GE Nuclear Energy

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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Robert C. Pierson, Director
Standardization and Non-Power Reactor Project Directorate

Subject: **Additional Tier 1 Design Certification Material for the GE ABWR Design, Stage 2 Submittal**

Reference: Letter, P. W. Marriott to Robert C. Pierson, "Tier 1 Design Certification Material for the GE ABWR Design, Stage 2 Submittal," Docket No. STN 52-001 dated April 6, 1992.

Enclosed are thirty-four (34) copies of the Section 2.15.10, Reactor Building, of the Stage 2 GE ABWR Tier 1 Design Certification Material . This submittal supplements the Tier 1 ABWR Design Certification Material transmitted earlier by the referenced letter.

Also included in the attachment is the reprint of the remainder of Section 2.15, Sections 2.15.11 through 2.15.14, with sequential page numbers following Section 2.15.10 which now occupies 28 pages.

Sincerely,

P. W. Marriott, Manager
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2.15.10 Reactor Building

Design Description

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 approximately 59 meters in 90-270 deg. direction; approximately 56 meters in the 0-180 deg. direction, and a height of about 58 meters from the top of the basemat.

The Reinforced Concrete Containment Vessel (RCCV) in the center of the RB encloses the Reactor Pressure Vessel (RPV). The RCCV supports the upper pool and is integrated with the RB structure from the basemat up through the elevation of the RCCV top slab. The interior floors of the RB are also integrated with the RCCV wall. The RB has slabs and beams which join the exterior wall. Columns support the floor slabs and beams. The fuel pool girders are integrated with the RCCV top slab and with R[illegible] columns. The RB is a shear wall structure designed to accom[illegible] seismic loads with its walls. Frame members such as beams or columns [illegible] designed to accommodate deformations of the walls in case of earthquake conditions.

The general building arrangement including watertight doors and sills for doorways where needed for flood control is presented in Figures 2.15.10.a through 2.15.10.o.

Seismic Category I Structure

The RB is a Seismic Category I structure designed to provide missile and tornado protection. Major nominal dimensions are as follows:

Structures	Dimensions (m)
Outer Box Walls:	
Overall height above top of basemat	57.9
Overall planar dimensions (outside)	
0-180 deg. direction	59.0
90-270 deg.direction	56.0
Wall thickness of each outer wall along 0-180 deg.	
Eighth level	0.3
Seventh level	0.3
Sixth level	0.5
Fifth level	0.8
Fourth level	0.9
Third level	1.2
Second level	1.3
First level	1.5

Structures (Continued)	Dimensions (m)
Wall thickness of each outer wall along 90-270 deg.	
Eighth level	0.3
Seventh level betw. col. lines R2 and R6	0.6
Seventh level betw. col. lines R1 and R2	
Seventh level betw. col. lines R6 and R7	0.3
Sixth level	0.9
Fifth level along col. line RA	1.2
Fifth level along col. line RG	0.9
Fourth level	1.2
Third level	1.2
Second level	1.3
First level	1.5
Containment:	
Diameter (I.D.)	29.0
Thickness	2.0
Height from top of basemat to the bottom of containment top slab	29.5
Pedestal:	
Diameter (I.D)	10.6
Thickness	1.7
Basemat thickness	5.5

Column sizes and floor slab thickness are provided in the general building arrangement figures. With major dimensions defined as listed above for specified reinforced concrete materials and design procedures, the dynamic characteristic of the RB structure is defined. Seismic adequacy of the detailed site-specific Reactor Building design will be evaluated using the dimensional characteristic noted above and approved analytical procedures and methodology for dynamic analysis of structures. This work will be in compliance with the required applicable ACI and AISC codes governing design of the reinforced concrete structures for nuclear power plants. Detailed analyses of the site-specific RB design will utilize appropriate site data for seismic events, floods, tornados, winds and other loading conditions.

The RB is arranged and designed to provide a structure with the following characteristics:

a. Withstand applied loads - seismic, dead, live, dynamic, LOCA, etc.

b. Physical protection and separation of systems, both mechanical and electrical.

c. Radiation shielding.

d. Clean and controlled access for personnel and equipments.

e. Primary and secondary containment barriers.

The above characteristics are primarily accomplished by strategic grouping of equipment and positioning of building walls and floors.

The RB is arranged to achieve these characteristics as follows:

a. Three Divisional Separation Arrangement - Separation is achieved by grouping each division of safety equipment, piping and electrical into separate quadrants of the RB. Each quadrant is in turn separated by the building structural walls.

b. Counter measures for radiation - Radioactive equipment within the RB is positioned behind shield walls for personnel protection. The basic building layout contributes to minimized exposure since radioactive piping chases are routed vertically within the building next to the cylindrical containment wall. The equipment rooms containing radioactive process equipment are accessed from hallways near the building outer walls. Thus personnel entering radiation zones for equipment inspections or maintenance move from a low radiation area to progressive higher radiation areas.

c. Clean and controlled access - The overall RB is partitioned into a clean zone and potentially contaminate zone with continuous walls separating the two major zones. Normal personnel access to the clean zones or contaminated zones of the building is accomplished by separate entrances to the building. Contaminated equipment is moved only in contaminated spaces for removal from the building.

Flooding Protection

To protect against external flood damage, the following design features are provided:

a. wall thickness below flood level greater than 0.6m.

b. water stops provided in all construction joints below grade.

c. watertight doors and piping penetrations installed in external walls below flood level.

d. waterproof coating on exterior walls below grade.

e. foundations and walls of structures below grade are designed with water stops at expansion and construction joints.

f. roofs are designed to prevent pooling of water.

g. building will be sited so that the design basis maximum flood level is one foot (0.3m) below grade.

To protect against internal flood damage, the following design features are provided:

a. flooding in one division is limited to that division and flood water is prevented to propagate to other divisions by elevation differences and divisional separation, also by watertight doors or sealed hatches.

b. sloped floor and curbs to divert water to floor drains and sumps.

c. sills for doorways to provide flood control.

d. watertight doors installed below internal flood level.

e. wall thickness below internal flood level greater than 0.6m.

f. service water system does not enter reactor building.

The flood protection measures also guard against flooding from on-site storage tanks that may rupture. There will be no direct entries to RB. All plant entries start 0.3m above grade. Any flash flooding that may result from tank rupture will drain away from the site and cause no damage to site equipment. There is no service water pipe line routing through RB. All cooling loops have a finite volume of water.

Additional specific provisions for flood protection include administrative procedures to assure that all watertight doors and hatch covers are locked in the event of flood warning. If local seepage occurs through the walls, it is controlled by sumps and sump pumps from perimeter hallway at basement level. On the basement level all essential safety equipment is located off perimeter hallway by a second divisional barrier with watertight doors.

Compartment flooding from postulated component failures are evaluated. Floor-by-floor analysis of potential pipe failure generated flooding events in the reactor building shows the following:

a. Where extensive flooding may occur in a division rated compartment, propagation to other divisions is prevented by watertight doors or sealed hatches. Flooding in one division is limited to that division and perimeter hallways. Flood water is prevented from entering other divisions by walls and water tight doors.

b. Leakage of water from large circulating water lines, such as reactor building cooling water lines may flood individual rooms and corridors, but through sump alarms and leakage detection systems the control room is alerted and can control flooding by system isolation. Divisional areas are protected by watertight doors, or where only limited water depth can occur, by raised sills with pedestal mounted equipment within the protected rooms.

c. Limited flooding that may occur from manual firefighting or from lines and tanks having limited inventory is restrained from entering division areas by raised sills and elevation differences.

Therefore, within the reactor building, internal flooding events as postulated will not prevent the safe shutdown of the reactor.

Fire Protection

The basic layout of the plant and the choice of system is such as to enhance the tolerance of the ABWR plant to fire. The systems are designed such that there are three independent safety-related divisions, any one of which is capable of providing safe shutdown of the reactor. In addition, there are non safety-related system such as the condensate and feedwater systems which can be used to achieve safe shutdown. The plant arrangement is such that points of possible common cause failure between these non safety-related systems and the safety-related systems have been minimized.

The design objective has been to assure that independence of the redundant systems required or available for safe shutdown is not compromised by fire, the consequences of fire or the failure of fire protection equipment or systems. This design priority was met by implementing a coordinated overall design including fire considerations for the following plant features:

Plant arrangement — The plant is laid out with the control building between the reactor and turbine buildings so that power and control signals from the reactor and turbine buildings enter the control building on opposite sides of the control building. The buildings are laid out internally so that fire areas of like divisions are grouped together in block form as much as possible. This grouping is coordinated from building to building so that the divisional fire areas line up adjacent of each other at the interface between the reactor and control building. An arrangement of this fashion naturally groups piping, HVAC ducts and cable trays together in divisional arrangements and does not require routing of services of one division across space allotted to another division.

Divisional separation — As stated above, there are three complete divisions of safety-related cooling systems. Any one division is capable of safe or emergency shutdown of the plant so that a division may be out for maintenance, a single random failure occur and the remaining functional division would still be able to provide safe plant shutdown. In general, systems are grouped together by safety division so that, with the exceptions of the primary containment, the control room and the remote shutdown room (when operating from the remote shutdown panels) there is only one division of safe shutdown equipment in a fire area. Complete burnout of any fire area without recovery will not prevent safe shutdown of the plant, therefore, complete burnout of a fire area is acceptable. All divisions are present in the control room. It is the purpose of the remote shutdown panel to provide redundant control of the safe shutdown function from outside of the control room. The controls on the remote shutdown panel are hard wired to the field devices and power supplies. The signals between the remote shutdown panel and control room are multiplexed over fiber optic cables so that there are no power interactions between the control room and the remote shutdown panel. During normal plant operation the remote shutdown room is divided into two rooms by a closed sliding fire door. A fire in one divisional section will not affect the other divisional section.

Fire containment system — The fire containment system is the structural system and appurtenances that serve together to confine the direct effects of a fire to the fire area in which the fire originates. The fire containment system is required to contain a fire with a maximum severity by the time-temperature curve defined in ASTM E119 for a fire with a duration of three hours.

Combustible loading — Allowable combustible loadings for the plant were established.

HVAC systems — The HVAC systems have been matched to the divisional areas which they serve. The divisions are in separate fire areas and each fire area is served by its corresponding division of HVAC.

Smoke control system — Major features are provided for the smoke control system for the plant, such as venting of fire areas, pressure control across the fire barriers, pressure control and purge air supply, augmented and directed clean air supply, smoke control by fans and systems external to the fire area, and removal of smoke and heat from the fire by fans.

Spurious control actions — The systems are separated by fire areas on a divisional basis as stated above. In addition, the multiplexed design is such that in case of fire in the control room, spurious control signals will not be sent out from the control room.

Support systems — Support systems such as HVAC and reactor building closed cooling water systems are designed as a safety- related if they support safety-related systems. They are given divisional assignments and separated by fire barriers in the same fashion as the safety-related primary systems.

Fire alarm system — Fire alarm systems are designated as safety-related. It is a requirement that fire alarm systems be zoned by division according to the divisional assignment of the area which each zone covers.

Fire suppression system — Automatically initiated fire suppression systems are initiated on a divisional basis so that there are no inter-actions between divisions.

Personnel access routes — The personnel access routes for fire suppression activities have been reviewed to see that access compatible with the design of the fire barriers, HVAC and smoke control systems has been provided. A source of clean cool air is provided for access routes to fire areas. The air supply is by fans out of the fire area experiencing the fire.

Manual fire suppression activities — The plant is designed such that the divisional area in which a fire is occurring will be apparent to the operators at the time the fire is discovered. If the fire is significant, the operator can transfer operations to one of the two unaffected divisions and shutdown the equipment in the affected division.

The intent of providing features described above is to have an adequate balance in:

a. preventing fires from starting;

b. timely detection and extinguishing fires that occur, thus limiting fire damage; and

c. designing safety-related systems so that a fire that starts in spite of the fire prevention program and burns out of control for a considerable length of time will not prevent safe shutdown.

In addition, fire protection systems are designed so that their inadvertent operation or the occurrence of a single failure in any of these systems will not prevent plant safe shutdown.

It is required that the ABWR design shall provide 3-hour fire rated penetration seals for all high energy piping or, as a minimum, state those conditions when such seals cannot be provided and what will be installed as a substitute.

Pipe Breaks Protection

Structures, component arrangement, pipe runs, pipe whip restraints and compartmentalization are designed to protect against dynamic effects associated with a pipe break event. Pipe whip restraints preclude damage base on the pipe break evaluation. Protection against pipe break event dynamic effects is provided to fulfill the following objectives:

a. Assure that the reactor can be shut down safely and maintained in a safe cold shutdown condition and that the consequences of the postulated piping failure are mitigated to acceptable limits without offsite power.

b. Assure that containment integrity is maintained.

c. Assure that the radiological doses of a postulated piping failure remain below the limits of 10CFR100.

To comply with the above objectives, the essential systems, components and equipment are identified. An analysis of pipe break events is performed to identify those essential systems, components and equipment that provide protective actions required to mitigate, to acceptable limits, the consequences of the pipe break event. By means of the design features such as separation, barriers, and pipe whip restraints, adequate protection is provided against the effects of pipe break events for essential items to an extent that their ability to shut down the plant safely or mitigate the consequences of the postulated pipe failure would not be impaired.

Tornado and Missile Protection

The Reactor Building is not a vented structure. The exposed exterior roofs and walls of the RB are designed for the required pressure drop. Tornado dampers are provided on all air intake and exhaust openings. These dampers are designed to withstand the specified negative pressure of -1.46 psi.

Missiles considered in RB design are those that could result from a plant-related failure or incident including failures within and outside of containment, environmental- generated missiles. The structures, shields, and barriers that have been designed to withstand missile effects, the possible missile loadings, and the procedures to which each barrier has been designed to resist missile impact are described and analyzed in detail in the process of design.

Tornado-generated missiles have been determined to be the limiting natural phenomena hazard in the design of all structures required for safe shutdown of the nuclear power plant. Since tornado missiles are used in the design, it is not necessary to consider other externally generated missiles. The essential safety equipment in the reactor building is located below grade level except for the divisional diesel generator units. Thus it is unnecessary to consider external missiles for most safety equipments. The divisional diesel generators and supporting equipment are located at grade level and protected by tornado resistant walls. The primary containment is embedded within the RB and protected by multiple walls and floors from external missiles.

Internally generated missiles (outside containment) are considered to be those resulting internally from plant equipment failures within the ABWR Standard Plant but outside containment. Examples of rotating equipment potential missiles are RCIC steam turbine. Examples of pressurized components potential missiles are valve bonnets, valve stems and retaining bolts. After a potential missile has been identified, its statistical significance is determined by an approved procedure. A statistically significant missile is defined as a missile which could cause unacceptable plant consequences or violation of the guidelines of 10CFR100. Barriers are designed based on the approved procedures to protect against the potential missiles.

Protection of essential structures, systems and components is afforded by one or more of the following practices:

a. Location of the system or component in an individual missile-proof structure;

b. Physical separation of redundant systems or components of the system for the missile trajectory path or calculated range;

c. Provision of localized protection shields or barriers for systems or components;

d. Design of the particular structure or component to withstand the impact of the most damaging missile;

e. Provision of the design features on the potential missile source to prevent missile generation; and/or

f. Orientation of the potential missile source to prevent unacceptable consequences due to missile generation.

Design Description Radioactive Shielding and Containment

Administrative programs and procedures, in conjunction with facility design, ensure that the occupational radiation exposure to personnel will be kept as low as reasonably achievable (ALARA). The primary objective of the radiation shielding for RB design is to protect operating personnel and the general public from radiation emanating from the reactor, the power conversion systems, the radwaste process systems, and the auxiliary systems, while maintaining appropriate access for operation and maintenance. The radiation shielding is also designed to keep radiation doses to equipment below levels at which disabling radiation damage occurs. For further discussion see Section 3.7, Radiation Protection.

The secondary containment boundary completely surrounds the primary containment vessel (PCV) except for the basemat and together with clean zone comprises the reactor building. The secondary containment encloses all penetrations, except those into the steam tunnel, through the primary containment that may become a potential source of radioactive release after an accident. During normal plant operation, the secondary containment areas are kept at a negative pressure with respect to the environment and clean zone by the HVAC system. Following an accident, the standby gas treatment system (SGTS) provides this function.

Fission products that may leak from the primary to secondary are processed by the SGTS before being discharged to the environment. The HVAC exhaust systems and SGTS are located within the secondary containment to assure collection of any leakage. The secondary containment provides detection of the level of radioactivity released to the environment during abnormal and accident plant conditions. Personnel or material entrances to the secondary containment consist of vestibules with interlocked doors.

Inspection, Test, Analyses and Acceptance Criteria

Table 2.15.10 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria which will be undertaken for the Reactor Building.

Table 2.15.10: Reactor Building

Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Reactor Building general arrangement is shown in Figures 2.15.10.a rough 2.15.10.o.	1. Plant walk through.	1. The configuration conforms with Figures 2.15.10.a through 2.15.10.o.
2. Design features are provided to protect against design basis internal and externa. floods.	2. Review construction records and perform visual inspections of the flood control features.	2. For external flooding: a. Exterior wall thickness below flood level greater than o.6m. b. Water stops. c. Watertight doors and piping penetrations below flood level. d. Water proof coating on exterior walls. e. Foundations and walls of structures below grade are designed with water stops at expansion and construction joints. f. Roofs are designed to facilitate drainage and prevent pooling. g. Building will be sited so that the design basis maximum flood level is one foot(0.3m) below grade. For internal flooding: a. Flooding in one division is limited to that division by preventing flood water from propagating to other divisions by elevation differences and divisional separation, also by watertight doors or sealed hatches. b. Sloped floors and curbs to divert water to floor drains and sumps. c. Sills for doorways as required to provide flood control. d. Watertight doors installed below internal flood level. e. Wall thickness below interal flood level greater than 0.6m. f. Service water system does not enter reactor building.

Table 2.15.10: Reactor Building (Continued)

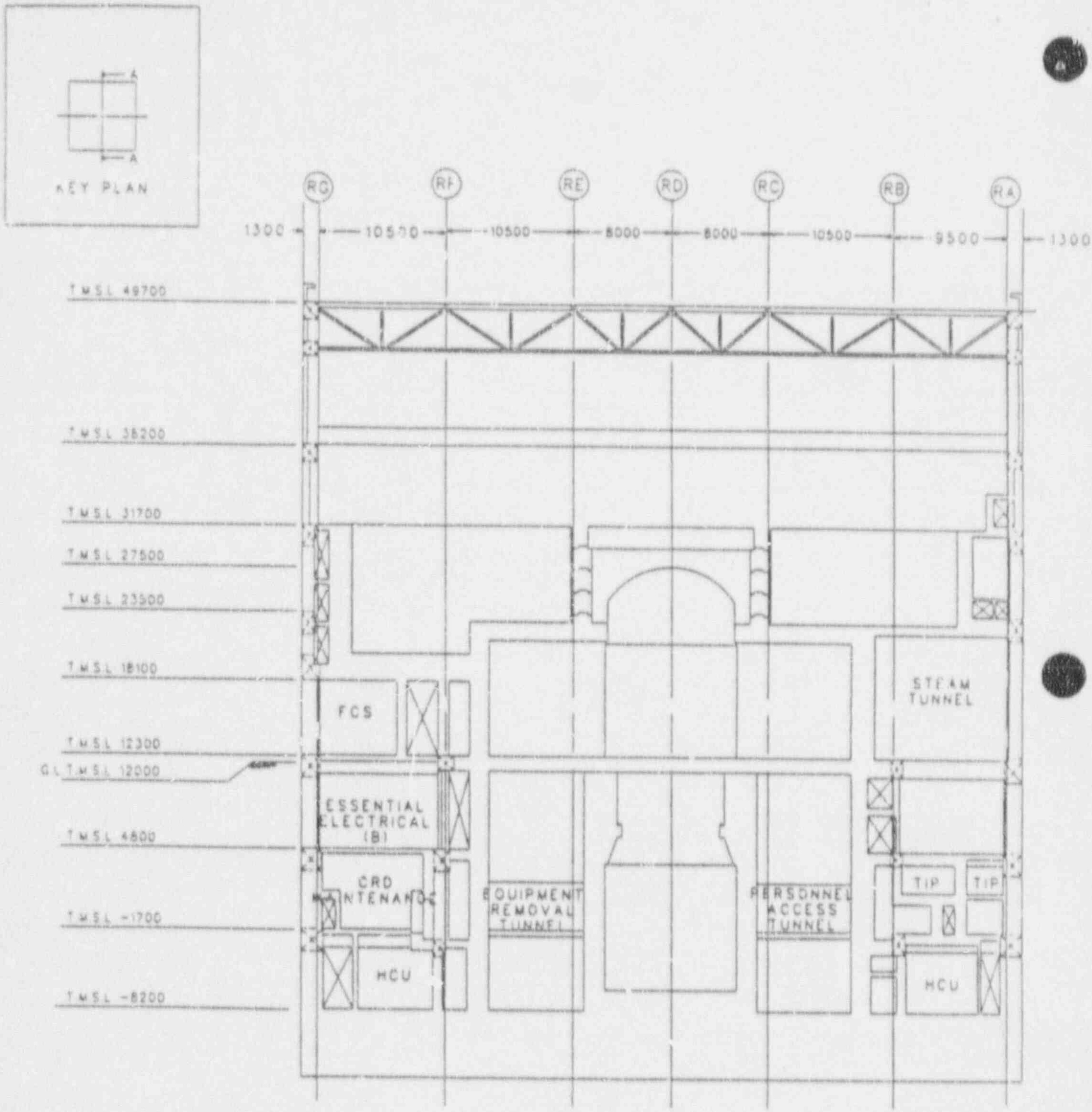
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The RB is a Seismic Category I structure and has major dimensions defined in the certified design.	3. Plant walk through to check and verify RB major dimensions including column sizes and floor slab thickness. Review final design record for material properties, site input data and analytical procedures and methodology for seismic analysis. Visual inspections of structures and review of as-built documentation will be conducted to assure compliance with the certified design commitments.	3. Structures have dimensions compatible with data in the certified design. (Figures 2.15.10.a through 2.15.10.o).
4. The detail structural design will be based on required applicable ACI and AISC codes and will use site data for seismic events, floods, tornados winds and other loading conditions.	4. The Reactor Building design documentation will be reviewed.	4. Confirmation that the as-built design is in compliance with required applicable ACI and AISC requirements and is based on appropriate site design data.
5. The RB is designed to have adequate radiation shielding to ensure that the occupational radiation exposure to personnel will be kept as low as reasonably achieveable (ALARA).	5. Perform dimensional inspections of the RB walls, ceiling,floors, and other structural features.	5. See Section 3.7, Radiation Protection.
6. The RB is designed to protect against design basis tornado and tornado generated missiles.	6. Review construction records and perform visual inspections of the tornador protection features.	6. a. Per Figures 2.15.10.a through 2.15.10.o. for RB wall and roof dimensions. b. HVAC dampers designed for differential pressure > 1.46 psi. c. HVAC dampers and tornado missile barriers are provided.
7. The RB provides walls and other facilities for separation required by the three independent divisional safe shutdown systems.	7. Review of construction records and visual examinations of the as built facility.	7. Confirmation that separation of the redundant systems for safe shutdown is provided.

Table 2.15.10: Reactor Building (Continued)

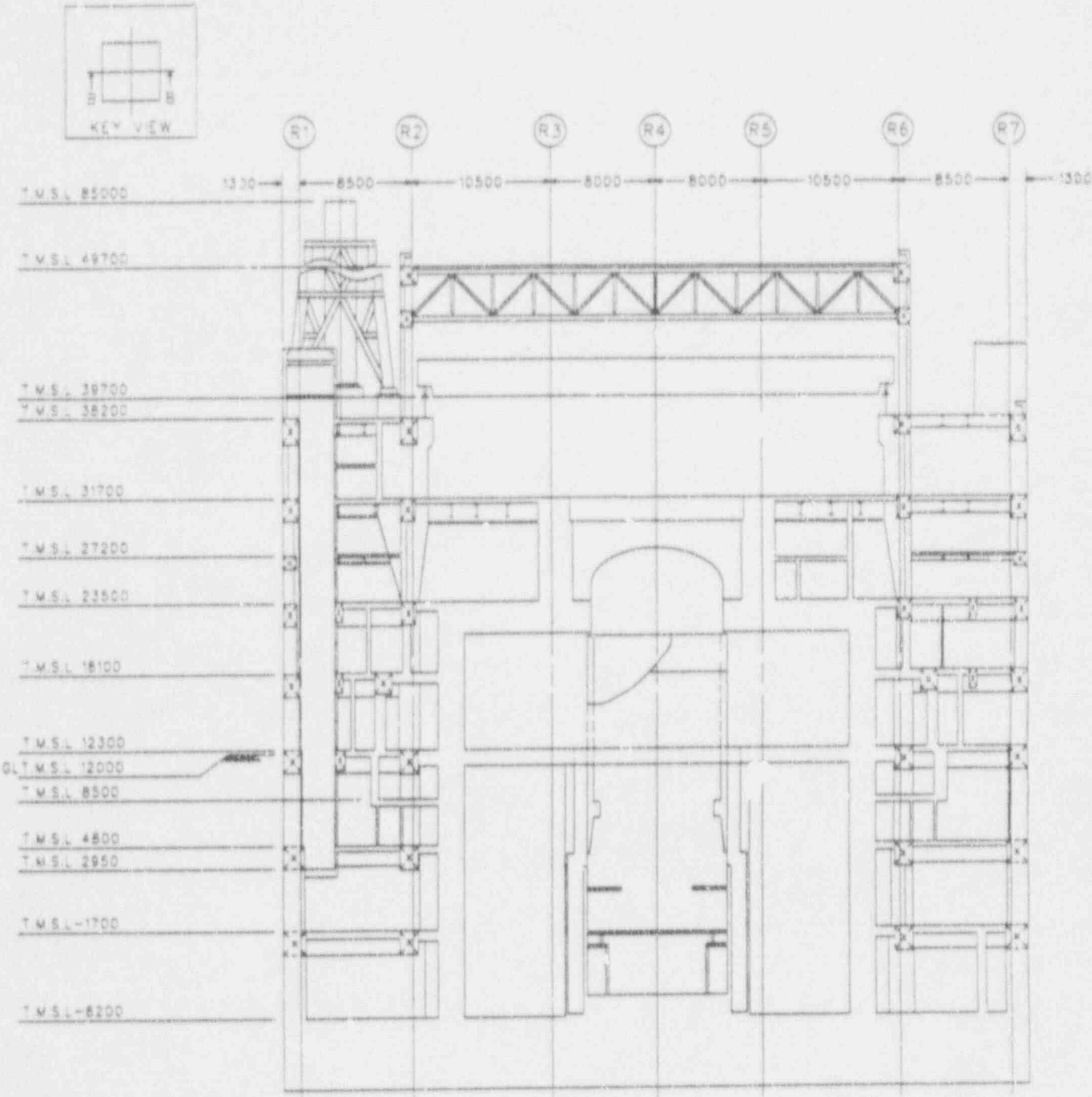
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Protection against pipe break event dynamic effects is provided to assure that the reactor can be shut down safely, that the containment integrity is maintained, and that the radiological doses of a postulated piping failure remain below the limits.	8. Review the design documentation to assure that the analysis of pipe break events is performed for design features such as separations,barriers, and pipe whip restraints provided for essential items for plant safe shutdown.	8.Comformation that the as built structures are in compliance with the design documentation. For radiation protection, see Section 3.7, Radiation Protection.
9. Secondary containment boundary copletely surrounds the PCV and encloses all PCV's penetrations that may become a potential source of radioactive release after an accident.	9. Review RB construction records and perform visual inspections of the as-built arrangement. Reference to Sec.2.14.4 for SGTS and Sec.2.15.5 for HVAC functions.	9. a. Per Figures 2.15.10.a through 2.15.10.o. b. Sec.2.14.4, SGTS. c. Sec.2.15.5, HVAC.



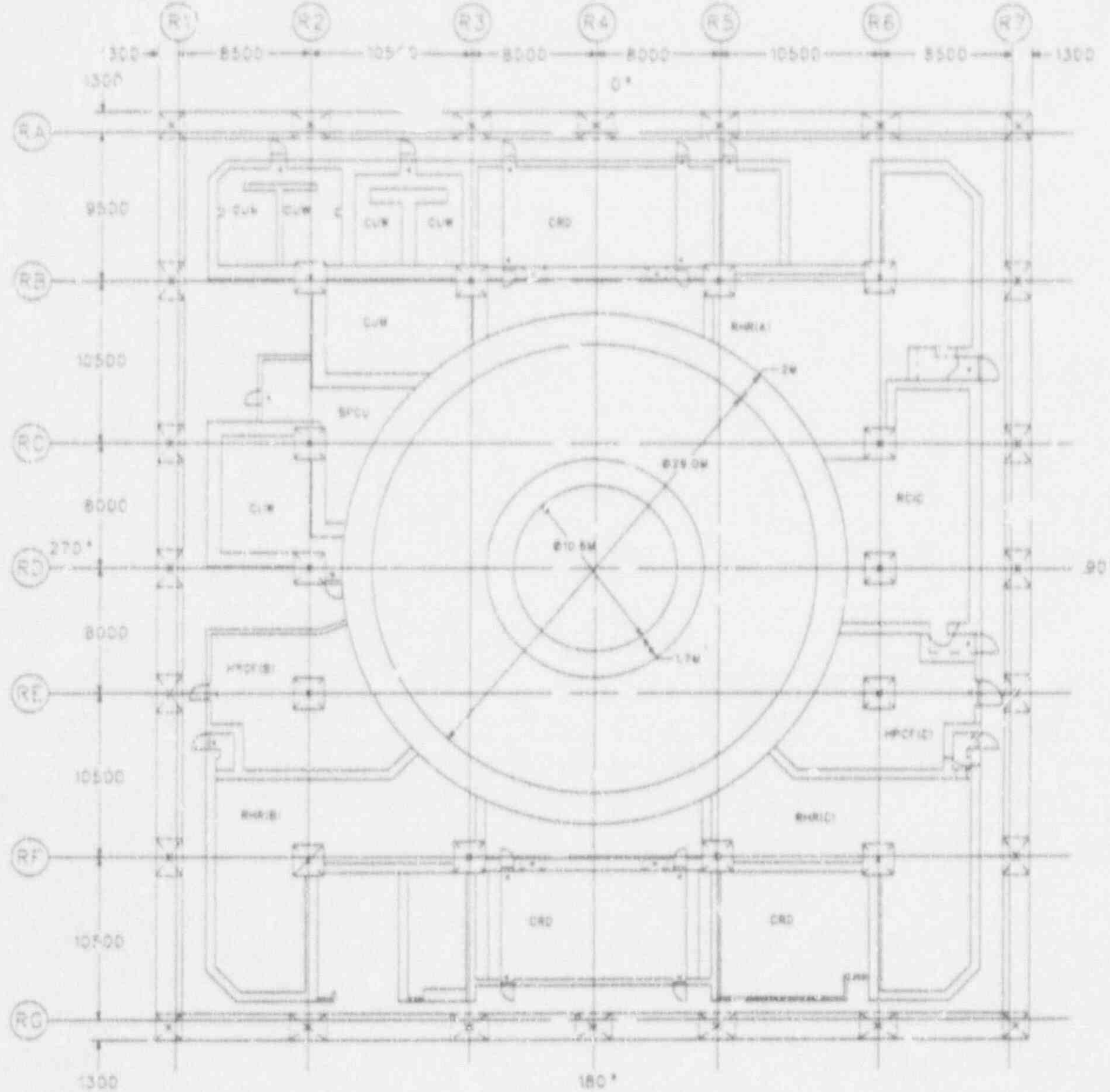
SECTION A-A

FIGURE 2.15.10.a REACTOR BUILDING ARRANGEMENT - 0°/180°



SECTION B-B

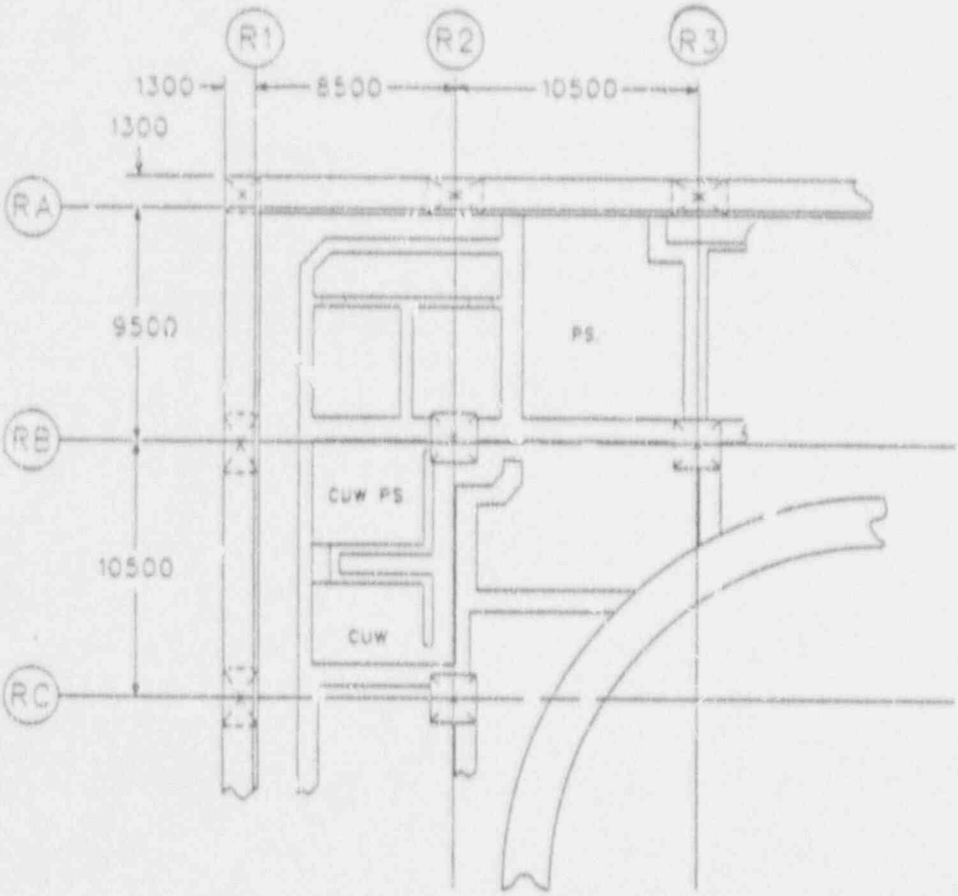
FIGURE 2.15.10.b REACTOR BUILDING ARRANGEMENT - 270° / 90°



NOTES:

1. "+" DENOTES DOORS WITH RAISED SILLS.
2. "⌂" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 2.0M X 2.0M (TYPICAL)
4. BASEMENT THICKNESS IS 5.5M.

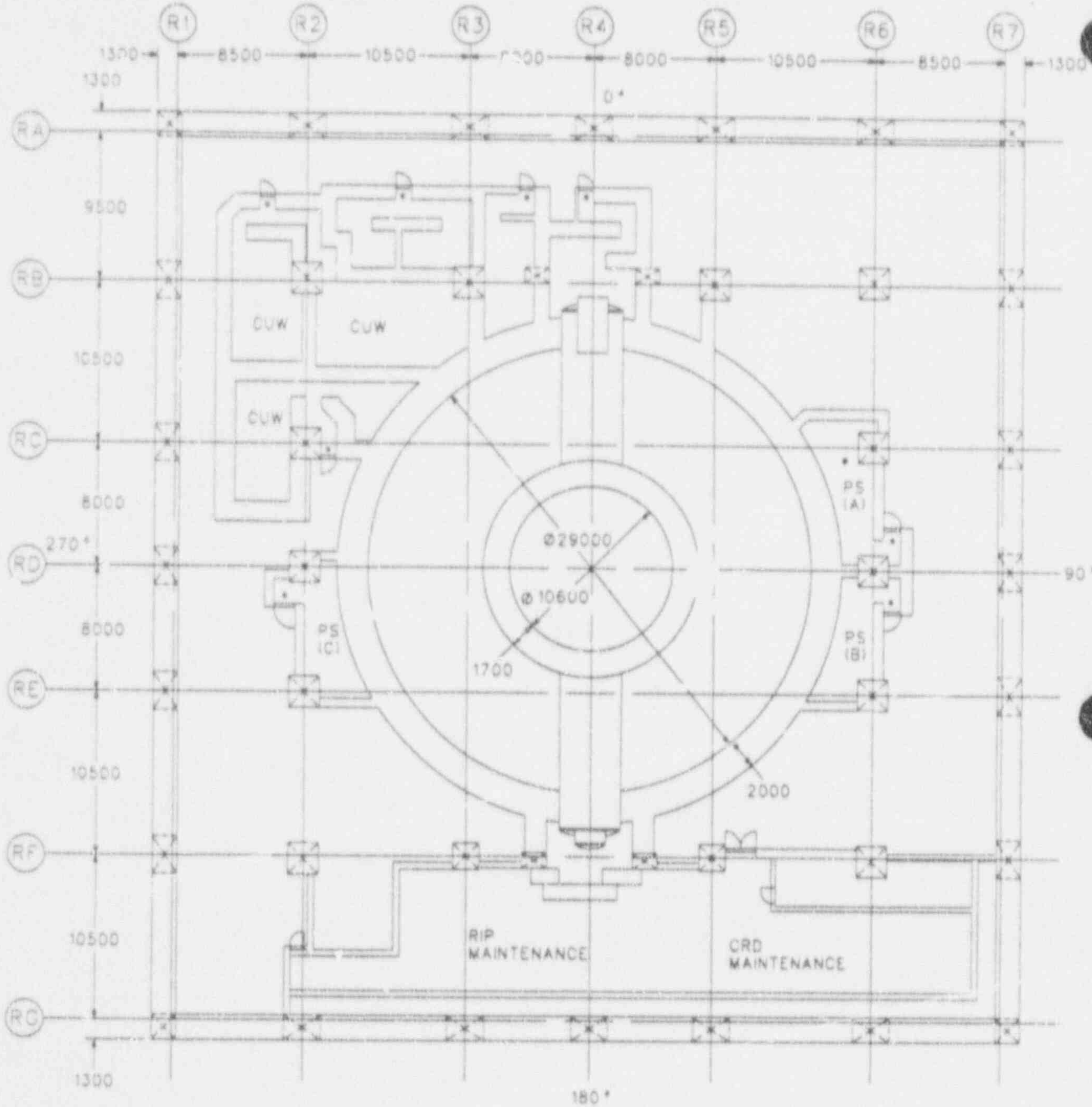
FIGURE 2.15.10.C REACTOR BUILDING ARRANGEMENT – T.M.S.L. –8200



NOTES:

1. COLUMN DIMENSIONS ARE 2.0M X 2.0M (TYPICAL).
2. FLOOR SLAB THICKNESS IS 0.6M.
3. MAIN BEAM DIMENSIONS ARE 1.5M X 1.8M.

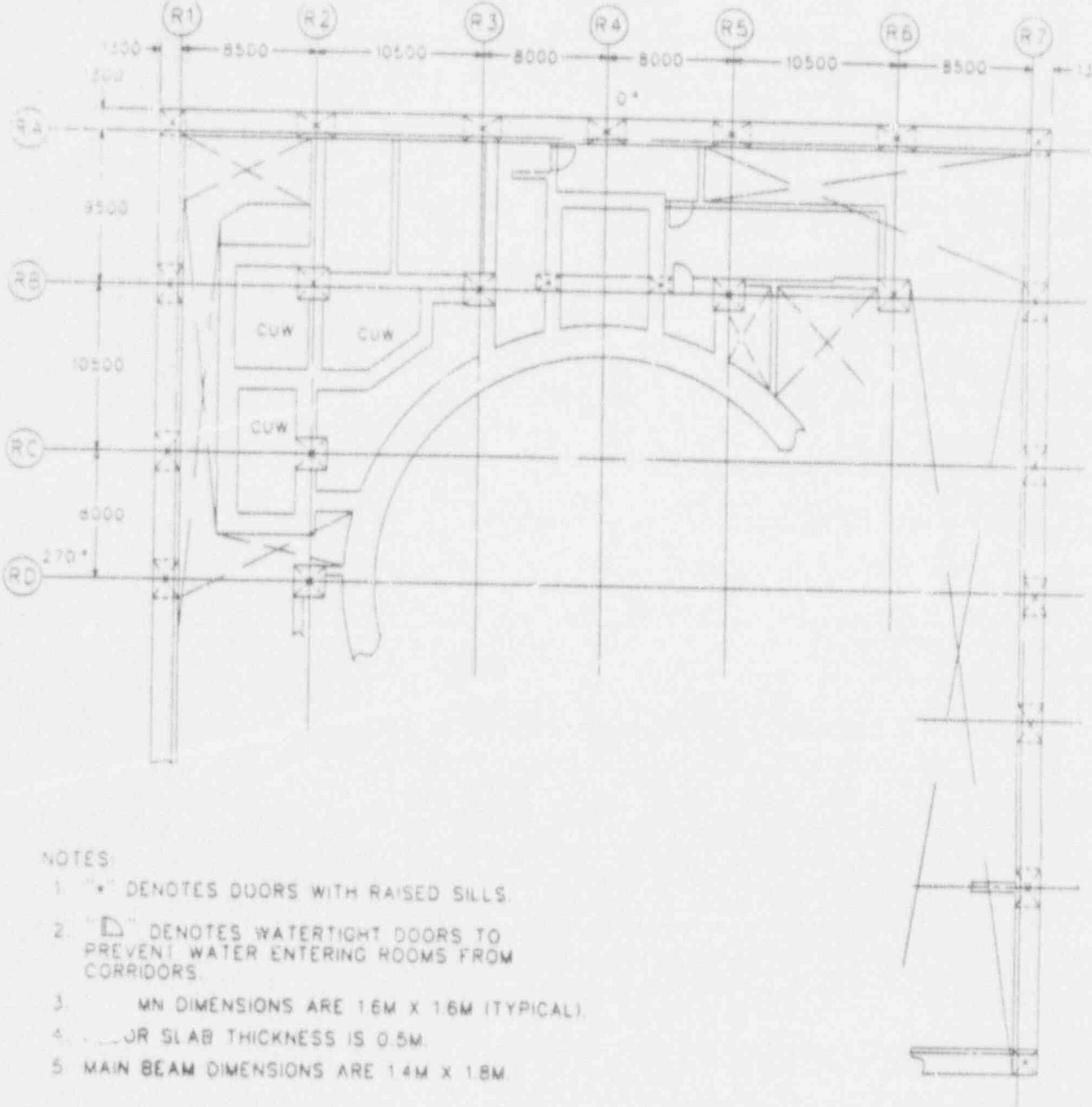
FIGURE 2.15.10d REACTOR BUILDING ARRANGEMENT -- T.M.S.L.-5100



NOTES:

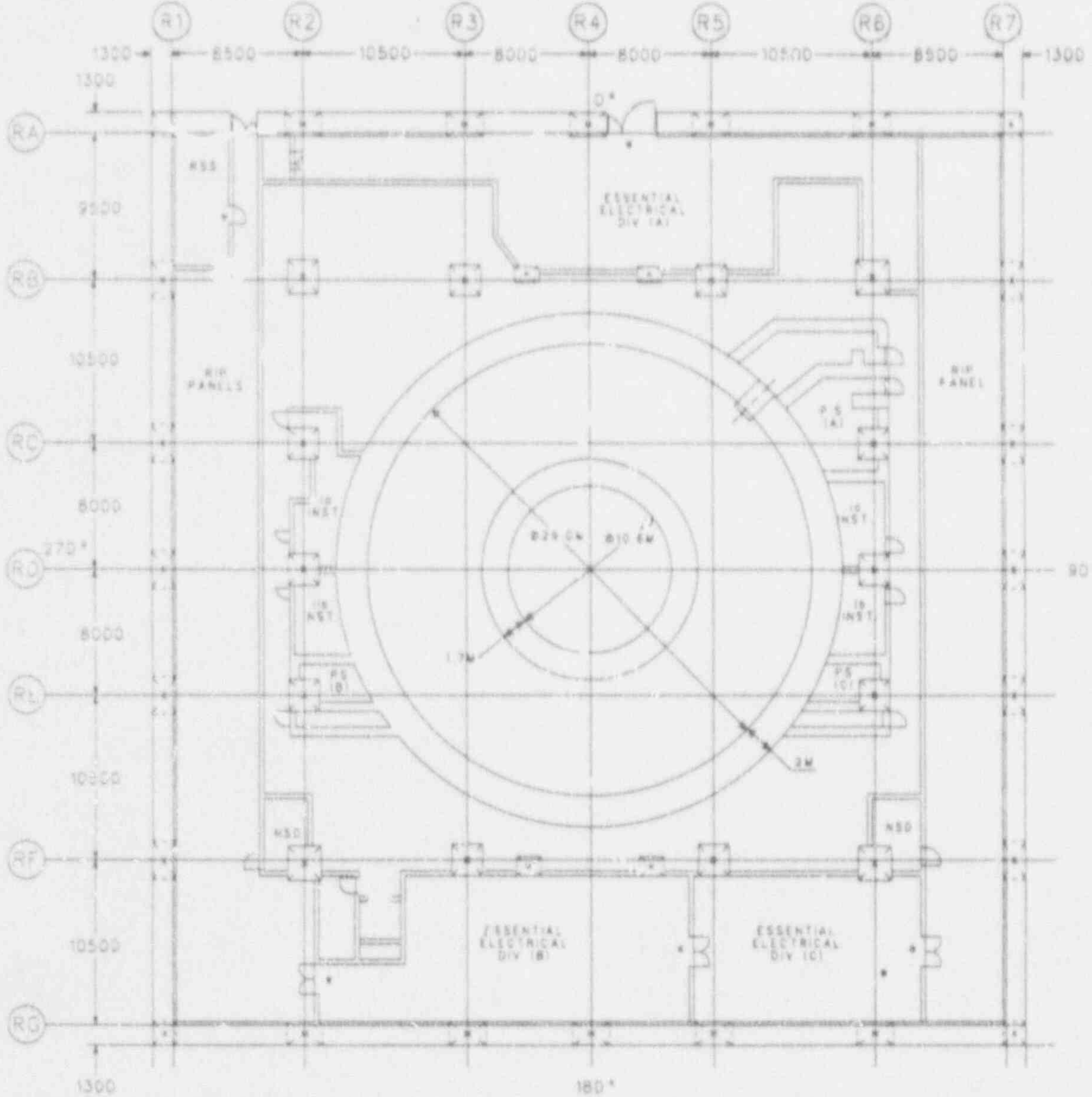
1. "•" DENOTES DOORS WITH RAISED SILLS.
2. "D" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 2.0M X 2.0M (TYPICAL).
4. FLOOR SLAB THICKNESS IS 0.6M.
5. MAIN BEAM DIMENSIONS ARE 1.5M X 1.8M.

FIGURE 2.15.10e REACTOR BUILDING ARRANGEMENT – T.M.S.L. –1700



NOTES:
1. "*" DENOTES DOORS WITH RAISED SILLS.
2. "D" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. MN DIMENSIONS ARE 1.6M X 1.6M (TYPICAL).
4. OR SLAB THICKNESS IS 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.4M X 1.8M.

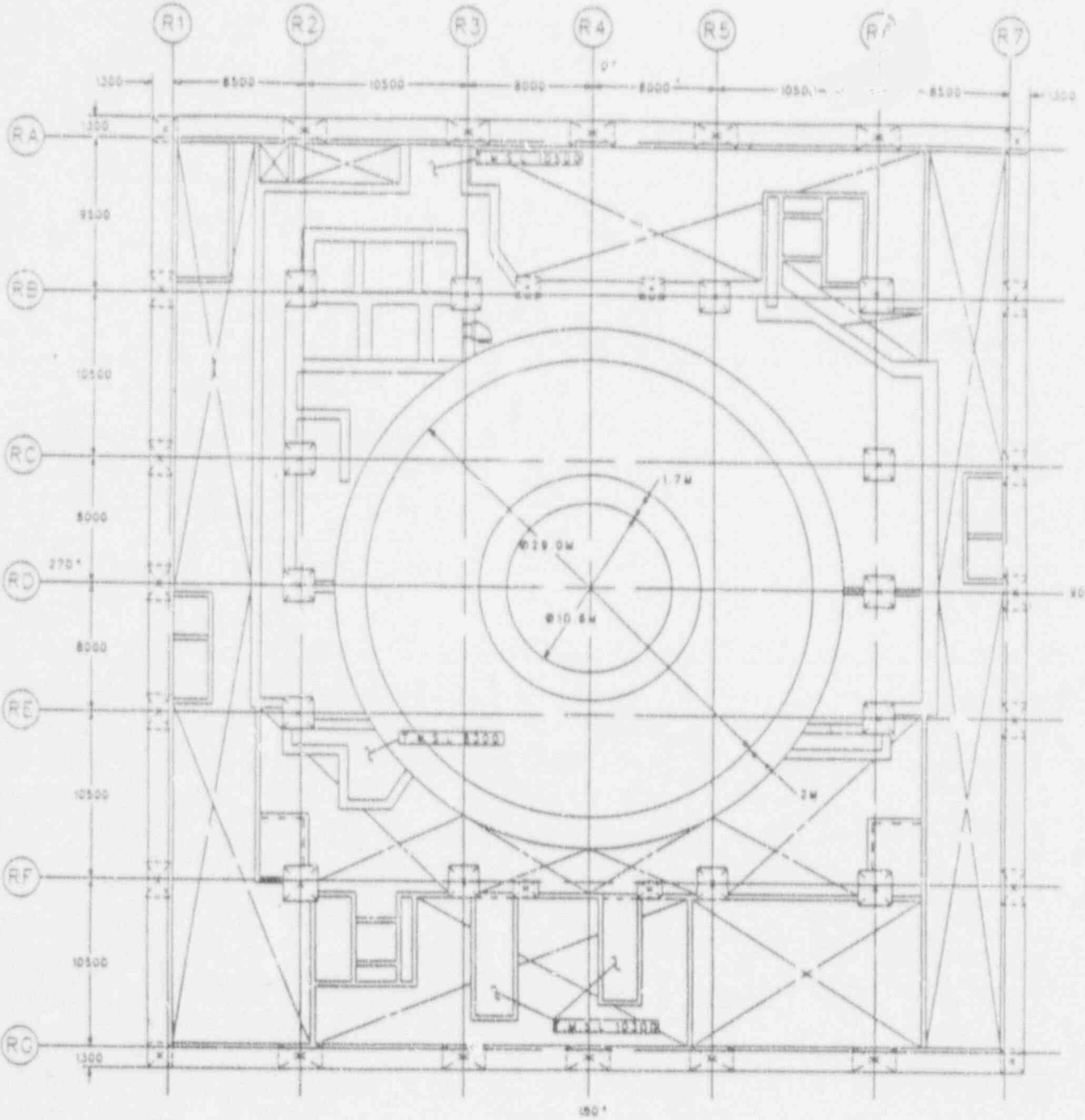
FIGURE 2.15.101 REACTOR BUILDING ARRANGEMENT = T.M.S.L. 1500



NOTES:

1. "*" DENOTES DOORS WITH RAISED SILLS.
2. "◺" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 1.8M X 1.8M (TYPICAL).
4. FLOOR SLAB THICKNESS IS 0.6M.
5. MAIN BEAM DIMENSIONS ARE 1.5M X 1.8M.

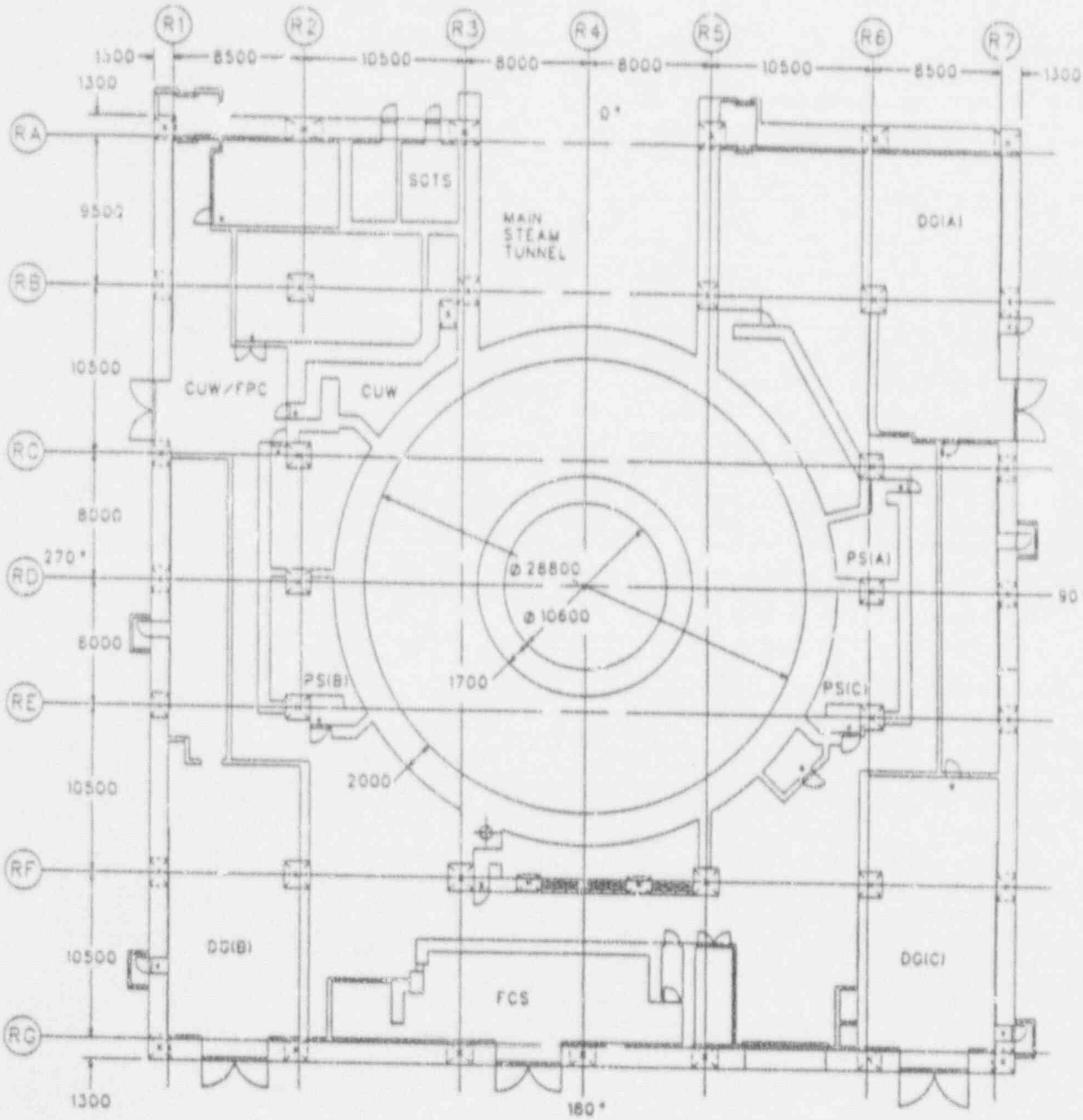
FIGURE 2.15.10.g REACTOR BUILDING ARRANGEMENT – T.M.S.L. 4800



NOTES:

1. "◺" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
2. COLUMN DIMENSIONS ARE 1.8M X 1.8M (TYPICAL).
3. MAIN BEAM DIMENSIONS ARE 1.5M X 1.8M.

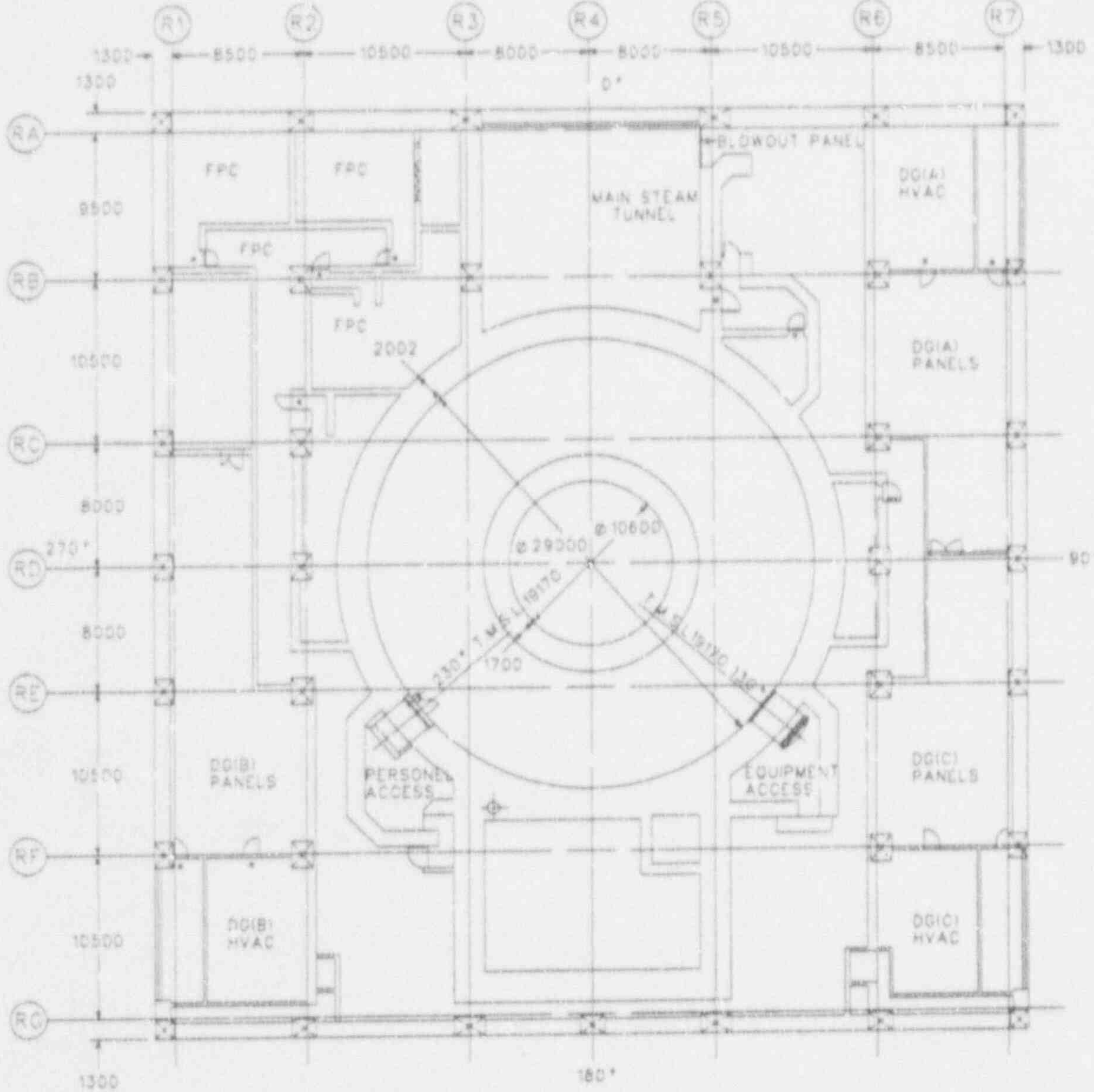
FIGURE 2.15.10.h REACTOR BUILDING ARRANGEMENT – T.M.S.L. 8500



NOTES:

1. "•" DENOTES DOORS WITH RAISED SILLS.
2. "◺" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 1.6M X 1.6M (TYPICAL).
4. FLOOR SLAB THICKNESS IS 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.4M X 1.8M.

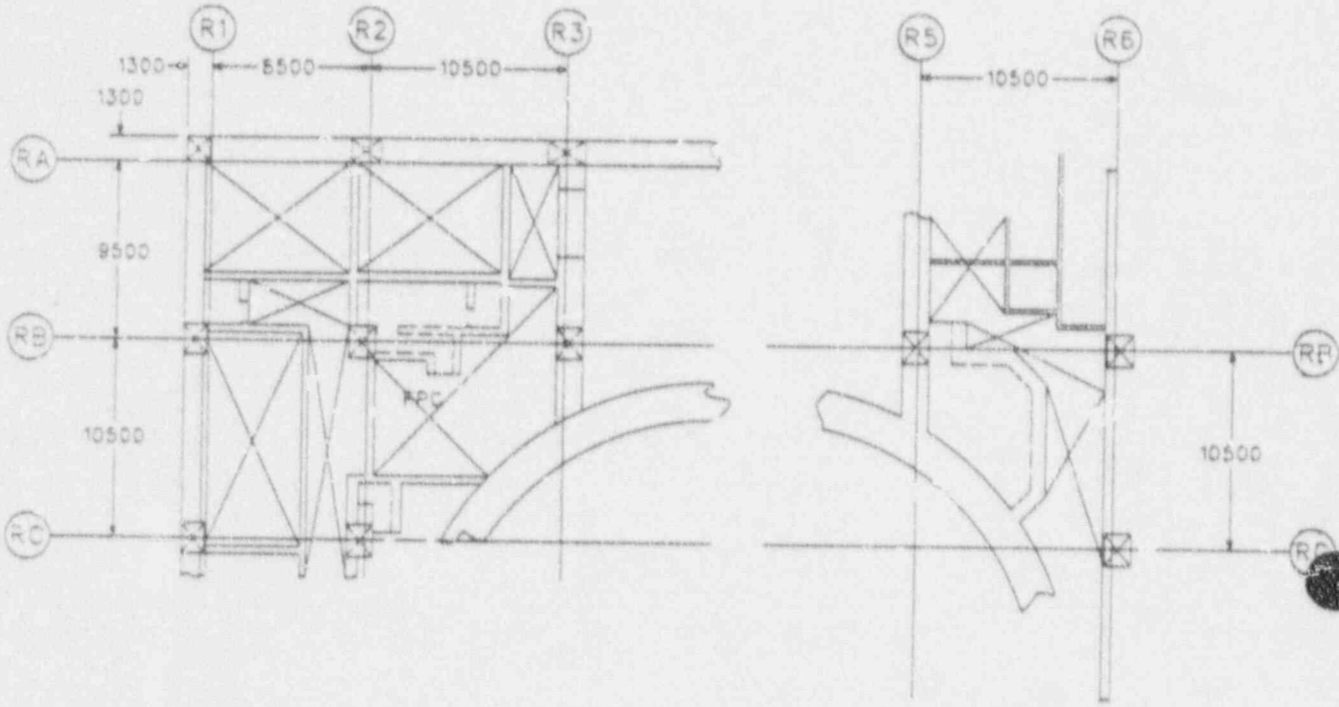
FIGURE 2.15.10i REACTOR BUILDING ARRANGEMENT – T.M.S.L. 12300



NOTES:

1. "▾" DENOTES DOORS WITH RAISED SILLS.
2. "D" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS AR[illegible] .6M (TYPICAL).
4. FLOOR SLAB THICKNE[illegible] [illegible] 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.4M X 1.8M.

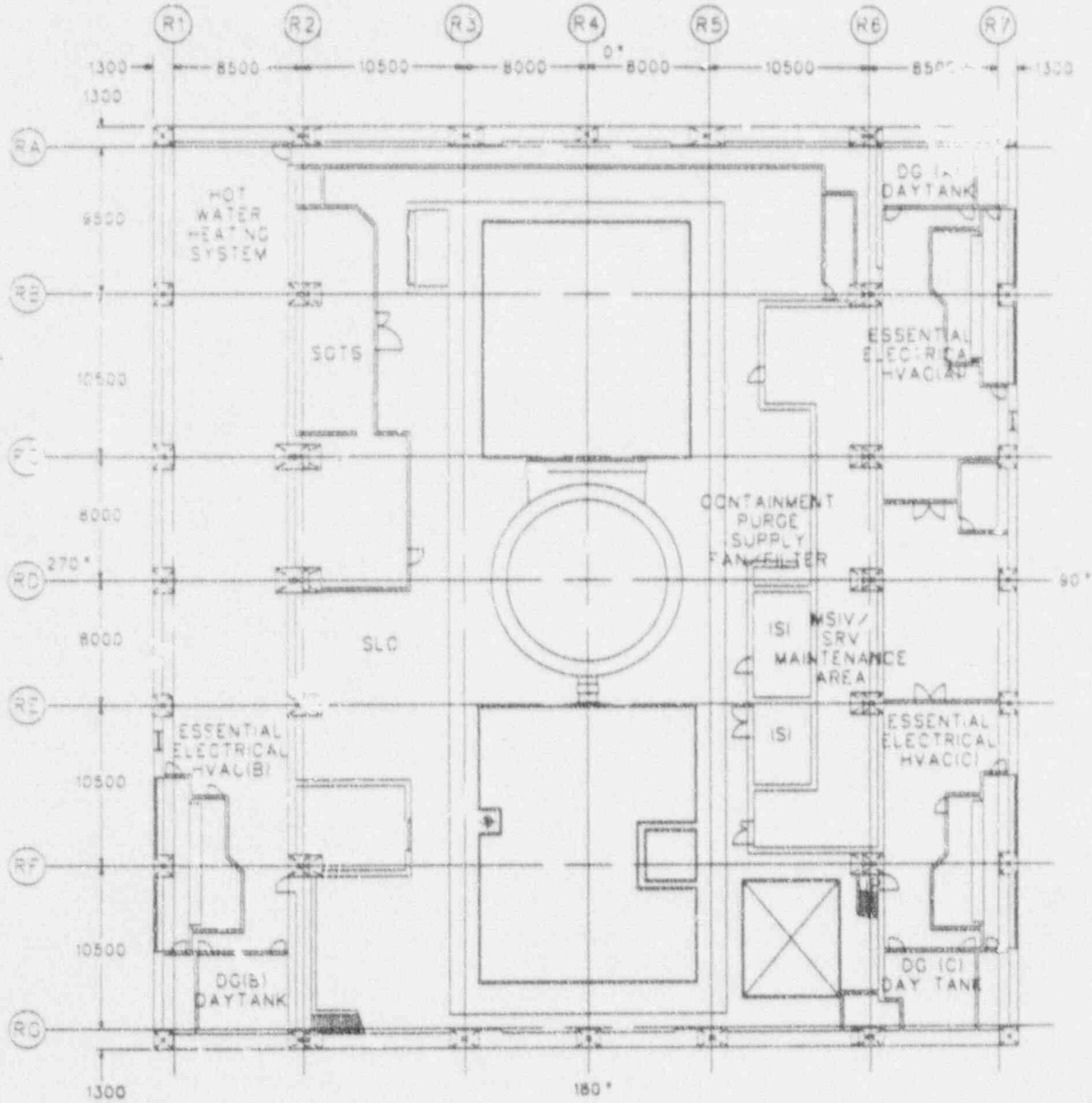
FIGURE 2.15.10J REACTOR BUILDING ARANGEMENT – T.M.S.L. 18100



NOTES:

1. "•" DENOTES DOORS WITH RAISED SILLS.
2. "⌂" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. C(_ 'MN DIMENSIONS ARE 1.4M X 1.4M (TYPICAL).
4. FLOOR SLAB THICKNESS IS 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.5M X 1.8M.

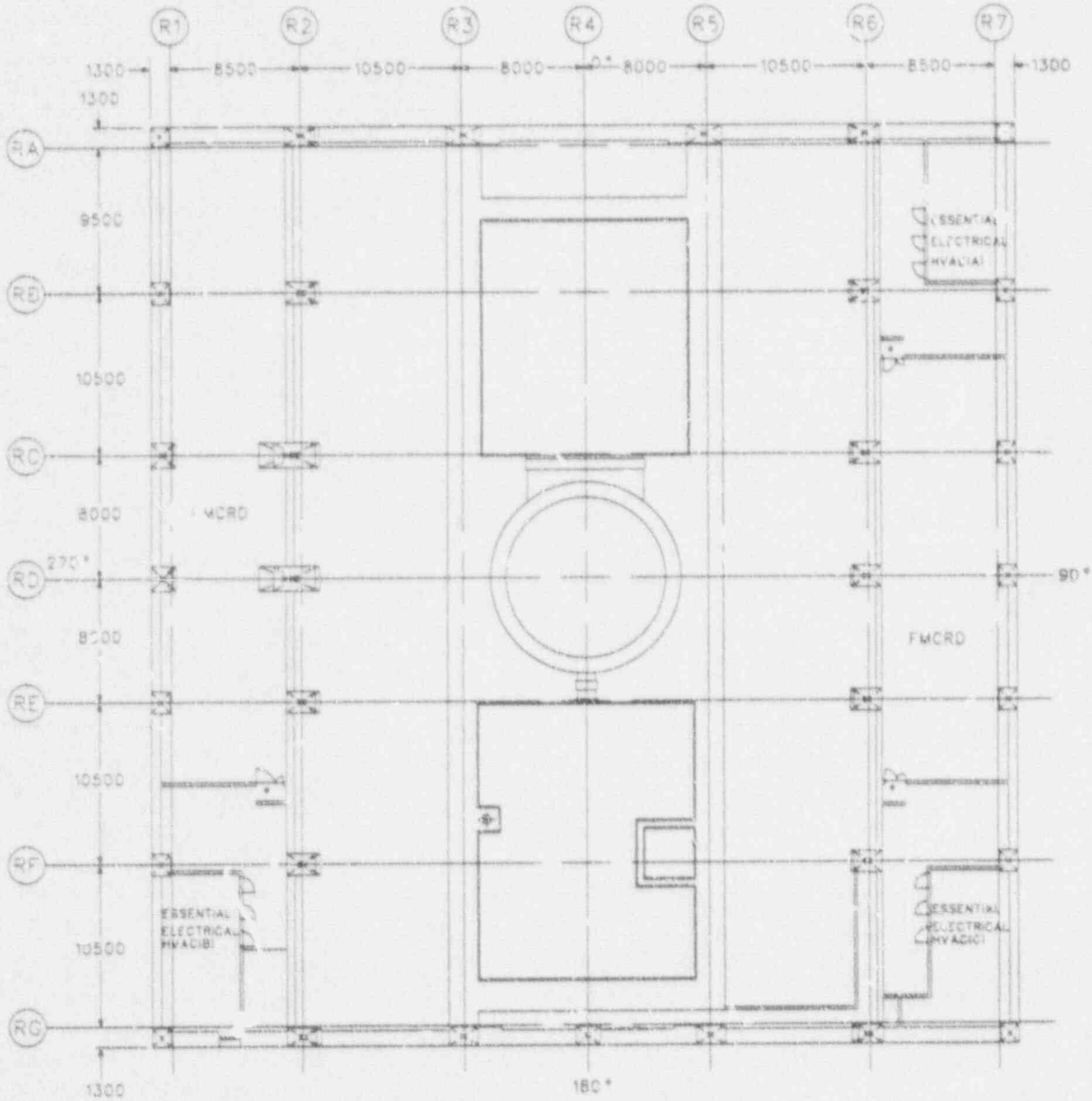
FIGURE 2.15.10.k REACTOR BUILDING ARRANGEMENT -- T.M.S.L 20800 AND 21200



NOTES:

1. "•" DENOTES ..OORS WITH RAISED SILLS.
2. "◺" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 1.4~2.2 X 1.4M (TYPICAL)
4. FLOOR SLAB THICKNESS IS 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.2M X 1.8M.

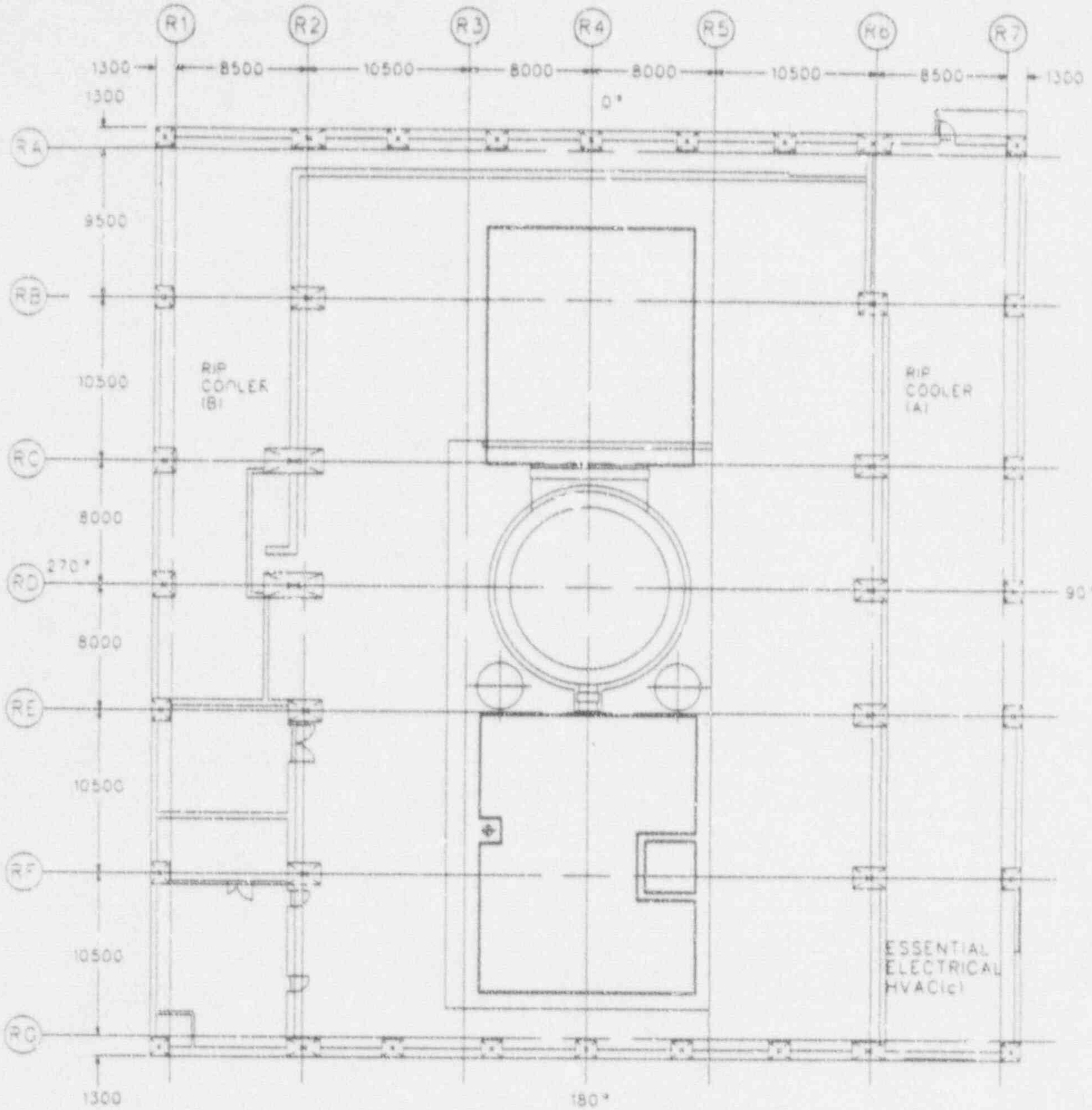
FIGURE 2.15.10.1 REACTOR BUILDING ARRANGEMENT – T.M.S.L. 23500



NOTES:

1. "*" DENOTES DOORS WITH RAISED SILLS.
2. "◻" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 1.4~2.2 X 1.4M (TYPICAL)
4. FLOOR SLAB THICKNESS IS 0.5M.
5. MAIN BEAM DIMENSIONS ARE 1.2M X 1.8M.

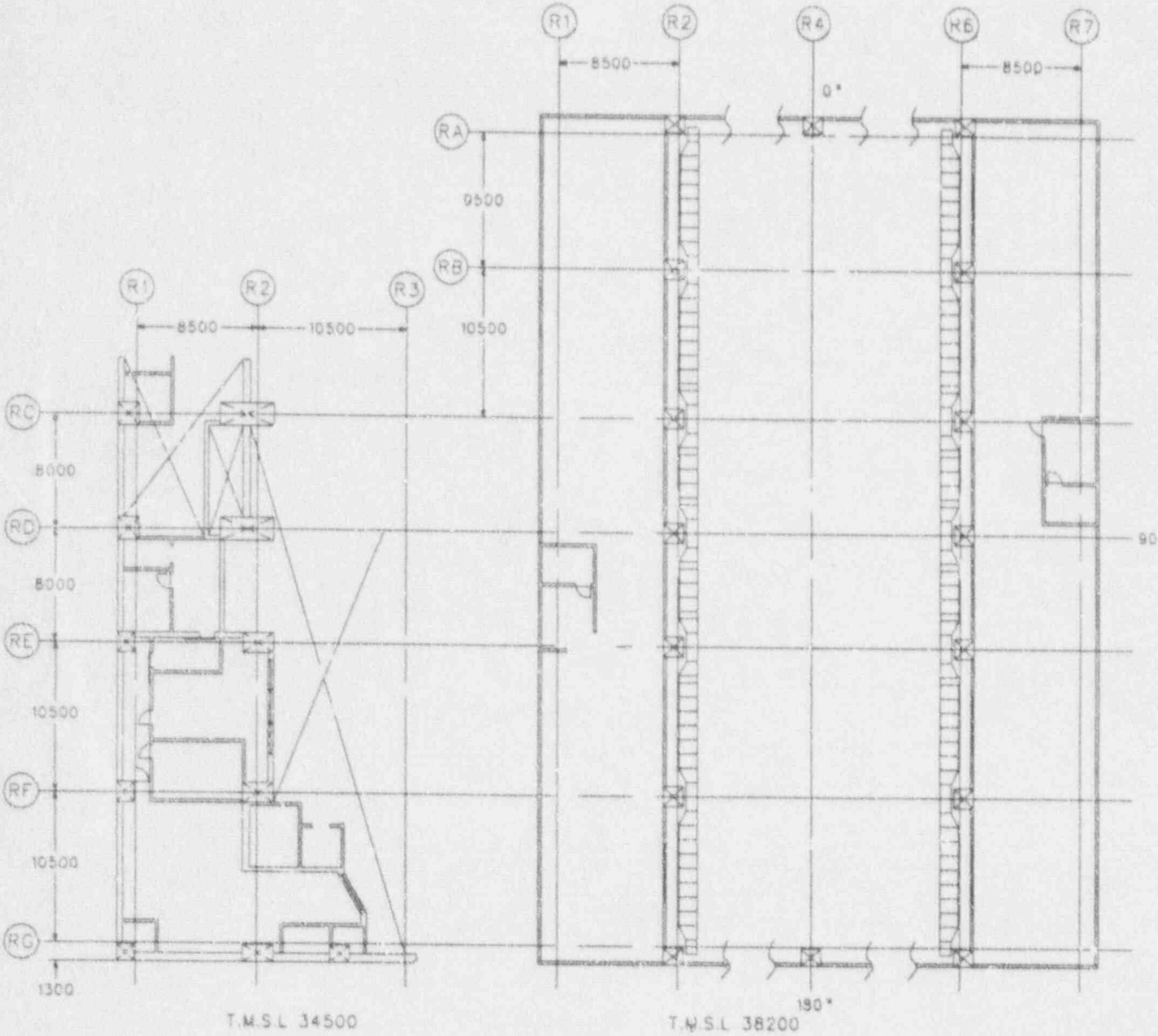
FIGURE 2.15.10.m REACTOR BUILDING ARRANGEMENT – T.M.S.L. 27200



NOTES:

1. "•" DENOTES DOORS WITH RAISED SILLS.
2. "◺" DENOTES WATERTIGHT DOORS TO PREVENT WATER ENTERING ROOMS FROM CORRIDORS.
3. COLUMN DIMENSIONS ARE 2.2M X 1.6M (TYPICAL).
4. FLOOR SLAB THICKNESS IS 0.5M.
5. MAIN STEEL H-SECTION BEAM DIMENSIONS ARE BH-1.5 X 0.7M

FIGURE 2.15.10n REACTOR BUILDING ARRANGEMENT – T.M.S.L. 31700



NOTES: (FOR T.M.S.L. 34500)

1. COLUMN DIMENSIONS ARE 2.2M X 1.4M.
2. FLOOR SLAB THICKNESS IS 0.5M.

NOTES: (FOR T.M.S.L. 38200)

1. COLUMN DIMENSIONS ARE 1.4M X 1.4M (TYPICAL).
2. ROOF THICKNESS IS 0.5M.
3. MAIN BEAM DIMENSIONS ARE BH-0.8 X 0.45.

FIGURE 2.15.10.o REACTOR BUILDING ARRANGEMENT - T.M.S.L. 34500 AND 38200

2.15.11 Turbine Building

Design Description

Later. Stage 3 Item.

2.15.12 Control Building

Design Description

The control building (CB) is the building that houses the main control room, control equipment and operations personnel for the Reactor and Turbine Islands. The control building is located between the reactor and turbine buildings.

In addition to the control room and operations personnel, this building houses the essential electrical, control and instrumentation equipment, essential switch gear, essential battery rooms, the CB heating and air conditioning (HVAC) equipment, reactor building component cooling water pumps and heat-exchangers, and the steam tunnel.

The general building arrangement including watertight doors and sills for doorways where needed for flood control is found in Figures 2.15.12a through 2.15.12g.

The CB is a Seismic Category I structure designed to provide missile and tornado protection.

The CB is constructed of reinforced concrete with steel truss roof. The CB has two stories above the grade level and four stories below. The building shape is rectangle. Major nominal dimensions are as follows:

Overall height above top of basemat	30.5 m
Overall planar dimensions (outside)	
0 deg-180 deg direction	24.0 m
90 deg-270 deg direction	56.0 m
Thickness of Outer Wall	
from -8.2m TMSL to 17.15m TMSL	1.0m
from 17.15m TMSL to 22.2 m TMSL	0.6m
Thickness of Steam Tunnel	
Walls, Floors, and Ceiling	1.6m
Thickness of Walls supporting Steam Tunnel	1.6m

The CB is a shear wall structure designed to accommodate all specified seismic loads with its perimeter walls. Therefore, frame members such as beams or columns are designed to accommodate deformations of the walls in case of earthquake condition. Column sized and floor slab thicknesses are also provided in the general building arrangement figures. With major dimensions defined as listed above for specified reinforced concrete materials and design procedures, the dynamic characteristic of the CB structure is defined. Seismic adequacy of the detailed site-specific control building design will be evaluated using the dimensional characteristics noted above and approved analytical procedures and methodology for dynamic analysis of structures. This work will be in compliance with the ACI and AISC codes governing design of reinforced concrete structures for nuclear power plants. Detailed analyses of the site specific control building design will utilize appropriate site data for seismic events, floods, tornados, winds and other loading conditions.

To protect against external flood damage, the following design features are provided:

a. wall thickness below flood level greater than 0.6m.

b. water stops provided in all construction joints below grade.

c. watertight doors and piping penetrations installed below flood level.

d. waterproof coating on exterior walls.

e. foundations and walls of structures below grade are designed with water stops at expansion and construction joints.

f. roofs are designed to prevent pooling of large amounts of water.

To protect against internal flood damage, the following design features are provided:

a. elevation differences and divisional separations from remainder of the CB.

b. drainage system to divert water to assigned floor and location.

c. sills for doorways as needed to provide flood control.

d. watertight doors installed below internal flood level.

e. wall thickness below internal flood level greater than 0.6m.

Inside the steam tunnel is the mainsteam piping, the mainsteam drain line, and the feedwater piping. The steam tunnel has no penetrations from the steam tunnel into the control building. Any high energy line breaks inside the steam tunnel will vent out to the turbine building. All standing water will collect in the large volumes in the lower portions of the steam tunnel at the reactor building or turbine building ends.

On Floor B1F, there are fire hose stands and reactor cooling water (RCW) piping. It is designed that any rupture of the fire hose stand will leak onto the floor and drain to the -8200 level by floor drains. Sills will be provided at doorways to prevent the entry of standing water into the control room complex. The RCW piping runs vertically in a concrete pipe chase. No flooding outside this pipe chase is possible.

On the floor where computer room located, there are fire hose stands, RCW piping, and other piping systems. A limited amount of standing water is expected upon a rupture of any of these systems. Sills will be provided at doorways to prevent water from crossing divisional boundaries. Similar arrangements and designs are also provided for other floors for floods protection.

During normal operation, the concrete surrounding the steamline tunnel provides shielding so that operator doses are below the value associated with uncontrolled, unlimited access. The outer walls of the control building are designed to attenuate radiation from radioactive materials contained within the reactor building and from possible airborne radiation surrounding the control building following a LOCA. The walls provide shielding to limit the direct-shine exposure of control room personnel following a LOCA. Shielding for the outdoor air cleanup filters also is provided to allow temporary access to the mechanical equipment area of the control building following a LOCA, should it be required.

The control building is not a vented structure. The exposed exterior roofs and walls of the structure are designed for the required pressure drop. Tornado dampers are provided on all air intake and exhaust openings. These dampers are designed to withstand the specified negative pressure.

Inspection, Test, Analyses and Acceptance Criteria

Table 2.15.12 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria which will be undertaken for the control building.

Table 2.15.12: CONTROL BUILDING

Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Control buildin‹ ‹eneral arrangement is shown in Figures 2.15.12a through 2.15.12g.	1. Plant walk through to che‹‹ and verify requirements are met.	1. Per Figure 2.15.12a through 2.15.12.g.
2. Design features are provided to protect against design basis internal and external floods.	2. Review construction records and perform visual inspections of the flood control features.	2. For external flooding: a. Exterior wall thickness below flood level greater than 0.6m. b. Water stop c. Watertight door and piping penetrations below flood level d. Water proof coating on exterior walls e. Foundations and walls of structures below grade are designed with water stops at expansion and construction joints f. Roofs are designed to prevent pooling of large amounts of water. For internal flooding: a. Elevation differences and divisional separation of the mechanical functions from the remainder of the CB b. Drainage system to divert water to assigned floor and location c. Sills for doorways as needed to provide flood protection d. Watertight doors installed below internal flood level e. Wall thickness below internal flood level greater than 0.6m. f. Steam tunnel has no penetrations from the steam tunnel into the control building. Any high energy line or feedwater piping breaks inside the steam tunnel will vent out to the Turbine Building.

Table 2.15.12: CONTROL BUILDING (Continued)

Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The control building is designed to have adequate radiation shielding to protect operating personnel during operation and following a LOCA.	3. Performed dimensional inspections of the Control Building walls, ceiling, floors, and other structural features.	3. The concrete thickness for the steam tunnel wall, floor and ceiling shall be greater than 1.6m. The steam tunnel interface structure and control building wall below the steam tunnel should have a combined thickness of 1.6m.
4. The CB is designed to protect against design basis tornado and tornado missiles.	4. Review construction records and perform visual inspections of the tornado protection features.	4. For tornado a. Roof and walls above grade designed greater than 0.5m b. HVAC dampers designed for differential pressure > 1.46 psi. c. HVAC dampers have tornado missile barriers.
5. The CB is designed as a Seismic Category I structure and has major dimensions defined in the certified design.	5. Plant walk through to check and verify CB building major dimensions including column sizes and floor slab thickness. Review final design record for material properties site input data and analytical procedures and methodology for seismic analysis. Visual inspections of structures and review of as-built documentation will be conducted to asses compliance with the certified design commitments.	5. Structures have dimensions compatible with data in the certified design. (Figures 2.15.12a through 2.15.12g)
6. The detail structural design will be based on ACI and AISC codes and will use site data for seismic events, floods, tornadoes winds and other loading conditions.	6. The control building design documentation will be reviewed.	6. Confirmation that the as-built design is in compliance with ACI and AISC requirements and is based on appropriate site design data.

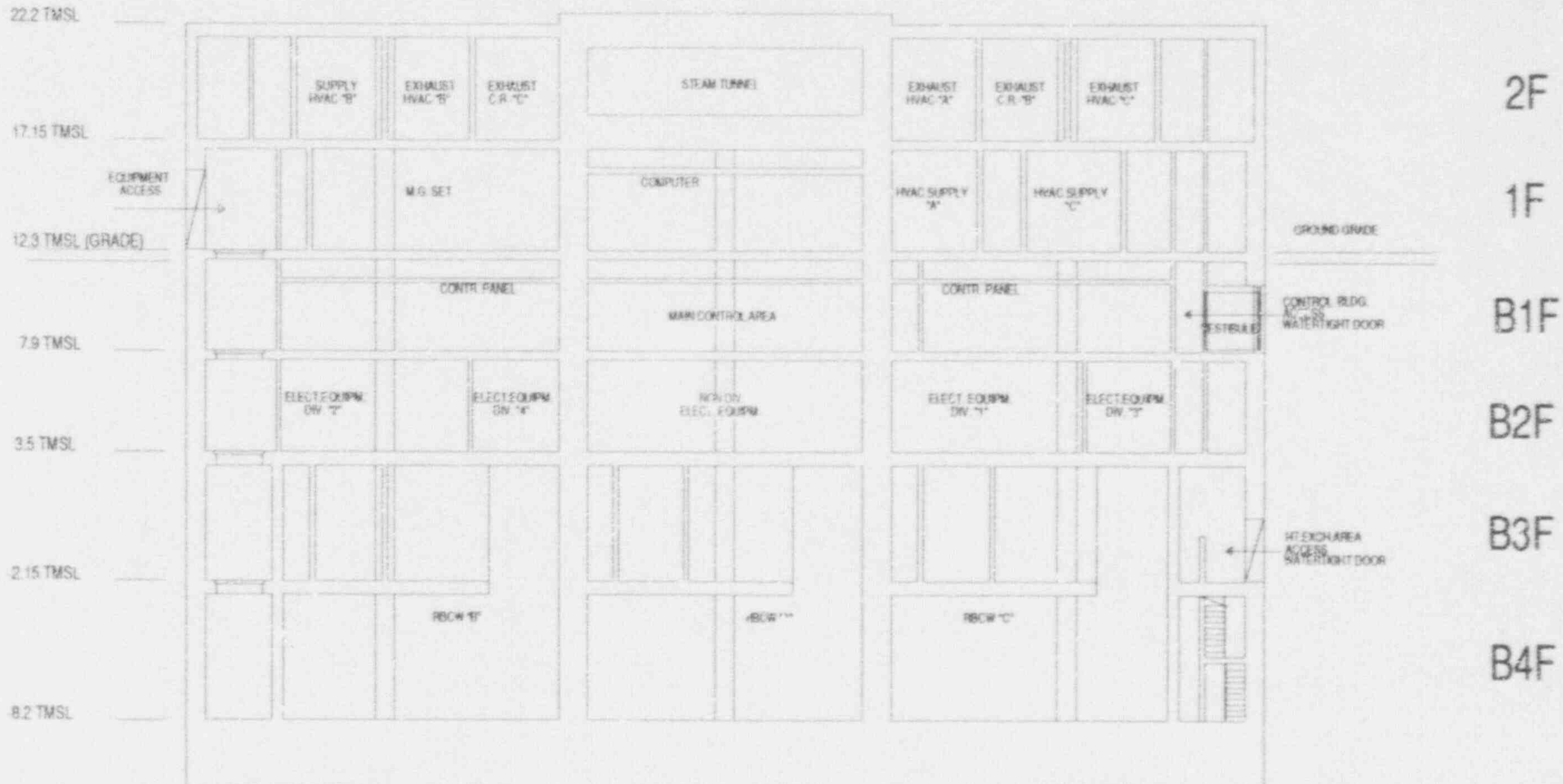


Figure 2.15.12a CONTROL BUILDING ELEVATION (90° - 270°)

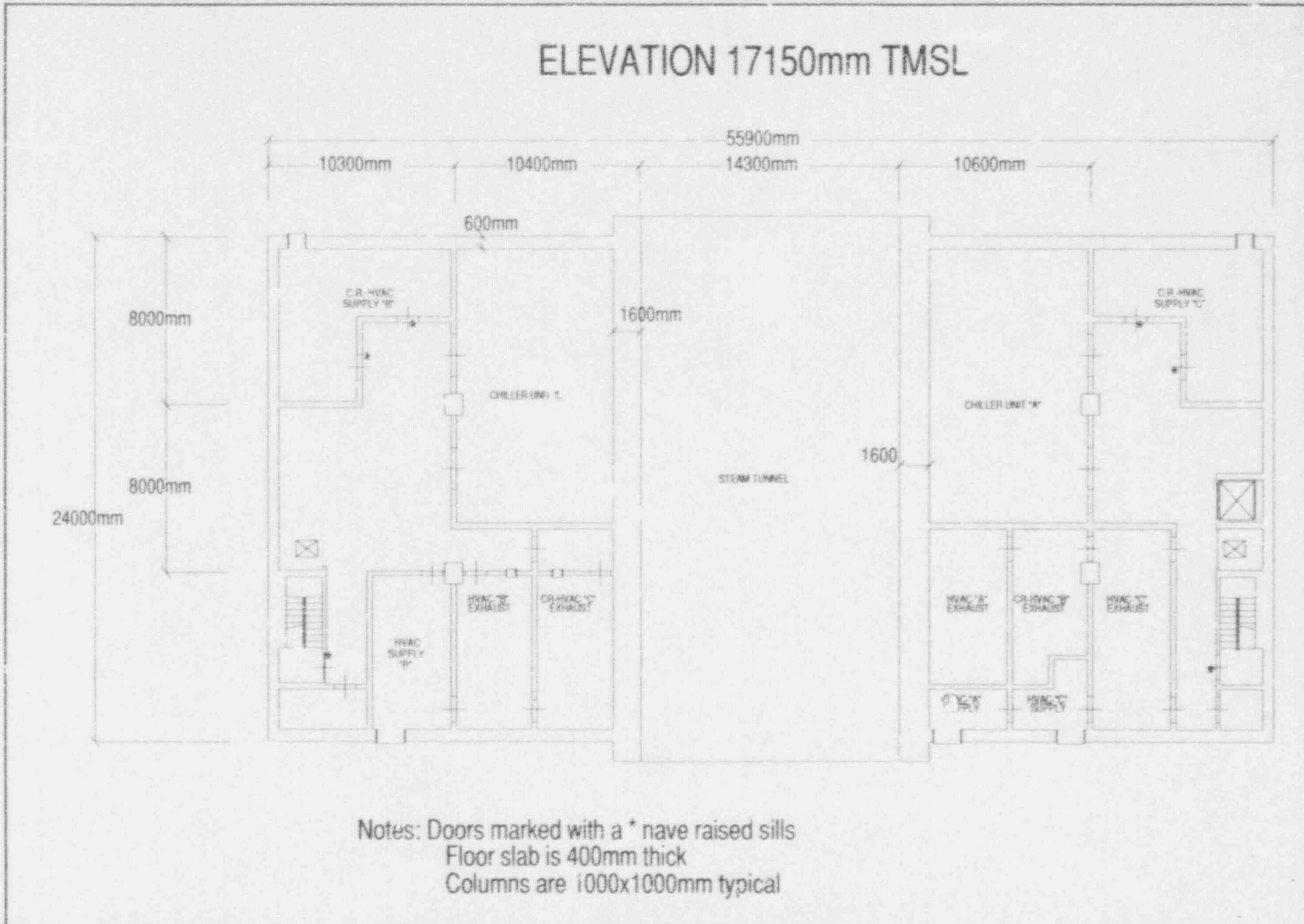
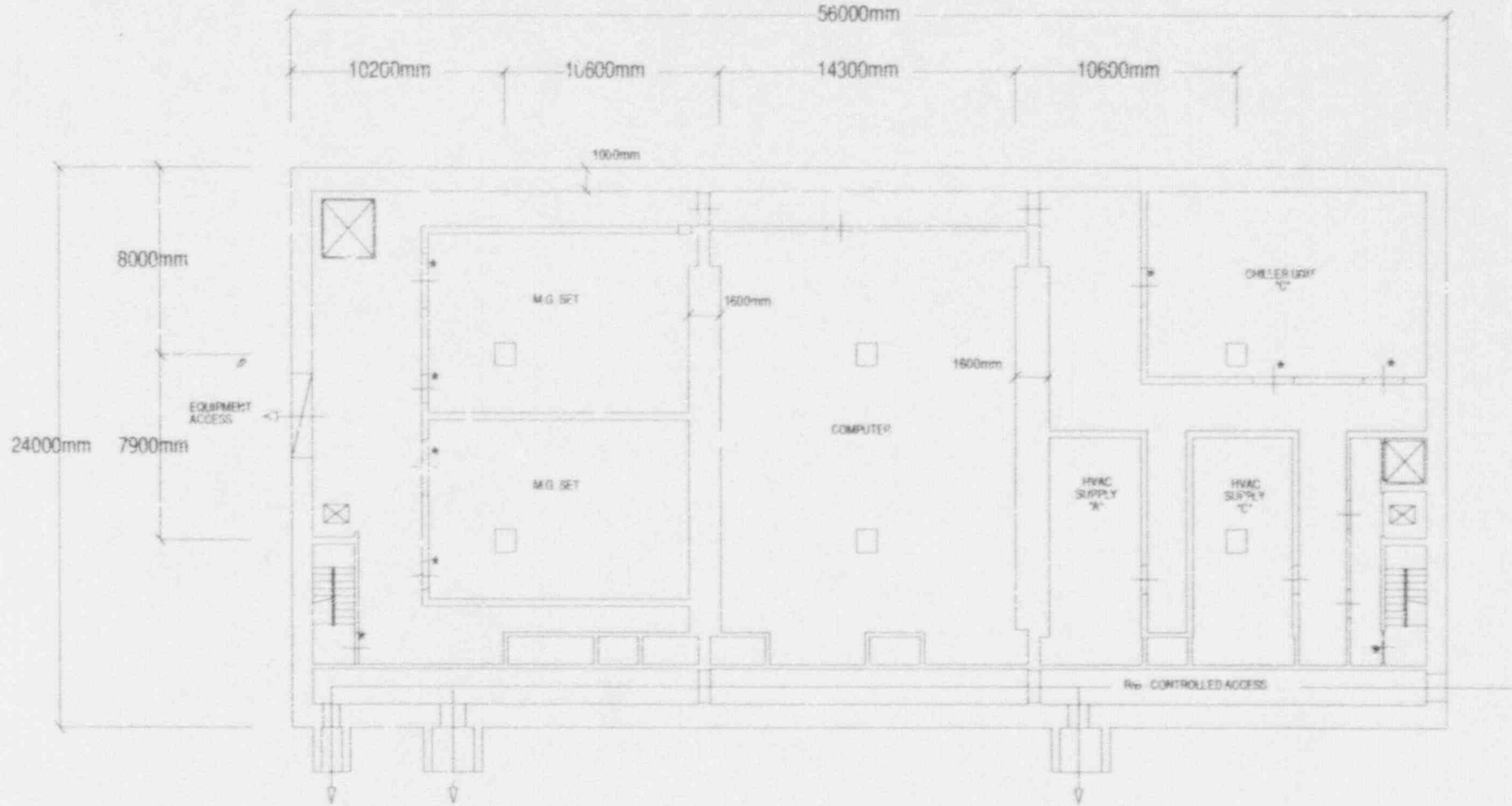


Figure 2.15.12b CONTROL BUILDiNG - FLOOR 2F

ELEVATION 12300mm TMSL



Notes: Doors marked with a * have raised sills
Columns are 1000x1000mm typical
Floor slab is 400mm thick

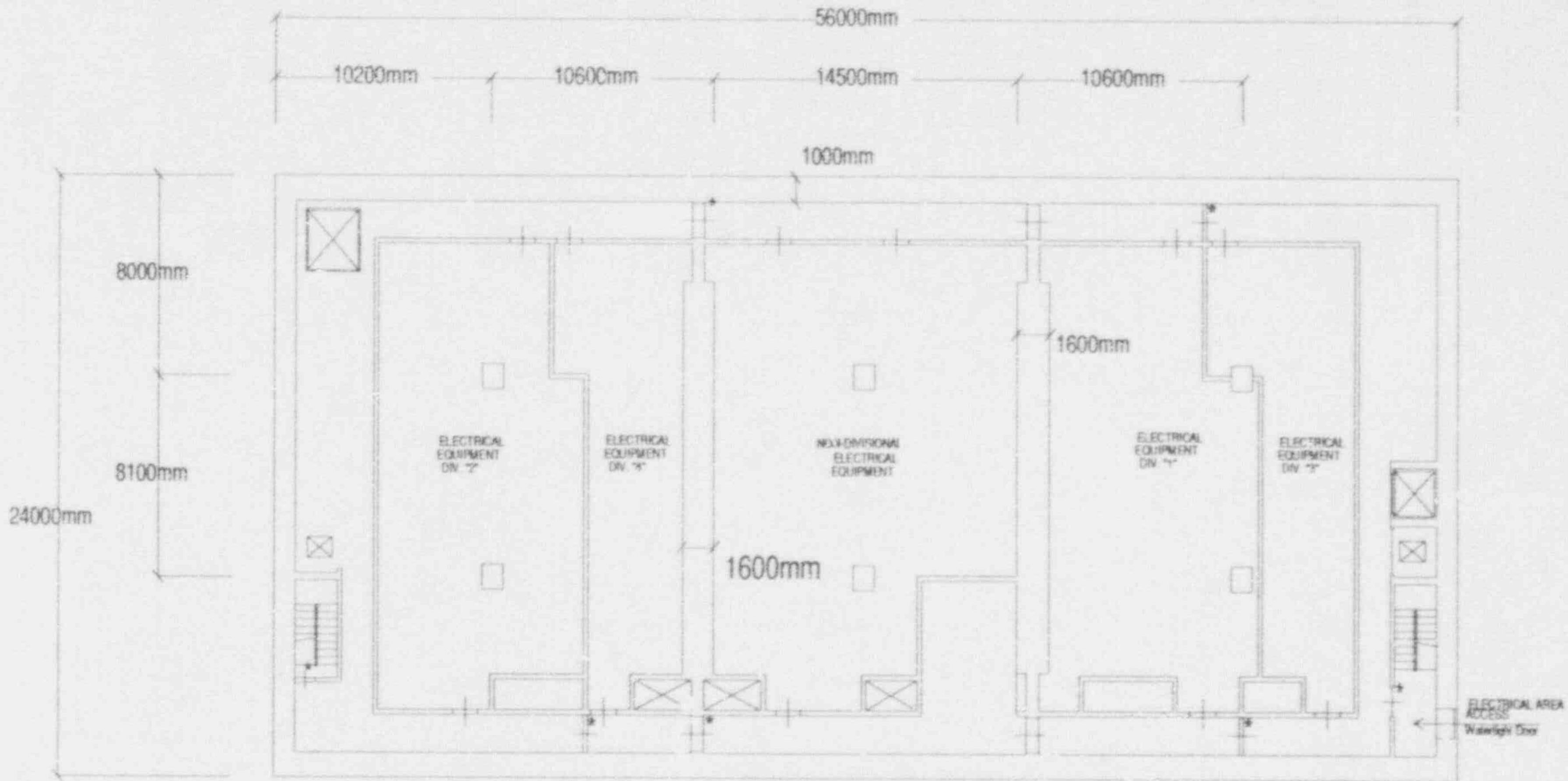
Figure 2.15.12c CONTROL BUIDING FLOOR 1F - GROUND GRADE

ELEVATION 7900mm TMSL

Notes: Floor slab is 400mm thick
Columns are 1000x1000mm typical

Figure 2.15.12d CONTROL BUILDING FLOOR B1F

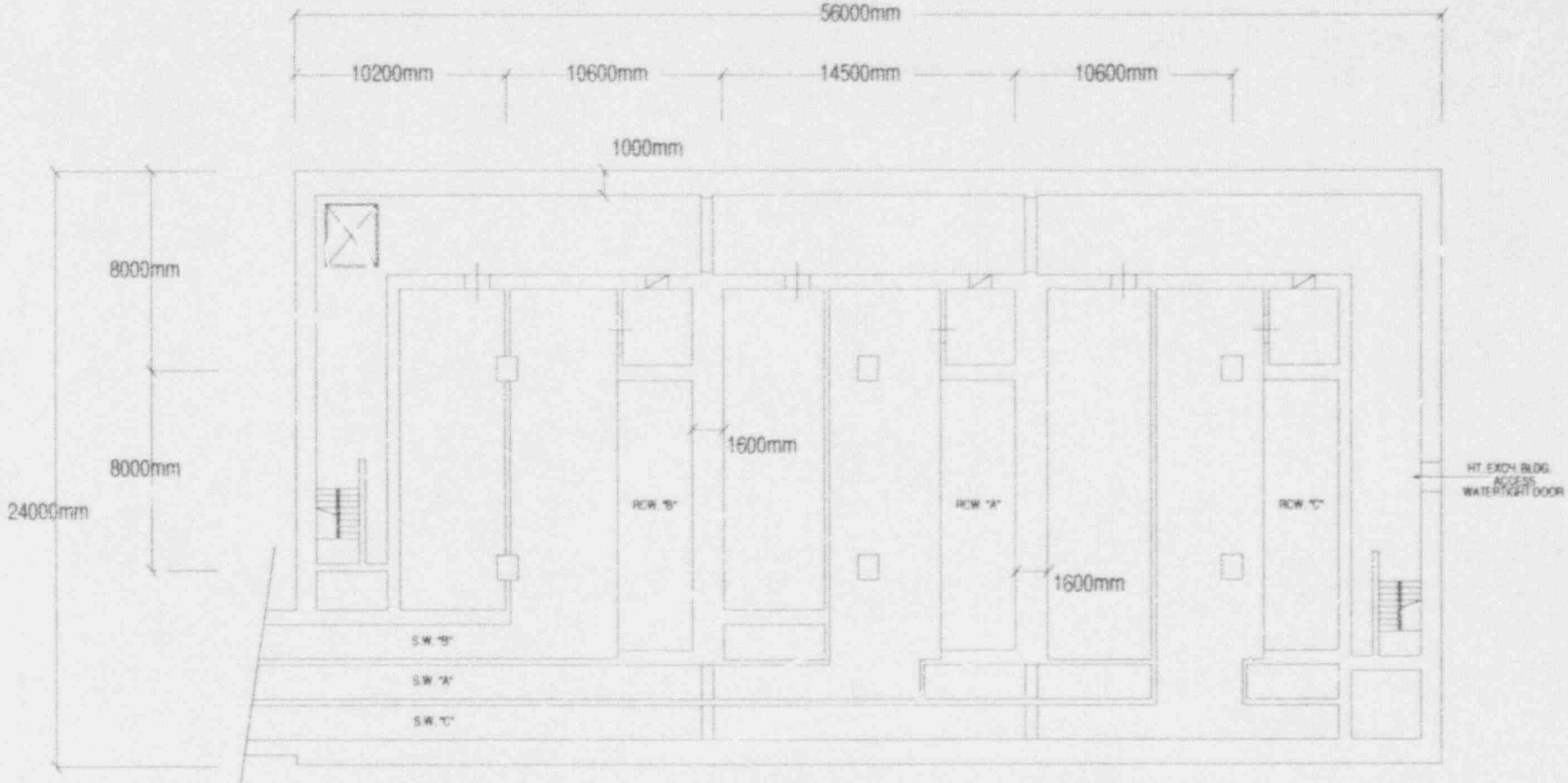
ELEVATION 3500mm TMSL



Notes: D[illegible] marked with a * have raised sills
[illegible]oor slab is 400mm thick
Columns are 1000x1000mm typical

Figure 2.15.12e CONTROL BUILDING FLOOR B2F

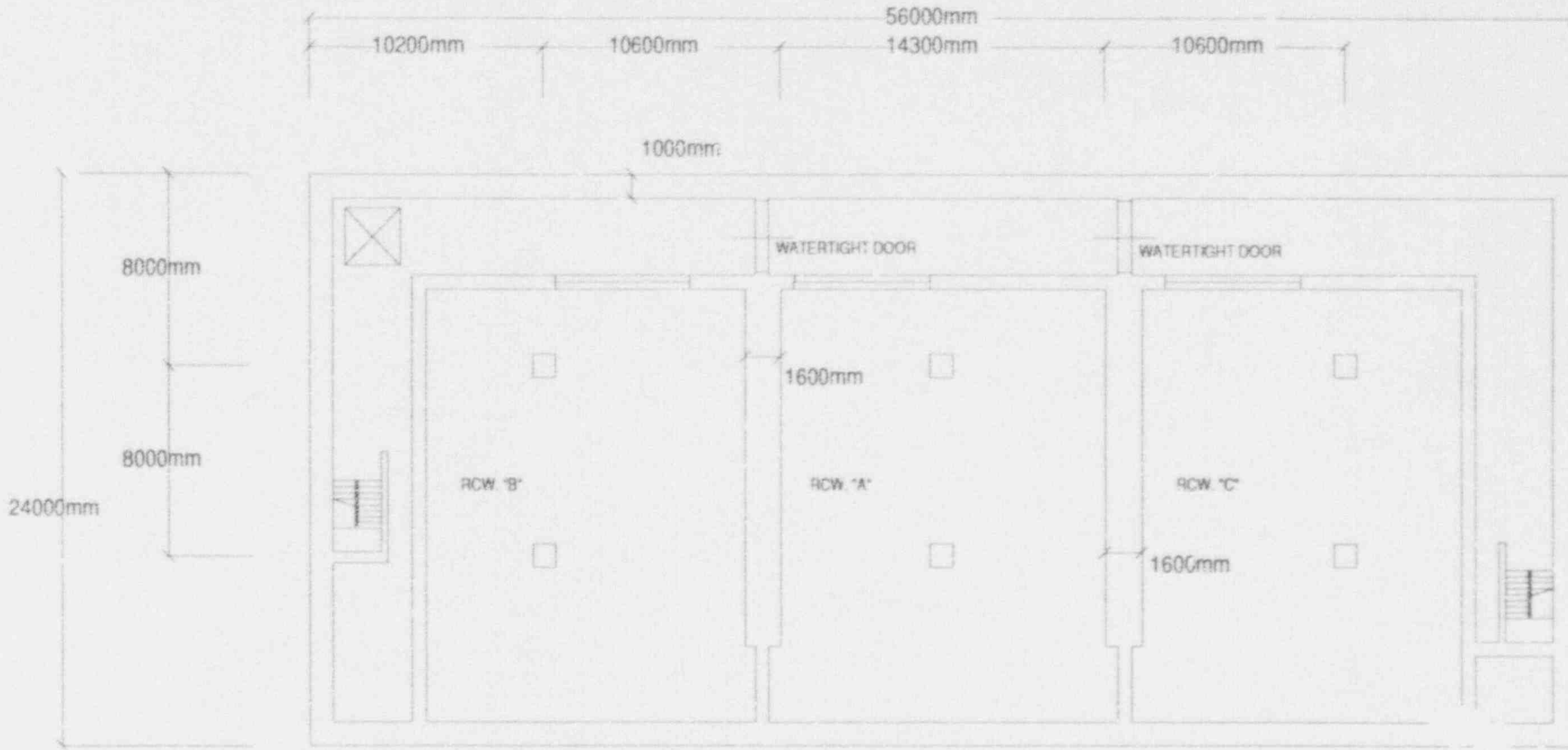
ELEVATION -2150mm TMSL



Notes: Columns are 1000x1000mm typical
Floor slab is 400mm thick

Figure 2.15.12f CONTROL BUILDING FLOOR B3F

ELEVATION -8200mm TMSL



Notes: Columns are 1000x1000mm typical
Basemat is 2600mm thick (min)

Figure 2.15.12g CONTROL BUILDING FLOOR B4F

2.15.13 Radwaste Building

Design Description

Later. Stage 3 Item.

2.15.14 Service Building

Design Description

Later. Stage 3 Item.