DRESDEN STATION SPECIAL REPORT NO. 33

Final Flood Protection Measures (Permanent Flood Protection of the Containment Cooling Service Water Pumps and Diesel Generator Cooling Water Pumps)

Dresden Units 2 and 3

AEC Dockets
50-237
50-249

Commonwealth Edison Company

August, 1973

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1.0 Introduction

On June 7, 1972, while the Quad-Cities - Unit 1 was in the cold shutdown condition, an operator was performing maintenance and scheduled modification on the circulating water system when the air was vented from the hydraulic system on one of the 120" circulating water butterfly valves at the condenser. The resultant sudden butterfly valve closure caused a water hammer in the system. The water hammer effect led to a failure of a rubber expansion joint in the 120" circulating water line and the subsequent flooding of the condenser pit (where the expansion joint is located) and the condensate pump room.

The water flowed from the condenser pit to the condensate pump room by way of a doorway and two large ventilation openings between the two areas. The water rose to a height of approximately 16 feet in the condensate pump room and flooded all the pumps in that room some of which are Class I safety related equipment normally required to bring the unit to a cold shutdown. As the plant was already in the cold shutdown condition this damage did not present a problem for plant safety or operation. Plans were implemented immediately to remove the water and place the equipment back into service.

As a result of this flooding at Quad-Cities Station, modifications will be made both at the Quad-Cities Station and at the Dresden Station. The remainder of this report discusses those modifications to be made at the Dresden Station.

Basically three design modifications will be made at Dresden:

1. The paths that flood water could follow from the condenser pit to the condensate pump room will be permanently sealed. This isolates the condenser pit and prevents any source of flood water in the condenser pit from becoming a source of flood water to the condensate pump room (floor elevation 469'6") and consequently to the containment cooling service water pumps (CCSW) located one floor above the condensate pump room (at floor elevation 495'0").

2. Two of the four containment cooling service water pumps (i.e., the B and C pumps) per unit will be enclosed in a watertight vault. These vaults are designed to ensure that a postulated rupture in the containment cooling service water system will not result in loss of all four pumps due to flooding.

3. The diesel generator cooling water pumps, which are located in the crib house pit, will be replaced with special submersible type pumps and motor drives. In the event that the crib house pit is flooded the pumps can operate while submerged.

The complete design details of these three modifications are discussed in the following section.

2.0 Design Details

2.1 Isolation of the Condenser Pit from the Condensate Pump Room

2.1.1 Determination of Maximum Flood Level

There are three possible sources of flood water in the condenser pit. They are:

Case 1. A break in an expansion joint (as happened at the Quad-Cities Station) after which the circulating water pumps continued to fill the condenser pit until they are shut off.

Case 2. A break in an expansion joint after which the circulating water pumps are shut off, but the condenser pit is flooded by backflow from the river.

Case 3. A failure of the hotwell.

The maximum flood level inside the condenser pit from the above sources is the 508'0" elevation (27'0" above the condenser pit floor elevation 481'0"). This maximum flood level was arrived at in the following manner:

2.1.1.1 In Case 1 above the expansion joint break was analyzed for the worst condition in which the entire expansion joint material is blown out leaving a 6" circumferential gap around the pipe for water to escape. In order to calculate the maximum flow of water from the break it was assumed that the gap would act as an orifice of area equal to the area of the gap. Using the circulating water pump head and system friction loss curves, it was calculated that a maximum of 250,000 gpm could be pumped through the opening in the pipe.

If this 250,000 gpm were allowed to continue being pumped the condenser pit would be filled to the 517'0" elevation (ground level) in approximately 1.5 minutes. At this point, the water would begin to flow throughout the 517'0" elevation of the turbine cavity and the plant. In order to prevent this occurrence, a system of level switches will be installed in the condenser pit to indicate and control flooding of the condenser area. The following switches

will be installed:

Level	Function
a. 1'0" (1 switch)	Alarm on main control room panel "Hi Water Condenser Pit"
b. 3'0" (1 switch)	Alarm on main control room panel "Hi Circ. Water Condenser Pit"
c. 5'0" (2 redundant switches)	Alarm on main control room panel and circ. water pump trip

Level (a) indicates water in the condenser pit from either the hotwell or the circulating water system. Level (b) is above the hotwell capacity and indicates a probable circulating water failure. At the level (b) alarm the operator in the control room shall manually trip the circulating water pumps for the affected unit thereby preventing the flooding to continue due to operation of the pumps.

Should the switches at level (a) and (b) fail or the operator fail to trip the circulating water pumps on alarm at level (b), the actuation of either level switch

at level (c) shall trip the circulating water pumps automatically and alarm in the control room. These redundant level switches at level (c) will be designed and installed to IEEE 279, "Criteria for Nuclear Power Plant Protection Systems." As the circulating water pumps are tripped, either manually or automatically at level (c) of 5'0", the maximum water level reached in the condenser pit due to pumping will be at the 491'0" elevation (10' above condenser pit floor elevation 481'0", 5' plus an additional 5' attributed to pump coast down).

2.1.1.2 Once the circulating water pumps have been shut off the condenser pit will continue to fill up due to backflow from the river. Theoretically, this backflow will continue until the level inside the condenser pit is equal to the elevation of the river. Then the maximum theoretical flood elevation in the condenser pit is 508'0" (maximum historical flood level).

For design purposes, the maximum flood elevation contributible to backflow was taken as 508'0".

2.1.1.3 The hotwell contains 10,200 cubic feet of water at its normal overflow level. Should the hotwell rupture (catastrophically) this water would be dumped into the condenser pit (as this happens, loss of condenser vacuum will trip the turbine and the bypass valves so that flow to the condenser will cease). The maximum flood level due to this water would be approximately 3 feet to the 484'0" elevation.

2.1.1.4 In reviewing paragraphs 2.1.1.1 - 2.1.1.3 it can be seen that if any one or all three of the above cases occur, the maximum flood level in the condenser pit will be be 508'0". Therefore, in the design modification to isolate the condenser pit from the condensate pump room a maximum flood to the 508'0" elevation in the condenser pit was used. This overall height of 27.0' (elevations 508'0" less

481'0") was used, plus 10% margin to come up with a maximum flood depth of 30 feet.

2.1.2 Design Modification of Condenser Pit

During a postulated flooding incident, water would pass from the condenser pit to the condensate pump room through two vent openings, a doorway, pipe penetrations, and several floor and equipment drains. The following modifications will be made to isolate the condenser pit from the condensate pump room in the event of a flood to the 508'0" elevation:

2.1.2.1 The two ventilation openings between the condenser pit and the condensate pump pit will be permanently sealed by means of a 1" steel plate to which 8" channels will be attached on the upper side for support (see Fig. 1, 2 and 6).

This entire assembly will be anchored into the concrete with 1/2" diameter cinch anchors on 6" centers on all four sides.

The ventilation closures have been analyzed and found acceptable to withstand a 30' head of water in addition to a 0.12 g (DBE earthquake load value) vertical acceleration as applied to the mass of water. Because of the small mass of the plate, the horizontal seismic forces are negligible. The plate and structural members providing these closures undergo stresses which do not exceed 1-1/3 times the working allowable stresses for the materials.

2.1.2.2 The doorway between the condenser pit and the condensate pump room will be sealed by a watertight door. The watertight door will be designed to withstand a 30' head of water plus the effects of a 0.18 g (DBE earthquake load value) horizontal seismic occurrence (this includes the "sloshing effect" of the 30' head of water as analyzed using TID-7024, Nuclear Reactors and Earthquakes. Because of the small mass of the door the vertical seismic forces are negligible. The door materials undergo stresses which do not exceed 1 1/3 times the working allowable stresses of the materials.

2.1.2.3 The piping and electrical penetrations between the condenser pit and the condensate pump room will be permanently sealed with concrete, RTV silicone sealant, or rubber boot type seals (designed by Brand Industrial Services) to prevent leakage between the condenser pit and the condensate pump room in the event of a flood. These seals will be designed for the maximum flood condition in relation to the elevation where each is located.

2.1.2.4 The wall between the condenser pit and the condensate pump room (approximately Column "E" on Figs. 1 and 2) provides a watertight seal with the addition of the seals specified in paragraphs 2.1.2.2 and 2.1.2.3 above. This wall has been analyzed and found capable of withstanding a head of 30' of water acting on the condenser side of the wall plus the effects of a 0.18g horizontal and a 0.12g vertical seismic occurrence (this includes "sloshing" as in paragraph 2.1.2.2). The construction

of the existing wall is more than adequate to contain the water pressure and the effects of the seismic occurrence with stresses in the concrete and reinforcing steel not exceeding 1 1/3 times the allowable working stresses.

It is recognized that the flooding of the condenser pit is an additional load onto the foundation of the structure
The added weight is more than adequately supported directly on the founding rock through the concrete mat on which the structure rests.

2.1.2.5 The floor and equipment drains which run from the condenser pit to the sumps in the condensate pump room will be permanently sealed or sealed with removable plugs where periodic drainage is necessary. The seals and plugs are designed to withstand the maximum flood level.

2.1.2.6 Included in the design modifications are the level switches as discussed in paragraph 2.1.1.1.

2.1.3 Testing

2.1.3.1 There will be no testing required for the bulkhead door or penetration seals in the condenser pit wall. These seals will be designed for maximum flood level therefore no catastrophic failure of the seals will occur. Testing the seals would only assure that no small leaks are present. Since the CCSW pumps are located on the floor approximately 25' above the condensate pump room, small leakage flow will in no way endanger the CCSW pumps. Therefore, testing of the seals would be an unnecessary expense without any benefit to plant safety.

2.1.3.2 The IEEE-279 design switches discussed in paragraph 2.1.1.1 will be testable with the plant in operation.

2.2. Separation of the Containment Cooling Service Water Pumps

2.2.1 Determination of Maximum Flood Level

There are three other possible sources of flood water in the condensate pump room. They are:

1. The three contaminated condensate storage tanks.
2. The condenser hotwell and condensate piping to the condensate pumps.
3. The CCSW system piping to the CCSW pumps.

2.2.1.1 The three contaminated condensate storage tanks hold a combined storage of 700,000 gallons of water. Of this 700,000 gallons, 520,000 gallons could flow into the condensate pump room upon failure of contaminated condensate line in the room (180,000 gallons is held for the HPCI and LPCI systems).

2.2.1.2 The hotwell and condensate piping to the condensate pumps contain approximately 85,000 gallons of water. In the event of a postulated condensate line break this volume of water would flow into the condensate pump room. At the time of the pipe break the condenser would lose its vacuum, and consequently, the turbine would trip and the main steam bypass valves would trip closed essentially stopping any additional flow into the condenser. Therefore, the volume available to flood the condensate pump room would be 85,000 gallons.

The floor area of each condensate pump room is approximately 3,465 sq.ft. (free floor area minus pump base plates). Therefore, the 605,000 gallons (520,000 plus 85,000 gallons equals 80,872 cu.ft.) available would flood the condensate pump room to a height of 23.3 feet. (This is a conservative estimate as the pump base plate dimensions were projected upward and subtracted from the total volume available as an estimate of the volume of the pumps and piping that would be under water).

2.2.1.3 The other possible source of flooding in the condensate pump room is a postulated rupture in the CCSW system piping. If such a postulated accident occurred outside the CCSW vault, water would backflow from the river and fill the condensate pump room and CCSW pump room until water reached river level of 508'0".

2.2.1.4 Likewise, a postulated CCSW pipe rupture inside the CCSW vault will result in water backflowing and filling the CCSW vault to river level of 508'0" (13'0" above the vault floor elevation 495'0").

2.2.1.5 In reviewing paragraphs 2.2.1.1 - 2.2.1.4 it can be seen that if any one of the above cases occurs, the maximum flood level will be 508'0". Therefore, in the design modification to protect the CCSW pumps a maximum flood to the 508'0" elevation was used. This height of 13' (elevations 508'0" less 495'0") was used as the maximum CCSW flood depth.

2.2.2 Design Modifications of CCSW Pump Room

2.2.2.1 Each unit at the Dresden Station has four containment cooling service water pumps, any two of which will provide the required containment cooling. Each unit will have two of the above pumps in an isolated vault. The pumps are enclosed in the following manner, using Unit 2 as an

example (See Fig. 1A): Containment Cooling Service Water pumps 2B-1501-44 and 2C-1501-44 are in a vault. Unit 3 pumps are enclosed in a like manner (See Fig. 2A).

2.2.2.2 The following piping will remain in the vaults because of the complexity of its removal and its necessity to the operation of the CCSW pumps:

Hypochlorite Injection Piping
Service Water Injection Piping
Two ventilation Ducts

Penetrations for all of the above piping through the watertight vaults will be properly sealed as discussed in paragraph 2.2.2.5.

2.2.2.3 Each of the vaults will be constructed by building a new flood protection wall around the B and C CCSW pumps in each unit. These new walls are keyed into the existing walls and slabs and anchored with drilled in anchors (see Figs. 1A, 2A, 3, 4 & 5).

The walls are designed and will be constructed to withstand a 13' head (see paragraph 2.2.1.5, Determination of Maximum Flood Level) of water on either side of the wall in addition to the combined horizontal effect of a 0.18 g (DBE earthquake loading) seismic occurrence, vertical effect of a 0.12 g (DBE earthquake loading) seismic occurrence and including a sloshing effect of the water per Nuclear Reactors and Earthquakes TID-7024.

The walls are capable of withstanding the above mentioned combined loads with stresses not exceeding 1 1/3 times the allowable working stresses for the materials. Stresses in these reinforced walls are such that no cracking is expected to occur which would cause flooding of the pump vaults.

2.2.2.4 Access into the pump vaults will be by means of either watertight, steel, bulkhead or submarine type doors. These doors will be designed and constructed to the same flood and seismic criteria as the walls.

2.2.2.5 Pipe penetrations through the vault walls will be sealed with grout cement.

Electrical cables supplying power to the CCSW pumps will be sealed in the vault walls using a Nelson-Multi-Cable Transit fitting (see Figs. 9 and 10). The fitting consists of a box frame which is cast into the vault wall. Inside this frame are rubber blocks which are pre-cut to accept the exact cables that are routed through the opening. The rubber blocks are then compressed within the frame to form a seal. These seals are designed to withstand a head of 50' of water. Small conduit penetrations are sealed with grout cement in a manner similar to the pipes discussed above.

Junction boxes connected to conduit which penetrates the vault walls will be sealed with RTV (silicone rubber sealant) to prevent leakage into the vaults.

2.2.2.6 Electrical instrumentation, controls and other components which are susceptible to water damage will be located at an elevation above the flood elevation of 508'0".

2.2.2.7 There are provisions for two types of drains from the flood protection vaults: (1) floor drainage and (2) equipment drainage via the containment cooling service water pump bed plate drains.

Floor drainage of each vault is accomplished through a carbon steel pipe which penetrates the new vault wall. When open this pipe will drain the vault floor to a floor drain outside the vault. Under normal conditions the pipe will be closed off by a standard, screwed pipe cap good for 125 psi. When it is desired that the vault floor be drained, the cap is removed manually.

Equipment drainage from the vaults will be via the CCSW pump bed plate drains (see Fig. 11). The following equipment in the vault will drain to the above bed plates:

1. CCSW pumps

2. Vault coolers for each of the above pumps

Each bed plate drain enters the floor slab where it is tied into other bed plate drain piping which runs through the slab to the equipment drain sump (located outside the vaults) (See Fig. 9).

As a means of preventing backflow from outside the vaults in the event of a flood, a check valve and an air operated valve are installed in each bed plate drain line above the point where it enters the floor slab. The check valve is a 2" Crane swing check No. 34 designed for 125 psig service. The air operated valve is a Fisher control valve designed for a 15 psi differential pressure. The control valve will be in the normally open position in the energized condition and will close upon any one of the following:

1. Loss of air or power
2. High level in the equipment drain sump (signalling a possible flood)
3. High level in the vault

Closure of the control valve on high water level in the vault is affected by use of a level switch set at a water level of 6" inside the vault. Upon actuation of the switch, it will close the control valve and alarm in the control room to notify the operator of trouble in the vault. The operator will also be aware of problems in the condensate pump room if the high level alarm on the equipment drain sump is not terminated in a reasonable amount of time. It must be pointed out that these alarms provide information to the operator but that operator action upon the above alarms is not a necessity since the automatic provisions provide adequate protection.

2.2.2.8 In order to prevent the CCSW pump motors from overheating two vault coolers are supplied for each pump. The vault coolers are designed to maintain the vault at a maximum 105°F temperature during operation of a respective pump and provide humidification.

For example, if CCSW pump 2B-1501-44 starts, its coolers also start and maintain the vault at 105°F by removing heat supplied by the pump motor of 2B-1501-44. If, at the same time pump 2B-1501-44 is in operation, CCSW pump 2C-1501-44 starts, its coolers will also start and compensate for the added heat supplied to the vault by the 2C pump motor keeping the vault at 105°F.

Each of the coolers is supplied with cooling water from its respective pump's discharge line (see Fig. 10). After the water has been passed through the cooler it returns to its respective pump's suction line. In this way the vault coolers are supplied with cooling water totally inside the vault. The cooling water quantity needed for each cooler is approximately 1% to 5% of the design flow of the pumps so that the recirculation of this small amount of heated water will not affect pump or cooler operation.

The cooling water piping and vault coolers are designed and constructed for seismic Class I conditions. The coolers are similar in design and construction to coolers which have been specified and installed at the Zion Station (Docket No. 50-295). The coolers are manufactured by The Buffalo Forge Company.

Electrical supply to the fan motors of the vault coolers is supplied in the same manner and off the same bus as that of their respective pumps, thereby upholding the Class I integrity of these systems and assuring cooler operation concurrent with pump operation.

2.2.3 <u>Testing</u>

The watertight bulkhead door and the penetration seals for cables penetrating the vault walls and ceilings will be designed to withstand the maximum flood conditions. However, in order to assure that their installation is adequate for maximum flood conditions a method of testing each seal has been devised.

2.2.3.1 In order to test the watertight doors, a test frame will be installed on the condenser side of the condenser pit wall door and both sides of the CCSW vault door. At the time of the t[illegible]

reinforced rubber diaphrams as manufactured by the Goodyear Tire and Rubber Company will be clamped into test frames. Water will then be pumped into the rubber diaphragms to the design pressure of 13' and 30' respectively and held for several minutes to insure a watertight seal around the door.

2.2.3.2 In order to test an electrical penetration sealed with the Nelson Multi-Cable Transit fitting an identical fitting is permanently installed on the opposite side of the penetration (see Fig. 11). Compressed air is supplied to a test connection on the second fitting and the space between the fitting is pressurized to approximately 15 psig. The outer face/s of Nelson fitting/s is/are then tested for leaks using a soap bubble solution. Any leaks noted can be stopped by a readjustment of the seal.

2.2.3.3 No test will be made on the total vault walls themselves as the only reliable method to do this is to flood either the vault or the condensate pump room, neither of which is feasible.

2.3 Protection of the Diesel Generator Cooling Water Pumps

2.3.1 Determination of Maximum Flood Level

2.3.1.1 The three diesel generator cooling water pumps are located in the crib house pit (elevation 490'8").

There is only one source of flood water in the crib house pit. Flood water would enter the pit if a rubber expansion joint on one of the six circulating water pumps failed. If this occurred and the circulating water pumps continued to run, the crib house pit would fill with water and would be filled to the 517'0" elevation (ground level). At this point, the flood water would spill back to the river.

2.3.1.2 The flood elevation of 517'0" for the diesel generator cooling water pumps yields a flood depth of 26'4" (elevations 517'0" less 490'8"), plus a 10% margin to come up with a maximum flood depth of 30 feet.

2.3.2 Design Modifications

2.3.2.1 The three diesel generator cooling water pumps have been replaced with watertight, submersible "canned" type pumps and motor drives, as manufactured by Crane Chempump Division, with capacity and head equal to the original pumps (see Fig. 12).

2.3.2.2 The electrical feed conduit to these pumps is furnished with the replacement pumps and is also of watertight design. The electrical motor control center for these pumps is located at elevation 517'0" in the turbine building and is not susceptible to flood damage as it is above flood level.

2.3.3 Testing

2.3.3.1 The replacement pumps will be factory tested and certified to operate while submerged under 30 feet of water. The diesel generator system will be given a preoperational test after the cooling water pumps have been installed to confirm proper starting and cooling under load.

3.0 Safety Evaluation

3.1 If a rubber expansion joint ruptures at the Dresden Station, as it did at the Quad-Cities Station, the resultant flood water will be isolated in the condenser pit and no Class I equipment will be affected. Design modifications have been made to protect flooding of the areas of the plant by the installation of IEEE-279 standard circulating water pump trip and by sealing off of the condenser pit. The condenser pit has been analyzed to be able to withstand the maximum flooding condition of all the postulated floods combined with the plant design basis earthquake including a sloshing effect of the flood water.

3.2 As described in the "Design Details" of this report:

1. Two of the four containment cooling service water pumps per unit will be enclosed in a watertight vault which will withstand the maximum flooding (total of all potential floods) of the condensate pump room. There is no other Class I equipment in the condensate pump room th t would be affected by such a flood.

2. The diesel generator cooling water pumps will be replaced with watertight, submersible type pumps which will withstand the maximum flooding of the crib house pit. There is no other Class I equipment in the crib house pit that would be affected by such a flood.

4.0 Conclusion

When the design modifications discussed in this report are completed, Class I equipment - the contaiment cooling service water pumps and diesel generator cooling water pumps in particular - will not be degraded by flooding such as occurred at the Quad-Cities Station or any other postulated flooding. Therefore, the containment cooling service water pumps and diesel generator cooling water pumps and associated Class I equipment in both Dresden - Units 2 and 3 will meet all engineering safe guards and seismic Class I criteria to ensure their availability and plant reactor safety.

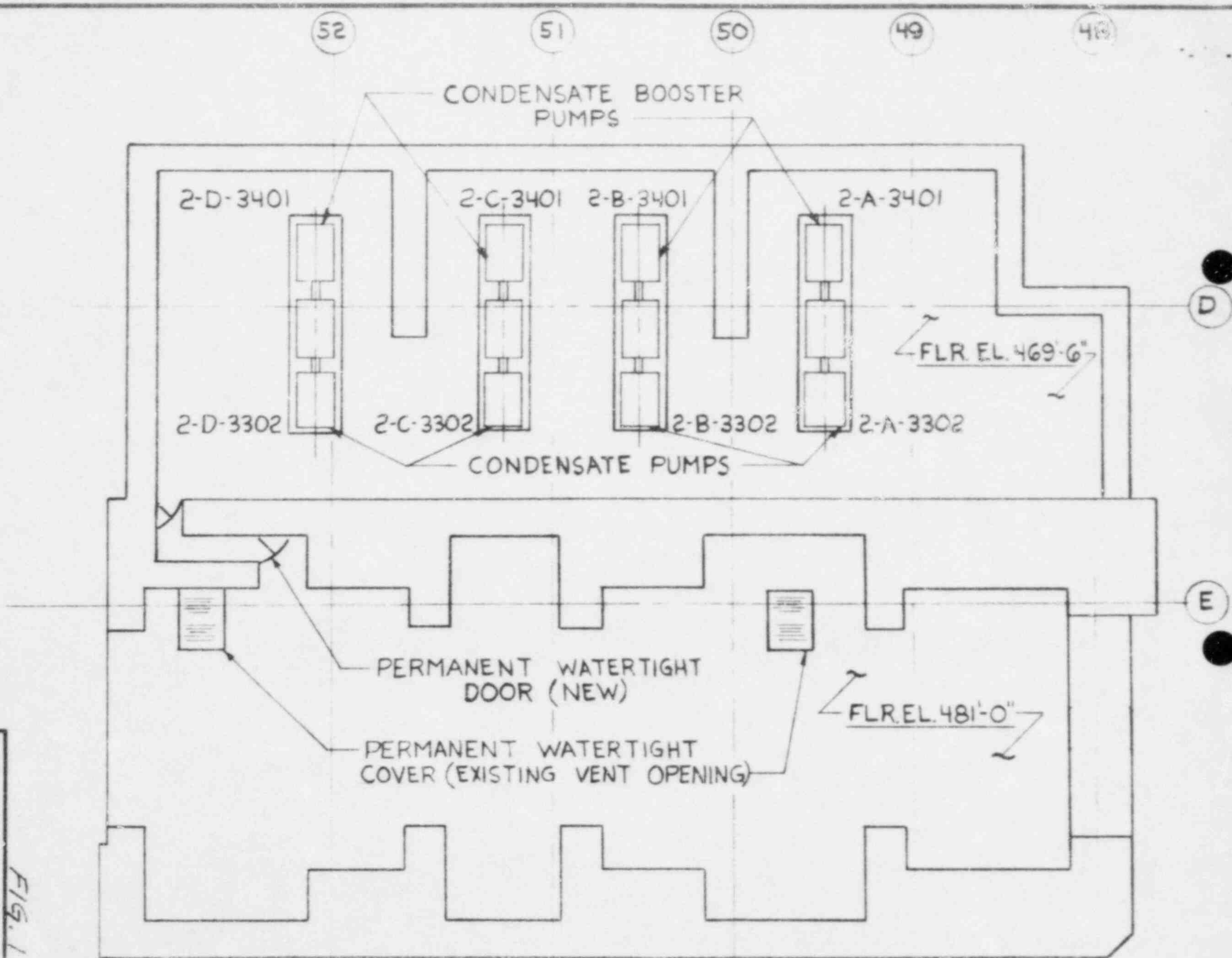


FIG. 1

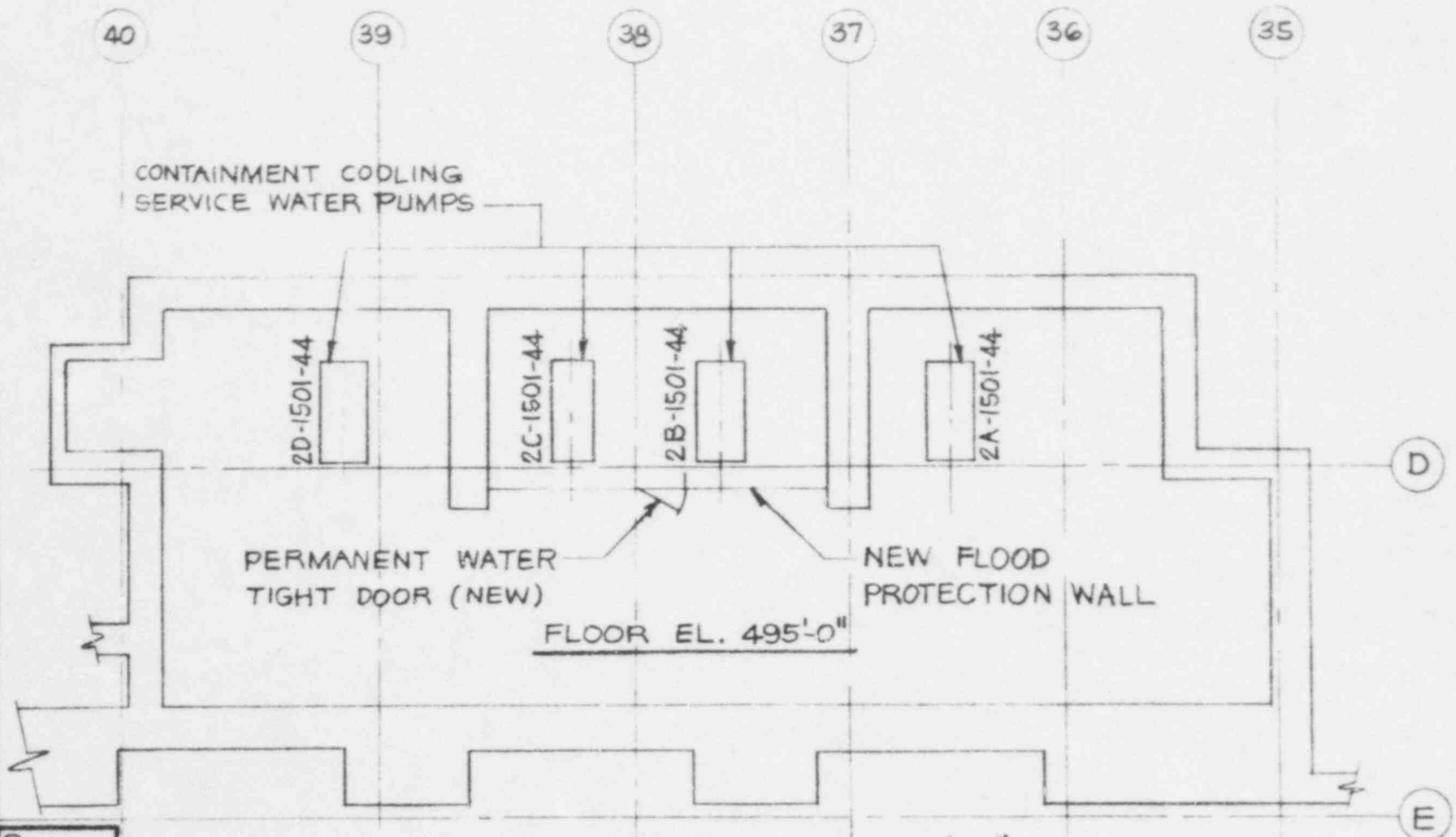
LAYOUT CCSW
FLOOD PROTECTION

DRESDEN STATION UNIT 2
GENERAL ELECTRIC CO.
for
COMMONWEALTH EDISON CO.

SARGENT & LUNDY
ENGINEERS
CHICAGO

SCALE None
DRAWN
CHECKED
ENGINEER
APPROVED
REVISED 7-16-73

JOB NO.
DRG. NO.



PLAN EL. 495'-0"

LAYOUT CCSW
FLOOD PROTECTION

DRESDEN STATION UNIT 2
GENERAL ELECTRIC CO.
FOR
COMMONWEALTH EDISON CO.

FIG. 1A

SCALE None
DRAWN
CHECKED
ENGINEER
APPROVED
REVISED 7-16-73

SARGENT & LUNDY
ENGINEERS
CHICAGO

JOB NO.
DRG NO.

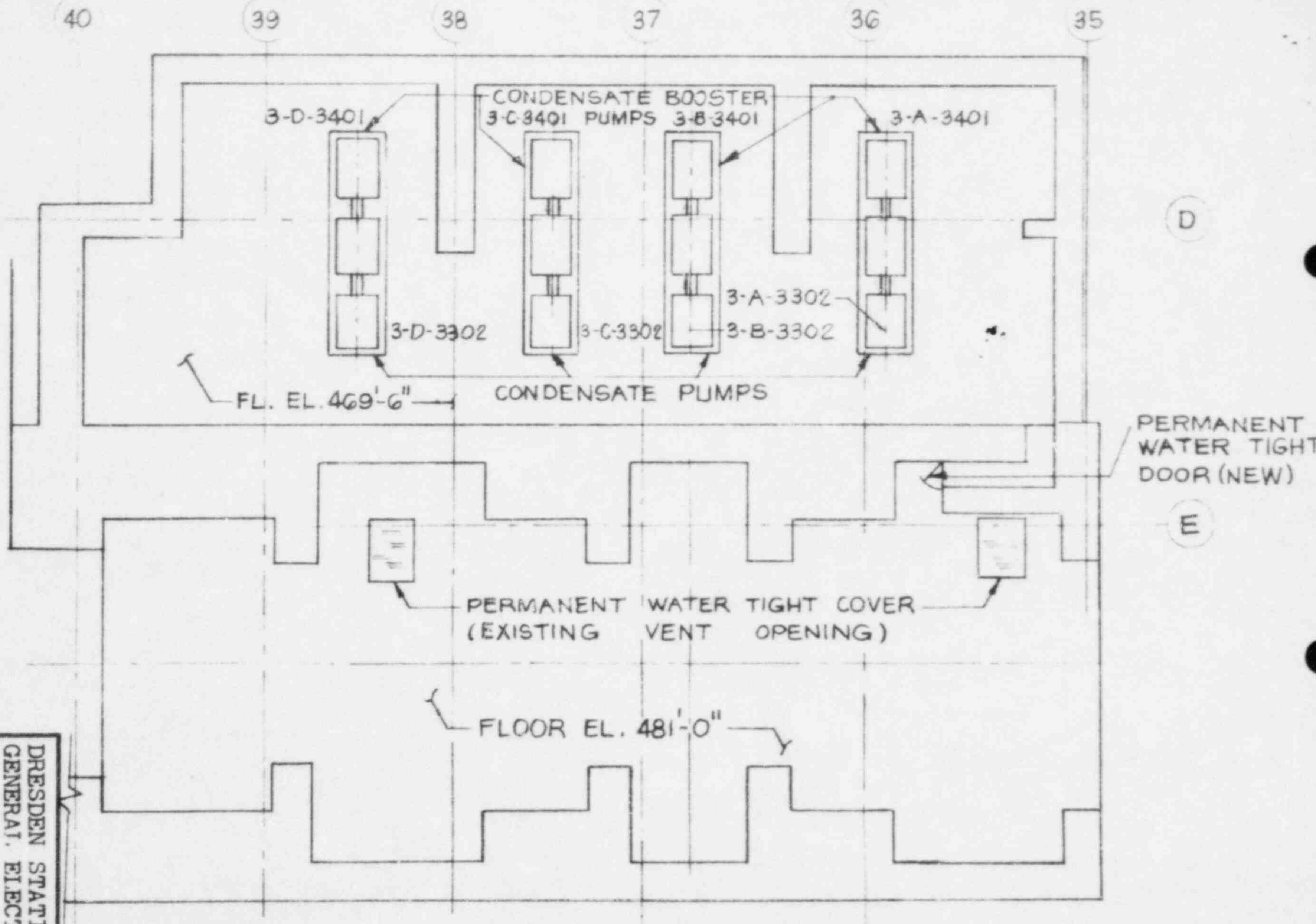


FIG. 2

LAYOUT CCSW FLOOD PROTECTION

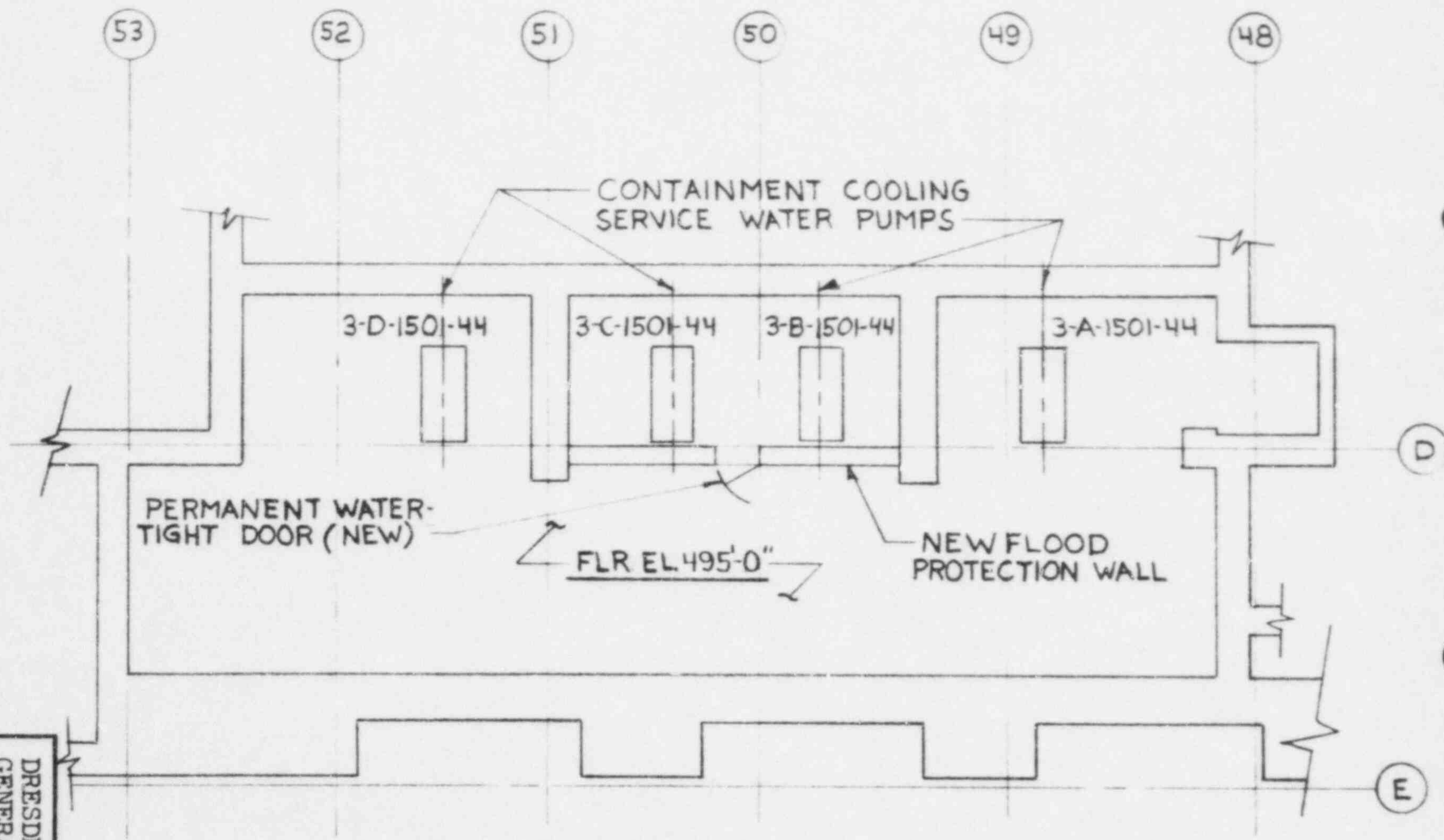
DRESDEN STATION UNIT 3
GENERAL ELECTRIC CO.
for
COMMONWEALTH EDISON CO.

SCALE None
DRAWN
CHECKED
ENGINEER
APPROVED
REVISED 7-16-73

SARGENT & LUNDY ENGINEERS CHICAGO

JOB NO.

DRG. NO.



PLAN EL. 495'-0"

LAYOUT CCSW FLOOD PROTECTION

DRESDEN STATION UNIT 3
GENERAL ELECTRIC CO.
FOR
COMMONWEALTH EDISON CO

SCALE None
DRAWN
CHECKED ALM
ENGINEER
APPROVED
REVISED 7-16-73

SARGENT & LUNDY ENGINEERS CHICAGO

JOB NO.

DRG. NO.

FIG. 2A

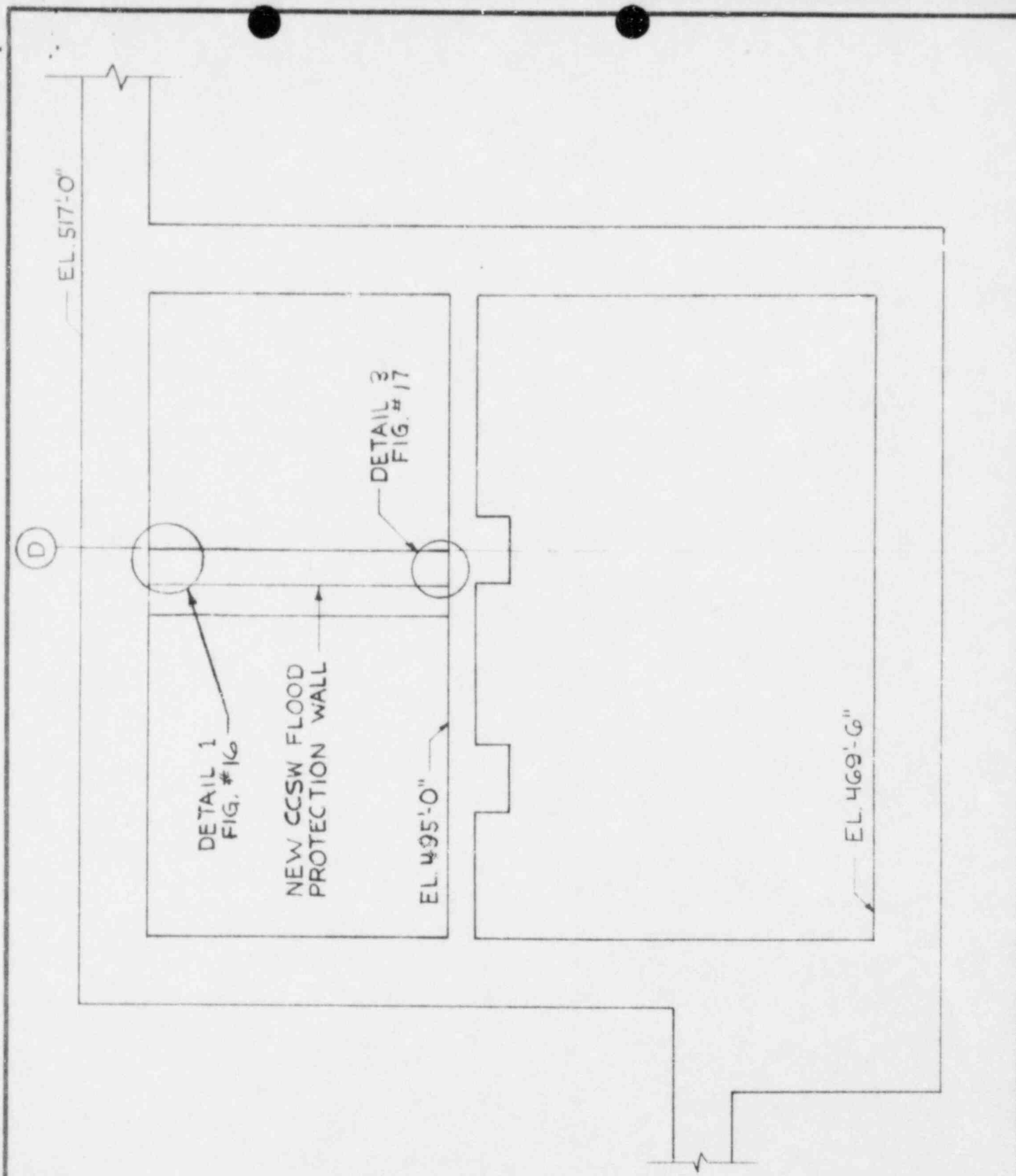
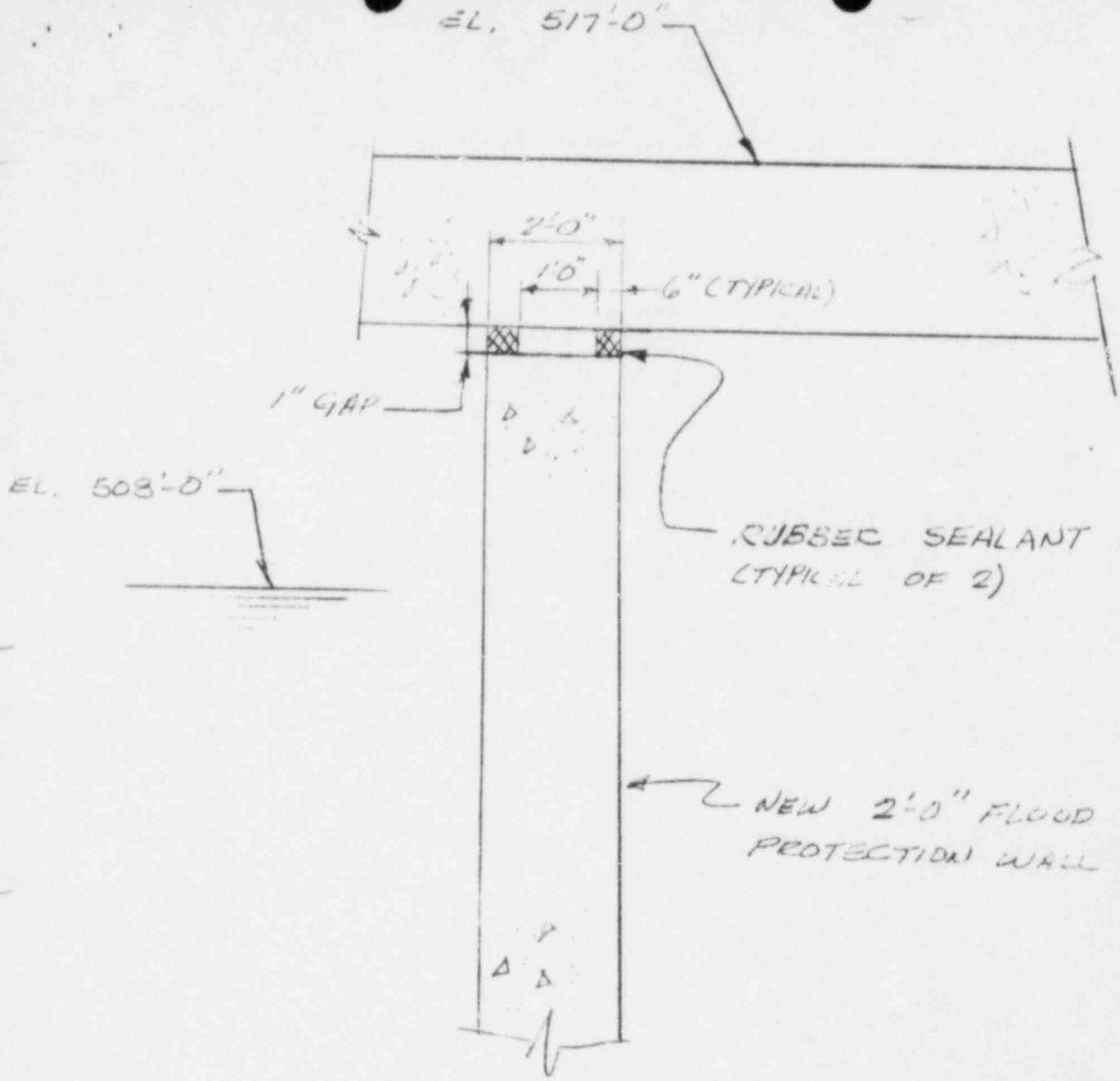


FIG. 3

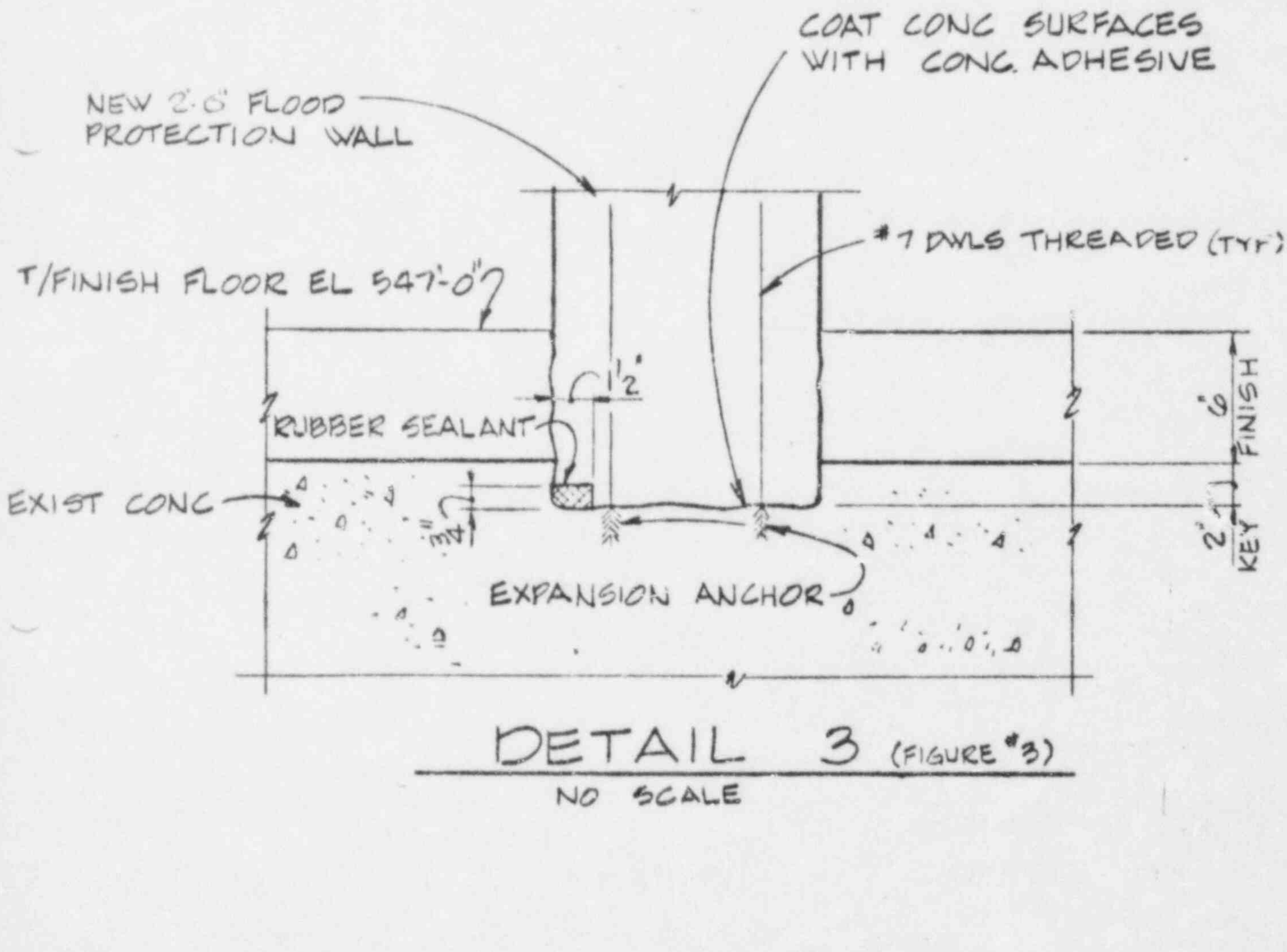
SECTION CCSW
FLOOD PROTECTION

DRESDEN STATION UNIT 2/3 GENERAL ELECTRIC CO. for COMMONWEALTH EDISON CO.	
SCALE None DRAWN L. ALM CHECKED ENGINEER	SARGENT & LUNDY ENGINEERS CHICAGO
APPROVED	JOB NO. / DRG. NO.
REVISED 7-16-73	



DETAIL I (FIGURE #3)

FIGURE #4



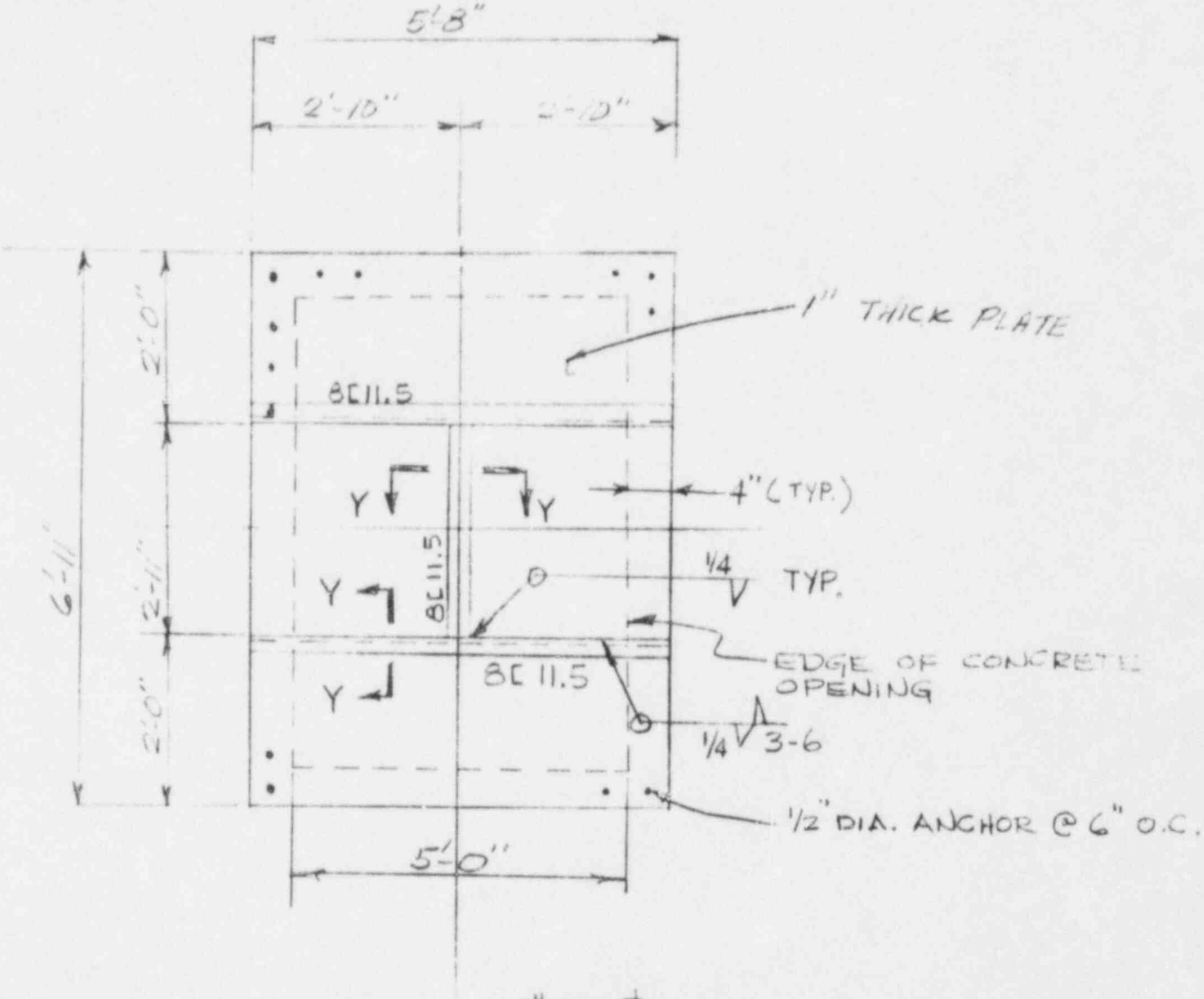
DETAIL 3 (FIGURE #3)

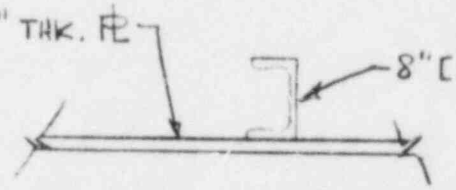
NO SCALE

FIGURE # 5

VENT OPENING COVER PLATE

FIGURE 6

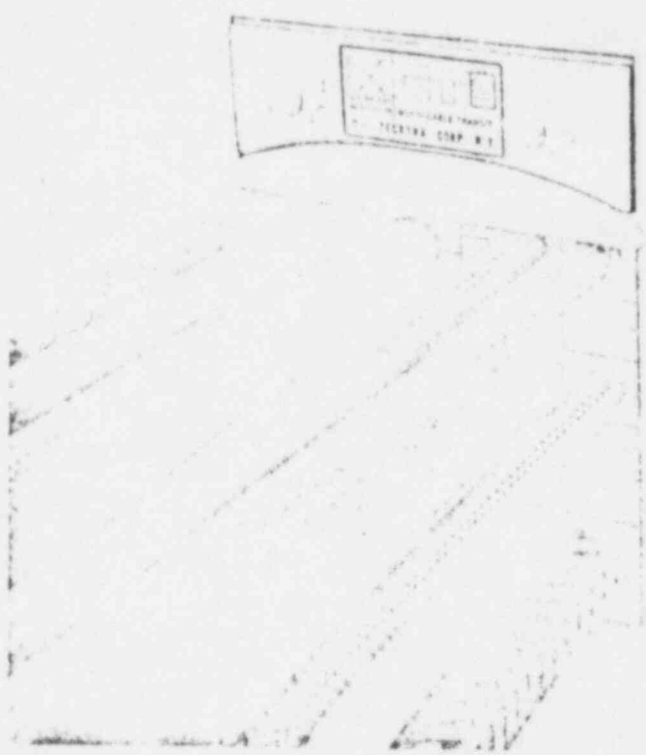




SECTION Y-Y

NOTE: USE 3/8" THICK RUBBER GASKET BETWEEN COVER PLATE AND CONCRETE.

Fig. 7



USER LIST

- Industrial Complexes
- United States Coast Guard
- United States Naval Shipyards
- Most Major Private Shipyards

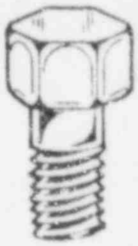
Multi-Cable Transit Complies with Government Specifications

- U. S. Military Specifications MIL-P-16685C
  PERFORMANCE TEST (Thermocycling)
- U. S. Military Standard 167
  VIBRATION TEST
- U. S. Military Specification MIL-S-901C
  SHOCK TEST
- U. S. Military Standard MIL-STD-108D
  WATERTIGHT TEST
- International Convention for Safety of Life at Sea
  FIRE TEST (STANDARD)
- ASTM-E119-61
  FIRE TEST

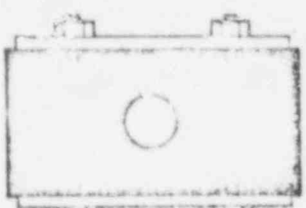
NOTE: All Multi-Cable Transit test units contained an assortment of plain and armored marine cables.

Components of the Multi-Cable Transit

1 TRANSIT FRAMES
Available in 3 sizes and a number of different types to fit any application. (See page 8 for specific information)



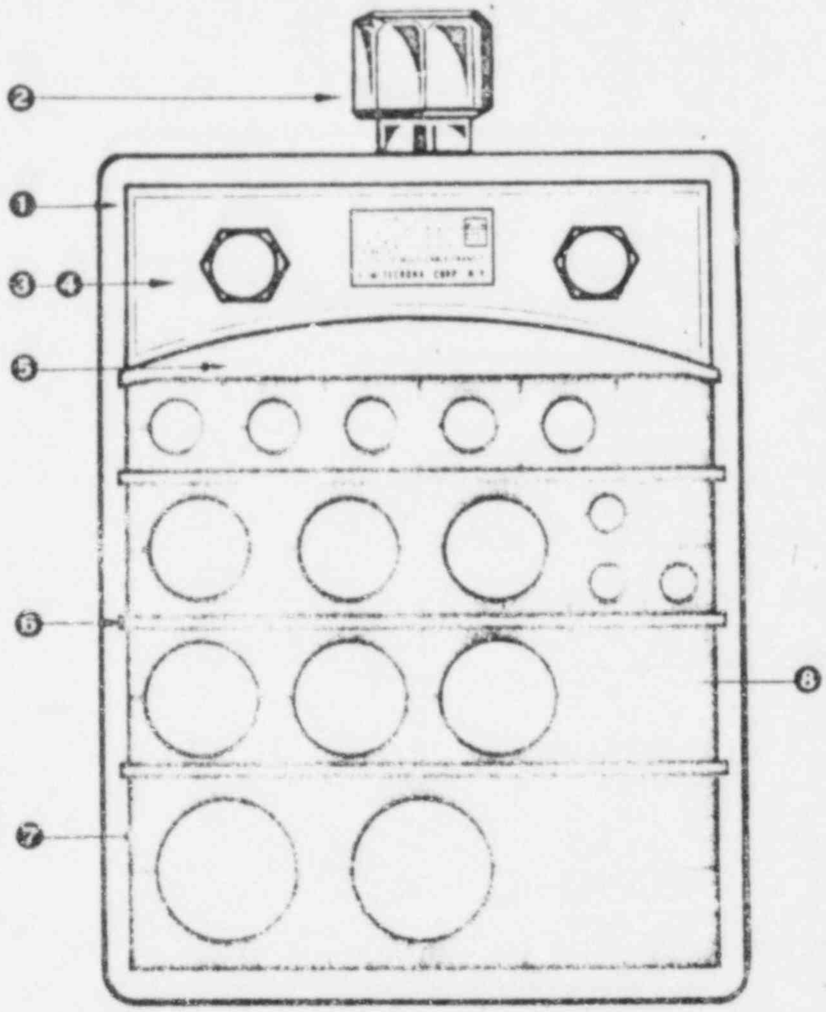
2 COMPRESSION BOLT
When tightened the bolt seats the compression plate and seals cables. (One size only, one required)



TOP VIEW

FRONT VIEW

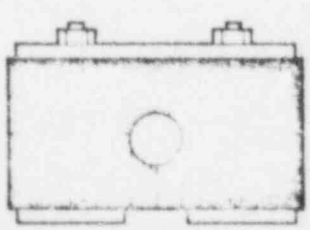
3 END PACKING — STANDARD
Compresses to seal off frame area above compression plate. (One size only, one required)



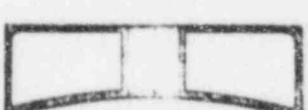
FRONT VIEW

COMPONENT MATERIALS

Transit Frames are fabricated either of steel, aluminum, or steel alloys. **Compression Plates** are steel or aluminum castings. **Compression Bolts** are available in stainless steel or galvanized. **Stay Plates** are made of steel or aluminum. **Insert Blocks and End Packings** are made from a specially formulated fire-proof elastomer.



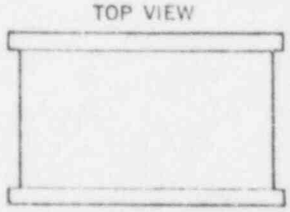
TOP VIEW



REAR VIEW

4 END PACKING — SPECIAL
Used when a transit frame can be packed from one side only. (One size only, one required)

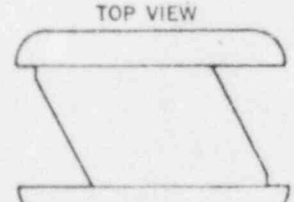
TOP VIEW

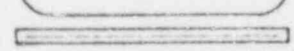


FRONT VIEW

5 COMPRESSION PLATE
Seats and compresses the Insert Blocks so that the End Packing can be inserted in the transit frame. (One size only, one required)

TOP VIEW





FRONT VIEW

6 STAY PLATE
Stay plates are normally placed between every row of Insert Blocks keeping them positioned in the transit frame. (One size only)

7 GROOVED INSERT BLOCKS
See page 6 for information.

8 SPARE INSERT BLOCKS
See page 6 for information.

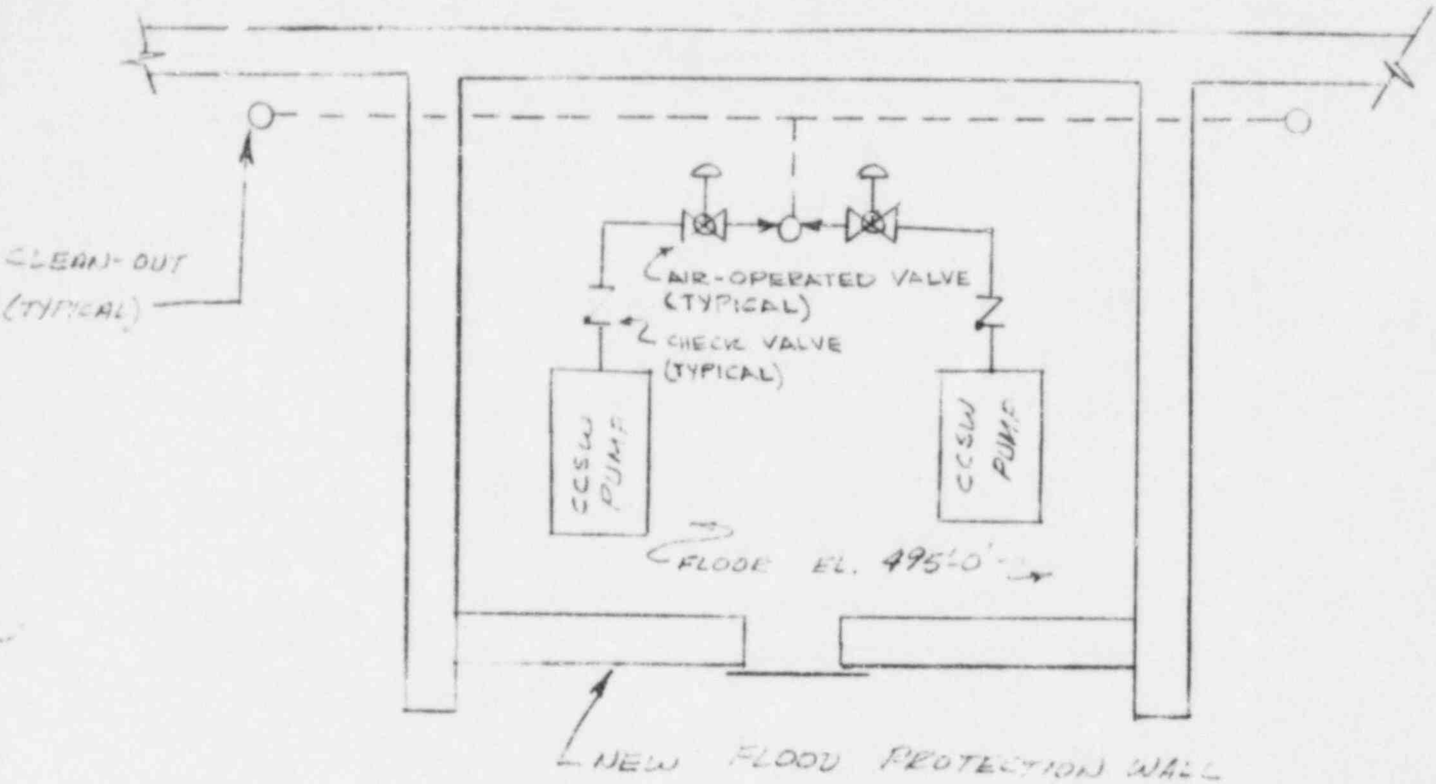
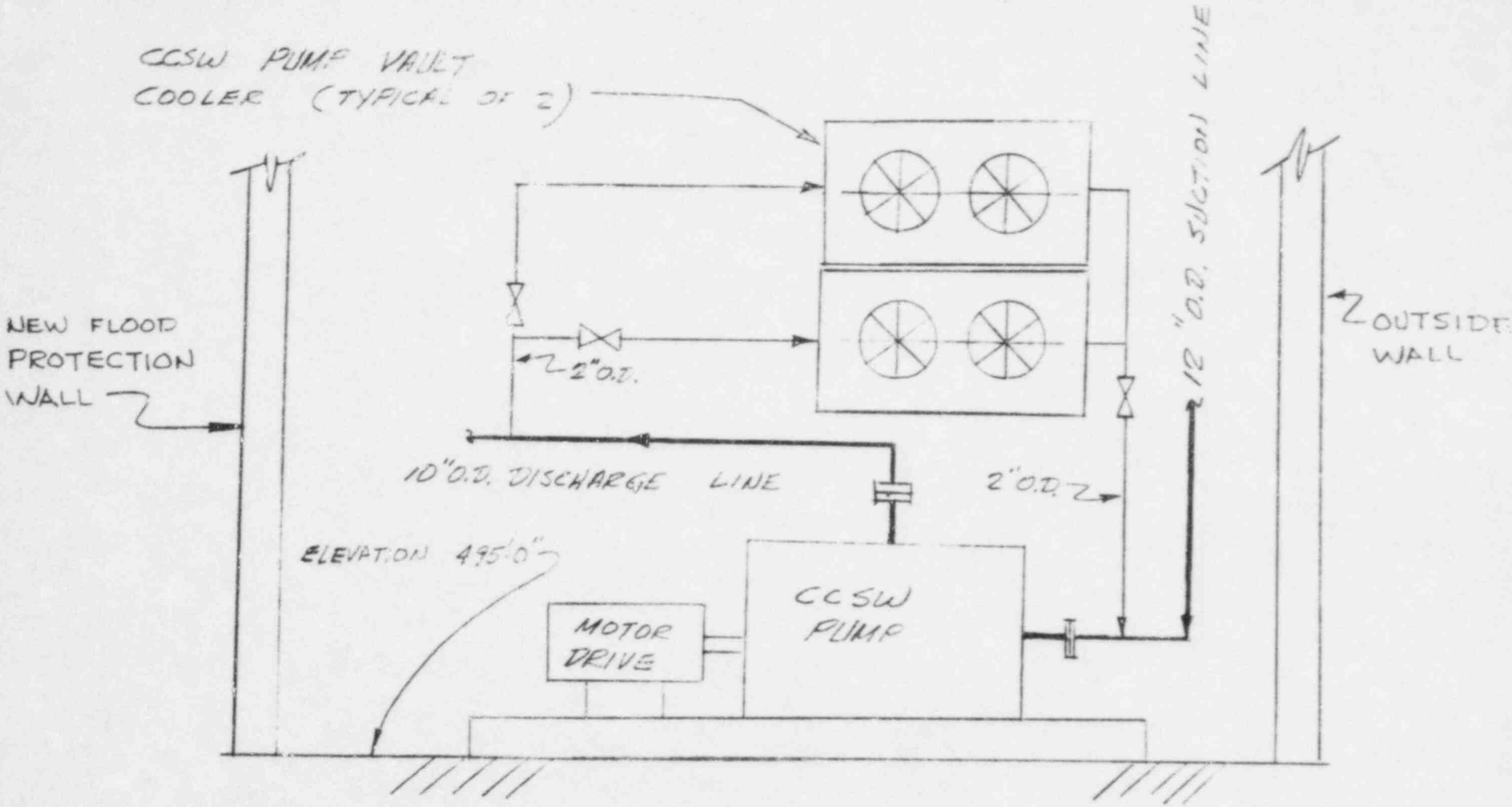


FIGURE 9

BED PLATE DRAINS – CCSW PUMP ROOM FLOOD PROTECTION

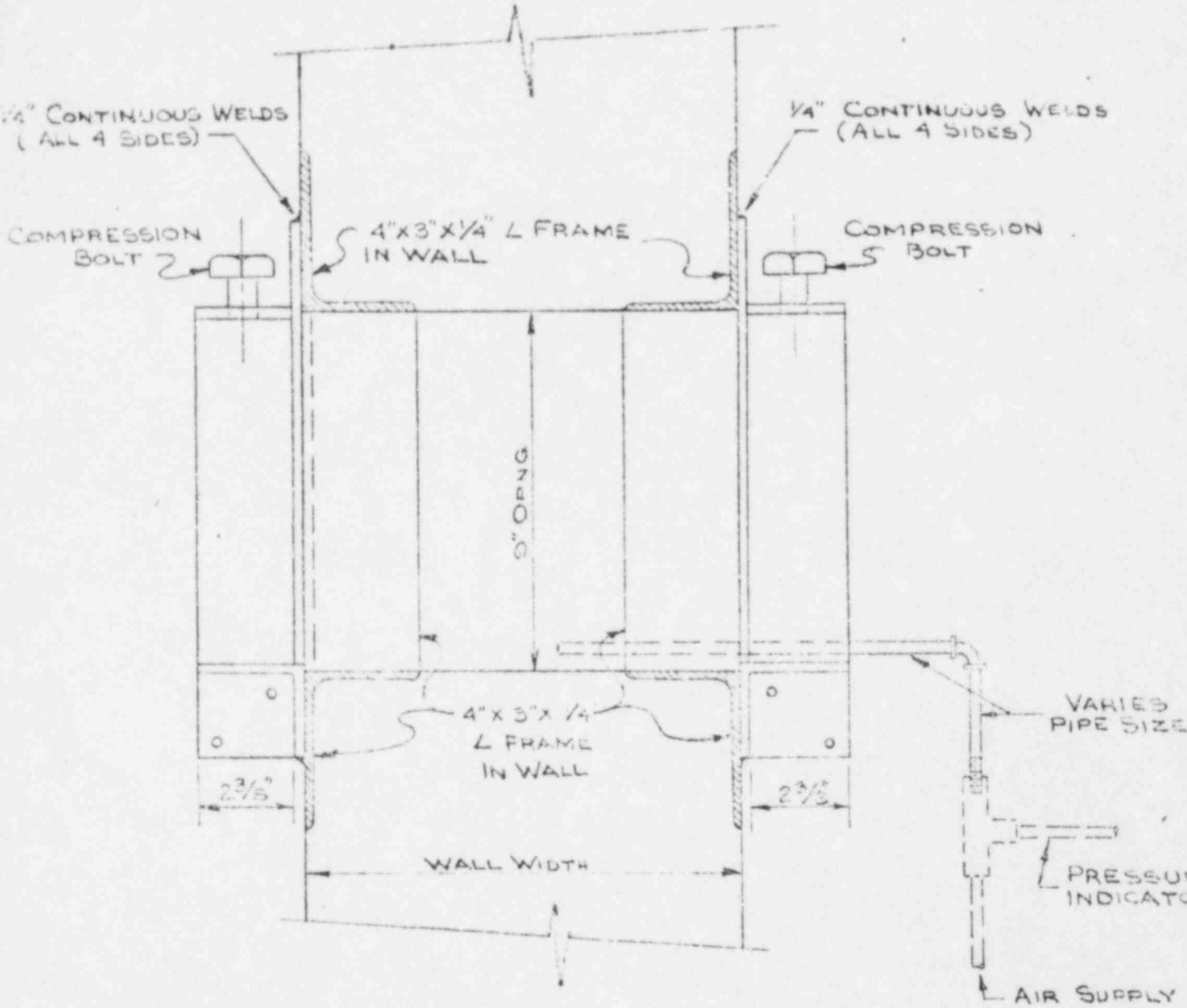
DRESDEN STATION – UNITS 2 & 3



VAULT COOLER SCHEME
CCSW PUMPS

FLOOD PROTECTION MODIFICATION
DRESDEN STATION - UNITS 2 & 3

FIGURE 10



NELSON MULTI-CABLE TRANSIT

CAT. # RGBO-6

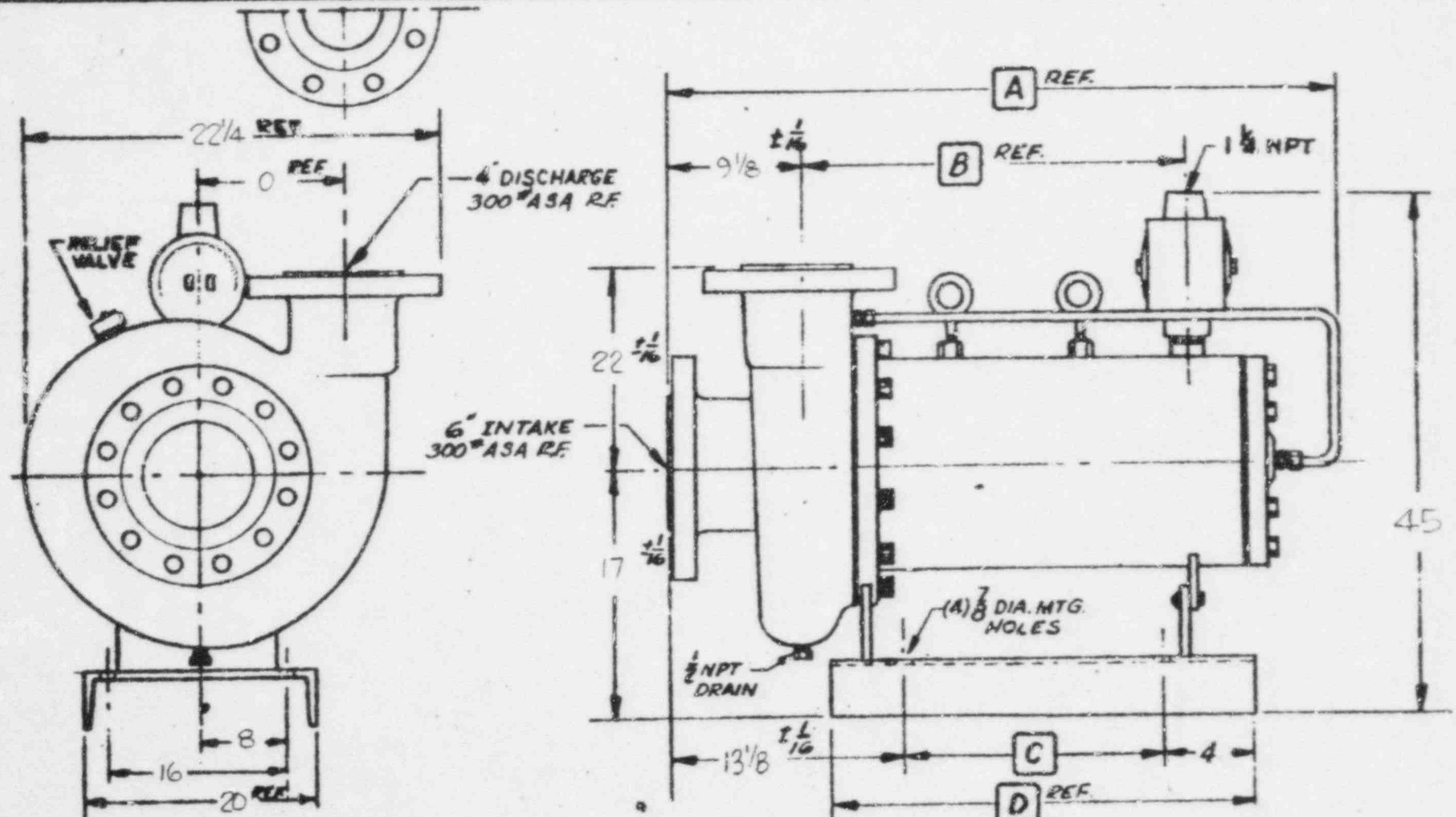
WATERTIGHT SEAL DETAIL-TEST

FIG. 11

DRESDEN UNITS 2&3

SCALE	SARGENT & LUNDY ENGINEERS CHICAGO
DRAWN	
CHECKED	
ENGINEER	
APPROVED	DRAWING NO.
JOB NO.	

DIETZGEN NO. 198-4 ALEPROOF



75L	55⅜	24⅜	39	42
MOD	A	B	C	D

CRANE
CHEMPUMP DIVISION
CRANE CO.
WARRINGTON, PENNSYLVANIA

DRESDEN - UNITS 2/3
DIESEL GEN. WTC. COOL PUMPS

FIGURE 12
REPLACEMENT PUMP