GE Nuclear Energy

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April 30, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **DFSER Open Item 3.8.3-1 and COL Action Item 9.4.8-1**

Dear Chet:

Enclosed are SSAR markups addressing DFSER Open Item 3.8.3-1 and COL Action Item 9.4.8-1.

Please provide copies of this transmittal to Tom Cheng and Butch Burton.

Sincerely,

Jack Fox
Advanced Reactor Programs

cc: Gary Ehlert (GE)
Norman Fletcher (DOE)

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internal structures of the containment conform to the applicable codes, standards, and specifications and regulations listed in Table 3.8-4 except where specifically stated otherwise.

Structure or Component	Specific Reference Number
Diaphragm Floor	14
Reactor Pedestal	1-13, 15-22
Reactor Shield Wall	1-13, 15-22
DEPSS	15-22
Miscellaneous platforms	15-22
L/D Equipment Tunnel	15-22
L/D Personnel Tunnel	15-22
Reactor Shield Wall Stabilizer	15-22

3.8.3.3 Loads and Load Combinations

3.8.3.3.1 Load Definitions

The loads and applicable load combinations for which the structure is designed depend on the conditions to which the particular structure is subjected.

The containment internal structures are designed in accordance with the loads described in Appendix 3B. These loads and the effects of these loads are considered in the design of all internal structures as applicable. The loads within the loading combinations are combined using the absolute sum technique. (Those loads which are defined as reversible in algebraic sign are combined in such a way as to produce the maximum resultant stresses in the structure. All other loads are combined in accordance with their direction of application to the structure.) The loads are defined in Subsection 3.8.1.3 except as follows:

(1) P_o--Pressure loads resulting from the normal operating pressure difference between the drywell (upper and lower) and the suppression chamber of the containment.

(2) Construction Loads--Construction loads are loads which are applied to the containment internal structures from start to completion of construction. The definitions for D, L and T_o are applicable, but are based on actual construction methods and /or conditions.

(3) RV2--Loads from component response or direct fluid forces, on components located in the suppression pool, caused by safety relief valve air cleaning loads.

(4) RBV--Loads due to reactor building vibrations caused by an SRV and LOCA event.

(5) AP--Loads and pressures directly on the reactor shield wall and loads from component response or direct steam flow forces on components located in the reactor vessel shield wall annulus region, caused by a rupture of a pipe within the reactor vessel shield wall annulus region.

(6) SL--Loads from component response or direct fluid forces, on components located in the sloshing zone of a pool or component, caused by the sloshing phenomenon from any dynamic event.

3.8.3.3.2 Load Combination

The load combinations and associated acceptance criteria for concrete and steel internal structures of the containment are listed in Table 3.8.3-5 and Table 3.8.3-6, respectively; for the reactor shield wall refer to appendix 3B.

3.8.3.4 Design and Analysis Procedures

3.8.3.4.1 Diaphragm Floor

The design and analysis procedures used for the diaphragm floor are similar to those used for the containment structure. The diaphragm slab is included in the finite element model described in Subsection 3.8.1.4.1.1.

3.8.3.4.2 Reactor Pedestal

The reactor pedestal is included in the finite element model described in Subsection 3.8.1.4.1.1.

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The design and analysis is based on the elastic method. All loads are resisted by the integral action of the inner and outer steel shells. The concrete placed in the annulus between the inner and outer shells acts to distribute loads between the steel shells, and provides stability to the compression elements of the pedestal.

3.8.3.4.3 Reactor Shield Wall

The design and analysis procedures used for the reactor shield wall are similar to those used for the reactor pedestal described in Subsection 3.8.3.4.2.

3.8.3.4.4 Drywell Equipment and Pipe Support Structure

The drywell equipment and pipe support structure is designed using the AISC working stress methods for steel safety-related structures for nuclear facilities (ANSI/AISC N690). The design of beams supporting pipe whip restraints allows inelastic deformations due to postulated pipe rupture loads. All safety-related items which the inelastic beam deformations may affect are evaluated to verify that no required safety function would be compromised.

3.8.3.4.5 Other Internal Structures

The design and analysis procedures used for other internal structures are similar to those used for the drywell equipment and pipe support structure as described in Subsection 3.8.3.4.4.

3.8.3.5 Structural Acceptance Criteria

3.8.3.5.1 Diaphragm Floor

The calculated and allowable stresses for the diaphragm floor are found in Tables 3H.3-8 and 3H.3-9.

3.8.3.5.2 Reactor Pedestal

The calculated and allowable stresses for the reactor pedestal are found in Tables 3H.3-10 and 3H.3-11.

3.8.5.3 Other Internal Structures

The structural acceptance criteria for other internal concrete or steel structures are in accordance with ACI-349 and ANSI/AISC-N690, respectively.

3.8.3.6 Materials, Quality Control, and Special Construction Techniques

3.8.3.6.1 Diaphragm Floor

The materials, quality control, and construction techniques used for the diaphragm floor and liner plate are the same as those used for the containment wall and liner plate in Subsection 3.8.1.6.

3.8.3.6.2 Reactor Pedestal

The materials conform to all applicable requirements of ANSI/AISC N690 and ACI 349 and comply with the following:

Item	Specification
Inner and outer shells	ASTM A441
Internal stiffeners	ASTM A441
Concrete fill	f' c = 4000 psi

3.8.3.6.3 Reactor Shield Wall

The materials conform to all applicable requirements of ANSI/ASIC N690 and ACI 349 and comply with the following:

Item	Specification
Inner and outer shells	ASTM A441
Internal stiffeners	ASTM A441
Concrete fill	f' c = ~~3000~~ 4000 psi
Stainless Steel Clad	SA-240 Type 304 L

3.8.3.6.4 Drywell Equipment and Pipe Support Structure

The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:

Item	Specification
Structural steel and connections	ASTM A36

High strength structural steel plates	ASTM A572 or A441
Bolts, studs, and nuts (dia. ≥ 3/4")	ASTM A325 or A490
Bolts, studs, and nuts (dia. ≤ 3/4")	ASTM A307

3.8.3.6.5 Other Internal Structures

The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:

Item	Specification
Miscellaneous platforms	Same as Section 3.8.3.6.4
Lower drywell equipment tunnel	ASTM A516 Grade 70 SA-240 Type 304 L
Lower drywell personnel tunnel	ASTM A516 Grade 70 SA-240 Type 304 L
Reactor shield wall stabilizer	
--tube sections	ASTM A501
--plates	ASTM A36
Lower drywell floor fill material	A material other than limestone concrete

3.8.3.7 Testing and Inservice Inspection Requirements

A formal program of testing and inservice inspection is not planned for the internal structures except the diaphragm floor, reactor pedestal, and lower drywell access tunnels. The other internal structures are not directly related to the functioning of the containment system; therefore, no testing or inspection is performed.

Testing and inservice inspection of the diaphragm floor, reactor pedestal and lower drywell access tunnels are discussed in Subsection 3.8.1.7.

3.8.4 OTHER SEISMIC CATEGORY I STRUCTURES

Other Seismic Category I structures which constitute the ABWR Standard Plant are the reactor building, control building and radwaste building substructure. Figure 1.2-1 shows the spatial relationship of these buildings. The only other structure in close proximity to these structures is the turbine building. They are structurally separated from the other ABWR Standard Plant buildings.

The Seismic Category I structure within the ABWR Standard Plant, other than the containment structures, that contains high-energy pipes is the reactor building. The steam tunnel walls protect the reactor building from potential impact by rupture of the high-energy pipes. This building is designed to accommodate the guard pipe support forces.

The reactor building, steam tunnel, residual heat removal (RHR) system, reactor water cleanup (RWCU) system, and reactor core isolation cooling (RCIC) system rooms are designed to handle the consequences of high energy pipe breaks. The RHR, RCIC, and RWCU rooms are designed for differential compartment pressures, with the associated temperature rise and jet force. Steam generated in the RHR compartment from the postulated pipe break exits to the steam tunnel through blowout panels. The steam tunnel is vented to the turbine building through the seismic interface restraint structure (SIRS). The steam tunnel, which contains several pipelines (e.g., main steam, feedwater, RHR), is also designed for a compartment differential pressure with the associated temperature changes and jet force.

Seismic Category I masonry walls are not used in the design. The ABWR Standard Plant does not contain seismic Category I pipelines buried in soil.

3.8.4.1 Description of the Structures

3.8.4.1.1 Reactor Building Structure

The reactor building (RB) is constructed of reinforced concrete with a steel frame roof. The RB has four stories above the ground level and three stories below. Its shape is a rectangle of 59 meters in the E-W direction, 56 meters in the N-S direction, and a height of about 57.9 meters from the top of the basemat.

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Table 3.8-4

CODES, STANDARDS, SPECIFICATIONS, AND REGULATIONS USED IN THE DESIGN AND CONSTRUCTION OF SEISMIC CATEGORY I INTERNAL STRUCTURES OF THE CONTAINMENT (Continued)

SPECIFICATION REFERENCE NUMBER	SPECIFICATION OR STANDARD DESIGNATION	TITLE
15	ANSI/AISCN690	Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities (as modified by SRP's 3.5.3, 3.8.1, 3.8.3, and 3.8.4)
16	AWS D1.1	Structural Welding Code
17	NCIG-02	Visual Weld Acceptance Criteria for Structural Welding at Nuclear Power Plants
18	ANSI/ASME NQA-1-1986	Quality Assurance Program Requirements for Nuclear Facilities
19	(Deleted)	
20	NRC Regulatory Guide 1.94	Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants
21	NRC Regulatory Guide 1.136	Materials for Concrete Containments (Article CC-2000 of the Code for Concrete Reactor Vessels and Containments)
22	NRC Regulatory Guide 1.142	Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments)

Explanation of Abbreviations

ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society for Mechanical Engineers
AWS	American Welding Society
NCIG	Nuclear Construction Issues Group
NRC	Nuclear Regulatory Commission

NOTES:

1. *Unless specified, the Edition of the Specification or Standard shall be the latest issued for industry use.*

COL 9.4.8-1

9.4.7 Diesel Generator Area Ventilation System

The diesel generator area ventilation system is part of the reactor building ventilation system described in Subsection 9.4.5.

9.4.8 Service Building Ventilation System

This system serves all areas within the service building, including locker rooms, men and women's change rooms, laundry, lunch room, instrument repair room, HVAC equipment rooms, and ~~service building control room~~ the TSC. This system operates during all normal station conditions.

9.4.8.1 Design Basis

9.4.8.1.1 Safety Design Basis

The service building HVAC system is not required to function in any but the normal station operating conditions and, therefore, has no safety bases.

9.4.8.1.2 Power Generation Design Bases

(1) The service building HVAC system is designed to maintain a quality environment suitable for personnel health and safety in the service building. It is designed to limit the maximum temperature in the service building to 85°F. The temperature in each area conforms to the equipment requirements in that area.

(2) The system provides a quantity of filtered outdoor air to purge any possible contamination. This air is processed through the dust collectors, prefilters, charcoal, and HEPA filters (as required) before it is monitored for radioactivity and released to the atmosphere.

(3) Both the supply air system and the exhaust air system operate manually and continuously. Isolation dampers at each supply fan, each exhaust fan, and each filter package close when the respective equipment is not operating. There is an additional isolation damper at the supply air inlet which closes when the supply air system is not operating. An automatic damper in the supply system ductwork regulates the flow of air to maintain the service building clean areas at a positive pressure with respect to atmosphere.

(4) In the event of a loss of offsite electric power, the service building system is shut down.

insert 'a'

9.4.8.2 System Description

~~(1) The schematic design of the service building ventilation system is shown on Figure 9.4-7.~~

1 (2) The service building ventilation system supplies filtered, heated or cooled air to the general areas through a central fan system consisting of an outside air intake, filters, a heating coil, a cooling coil, two 50% capacity supply air fans, and supply air ductwork.

2 (3) The two 50% capacity exhaust air fans induce the ventilation air from the clean areas through the exhaust ducts and discharge the air to the common station vent.

3 (4) Potentially contaminated air is routed through mechanical moisture separators, prefilters, and high-efficiency particulate filters (HEPA) before being routed to two 50% capacity exhaust air fans to discharge the air to the common station vent.

4 (5) The potentially contaminated areas are maintained at a slightly lower pressure then the surrounding clean areas and, therefore, the air flows from the clean areas to these potentially contaminated areas.

5 (6) Pressure control dampers are employed between clean and potentially contaminated areas and are of the back flow type and fail closed. This minimizes the back flow of contaminated air to clean areas when there is a loss of power and subsequent fan system shutdown.

insert 'b'

(7) Controls and Instrumentation

(a) Each fan and each exhaust filter package is controlled by hand switches located on local control panels. Pertinent system flow rates and temperatures are also indicated on the local control panels. Trouble on local con-

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trol panels is annunciated on the main control board.

(b) Controls are pneumatic and electric.

(c) Instrumentation is provided for monitoring system operating variables during normal station operating conditions. The loss of air flow; high and low system temperature; and high differential pressure across the ~~supply air filter, dust collector, and exhaust filter package filters are annunciated on the local control panel. Trouble on the local panel is annunciated on the main control board.~~ various filters are annunciated on the local control panel. Trouble on the local pane is annunciated ~~on~~ in the main control ~~board~~ room.

insert 'C'

9.4.8.3 Safety Evaluation

(1) The service building ventilation system is not safety-related and is not required to assure either the integrity of the reactor coolant pressure boundary or the capability to shut down the reactor and maintain it in a safe shutdown conditions.

(2) Pressure control dampers are employed between clean and potentially contaminated areas and are of the back flow type and fail closed. This minimizes the back flow of contaminated air to clean areas when there is a loss of power and subsequent fan system shutdown.

(3) The system incorporates features to assure its reliable operation over the full range of normal station conditions.

9.4.8.4 Testing and Inspection

All equipment is factory inspected and tested in accordance with the applicable equipment specifications and codes. System ductwork and erection of equipment is inspected during various construction stages. Preoperational tests are performed on all mechanical components and the system is balanced for the design air, and water flows and system operating pressures. Controls, interlocks and safety devices on each system are checked, adjusted, and tested to ensure the proper sequence of operation. A final integrated preoperational test is conducted with all equipment and controls operational to verify the system performance.

Maintenance will be performed on a scheduled basis in accordance with the equipment manufacturer's requirements.

The system is in operation during normal plant operation.

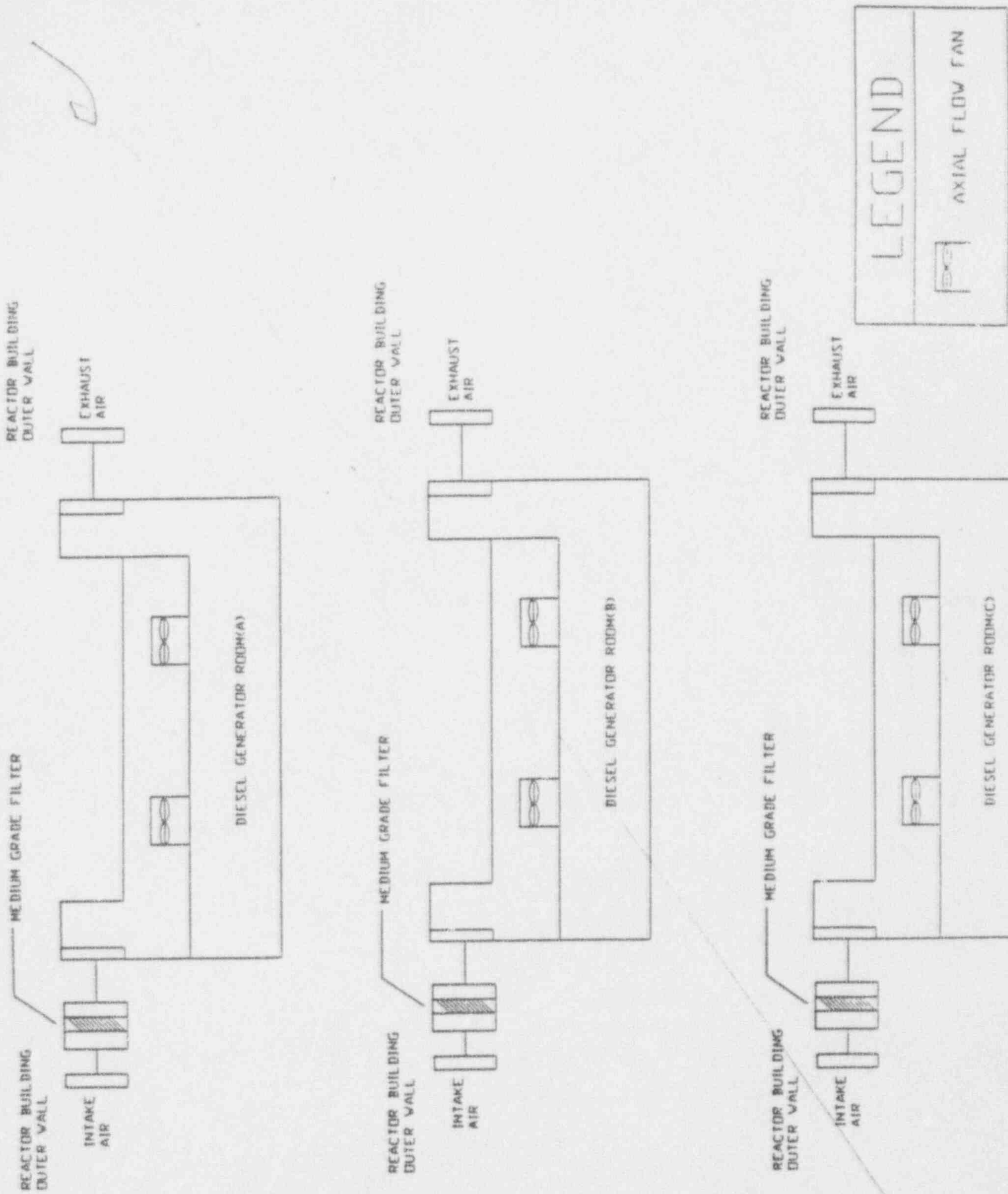

Figure 9.4-6 ESSENTIAL DIESEL GENERATOR HAVC SYSTEM

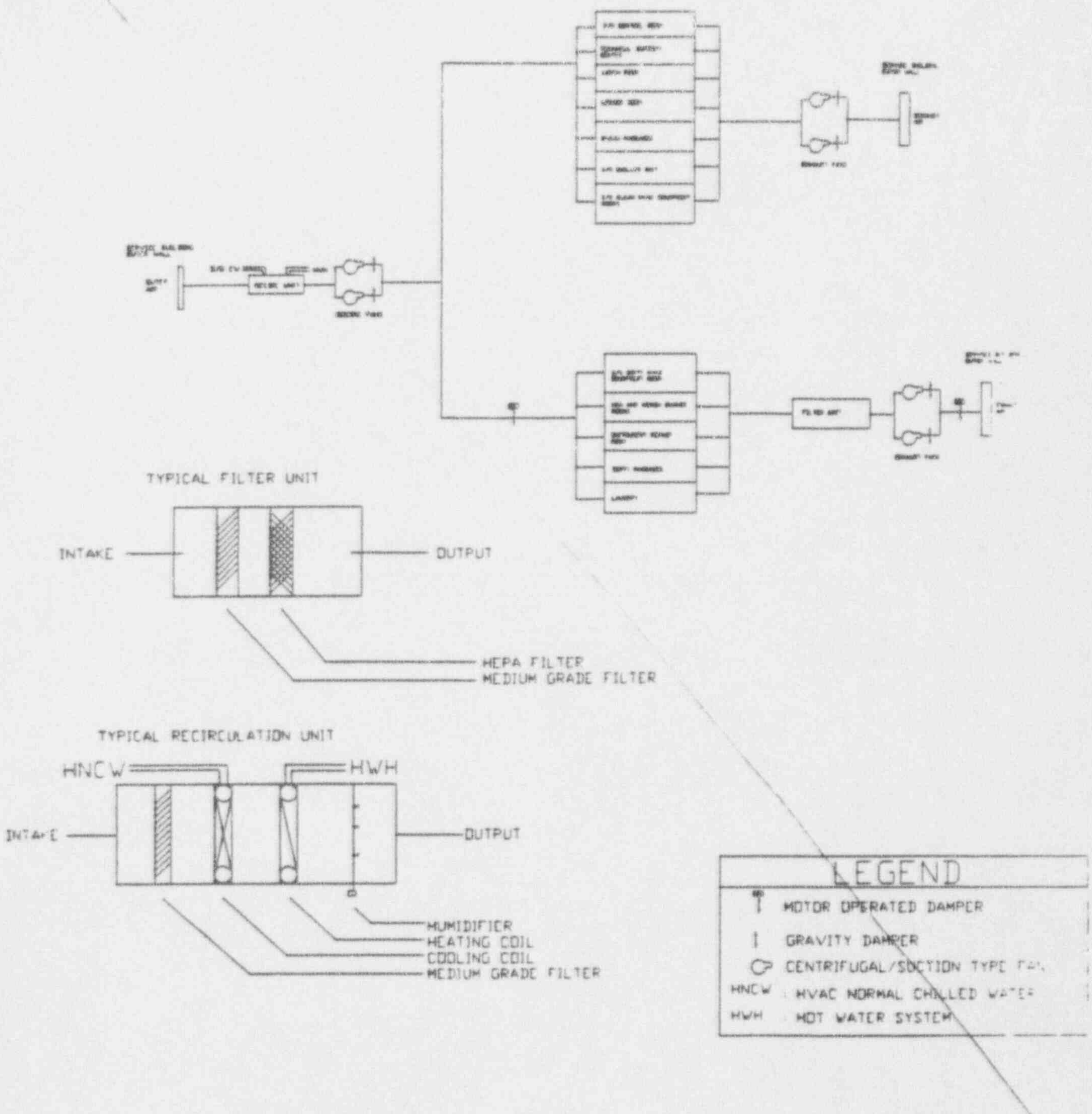

Figure 9.4-7 SERVICE BUILDING VENTILATION SYSTEM

COL 9.4.8-1

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(5) The clean areas served by the service building HVAC system has an emergency filter train. It is manually operated. In an emergency it supplies filtered air for the TSC and other normally clean areas.

insert b

(6) The clean areas of the service building is provided with an emergency filter train consisting of a heater/demister, prefilter, HEPA filter, 2" charcoal fileter bed, a second HEPA filter, and a fan.

insert c

(8) The COL applicant will provide a detailed P&ID and an equipment list, for the service building HVAC system, including the TSC, for NRC review. (See Subsection 9.4.10.1 for COL License Information)

9.4.10 COL License Information

The COL applicant will provide a detailed P&ID and an equipment list, for the service building HVAC system, including the TSC, for NRC review. (See Subsection 9.4.8.2)