environmental Control System	
VG	Fuel Building Environmental Control System	
VH	Radwaste Building Environmental Control System	
VI	Control Building/Control Complex Environmental Control System	
VJ	Emergency Onsite Power Supply Building Environmental Control System	
VK	Turbine Building Environmental Control System	
VL	Plant Exhaust System	
W — Waste Management Systems Group		
WA	Cask Decontamination System	Fig 78
WB	Solid Waste Management System	
WD	Liquid Waste Management System	
WE	Gaseous Waste Management System (PWR)	Fig 79
WF	Offgas System (BWR)	Fig 80
WG	Sanitary Waste Processing System	Fig 81
WH	Wastewater Disposal System	Fig 82
WI	Steam Generator Blowdown System (PWR)	Fig 83
WJ	Sludge Waste Dewatering System	
WK	Equipment and Floor Drain System	

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4. Conventions

The sequence identifier associated with a specific piece of equipment is assigned at the discretion of the organization applying the code. However, if the intent of the recommended practice is to be achieved, there must be uniformity in the assignment of system designators and function identifiers. To achieve this uniformity in the assignment of system identifiers, the following conventions regarding system cognizance should be followed:

- 1) *Heat Exchangers.* Heat exchangers are considered to be located in the system in which they perform a heating or cooling function in support of plant power production. Heat exchangers which provide both a heating and cooling function (for example, Condensate blowdown cooler) are assigned to the system which, under normal plant conditions, operates at the higher temperature.
- 2) *Instruments.* Sensors are assigned to the system in which they sense. Actuators are assigned to the system in which the actuation takes place.
- 3) *Circuit Breakers.* Where circuit breakers control specific equipment, the circuit breaker is assigned to the system in which the equipment is assigned. Where circuit breakers control the distribution of electrical power they are assigned to that electrical distribution system.
- 4) *Valves.* Valves are assigned to the system in which they control fluid flow.
- 5) *Transformers.* Transformers are assigned to the lower voltage system.

Table 2—EIS System List—Alphabetical by System Title

VE	Access Corridors Environmental Control System	
MA	Administration Building	
UD	Administration Building Environmental Control System	
IB	Annunciator System	
NF	Auxiliary Building	
VF	Auxiliary Building Environmental Control System	
BA	Auxiliary/Emergency Feedwater System (PWR)	Fig 6
SA	Auxiliary Steam System	Fig 59
CA	Boron Recycle System (PWR)	Fig 24
LH	Breathing Air System	
FA	Cable Raceway System	
LW	Carbon Dioxide (CO ₂) Supply System	
WA	Cask Decontamination System	Fig 78
FB	Cathodic Protection System	
CB	Chemical and Volume Control/Makeup and Purification System (WR)	Fig 25(a) and (b)
KM	Chilled Water System	
NN	Circulating Water Structures	
CC	Closed/Component Cooling Water System	Fig 26
FI	Communications System	
ID	Computer System	
KD	Condensate and Feedwater Chemistry Control System	
SF	Condensate Demineraliser System	Fig 63
KA	Condensate Storage and Transfer System	Fig 43
SD	Condensate System	Fig 61
SG	Condenser System	Fig 64

Table 2—EIS System List—Alphabetical by System Title (Continued)

SI	Condenser Tube Cleaning System	Fig 66
SH	Condenser Vacuum System	Fig 65
BB	Containment Combustible Gas Control System	Fig 7
IK	Containment Environmental Monitoring System	Fig 42
BK	Containment Fan Cooling System (PWR)	Fig 15
BC	Containment Ice Condenser System (PWR) Refrigeration System	Fig 8
BC	Containment Ice Condenser System (PWR) Ice Condenser Subsystem	Fig 9
JM	Containment Isolation Control System	
BD	Containment Leakage Control System	
BE	Containment Spray System (PWR)	Fig 10
BF	Containment Vacuum Relief System	
NA	Control Building/Control Complex	
VI	Control Building/Control Complex Environmental Control System	
CD	Control Rod Drive Cooling System (PWR)	Fig 27
AA	Control Rod Drive System (BWR)	Fig 2
AA	Control Rod Drive System (PWR)	Fig 3
IH	Core Vibration Monitoring System	
EI	DC Power System	Fig 38
EJ	DC Power System—Class 1E	Fig 39
KC	Demineralised Water Storage and Transfer System	Fig 45
LB	Diesel Cooling Water System	
DC	Diesel Fuel Oil System	Fig 30
LC	Diesel Generator Starting Air System	Fig 54
LA	Diesel Lube Oil System	
IU	Display Control System (DCS)	
VB	Drywell Environmental Control System (BWR)	
FH	Emergency DC Lighting System	
NB	Emergency Onsite Power Supply Building	
VJ	Emergency Onsite Power Supply Building Environmental Control System	
EK	Emergency Onsite Power Supply System	Fig 40
UG	Emergency Operations Facility Environmental Control System	
NC	Emergency Operations Facility (Offsite)	
BH	Emergency/Standby Gas Treatment System	Fig 12
JE	Engineered Safety Features Actuation System	
IS	Environmental/Meteorological Monitoring System (Ex PLT)	
WK	Equipment and Floor Drain System	
LE	Essential Air System	
MK	Essential Service Water Pump Building	
BI	Essential Service Water System	Fig 13
SK	Feedwater Pump Injection and Miscellaneous System	Fig 68
JK	Feedwater Pump Turbine Instrumentation and Control System	

Table 2—EIS System List—Alphabetical by System Title (Continued)

SL	Feedwater Pump Turbine Lube Oil System	Fig 69
JB	Feedwater/Steam Generator Water Level Control System	
SJ	Feedwater System	Fig 67
IC	Fire Detection System	
KQ	Fire Protection System (Chemical)	
KP	Fire Protection System (Water)	Fig 53
ND	Fuel Building	
VG	Fuel Building Environmental Control System	
DE	Fuel Oil Receiving, Storage, and Transfer System	Fig 31
DA	Fuel Pool Cooling and Purification System	
WE	Gaseous Waste Management System (PWR)	Fig 79
KO	Gland Seal Water Supply System	Fig 52
FC	Grounding and Lightning Protection System	
SN	HP Heater and MSR Drains and Vents System	Fig 71
KF	Heat Rejection Chemical Treatment System	Fig 47
KE	Heat Rejection System	Fig 46
FD	Heat Tracing System	
FE	Heat Tracing System—Class 1E	
BJ	High Pressure Coolant Injection System (BWR)	Fig 14
BG	High Pressure Core Spray System (BWR)	Fig 11
BQ	High Pressure Safety Injection System (PWR)	Fig 21
LJ	Hydrogen Supply System	
IG	Incore/Excore Monitoring System	
MB	Industrial/Sanitary Waste Treatment Building	
LD	Instrument Air Supply System	
EE	Instrument and Uninterruptible Power System	Fig 36
EF	Instrument and Uninterruptible Power System—Class 1E	Fig 37
LN	Insulating Oil System	Fig 58
JA	Integrated Control System	
BL	Isolation Condenser System (BWR)	Fig 16
SM	LP Heater Drains and Vents System	Fig 70
LQ	Laboratory Equipment System	
LP	Laboratory Gas System	
IJ	Leak Monitoring System	
WD	Liquid Waste Management System	
II	Loose Parts Monitoring System	
BM	Low Pressure Core Spray System (BWR)	Fig 17
EC	Low-Voltage Power System (600 V and less)	Fig 34
ED	Low-Voltage Power System—Class 1E	Fig 35
LM	Lube Oil Storage and Transfer System	Fig 57
LL	Lube Oil System	

Table 2—EIS System List—Alphabetical by System Title (Continued)

TL	Main Generator Excitation System	
TH	Main Generator Gas Purge System	
TK	Main Generator Hydrogen Cooling System	Fig 77
EL	Main Generator Output Power System	Fig 41
TI	Main Generator Seal Oil System	
TJ	Main Generator Stator Cooling System	Fig 76
TB	Main Generator System	
SB	Main/Reheat Steam System	Fig 60
TG	Main Turbine Control Fluid System	Fig 75
IT	Main Turbine Instrumentation System	
TA	Main Turbine System	Fig 72
MC	Maintenance and Warehouse Building	
KJ	Makeup Demineralizer System	Fig 49
MD	Makeup Water Intake Structure	
LR	Material and Equipment Handling System	
EA	Medium-Voltage Power System (601 V through 35 kV)	Fig 32
EB	Medium-Voltage Power System—Class 1E	Fig 33
TE	Miscellaneous Turbine Vents System	
LK	Nitrogen Supply System	Fig 56
KG	Nonessential Service Water System	
FF	Normal AC Lighting System	
DB	Nuclear Fuel Services System	
DF	Nuclear Fuel Transfer System	
WF	Offgas System (BWR)	Fig 80
JL	Panels System	
IO	Performance Monitoring System	
VL	Plant Exhaust System	
LV	Plant Hot Water System	
JC	Plant Protection System	
LS	Plant Shop System	
IP	Post Accident Monitoring System	
KK	Potable Water Distribution System	Fig 50
UA	Pumping Station Environmental Control System	
IL	Radiation Monitoring System	
NE	Radwaste Building	
VH	Radwaste Building Environmental Control System	
KI	Raw Water Makeup System	
NG	Reactor Building (BWR)	
VA	Reactor Building Environmental Control System	
NH	Reactor Containment Building	
AB	Reactor Coolant System (PWR)	Fig 4

Table 2—EIS System List—Alphabetical by System Title (Continued)

BN	Reactor Core Isolation Cooling System (BWR)	Fig 18
AC	Reactor Core System	
JD	Reactor Power Control System	
AD	Reactor Recirculation System (BWR)	Fig 5
CF	Reactor Services System	
CE	Reactor Water Cleanup System (BWR)	Fig 28
LT	Record Storage System	
KL	Removable Chemical Cleaning System	
BO	Residual Heat Removal/Low Pressure Coolant Injection System (BWR)	Fig 19
BP	Residual Heat Removal/Low Pressure Safety Injection System (PWR)	Fig 20
KN	Sampling and Water Quality System	Fig 51
WG	Sanitary Waste Processing System	Fig 81
UE	Security Building Environmental Control System	
IA	Security System	
IN	Seismic Monitoring System	
IQ	Sequence of Events Monitoring System	
LF	Service Air System	Fig 55
MF	Service Building	
UC	Service Building Environmental Control System	
VC	Shield Annulus Return and Exhaust System	
WJ	Sludge Waste Dewatering System	
JG	Solid State Control System/Auxiliary Logic Control System	
WB	Solid Waste Management System	
FG	Standby AC Lighting System	
BR	Standby Liquid Control System (BWR)	Fig 22
FJ	Station Generation Telemetry System	
SE	Steam Extraction System	Fig 62
WI	Steam Generator Blowdown System (PWR)	Fig 83
BT	Suppression Pool Makeup System (BWR)	Fig 23
CG	Suppression Pool Purification System (BWR)	Fig 29
FK	Switchyard System	
UF	Technical Support Center Environmental Control System	
IR	Television System	
IM	Temperature Monitoring System	
NM	Turbine Building	
KB	Turbine Building Closed Cooling Water System	Fig 44
VK	Turbine Building Environmental Control System	
TF	Turbine Drains and Miscellaneous Piping System	
TD	Turbine Lube Oil System	Fig 74
JI	Turbine Steam Bypass Control System	
TC	Turbine Steam Seal System	Fig 73(a) and (b)

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Table 2—EIS System List—Alphabetical by System Title (Continued)

JJ	Turbine Supervisory Control System	
BS	Ultimate Heat Sink System	
IV	Vibration Monitoring System	
MJ	Visitors Center	
UH	Visitors Center Environmental Control System	
WH	Wastewater Disposal System	Fig 82
MG	Wastewater Outfall Structure	
KH	Water Filtration System	
MH	Water Treatment Building	Fig 48
UB	Water Treatment Building Environmental Control System	
LG	Welding Gas System	
LT	Yard Handling and Maintenance System	

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5. System Descriptions

The narrative descriptions of systems are, in some cases, supplemented by diagrams which serve as an aid to understanding. The diagrams are intended to be generic in nature and show only sufficient detail to reinforce the text. Wherever possible, all pressurized water reactor system diagrams are combined into one drawing.

NOTES: Symbols listed here are to be used for drawing clarification only. Other components may be reportable above those indicated here dependent on plant design.

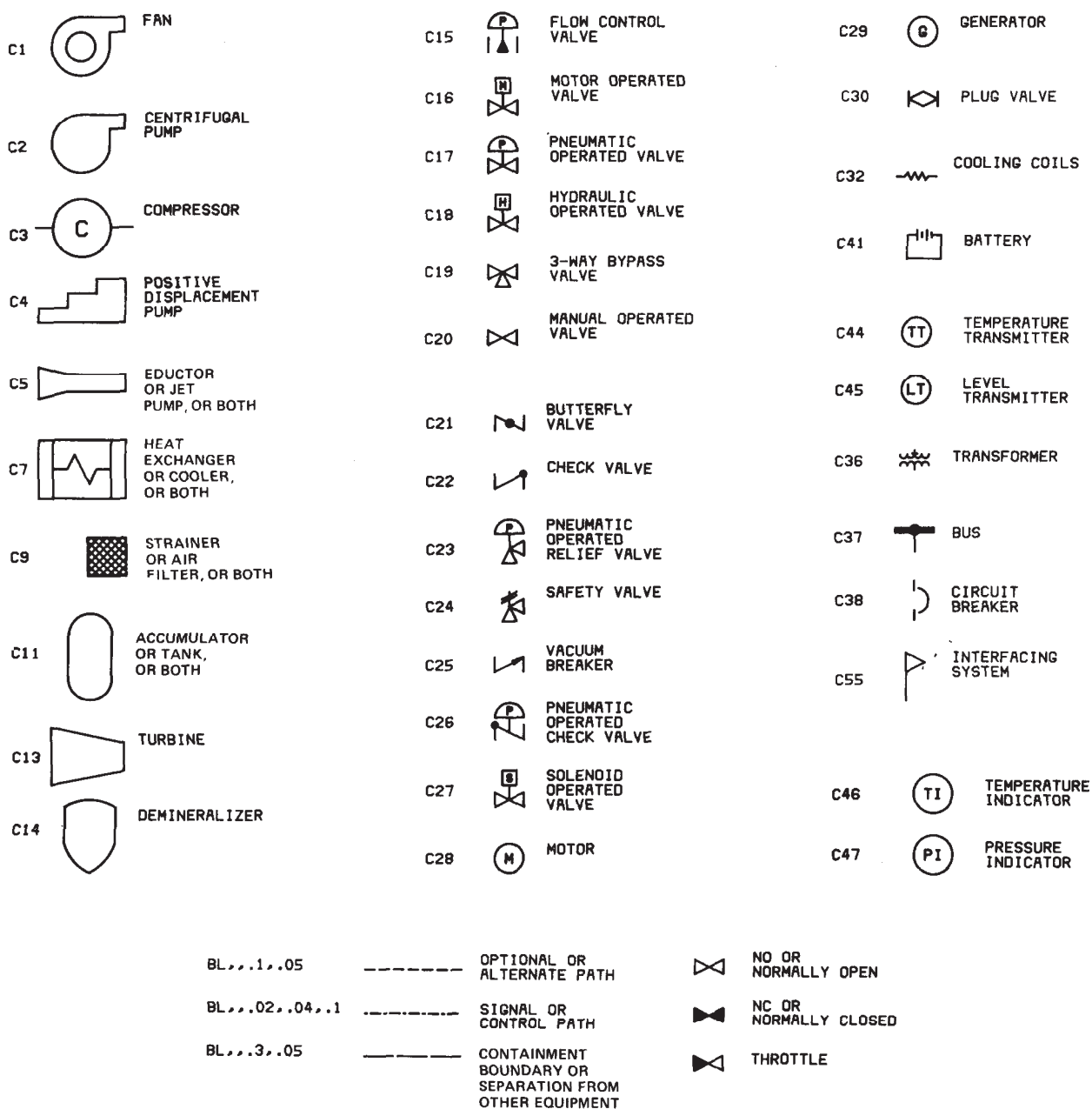


Figure 1—Legend of Symbols

WITHDRAWN

5.1 Primary Heat Source Systems Group

Table 3

Primary Heat Source Systems Group		Plant	Type	Revision
AA	Control Rod Drive System	B	P	
AB	Reactor Coolant System (PWR)		P	
AC	Reactor Core System	B	P	
AD	Reactor Recirculation System (BWR)	B		

B—BWR P—PWR

5.2 Control Rod Drive System (BWR)—AA

5.2.1 System Function

The Control Rod Drive System (BWR) provides the means to insert and retract control rods within the nuclear reactor core.

5.2.2 System Description

The Control Rod Drive System (BWR) consists of the control rods, control rod drive mechanisms, a hydraulic control unit for each control rod drive mechanism, their common hydraulic power supply, scram discharge volume piping, manual controls and interlocks for manipulating the control rods, and control rod position indication.

Each control rod drive mechanism is a double-acting, mechanically latched, hydraulic cylinder using water from the hydraulic power supply as the operating fluid. This water also cools the drive mechanisms and their seals. The hydraulic control units each contain all the hydraulic, pneumatic, electrical equipment, and controls necessary to actuate one control rod drive mechanism. Directional control valves are used to actuate normal rod insertion and withdrawal. Scram valves and a scram accumulator are provided for emergency rod insertion (scram). The scram valves are actuated by a scram signal from the reactor protection system. During a scram, water is discharged from the control rod drive mechanism into the discharge header. The hydraulic power supply to the hydraulic control units consists of two control rod drive system pumps, filters, and pressure regulating valves. The control rod drive system pumps receive water from the condensate storage tank in the condensate storage and transfer system. Control rod drive pump cooling is provided by the closed/component cooling water system. Manual controls, interlocks, and displays are provided in the main control room for the operator to manipulate control rods, and monitor control rod position and control rod drive system equipment status.

5.2.3 Mode of Operation

The control rod drive system (BWR) operates during normal reactor operation and in the event of an emergency reactor shutdown (scram).

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5.2.4 Major Interfacing Systems

Condensate Storage and Transfer System	KA
Reactor Recirculation System (BWR)	AD
Plant Protection System	JC
Closed/Component Cooling Water System	CC
Medium Voltage Power System	EA
Integrated Control System	JA
Reactor Core System	AC

5.3.6 Major Equipment

Control Rod Drive Pumps

Pressure Regulating Valves

Drive Water Filters

Hydraulic Control Units

Control Rod Drive Mechanisms

Scram Discharge Volume

Control Rod Manual Controls, Interlocks, and Instrumentation

Control Rods

Control Rod Position Indication

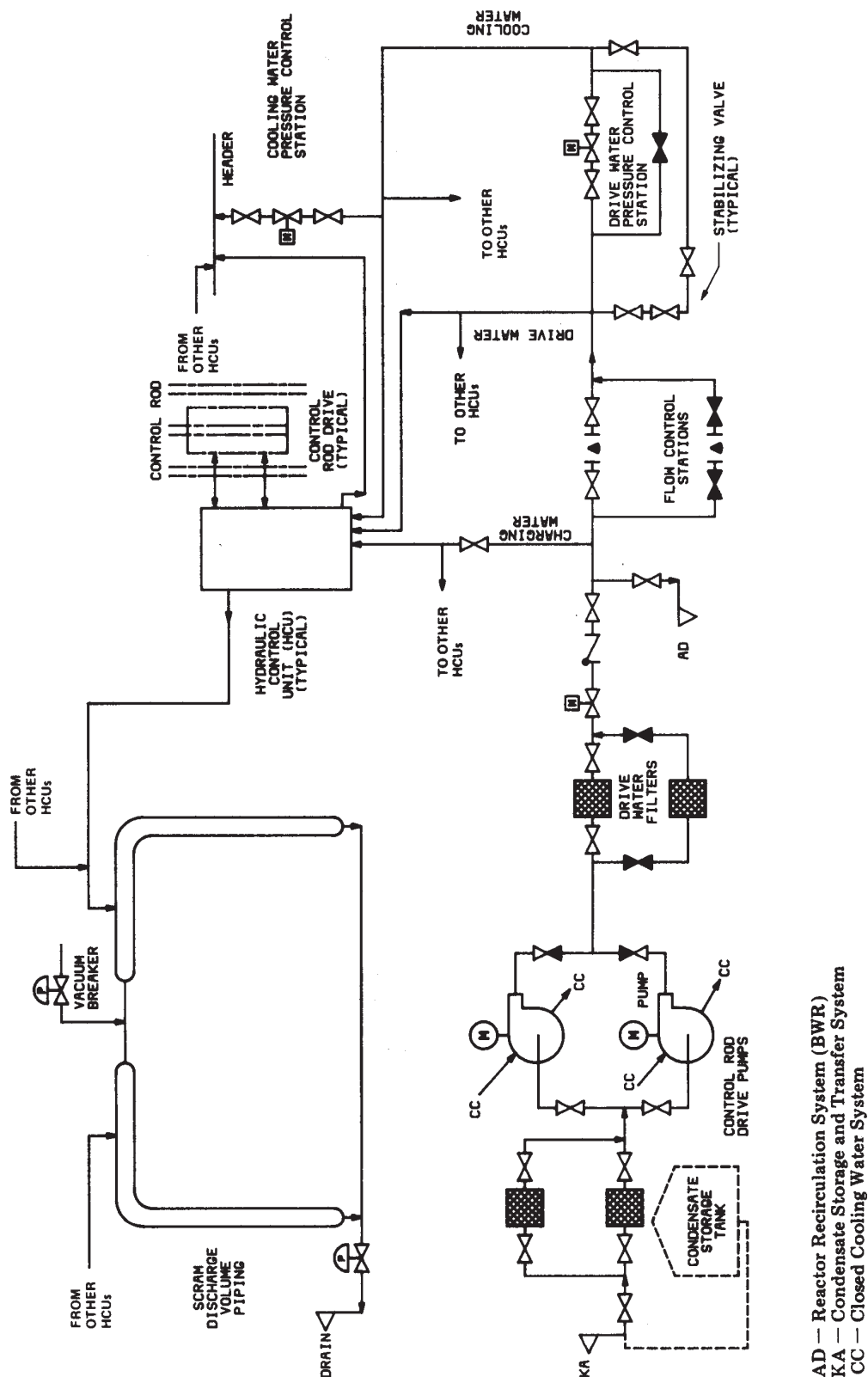


Figure 2—Control Rod Drive System (BWR) — AA

WITHDRAWN

5.3 Control Rod Drive System (PWR) — AA

5.3.1 System Function

The control rod drive system (PWR) provides the means to insert and retract control rods within the nuclear reactor core.

5.3.2 System Description

The control rod drive system (PWR) consists of control rod drive mechanisms, the control rods, manual controls and interlocks for manipulating the control rods, control rod position indication, and control rod drive electrical power supplies.

The control rod drive mechanisms are electromechanical devices which convert electrical energy into linear motion of the control rod. For rapid control rod insertion, electrical power to the control rod drive mechanism is interrupted by the reactor trip breakers which causes the control rod to be released and to fall into the reactor core by gravity. Two basic control rod drive system designs are in use. One type is the magnetic jack design and the other is a lead screw and roller nut mechanism.

5.3.3 Mode of Operation

The control rod drive system (PWR) operates during normal reactor operation and in the event of an emergency reactor shutdown (scram).

5.3.4 Major Interfacing Systems

Plant Protection System	JC
Control Rod Drive Cooling System (PWR)	CD
Low Voltage Power System—Class 1E	ED
Reactor Coolant System (PWR)	AB
Reactor Core System	AC
Reactor Power Control System	JD

5.3.5 Major Equipment

Control Rod Drive Mechanisms

Control Rods

Control Rod Position Indication

Control Rod Drive Power Supply

Control Rod Manual Controls, Interlocks, and Instrumentation

Reactor Trip Breakers

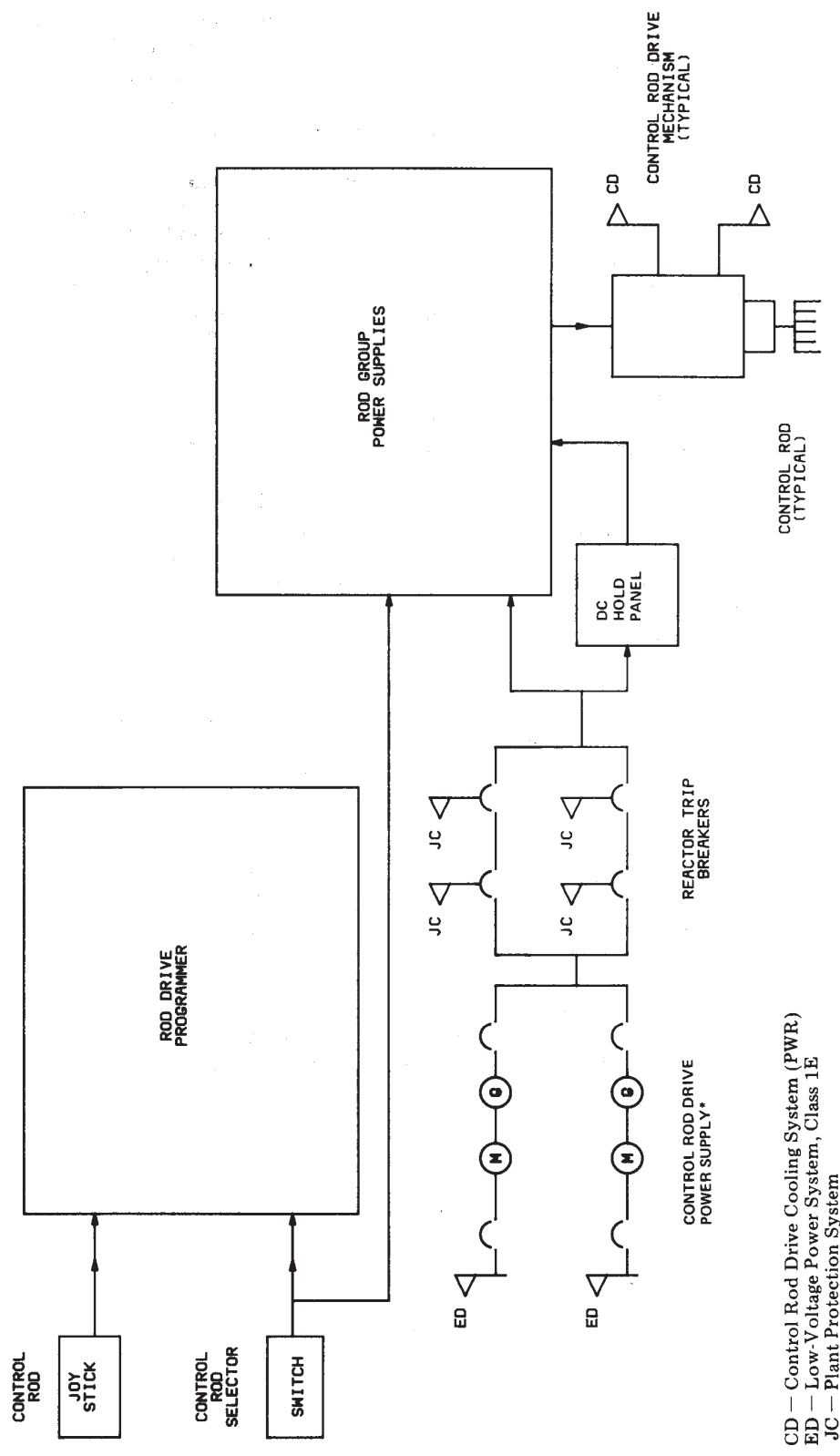


Figure 3—Control Rod Drive System (PWR) — AA

WITHDRAWN

5.4 Reactor Coolant System (PWR)—AB

5.4.1 System Function

The reactor coolant system (PWR) performs the following functions:

- 1) Transfers thermal energy to the steam generators where steam is produced for use in the turbine generator.
- 2) Serves as a secondary barrier to the release of radioactive fission products from the reactor core to the environment.

5.4.2 System Description

The reactor coolant system (PWR) circulates water in a closed cycle, removing heat from the reactor core and internals and using that heat to generate and deliver steam for the operation of the turbine generator. The major components of the system are the reactor vessel, two or more steam generators, two or more reactor coolant pumps, and a pressurizer vessel and its associated safety and relief valves.

Heat that is generated as a result of the nuclear reaction taking place within the reactor core is absorbed by the reactor coolant being circulated through the system. Upon exiting the reactor core, the heated coolant passes through the tube side of the steam generators. Steam is produced within the steam generators as a result of the heat exchange between the pressurized reactor coolant within the steam generator tubes and the feedwater being circulated through the shell side. The steam thus produced is routed from the steam generators to the turbine generator by way of the main steam system. After giving up its heat for steam production within the steam generators, the reactor coolant is pumped back to the reactor vessel by the reactor coolant pump(s) and the cycle begins anew. A pressurizer is connected to the circulation piping to accommodate coolant expansion/contraction and regulate the system's operating pressure through an arrangement of spray nozzles and electric heaters which alternately condense and generate steam inside the pressurizer as required in order to maintain the system's operating pressure. To prevent overpressurization of the system, safety and relief valves are provided on the pressurizer.

5.4.3 Mode of Operation

The reactor coolant system (PWR) is in use during startup, normal power operation, and hot standby.

5.4.4 Major Interfacing Systems

Chemical and Volume Control/Makeup and Purification System (PWR)	CB
Residual Heat Removal/Low Pressure Safety Injection (PWR)	BP
Main/Reheat Steam System	SB
Feedwater System	SJ
Auxiliary/Emergency Feedwater System (PWR)	BA
Steam Generator Blowdown System (PWR)	WI
Boron Recycle System (PWR)	CA
Reactor Core System	AC

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Closed/Component Cooling

Water System	CC
Feedwater/Steam Generator Water	
Level Control System	JB
Control Rod Drive System (PWR)	AA
Medium Voltage Power System	EA
Reactor Power Control System	JD
Post Accident Monitoring System	IP
High Pressure Safety	
Injection System	BQ

5.4.5 Major Components

Reactor Vessel and Internals

Reactor Coolant Pumps

Steam Generators

Pressurizer

Pressurizer Safety and Relief Valve

Reactor Coolant Loop Piping

Pressurizer Heaters and Controls

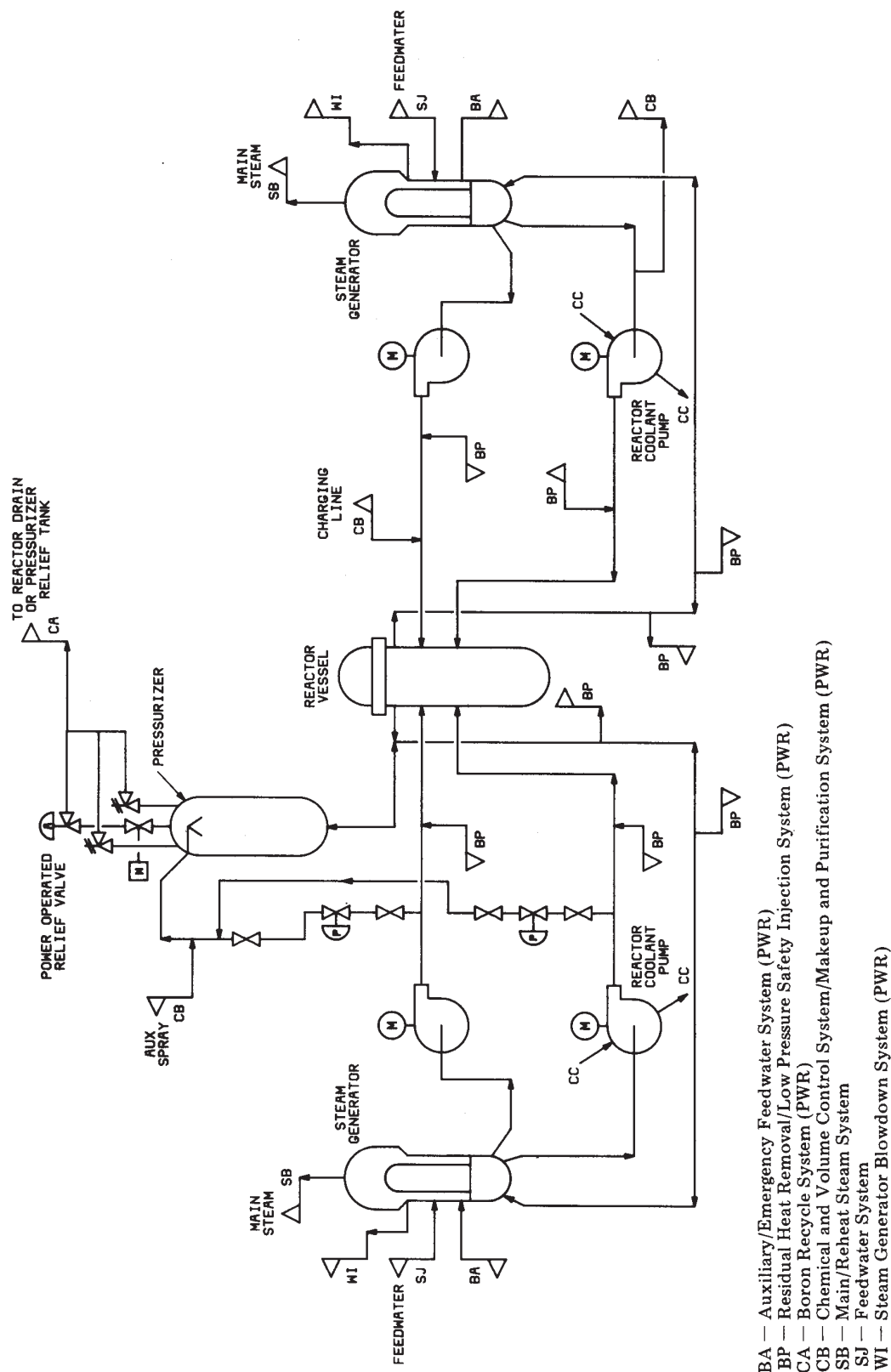


Figure 4—Reactor Coolant System (PWR) — AB

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5.5 Reactor Core System—AC

5.5.1 System Function

The reactor core system generates thermal energy by means of the nuclear fission process.

5.5.2 System Description

The reactor core system consists of nuclear fuel assemblies, fuel channels (BWR), and startup neutron sources.

Each fuel assembly consists of an array of fuel rods, which contain enriched uranium dioxide fuel pellets and burnable neutron poisons, control rod guide tubes (PWR), and in-core instrumentation guide tubes (PWR).

5.5.3 Mode of Operation

The reactor core system is in use during normal plant operation.

5.5.4 Major Interfacing Systems

Reactor Coolant System (PWR)	AB
Reactor Recirculation System (BWR)	AD
Control Rod Drive System	AA
Incore/Excore Monitoring System	IG

5.5.5 Major Equipment

Nuclear Fuel Assemblies

Startup Neutron Sources

5.6 Reactor Recirculation System (BWR) — AD

5.6.1 System Function

The reactor recirculation system (BWR) generates dry saturated steam from the thermal energy produced by nuclear fission in the reactor core.

5.6.2 System Description

A typical system consists of the reactor vessel, its internal components and appurtenances, and external recirculation loops and associated controls. Falling within the physical confines of the reactor recirculation system, but not a part of the system, are the nuclear fuel assemblies, control rods, control rod drive mechanisms, and in-core nuclear instrumentation.

Typical system operation for the most prevalent type of system arrangement begins when feedwater enters the reactor vessel in the upper region along the outer periphery. Feedwater spargers then distribute the incoming feedwater into the annular region between the core shroud and the vessel wall (annulus) and the flow starts a downward path. The system employs an internal/external recirculation arrangement to obtain forced feedwater flow through the reactor core where the conversion of feedwater to steam takes place. A portion of the downward flow in the annulus (normally about one-third) is removed from the vessel and pumped by the recirculation pump through a manifold to which a number of riser

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pipes are attached which feed jet pumps located at the bottom of the annulus. This flow is then discharged from one of several jet pump nozzles into the initial stage of jet pump throat where, due to a momentum exchange process, it induces surrounding water in the downcomer region (the remaining two-thirds of the downward annulus flow) to be drawn into the jet pump throat where these two flows mix and then diffuse in the jet pump diffuser to be finally discharged into the lower core plenum. The flow of water then turns upwards where it flows between the control rod drive guide tubes and enters the fuel support where the flow is individually directed to each fuel bundle through the nose piece. The coolant water passes along the individual fuel rods inside the fuel channel where it is heated and becomes a two-phase steam-water mixture. The steam-water mixture enters a plenum directly above the core and bounded by the separator dome which opens to the array of fixed steam separators. The steam is separated from the water and passes through a dryer where any remaining water is removed. Saturated steam leaves the vessel through main steam system piping connections near the top of the reactor vessel. Water collected in the support tray of the dryer is routed through drain lines, joins the water leaving the separators, and flows downward in the annulus where it joins the feedwater flow from the feedwater spargers.

5.6.3 Mode of Operation

The reactor recirculation system (BWR) operates during reactor startup, reactor shutdown, and normal reactor operation.

5.6.4 Major Interfacing Systems

Main/Reheat Steam System	SB
Feedwater System	SJ
Closed/Component Cooling Water	
System	CC
Reactor Water Cleanup System (BWR)	CE
Residual Heat Removal/Low Pressure	
Coolant Injection System (BWR)	BO
Low Pressure Core Spray System	
(BWR)	BM
Reactor Core Isolation Cooling System	
(BWR)	BN
Standby Liquid Control System (BWR)	BR
Control Rod Drive System (BWR)	AA
High Pressure Core Spray System	
(BWR)	BG

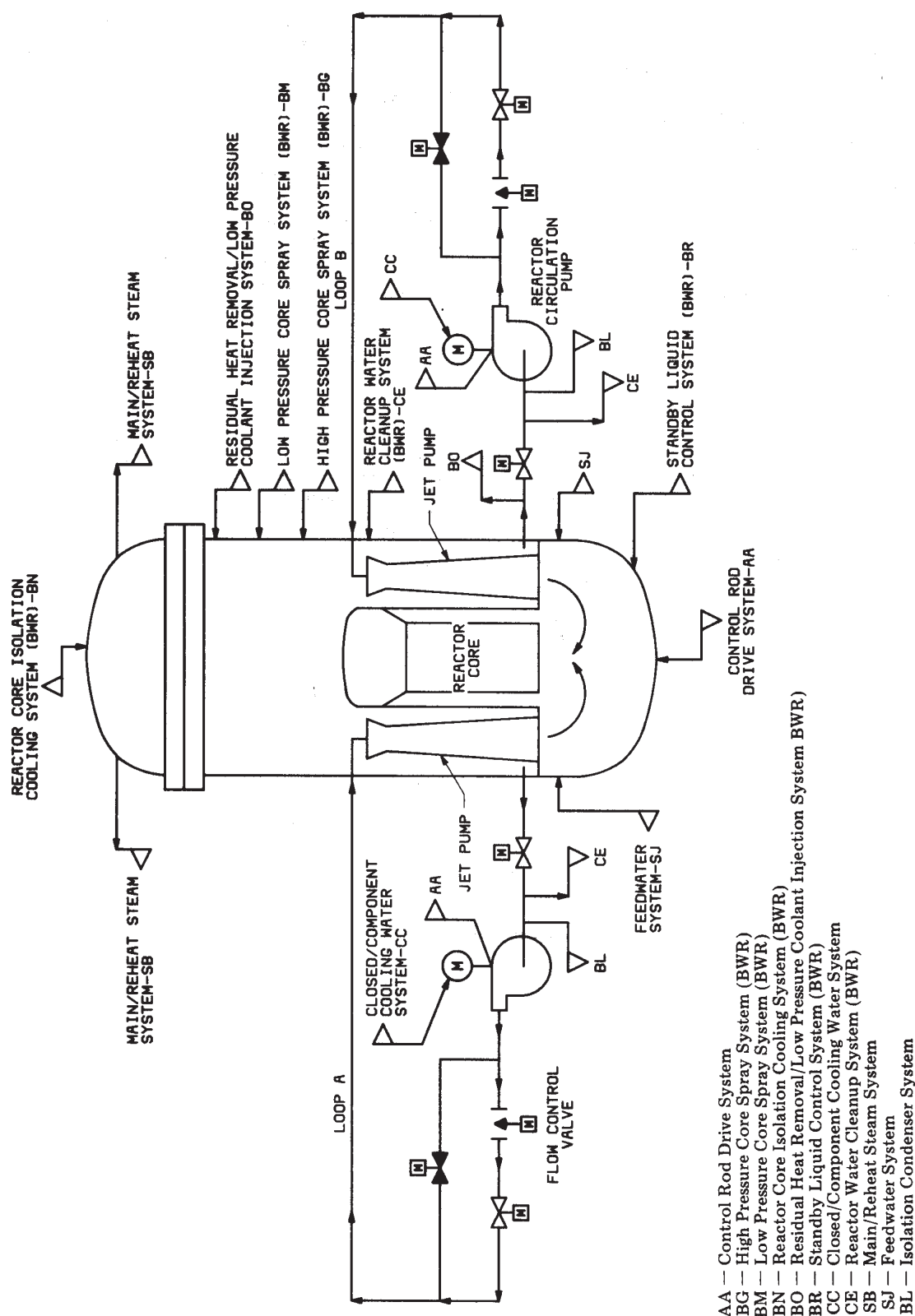


Figure 5—Reactor Recirculation System (BWR) — AD

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Reactor Core System	AC
Isolation Condenser System	BL
Feedwater/Steam Generator Water	
Level Control System	JB
Medium Voltage Power System	EA
Reactor Power Control System	JD

5.6.5 Major Equipment

Reactor Vessel

Core Shroud

Shroud Head

Shroud Support Structure

Control Rod Drive Housings and Supports

In-Core Flux Monitoring Housings and Guide Tubes

Core Support Plate

Fuel Supports

Control Rod Guide Tubes

Steam Separator Assembly

Steam Dryer Assembly

Jet Pump Assemblies

Reactor Recirculation Pumps

Recirculation Flow Control Valves

Recirculation Flow Control Circuitry

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5.6.6 Engineered Safety Systems Group

Table 4

	Engineered Safety Systems Group	Plant	Type	Revision
BA	Auxiliary/Emergency Feedwater System (PWR)		P	
BB	Containment Combustible Gas Control System	B	P	
BC	Containment Ice Condenser System (PWR)		P	
BD	Containment Leakage Control System	B	P	
BE	Containment Spray System (PWR)		P	
BF	Containment Vacuum Relief System	B	P	
BG	High Pressure Core Spray System (BWR)	B		
BH	Emergency/Standby Gas Treatment System	B	P	
BI	Essential Service Water System	B	P	
BJ	High Pressure Coolant Injection System (BWR)	B		
BK	Containment Fan Cooling System (PWR)		P	
BL	Isolation Condenser System (BWR)	B		
BM	Low Pressure Core Spray System (BWR)	B		
BN	Reactor Core Isolation Cooling System (BWR)	B		
BO	Residual Heat Removal/Low Pressure Coolant Injection System (BWR)	B		
BP	Residual Heat Removal/Low Pressure Safety Injection System (PWR)		P	
BQ	High Pressure Safety injection System (PWR)	B		
BR	Standby Liquid Control System (BWR)	B	P	
BS	Ultimate Heat Sink System	B		
BT	Suppression Pool Makeup System (BWR)			

B—BWR P—PWR

5.7 Auxiliary/Emergency Feedwater System (PWR)—BA

5.7.1 System Function

The auxiliary emergency feedwater system (PWR) provides a source of feedwater to the steam generators to remove decay heat when the feedwater system is not available, and steam generator pressure is sufficiently high to prevent decay heat removal by the residual heat removal system (RHR).

5.7.2 System Description

The auxiliary emergency feedwater system (PWR) consists of one or more motor-driven auxiliary/emergency feedwater system pumps, a steam-driven or diesel-driven auxiliary/emergency feedwater pump, isolation valves, and associated controls and instrumentation.

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The system provides feedwater to the steam generators for decay heat removal in the event of a loss of normal feedwater, a loss of normal ac electrical power, or a main steam or feedwater line rupture. The system may also serve as an alternate source of feedwater during plant startup, hot standby, or cool down operations whenever conditions are such that operation of the feedwater system is not desirable. The normal source of water is the condensate storage tank which provides a short term emergency source of condensate quality water. In the event of a transient or accident requiring long term auxiliary/emergency feedwater operation, an alternate noncondensate quality source(s) of water is provided.

5.7.3 Mode of Operation

The auxiliary/ emergency feedwater system (PWR) operates during startup, hot standby, cool down, and accident conditions.

5.7.4 Major Interfacing Systems

Condensate Storage and Transfer

System	KA
--------	----

Reactor Coolant System (PWR)	AB
------------------------------	----

Main/Reheat Steam System	SB
--------------------------	----

Closed/Component Cooling Water

System	CC
--------	----

Engineered Safety Features Actuation

System	JE
--------	----

Sampling and Water Quality System	KN
-----------------------------------	----

Nitrogen Supply System	LK
------------------------	----

Medium Voltage Power System—Class

1E	EB
----	----

5.7.5 Major Equipment

Auxiliary/Emergency Feedwater Pumps and Drives

Isolation Valves

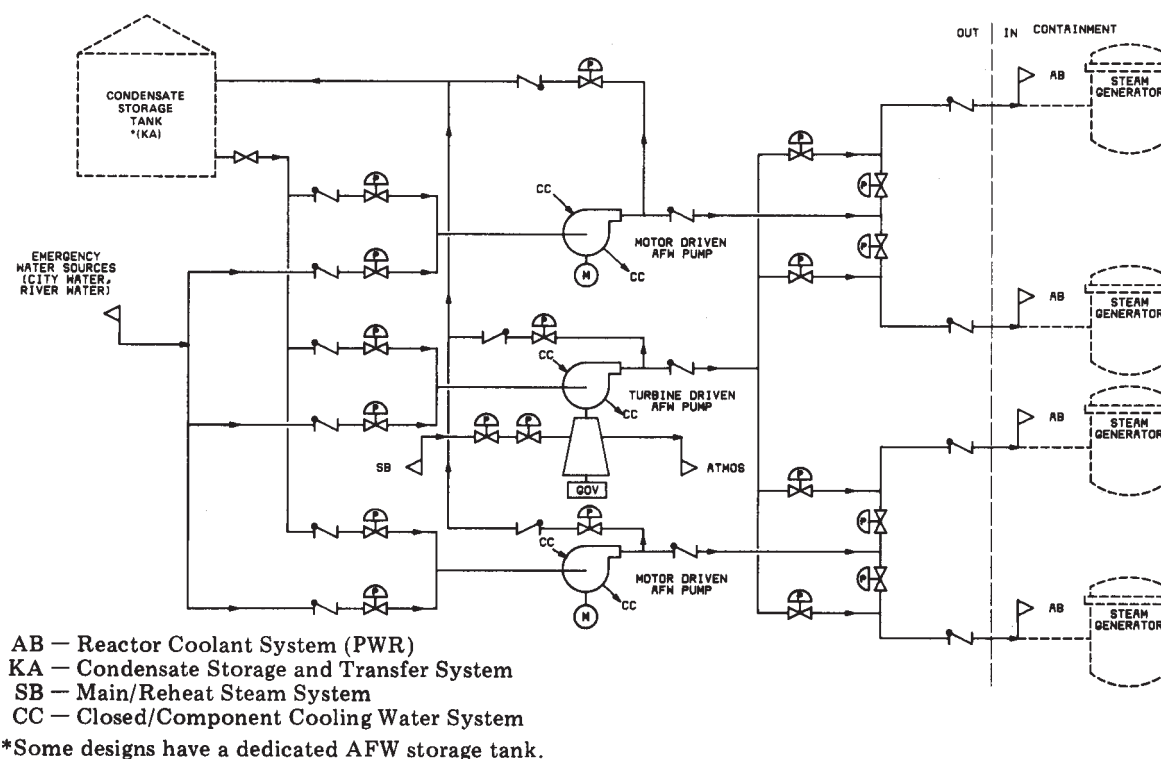


Figure 6—Auxiliary/Emergency Feedwater System (PWR) — BA

5.8 Containment Combustible Gas Control System—BB

5.8.1 System Function

The containment combustible gas control system maintains the hydrogen concentration inside containment below acceptable levels following a loss of coolant accident (LOCA).

5.8.2 System Description

The containment combustible gas control system consists of hydrogen recombiners which remove hydrogen from the containment atmosphere following a LOCA. The hydrogen recombiners use heat to cause recombination of hydrogen and oxygen molecules to form water. The hydrogen recombiners may be located either inside or outside containment.

Hydrogen recombiners located inside containment are normally mounted on the containment operating floor. If the recombiners are located outside containment, the containment combustible gas control system also includes piping, valves, and containment penetrations for routing the containment hydrogen mixture through the recombiners and returning it to the containment.

The containment combustible gas control system may also include a hydrogen mixing subsystem to prevent the buildup of high local concentrations of hydrogen in areas which do not have good communication with the containment atmosphere (if separate from the containment fan cooling system (PWR)). Such areas may include the drywell for a BWR or equipment compartments below the operating floor for a PWR. The mixing subsystem includes hydrogen mixing fans or compressors, and associated ductwork, dampers, and controls.

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The containment combustible gas control system may also include a backup purge subsystem (if separate from the reactor building environmental control system) to reduce the buildup of hydrogen in the containment atmosphere by dilution.

For small containments, the containment combustible gas control system also includes additional hydrogen control equipment such as distributed spark igniters to prevent the buildup of explosive hydrogen concentrations in the event the hydrogen production rate exceeds hydrogen recombiner capability. For small containments, the containment combustible gas control system may also include nitrogen inerting equipment to limit the oxygen concentration below that which can form a combustible mixture with hydrogen.

5.8.3 Mode of Operation

The containment combustible gas control system operates only following an accident.

5.8.4 Major Interfacing Systems

Essential Service Water System

BI

Varies with specific design.

5.8.5 Major Equipment

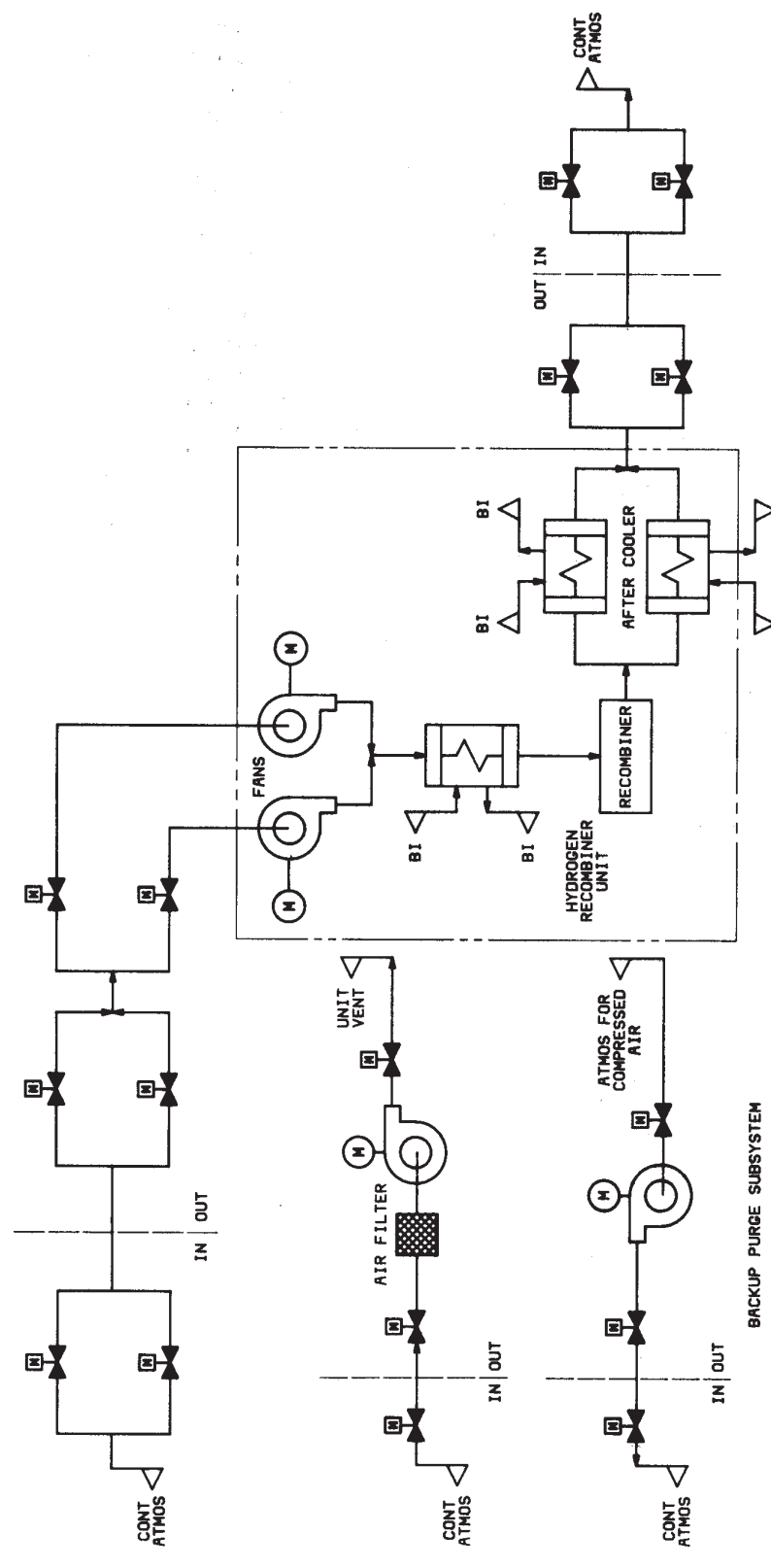
Hydrogen Recombiners

Hydrogen Mixing Fans or Compressors

Isolation Dampers

Nitrogen Inerting Equipment

Hydrogen Purge Fans



BI — Essential Service Water System

Figure 7—Containment Combustible Gas Control System — BB

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5.9 Containment Ice Condenser System (PWR)—BC

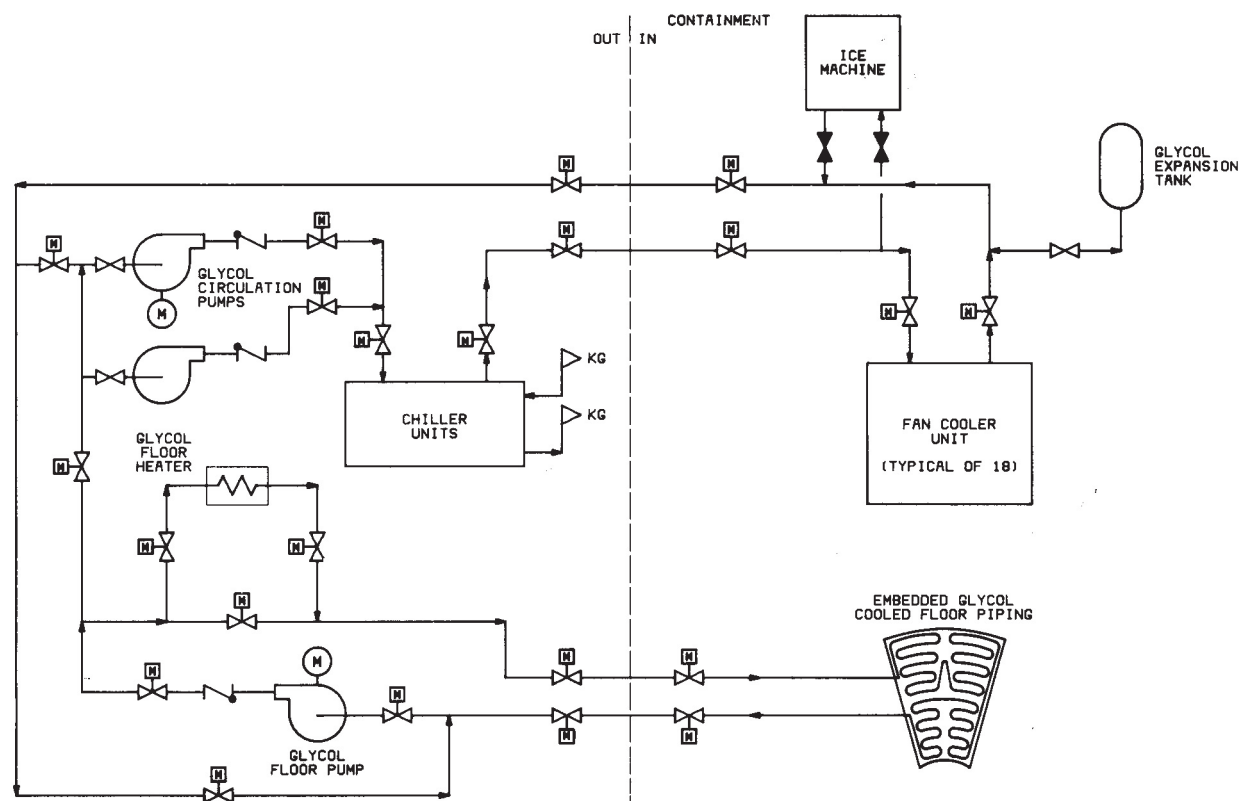
5.9.1 System Function

The containment ice condenser system (PWR) absorbs thermal energy released from a loss of coolant accident (LOCA) or a main steam line break so as to limit the peak containment pressure.

5.9.2 System Description

The system consists of an ice condenser and a refrigeration subsystem. The ice condenser includes the ice baskets, inlet and vent doors, support structures, cooling ducts, insulation, and associated instrumentation. The refrigeration subsystem includes refrigeration chiller units, glycol cooling loops, fan cooler units, an ice machine, and associated instrumentation and controls. The refrigeration units are cooled by the nonessential service water system.

The ice condenser consists of a number of insulated compartments distributed around the perimeter of the containment. Each compartment contains ice baskets filled with borated ice. The ice compartments connect with the lower region of the containment, which houses the reactor coolant system (PWR), and extend into the upper region of the containment above the operating deck. In the event of a LOCA, the pressure buildup in the lower containment region causes the ice condenser inlet doors to open. Steam is condensed as it flows through the ice compartments, thus limiting the peak containment pressure. Vent doors are provided at the top of the ice compartments to vent air entering with the steam from the lower containment region.



KG — Nonessential Service Water System

Figure 8—Containment Ice Condenser System (PWR) — BC Refrigeration Subsystem

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5.9.3 Mode of Operation

The ice condenser subsystem operates in the event of a LOCA. The refrigeration subsystem is normally in operation to refrigerate the ice condenser compartments.

5.9.4 Major Interfacing Systems

Reactor Containment Building	NH
Nonessential Service Water System	KG

5.9.5 Major Equipment

Chiller Units

Glycol Circulation Pumps

Fan Cooler Units

Inlet Doors

Vent Doors

Ice Baskets

Ice Machine

Glycol Expansion Tank

Glycol Flow Pump

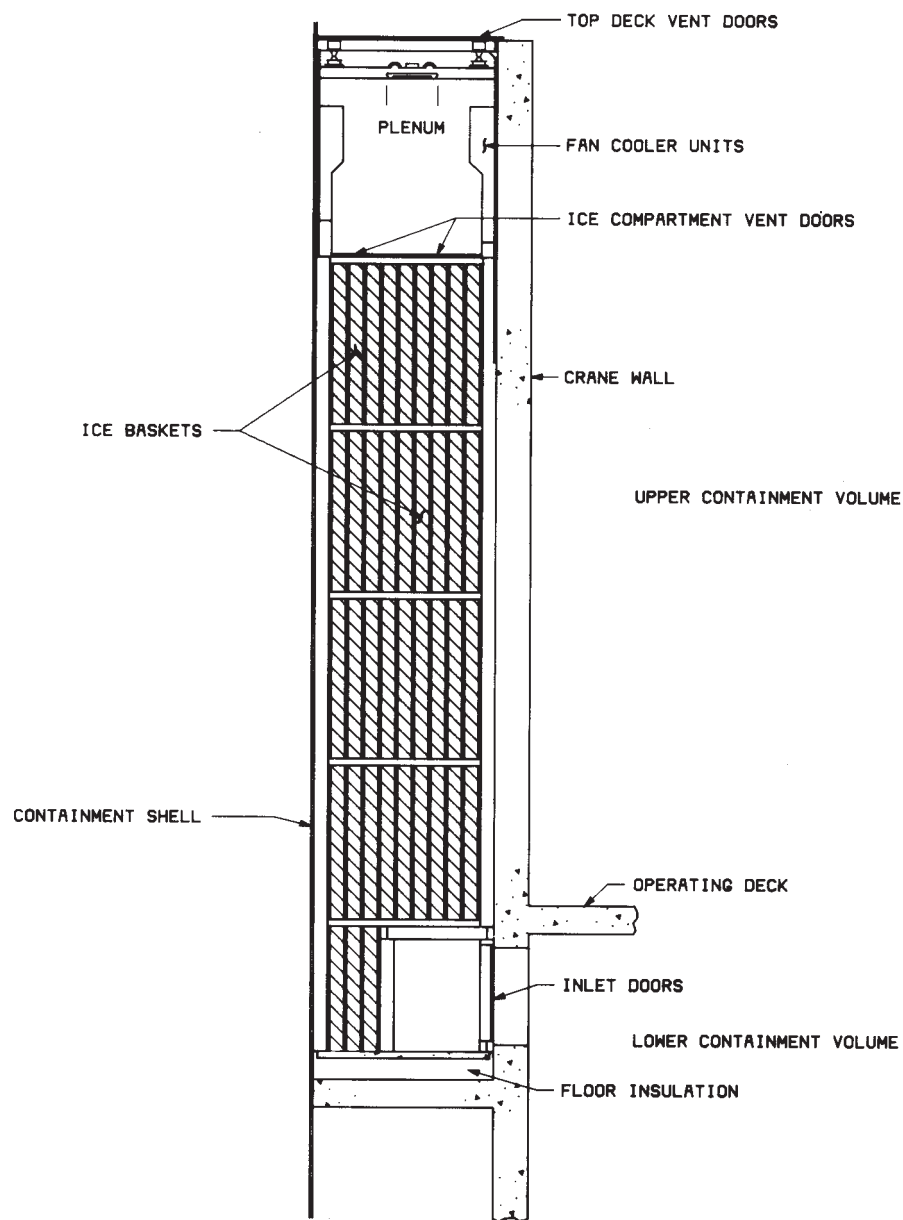


Figure 9—Containment Ice Condenser System (PWR) — BC Ice Condenser Subsystem

5.10 Containment Leakage Control System—BD

5.10.1 System Function

The containment leakage control system controls the leakage of radioactive fission products through containment penetrations following a loss of coolant accident (LOCA).

5.10.2 System Description

The system controls the post-LOCA leakage of radioactive fission products through containment penetrations using one or both of the following methods:

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- 1) Positive sealing
- 2) Leakage collection and filtration

A typical positive sealing subsystem maintains water, air, or nitrogen pressure between containment isolation valves at a higher pressure than the containment, so that, any leakage that can occur through the containment isolation valves is inward into the containment.

A typical leakage collection subsystem collects leakage past the inside containment isolation valve by maintaining the pressure between. The containment isolation valves at less than atmospheric pressure, thus ensuring that any leakage is collected. This leakage is then routed to a filtration system such as the emergency/standby gas treatment system where radioactive fission products such as iodine are removed. An example of this type of subsystem for a BWR is the main steam isolation valve leakage control system which collects leakage past the main steam isolation valves following a LOCA and routes this leakage to the containment shield building annulus where it is processed by the emergency/standby gas treatment system prior to release to the atmosphere.

5.10.3 Mode of Operation

The containment leakage control system operates only following an accident.

5.10.4 Major Interfacing Systems

Systems which penetrate the reactor containment.

5.10.5 Major Equipment

Water Supply Tanks

Pumps

Air Compressors

Air Flasks

Blowers

5.11 Containment Spray System (PWR)—BE

5.11.1 System Function

The containment spray system serves the following functions following a loss of coolant accident (LOCA).

- 1) Reduces peak containment pressure
- 2) Removes iodine from the containment atmosphere to reduce off-site radiation doses

5.11.2 System Description

A typical containment spray system consists of two redundant, full-capacity spray trains each of which include a containment spray pump, chemical additive tank, spray headers and associated valves, piping, and instrumentation. Some PWR designs also include a containment spray heat exchanger.

Each containment spray pump takes suction from the residual heat removal/low pressure safety injection system (PWR), which provides borated water from the refueling water storage tank or the containment sump. The water is pumped to circular piping headers equipped spray nozzles which are located high within the containment structure. A

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portion of the containment spray pump discharge flows through an eductor where a spray chemical additive, such as hydrazine or sodium hydroxide, is mixed with the spray water. The discharge from the spray headers serves to condense steam generated by the LOCA and thus reduce the peak containment pressure. The spray chemical additive removes any containment airborne iodine that may have been released during the LOCA and thus reduces off-site radiation doses.

5.11.3 Mode of Operation

The containment spray system operates only in the event of an accident.

5.11.4 Major Interfacing Systems

Residual Heat Removal/Low Pressure

Safety Injection System (PWR)	BP
-------------------------------	----

Closed Component Cooling Water

System	CC
--------	----

Engineered Safety Features Actuation

System	JE
--------	----

Medium Voltage Power System—Class

1E	EB
----	----

Nitrogen Supply System

LK

High Pressure Safety Injection System

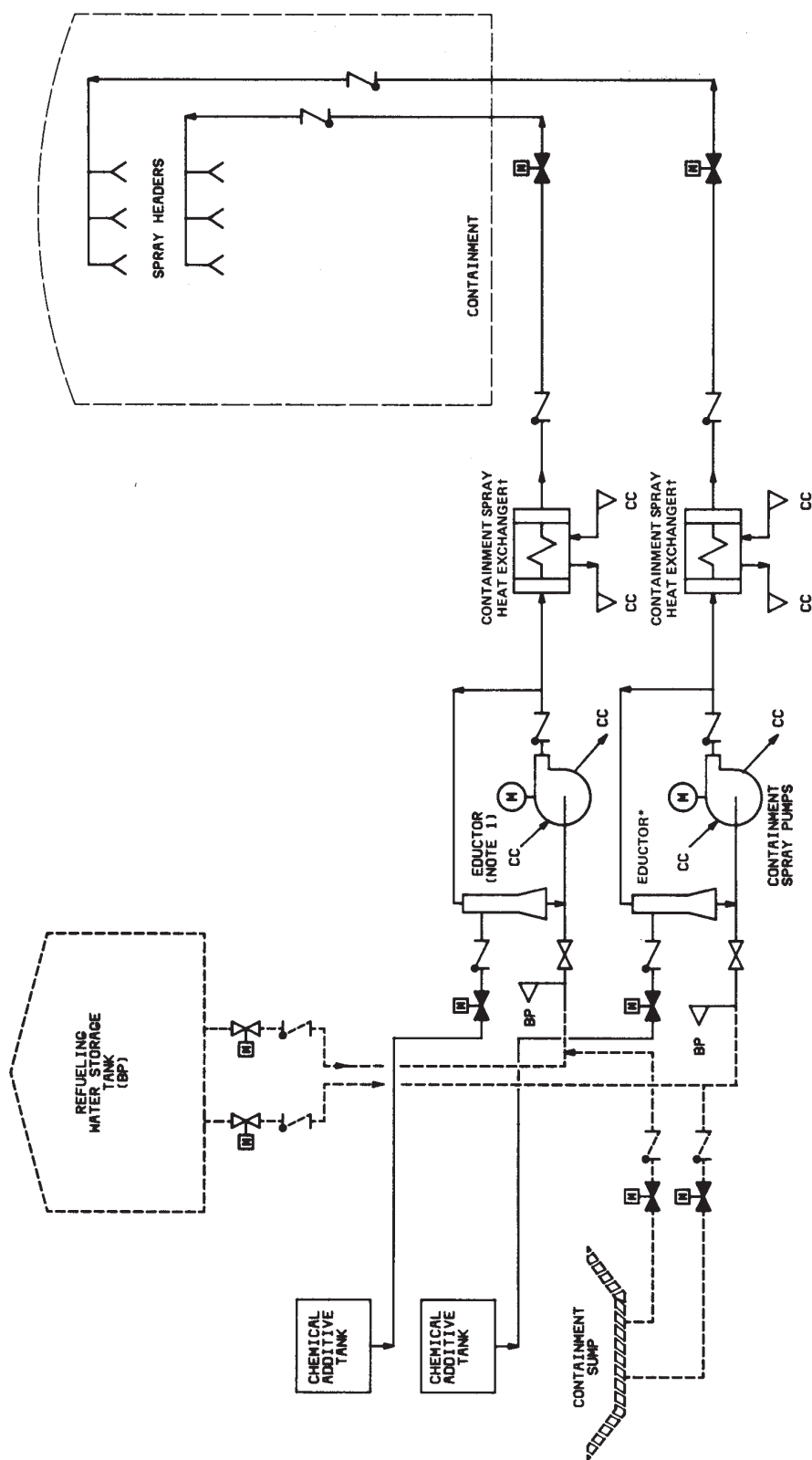
(PWR)	BQ
-------	----

5.11.5 Major Components

Containment Spray Pumps

Chemical Additive Tanks

Spray Headers



BP — Residual Heat Removal/Low Pressure Safety Injection System (PWR)
 CC — Closed/Component Cooling Water System (PWR)

*Some designs use spray additive pumps in lieu of eductors.
 †Not provided in some designs.

Figure 10—Containment Spray System (PWR) — BE

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5.12 Containment Vacuum Relief System—BF

5.12.1 System Function

The containment vacuum relief system relieves excess negative pressure in the drywell or containment to prevent the possibility of structural buckling.

5.12.2 System Description

A typical system consists of backdraft dampers or check valves, vacuum relief dampers or valves, ductwork or piping interconnecting the drywell with the containment (BWR) and the containment with atmosphere, and actuating instrumentation. This system is provided for containment designs such as steel containments which could possibly be damaged in the event of excess external differential pressure.

5.12.3 Mode of Operation

The containment vacuum relief system operates in the event of abnormal or accident conditions.

5.12.4 Major Interfacing Systems

Reactor Containment Building	NH
Essential Air System	LE

5.12.5 Major Equipment

Vacuum Relief Dampers or Valves

5.13 High Pressure Core Spray System (BWR)—BG

5.13.1 System Function

The high pressure core spray system (BWR) provides cooling water to the reactor core following a loss of coolant accident (LOCA), thus preventing nuclear fuel damage.

5.13.2 System Description

The high pressure core spray system (BWR) is an emergency core cooling water system which is initiated automatically to deliver cooling water to the reactor core following a LOCA. The system also serves as a backup source for makeup water to the reactor vessel in the event of reactor isolation and failure of the reactor core isolation cooling system (BWR). A typical high-pressure core spray system (BWR) consists of one or more high head pumps which take suction from the condensate storage tank (preferred source) or the suppression pool and deliver cooling water to the reactor core by way of a core spray sparger. A line fill pump is usually provided to maintain the system piping full of water to ensure quick system response and prevent any potential damage from hydraulic shock when the system is first brought into operation.

5.13.3 Mode of Operation

The high-pressure core spray system (BWR) operates following an accident.

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5.13.4 Major Interfacing Systems

Reactor Recirculation System (BWR)	AD
Condensate Storage and Transfer System	KA
Medium-Voltage Power System—Class 1E	EB

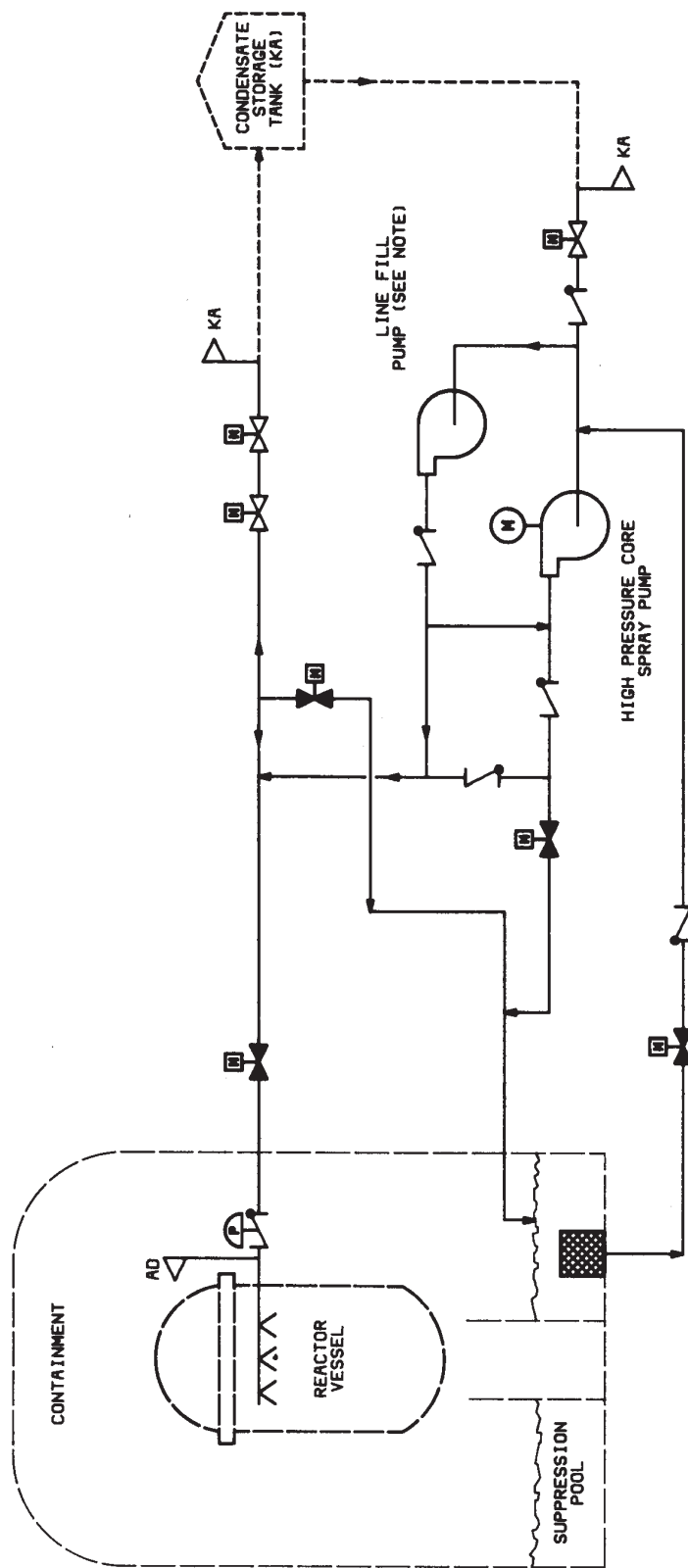
5.13.5 Major Equipment

High-Pressure Core Spray Pumps

Line Fill Pump

Strainers

Core Spray Sparger



KA — Condensate Storage and Transfer System
 AD — Reactor Recirculation System
 NOTE: Some designs use a head tank.

Figure 11—High-Pressure Core Spray System (BWR) — BG

WITHDRAWN

5.14 Emergency/Standby Gas Treatment System—BH

5.14.1 System Function

The emergency/standby gas treatment system limits the release of radioactivity to the environment following an accident.

5.14.2 System Description

The emergency/standby gas treatment system consists of two redundant divisions of equipment, each consisting of an exhaust fan, air cleanup unit and associated ductwork, dampers, and instrumentation. Each air cleanup unit includes a moisture separator, prefilter, electric heating coil, HEPA filters, and charcoal filters.

In the event of an accident, the emergency/standby gas treatment system is automatically initiated to maintain secondary containment areas at a negative pressure and filter the exhaust air to remove radioactive iodine which has leaked past primary containment. Depending upon the plant specific design, the emergency/standby gas treatment system may serve any or all of the following areas: the annulus between the containment and shield building, the annulus between the containment and the secondary containment enclosure, the fuel building, auxiliary building areas, and reactor building areas. The emergency/standby gas treatment system may also be used to limit the release of radioactivity in the event of a fuel handling accident.

5.14.3 Mode of Operation

The emergency/standby gas treatment system operates in the event of an accident.

5.14.4 Major Interfacing Systems

Auxiliary Building Environmental	
Control System	VF
Fuel Building Environmental Control	
System	VG
Reactor Building Environmental	
Control System	VA
Shield Building Annulus	
Return/Exhaust System	VC
Essential Air System	LE
Drywell Environmental Control System	VB

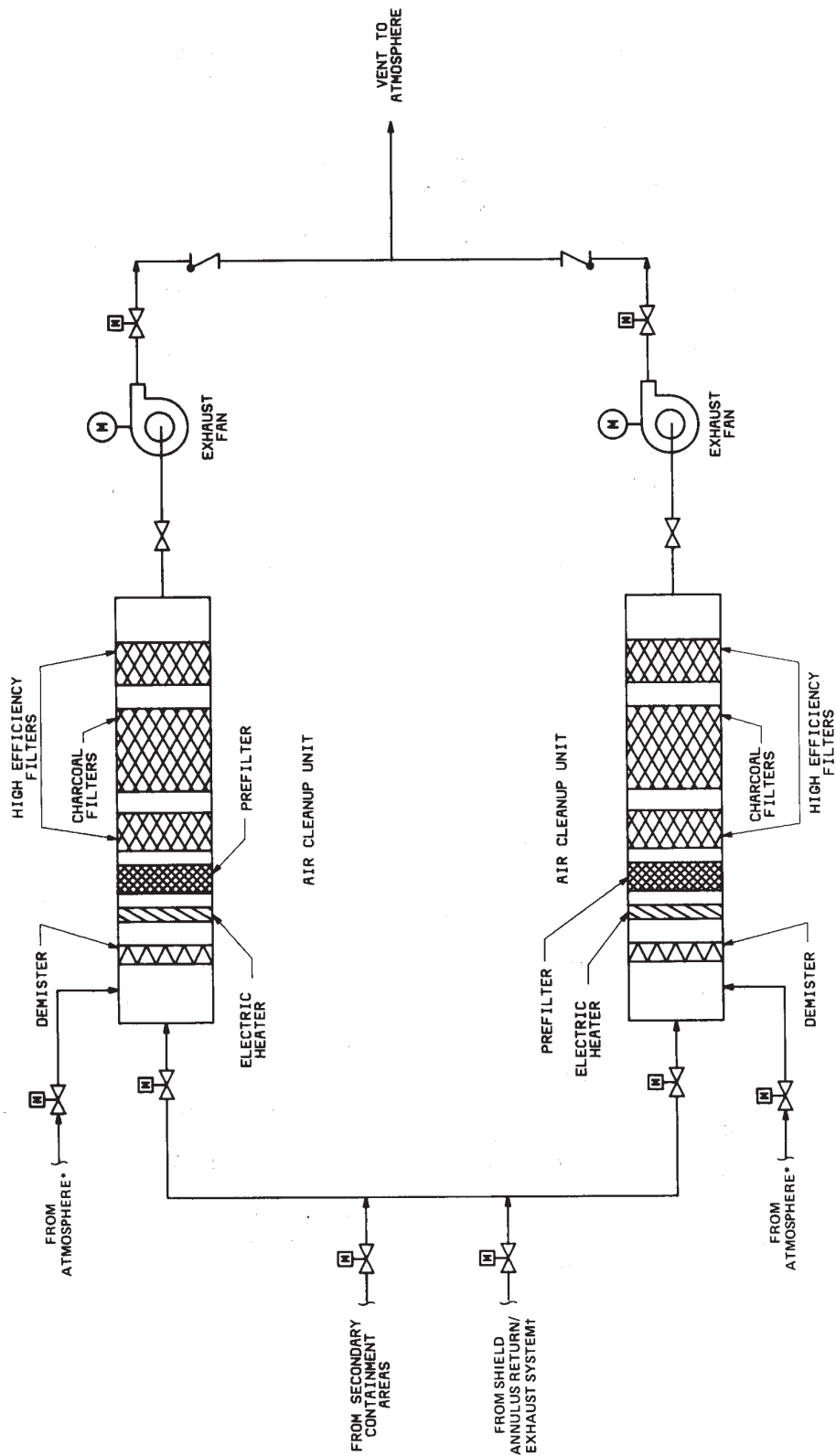
5.14.5 Major Equipment

Exhaust Fans

Air Cleanup Units

Annulus Mixing Fans

Isolation and Control Dampers



*Some designs use heat removal fans.
 †Not all designs.

Figure 12—Emergency/Standby Gas Treatment System — BH

WITHDRAWN

5.15 Essential Service Water System—BI

5.15.1 System Function

The essential service water system provides raw cooling water to essential equipment which is used for the safe shutdown of the reactor or to prevent or mitigate the consequences of accidents.

5.15.2 System Description

A typical essential service water system consists of two or more redundant cooling water loops (Divisions 1 and 2) each of which include an essential service water pump and associated valves, piping, and instrumentation. The essential service water pumps take suction from the ultimate heat sink system and deliver cooling water to the essential service water system cooling loads. The cooling water is then returned to the ultimate heat sink system where the waste heat is rejected to the environment. The essential service water system may also serve nonessential equipment to permit operation during a loss of normal plant ac electrical power. These cooling loads are automatically isolated in the event of an accident.

5.15.3 Mode of Operation

The essential service water system operates during normal, startup, shutdown, and accident conditions.

5.15.4 Major Interfacing Systems

The following list of interfacing systems is typical and may vary according to station design.

Containment Fan Cooling System	
(PWR)	BK
Diesel Cooling Water System	LB
Closed/Component Cooling Water	
System	CC
Auxiliary Building Environmental	
Control System	VF
Fuel Building Environmental Control	
System	VG
Control Red Drive Cooling System	
(PWR)	CD
Emergency Onsite Power Supply	
Building Environmental Control	
System	VJ
Control Building/Control Complex	
Environmental Control System	VI
Reactor Drywell Environmental	
Control System (BWR)	VB
Residual Heat Removal/Low Pressure	
Coolant Injection System (BWR)	BO
Ultimate Heat Sink System	BS
Containment Combustible Gas Control	
System	BB

WITHDRAWN

Fuel Pool Cooling and Purification

System DA

Fire Protection System (Water) KP

Medium Voltage Power System—Class

1E EB

Engineered Safety Features Actuation

System JE

Emergency Onsite Power Supply

System EK

Heat Rejection Chemical Treatment

System KF

Reactor Building Environmental

Control System VA

5.15.5 Major Equipment

Essential Service Water Pumps

5.15.6 Essential Cooling Loads (Typical)

Closed Cooling Water Heat Exchanger (PWR)

Standby Diesel Generator

Reactor Auxiliary Building Environmental Control System

Fuel Building Environmental Control System

Diesel Generator Building Environmental Control System

Control Building Environmental Control System

Essential Service Water Pump Building Environmental Control System

Residual Heat Removal Heat Exchangers (BWR)

Fuel Pool Cooling and Purification Heat Exchangers (BWR)

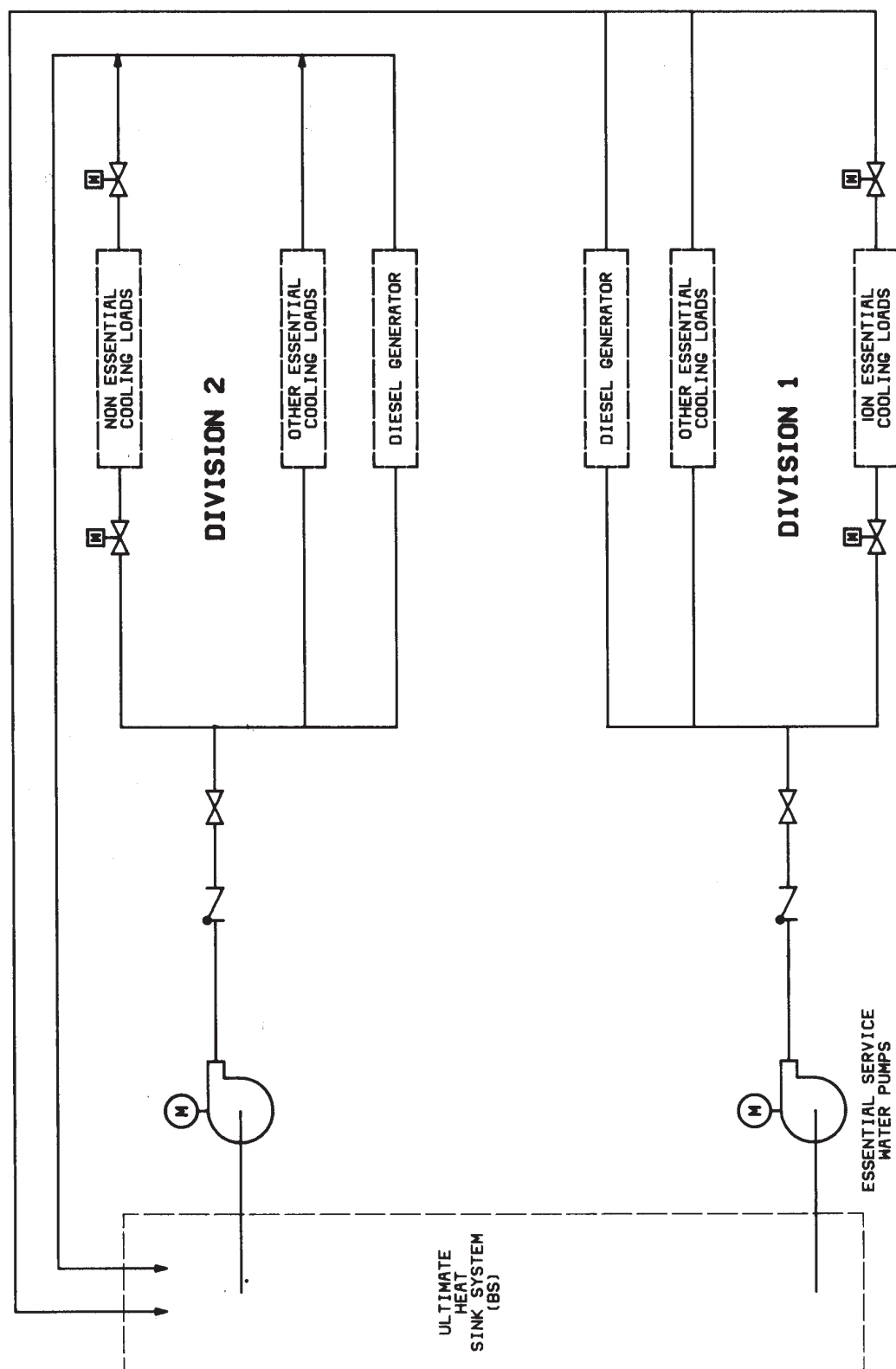
Containment Fan Coolers (PWR)

5.15.7 Nonessential Cooling Loads (Typical)

Control Rod Drive Cooling Water Heat Exchanger (PWR)

Closed Cooling Water Heat Exchanger (BWR)

Reactor Drywell Environmental Control System (BWR)



NOTE: Some designs have a division 3 cooling loop.

Figure 13—Essential Service Water System — BI