Consumers Power Company

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81-03 #14

May 10, 1982

Mr J G Keppler, Regional Administrator
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Mr H R Denton (25)
Office of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

MIDLAND PROJECT -
DOCKET NOS 50-329 and 50-330
BORATED WATER STORAGE TANK FOUNDATION OL DESIGN CALCULATIONS
FILE 0485.16, 0.4.9.49 SERIAL 17159

REFERENCES J W Cook letters to J G Keppler:

(1) Serial 11201, dated February 20, 1981
(2) Serial 11528, dated April 3, 1981
(3) Serial 12015, dated June 12, 1981
(4) Serial 12799, dated June 26, 1981
(5) Serial 13352, dated July 21, 1981
(6) Serial 13653, dated August 28, 1981
(7) Serial 14591, dated October 26, 1981
(8) Serial 14339, dated November 13, 1981
(9) Serial 14902, dated November 24, 1981
(10) Serial 14645, dated December 11, 1981
(11) Serial 14664, dated January 18, 1982
(12) Serial 16127, dated March 15, 1982
(13) Serial 16172, dated April 23, 1982

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ENCLOSURES (1) "Evaluation of Midland Nuclear Power Plant Borated Water Storage Tanks for Non-Uniform Support Loading Resulting from Ring Wall Settlement"

(2) Midland Plant Units 1 and 2, Response to the NRC Staff Request for Additional Information Required for Completion of Staff Review of the Borated Water Storage Tank and the Underpinning of the Service Water Pump Structure

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The referenced letters were interim 50.55(e) reports concerning the existence of cracks in the borated water storage tank foundation. This report will be the final submittal as a 50.55(e) report.

Enclosure 1 is a report prepared by Structural Mechanics Associates (SMA), and was previously submitted by our referenced Serial 14664. An addenda was added to the original report to address stresses induced in Tank 1T-60 from future settlement and Seismic Margin Earthquake loadings. The conclusions indicate that the BWST configuration with a ½ inch Celotex layer between the tank bottom and ring wall is acceptable. All the design code stress allowables are met for combined Seismic Margin Earthquake and settlement loading. The report provides the calculated loads and the ASME code allowables used for acceptance criteria. The contents of the report and addenda also serve as technical documentation of ASLB soils hearing testimony presented on February 16 and 17

Enclosure 2 is a portion of a submittal to the NRC Staff concerning confirmatory issues on the BWST remedial work. The releveling procedure to be applied on Tank 1T-60 is described under Confirmatory Issue #1 and the strain monitoring system for the new ring beam is described under Confirmatory Issue #2.

The enclosures should provide the necessary information for the NRC Staff to review and concur with our conclusions that the tanks have not been damaged and the remedial actions to the ring beam foundation will ensure the safety function of the system. The final designs and analytical results will be reported in the FSAR.

James W. Cook

JWC/cl

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Document Control Desk, NRC Washington, DC w/a
Atomic Safety & Licensing Appeal Board w/o
CBechhoefer, ASLB w/o
MMCherry, Esq w/o
FPCowan, ASLB w/o
RSDecker, ASLB w/o
DSHood, USNRC (2) w/a
USNRC w/a
JHarbour, ASLB w/o
JDKane, USNRC w/a
WOtto, US Army Corps of Engineers w/o
WHMarshall w/o
FRinaldi, USNRC w/a
HSingh, US Army Corps of Engineers w/a
MSinclair w/o
BStamiris w/o
SJPoulos, Geotech Eng, Inc w/a

MIDLAND PLANT UNITS 1 AND 2
RESPONSE TO THE NRC STAFF REQUEST FOR ADDITIONAL INFORMATION REQUIRED FOR COMPLETION OF STAFF REVIEW OF THE BORATED WATER STORAGE TANK AND THE UNDERPINNING OF THE SERVICE WATER PUMP STRUCTURE

BORATED WATER STORAGE TANK(S) FOUNDATION REPAIR

CONFIRMATORY ISSUE 1

Provide a detailed releveling procedure for the Unit 1 tank.

RESPONSE

A detailed procedure has been developed to define a plan of action to relevel BWST 1T-60. The tank will be lifted, the ring beam and the sand below the tank bottom will be leveled, and the tank will be reconnected to the foundation. A summary of the procedure is provided below. This procedure is supported by an analysis which demonstrates that the tank will not be overstressed during this operation. Strain gaging of the tank will be used as a backup to this analysis.

1. Lifting Procedure

The anchor bolts will be disconnected from the tank by removing the nuts, and strain gages will be mounted on the tank wall and bottom.

Protected steel cable will be looped about the three heater tubes, strung through the nozzle G vent, and fastened to provide support as well as to minimize deflection of the heater tubes during the lift.

Fourteen hydraulic jacks (see Figure BWST-1) will be located beneath the anchor bolt chairs and sequentially raised to lift the bolt chairs beyond the top of the bolts. The tank will be supported by wooden dunnage. At this point, 14 electromechanical jacks placed between the hydraulic jacks will be connected to complete the lift (see Figure BWST-2). The electromechanical jacks will be controlled from a central panel allowing the jacks to operate in unison to raise and lower the tank. The total tank lift will be at least 3 feet. Wooden dunnage will be placed between the tank bottom and ring wall for stable support during subsequent work. Strain gages will be monitored to confirm that the tank stresses remain within allowable limits.

2. Leveling Procedure for Ring Wall

Leveling will be accomplished by use of shims adjusted to a datum plane at least 1-1/2 inches above the lowest point on the original ring wall. The level datum plane will be determined using a transit and the benchmark leveling procedure. Forty numbered, prefabricated, 1-1/2 inch thick shims (see Figure BWST-3) will be placed between anchor bolts on the existing ring wall. (At least a 1-1/2-inch gap must exist between the bottom plate and the original ring wall to permit flow of grout (see Item 3 below). The top of the shim on the highest point on the ring wall will determine the elevation of the datum plane. The transit will be used to establish how much the other shims must be raised using prefabricated incremental shims. Final shim placement will be checked and documented. Results will be recorded as elevation compared to a suitable site benchmark. The leveled shim differential elevation shall be within ±1/8 inch within any 30 feet of circumference and within ±1/4 inch of the established datum over the entire circumference in accordance with American Petroleum Institute (API) 650 requirements for foundations (API 650, Welded Steel Tanks for Oil Storage, Fifth Edition, July 1973 and Supplement 1 of October 1973). The shims will be fixed in place by packing grout around the stack of shims (see Figure BWST-4). Five-Star Grout manufactured by the American Grout Company will be used; this grout meets site specification requirements.

3. Foundation Preparation and Tank Set-Down

Because the bottom of the tank will be elevated above the previous foundation due to the shims, additional sand must be added and contoured while the tank is supported by the dunnage. First, a cofferdam made of asphalt-impregnated fiberboard (Celotex) will be installed around the inner diameter of the ring wall to dike the additional sand (see Figure BWST-5). Oil-impregnated sand will be added up to the lip of the cofferdam and evenly sloped so that the center of the crown is 3-1/4 inches higher than the sand at the edge. A Celotex pad will be placed on the shims. Because the tank will be elevated 1-1/2 inches, coupling nuts and threaded rods will be used to lengthen anchor bolts as required. Dunnage will be removed and the vessel lowered, ensuring the anchor bolts are aligned with the bolt holes. Anchor bolt nuts will be reinstalled. The original ring wall will be cleaned in preparation for pouring grout. A form will be set up 4 inches outside the edge of the tank bottom (see Figure BWST-6). Grout will be poured and allowed to set at a level no higher than the lip of the tank bottom plate. This procedure will fill the void between the Celotex cofferdam and the bottom of the tank, providing a uniform level support for the tank. After the grout has cured, the anchor bolts will be sequentially tightened.

CONFIRMATORY ISSUE 2

Provide strain monitoring details, procedures, and acceptance criteria for new ring beam.

RESPONSE

After the new ring beam is constructed, the maximum strain areas of each foundation, which are the transition zones between the ring wall and the valve pit, will be monitored using a strain gage system. A summary of this strain gage system is provided below.

1. <u>Locations of Monitoring</u>

   During the plant construction and operation periods, the strain measurements will be taken at the locations on the ring beam of both tanks as shown in Figure BWST-7.

2. <u>Apparatus and Procedure for Monitoring</u>

   Figure BWST-8 shows details of the strain monitoring apparatus installed at each monitoring location. This apparatus consists of a stainless steel rod embedded at one end in the ring beam and positioned inside a structural steel tube. The other end of the rod protrudes into a square structural tube through a hole in the side. The tube is attached to the new ring beam with embedded studs and has a conduit attached to it; this conduit provides access for the expanding gage block shown in Figure BWST-9. The expanding gage block, when lowered into the structural tube, will fit onto a small positioning rail welded to the tube, which holds the gage block in place. The gage block can be expanded to fill the gap between the end of the rebar protruding into the tube and a small section of rebar welded to the opposite face of the tube. By removing the gage block and measuring its width with a micrometer, the gap length can be determined. By comparing the measured gap length to the initial gap length as installed, the average strain in the 20-foot gage length can be determined.

3. Frequency of Monitoring

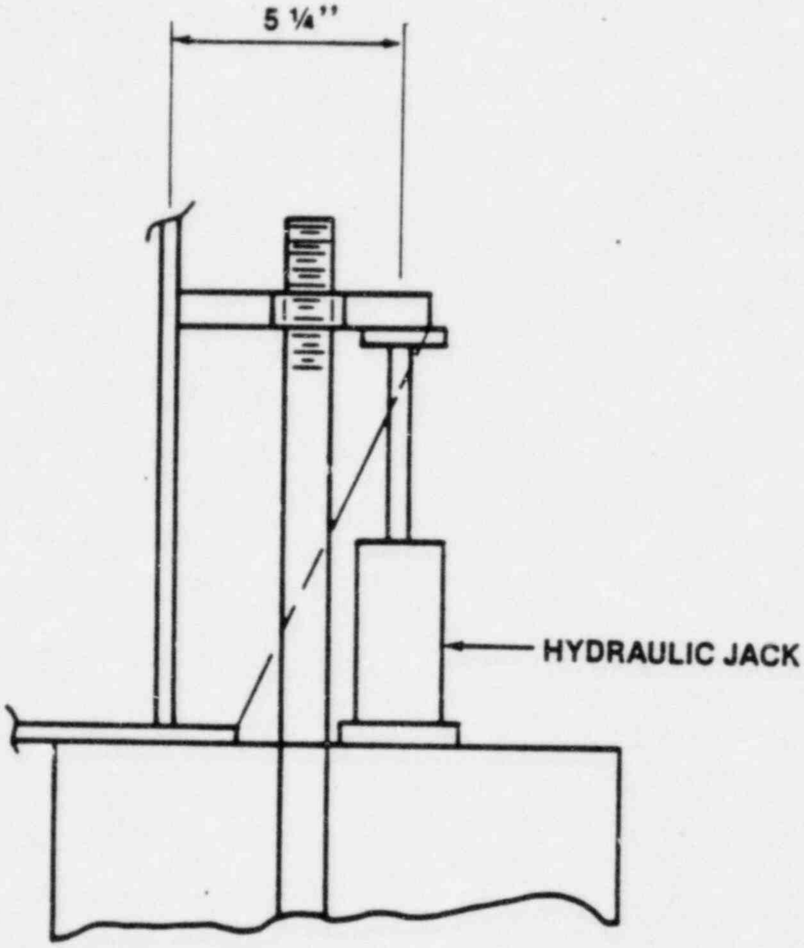
The strain monitoring frequency of selected locations is every 60 days during plant construction and every 90 days during the first year of plant operation. Subsequently, it is planned that the frequency of measurement will be established after evaluating the measurements taken during the first year. As a minimum, the BWST ring beams will be monitored annually for the next 5 years of plant operation and then at 5-year intervals thereafter.

4. Acceptance Criteria

a. Allowable Strain: If the cumulative increase in gap width exceeds 0.4 inch at any time during the monitoring period, at any monitoring location, the monitoring interval will be increased to at least every 60 days to permit evaluation of the strain. If it is determined to be necessary, observation pits will be made to expose the ring beam for inspection of possible cracks.

b. Absolute Strain: The absolute strain, as a measure of the cumulative increase in gap width, during 40 years of plant life, for all the reference monitoring locations is 0.5 inch.

Strain monitoring procedures, including frequency of monitoring and acceptance criteria, will be included as part of the technical specifications in the final safety analysis report.



CONSUMERS POWER COMPANY
MIDLAND UNITS 1 AND 2

PLACEMENT OF
HYDRAULIC JACK

FIGURE BWST-1

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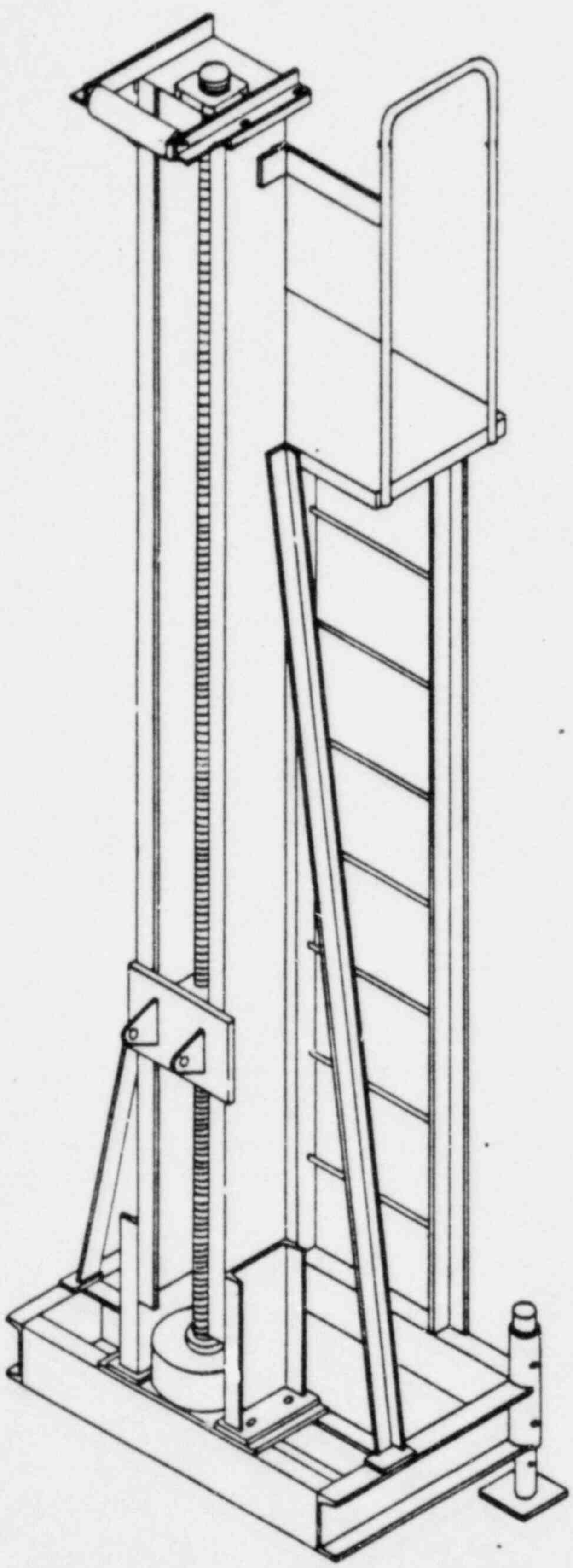

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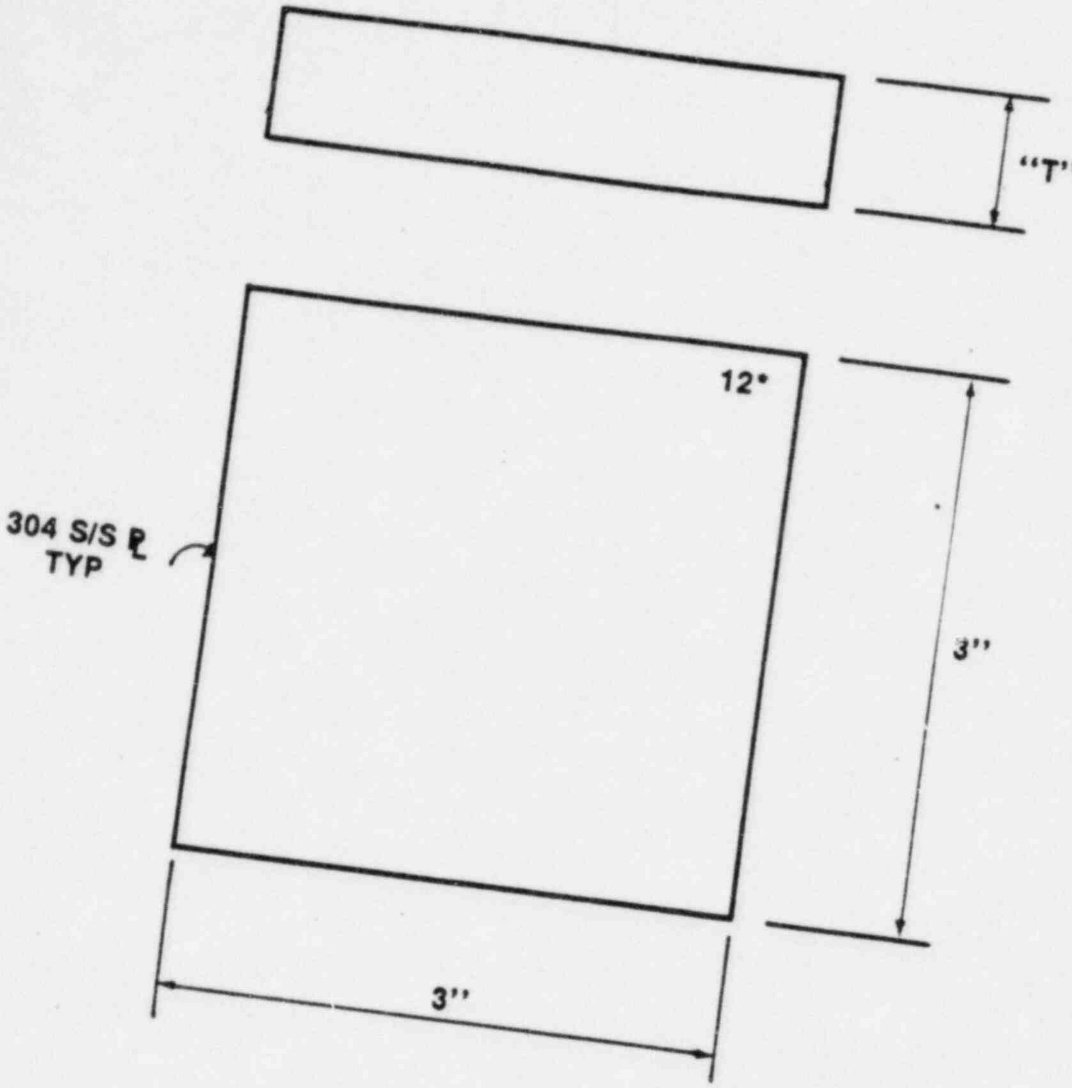
FIGURE I-2
ELECTROMECHANICAL JACK

FIGURE BWST-2

G-1986-85

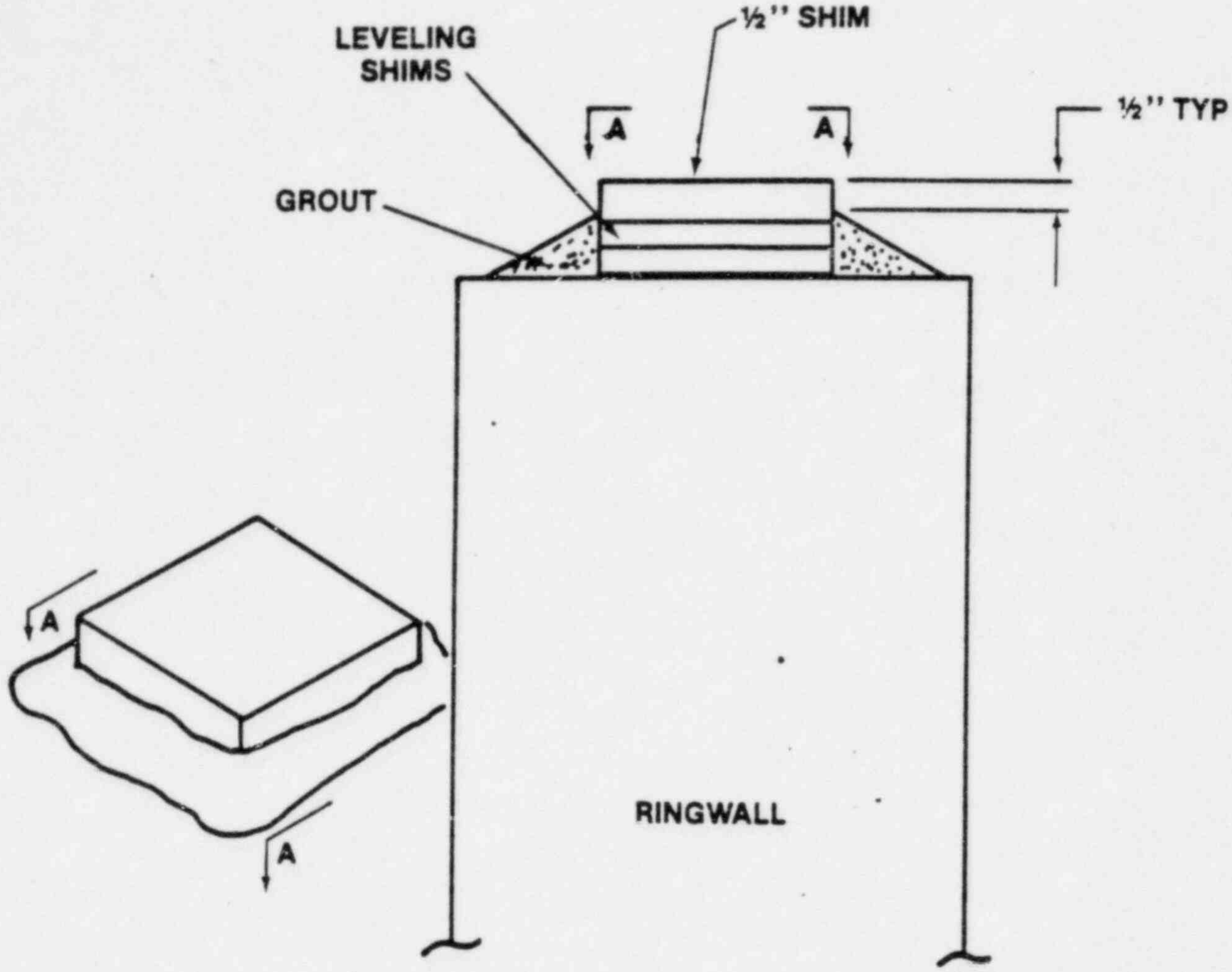


"T"
1/32"
1/16"
1/8"
1/4"
1/2"
1 1/2"

*Each 1-1/2" thick shim shall be identified with a numerical stamping sequentially from #1 through #42.

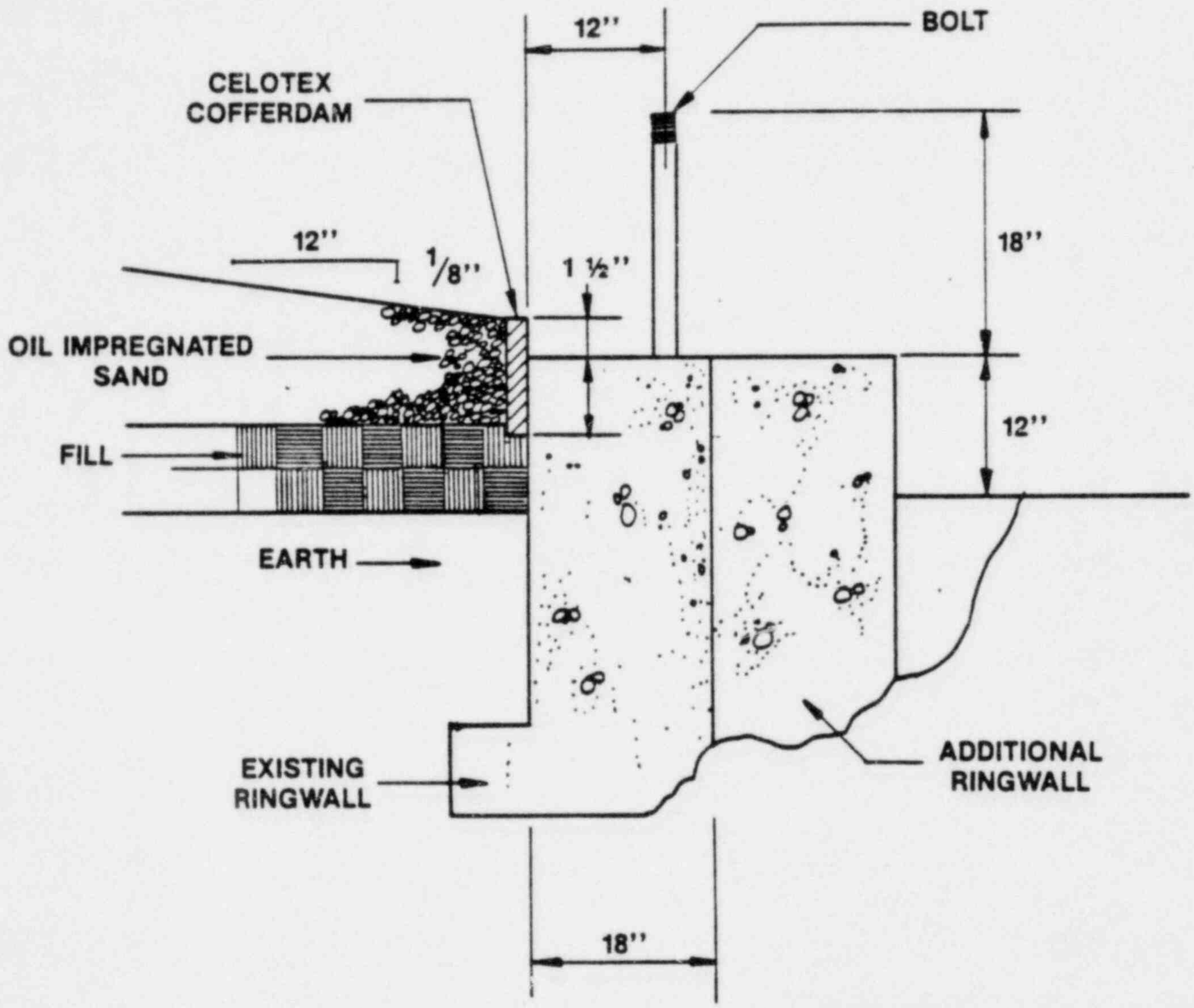
CONSUMERS POWER COMPANY MIDLAND UNITS 1 AND 2
STAINLESS STEEL SHIMS
FIGURE BWST-3

G-1986-51



CONSUMERS POWER COMPANY MIDLAND UNITS 1 AND 2
DETAIL OF SHIM STACK FIXED BY GROUTING
FIGURE BWST-4

G-1986-52



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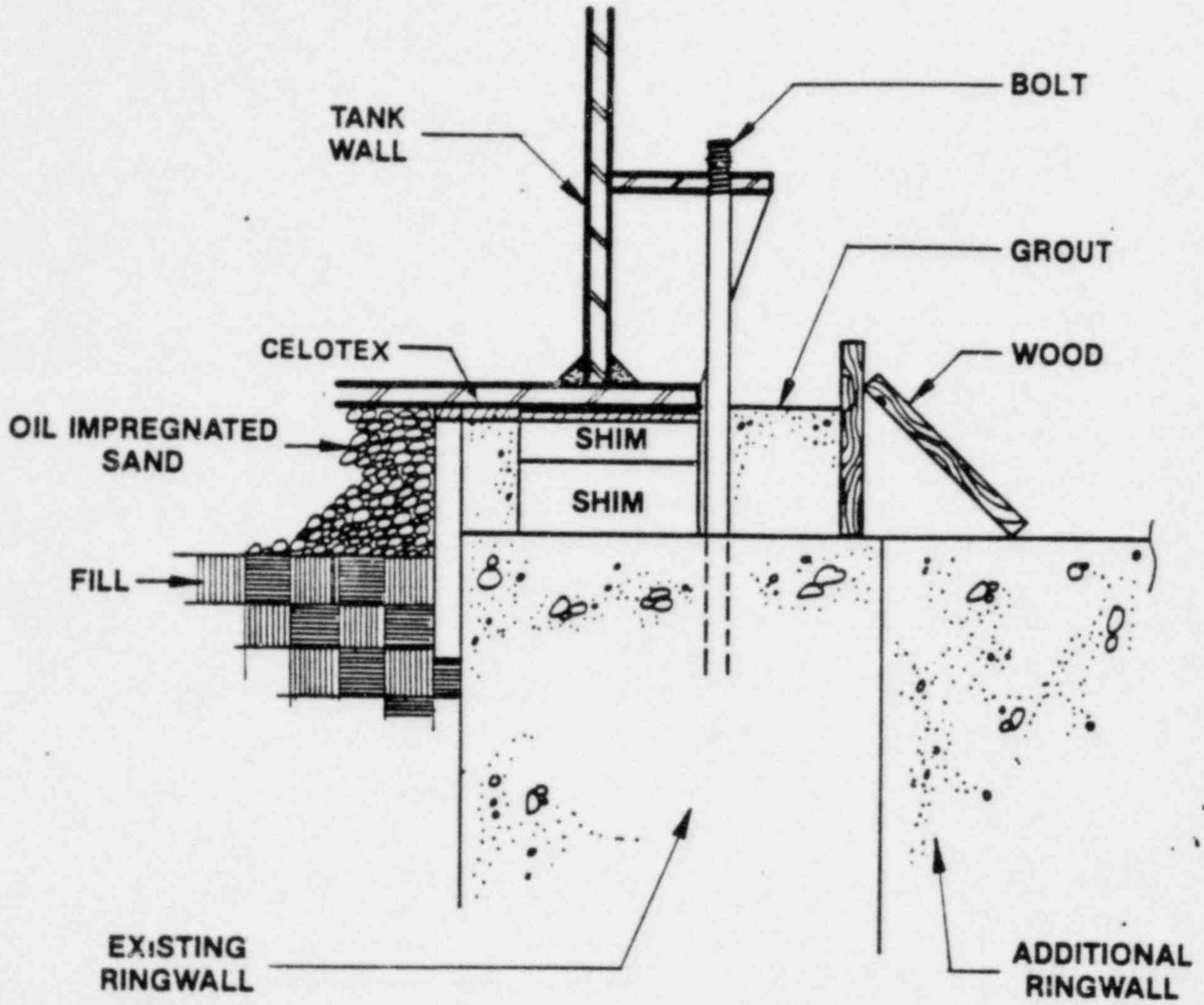
COFFERDAM AND OIL IMPREGNATED SAND PAD

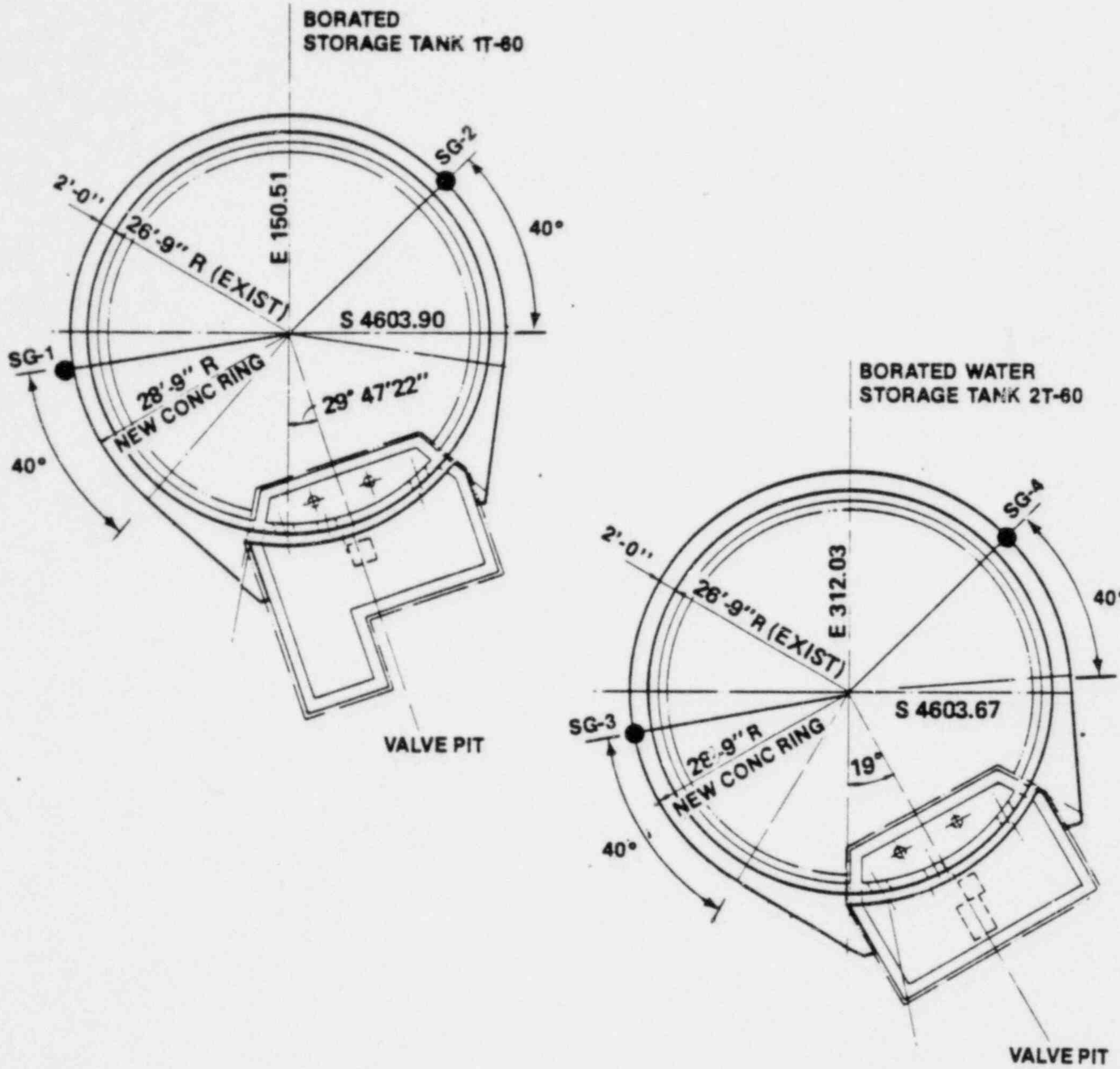
FIGURE BWST-5

G-1986-58



CONSUMERS POWER COMPANY MIDLAND UNITS 1 AND 2
TANK AND FOUNDATION AFTER POURING OF GROUT
FIGURE BWST-6

G-1986-57



CONSUMERS POWER COMPANY MIDLAND UNITS 1 AND 2
BORATED WATER STORAGE TANKS RING BEAM STRAIN MONITORING PROGRAM
FIGURE BWST-7

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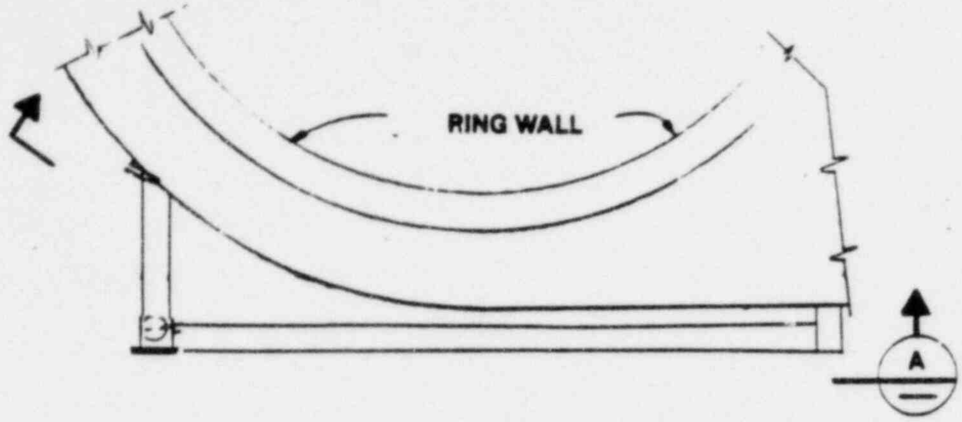
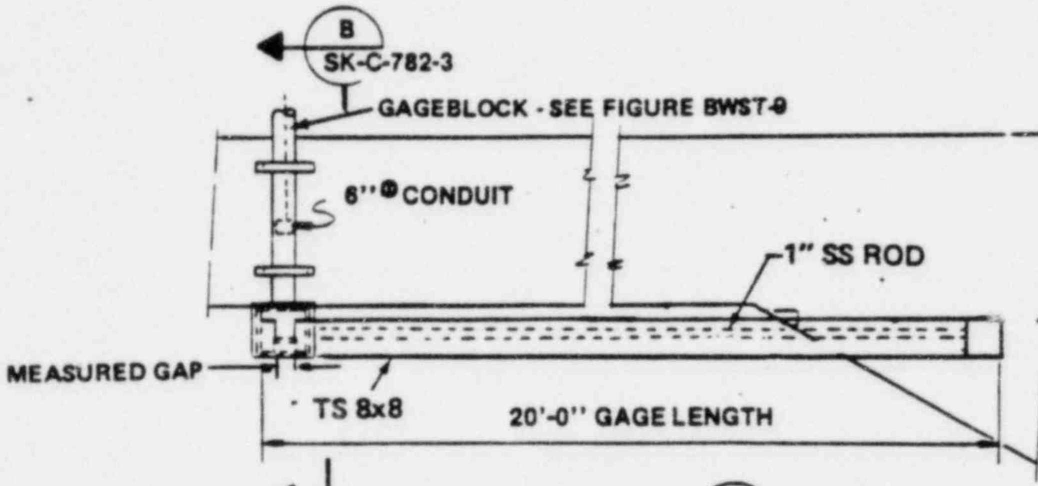
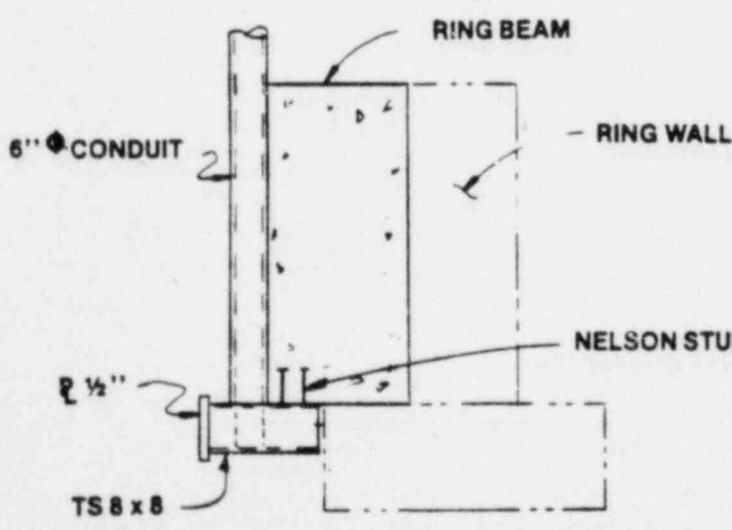


PLAN VIEW



SECTION A



SECTION B SK-C-782-3

CONSUMERS POWER COMPANY
MIDLAND UNITS 1 AND 2

BORATED WATER STORAGE TANK

FIGURE BWST-8

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