CP&L
A Progress Energy Company

James Scarola
Vice President
Harris Nuclear Plant

SERIAL: HNP-01-124
10CFR50.54

SEP - 4 2001

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC BULLETIN 2001-01, CIRCUMFERENTIAL CRACKING OF REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

Dear Sir or Madam:

By letter dated August 3, 2001, the U. S. Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles". The Bulletin requests that addressees provide information related to the structural integrity of the reactor pressure vessel head penetration (VHP) nozzles, including the extent of VHP nozzle leakage and cracking that has been found to date, the inspections and repairs that have been undertaken to satisfy applicable regulatory requirements, and the basis for concluding that their plans for future inspections will ensure compliance with applicable regulatory requirements.

Enclosure 1 to this letter provides Carolina Power & Light Company's (CP&L) response to this Bulletin for the Harris Nuclear Plant (HNP). Harris Nuclear Plant is considered to be in the NRC category of plants with low susceptibility (greater than 30 effective full power years of operation relative to Oconee 3). In addition, HNP has not previously identified either leakage from or cracking in vessel head penetrations. Therefore, in accordance with the Bulletin, CP&L is providing a response to only Question 1 of the requested information at this time for HNP.

Also in accordance with the Bulletin, CP&L will provide a response to Question 5 of the requested information for HNP within 30 days after plant restart following Refueling Outage 10, which is scheduled to commence in September 2001.

P.O. Box 165
New Hill, NC 27562

T > 919.362.2502
F > 919.362.2095

A028

Please refer any questions regarding this submittal to Mr. John Caves at (919) 362-3137.

Sincerely,

James Scarola

ONW/onw

Enclosure

James Scarola, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief, and the sources of his information are employees, contractors, and agents of Carolina Power & Light Company.

Darlene S. Yarborough
Notary (Seal)

My commission expires: 2-21-2005

DARLENE S. YARBOROUGH NOTARY *** PUBLIC HARNETT COUNTY, NC

c: Mr. J. B. Brady, NRC Sr. Resident Inspector
Mr. Mel Fry, Director, N.C. DENR
Mr. N. Kalyanam, NRC Project Manager
Mr. B. S. Mallett, NRC Regional Administrator (Acting)

bcc:
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SHEARON HARRIS NUCLEAR POWER PLANT
NRC DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC BULLETIN 2001-01, CIRCUMFERENTIAL CRACKING OF REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

NRC Requested Information Item 1.a:

1. All addressees are requested to provide the following information:

   a. the plant-specific susceptibility ranking for your plant(s) (including all data used to determine each ranking) using the PWSCC susceptibility model described in Appendix B to the MRP-44, Part 2, report.

CP&L Response to Requested Information Item 1.a:

Harris Nuclear Plant (HNP) has been analyzed for susceptibility relative to Oconee 3 using the time-at-temperature model and plant-specific input data reported in MRP 2001-48 [Reference 1].

This evaluation showed that it will take HNP 115.5 effective full power years (EFPY) of additional operation from March 1, 2001, to reach the same time at temperature as Oconee 3 at the time that leaking nozzles were discovered in March 2001. The value of 115.5 EFPYs was conservatively calculated based upon 11.6 EFPYs of operation with a reactor vessel head temperature of 558 ^{0}F. However, HNP currently operates at a reactor vessel head temperature of 551 ^{0}F and has operated at this temperature for 6 EFPYs prior to March 1, 2001. Upon the implementation of the Power Uprate Project during the upcoming refueling outage (RFO10), which begins in September of 2001, the temperature of the reactor vessel head will be restored to 558 ^{0}F.

Harris Nuclear Plant falls into the NRC category of plants with low susceptibility (greater than 30 effective full power years of operation relative to Oconee 3).

NRC Requested Information Item 1.b:

1. All addressees are requested to provide the following information:

   b. a description of the VHP nozzles in your plant(s), including the number, type, inside and outside diameter, materials of construction, and the minimum distance between VHP nozzles.

CP&L Response to Requested Information Item 1.b:

Harris Nuclear Plant has 66 reactor pressure vessel (RPV) head nozzles (65 control rod drive mechanism (CRDM) and 1 head vent). The nozzles are fabricated of Alloy 600 (SB-167). The CRDM nozzle material was supplied by Babcock & Wilcox, and the head vent nozzle material was supplied by Huntington. The head arrangement and requested nozzle details are provided in Table 2-3 of MRP 2001-48 [Reference 1].

Table 2-1 of MRP 2001-48 [Reference 1] identifies a design diametral nozzle interference fit of 0.0-4.0 mils. Information obtained to date from reactor vessel head fabrication drawings confirms an interference fit of 1.0-3.0 mils for 13 CRDM nozzles.

NRC Requested Information Item 1.c:

1. All addressees are requested to provide the following information:

   c. a description of the RPV head insulation type and configuration.

CP&L Response to Requested Information Item 1.c:

As reported in Table 2-1 of MRP 2001-48 [Reference 1], HNP has stepped reflective RPV head insulation. The insulation is constructed from horizontal and vertical removable panels that are not placed directly on the reactor vessel head. An air space is present between the top of the reactor vessel head and the bottom of the insulation.

Figures #6 and #7 provide additional details of the RPV head insulation.

NRC Requested Information Item 1.d:

1. All addressees are requested to provide the following information:

   d. a description of the VHP nozzle and RPV head inspections (type, scope, qualification requirements, and acceptance criteria) that have been performed at your plant(s) in the past 4 years, and the findings. Include a description of any limitations (insulation or other impediments) to accessibility of the bare metal of the RPV head for visual examinations.

CP&L Response to Requested Information Item 1.d:

In the past four years, HNP has performed visual inspections of the accessible portions of the RPV head and nozzles. No volumetric inspections of the RPV head CRDM nozzles have been performed. The visual inspections of the VHP nozzles are performed in accordance with approved plant procedures which implement the Generic Letter (GL)

88-05 boric acid corrosion program, as described in the HNP response to GL 97-01 (Reference 3). During RFO9 in April of 2000, the inspection was performed by a Qualified VT-2 Inspector. During RFO8 (1998) and RFO7 (1997), the inspections were performed by mechanics. After sufficient reactor vessel insulation is removed in order to remove the reactor vessel head, the reactor vessel head flange and the lower portion of the reactor vessel head below the shroud support ring are accessible for inspection (see Figure 2). These areas are inspected for boric acid deposits. The inspection results are considered acceptable if no boric acid deposits are identified. No boric acid deposits have been found due to leakage from vessel head penetrations since the inspections began in RFO5 (1994).

During RFO8, HNP discovered boric acid deposits on the reactor vessel head. The boric acid originated from a leaking lower canopy seal weld of CRDM nozzle #18. This condition was found during the GL 88-05 boric acid walk down. The condition was repaired by the installation of a weld overlay over the defective seal weld.

The presence of reactor vessel head insulation inhibits the direct visual inspection of many of the reactor vessel head penetration nozzles. The lower-most row of 24 CRDM penetration nozzles can be seen under the integrated head package shroud support ring.

NRC Requested Information Item 1.e:

1. All addressees are requested to provide the following information:

    e. a description of the configuration of the missile shield, the CRDM housings and their support/restraint system, and all components, structures, and cabling from the top of the RPV head up to the missile shield. Include the elevations of these items relative to the bottom of the missile shield.

CP&L Response to Requested Information Item 1.e:

The integrated reactor vessel head package missile shield is a 162" diameter 4" thick steel plate which seismically restrains the tops of the control rod drive mechanisms and protects other reactor coolant system (RCS) pressure boundary components from missiles that could be ejected from the reactor vessel head. The bottom of the missile shield is 334 inches above the top of the reactor vessel flange. The missile shield is supported by three reactor vessel head lifting rods. A composite sketch of the integrated reactor vessel head package is provided in Figure #1. Additional details are provided in Figure #2. The missile shield is a Safety Class 1, Seismic Category I component.

Equipment and Cables on Top of the Vessel Head

- Control Rod Drive Mechanisms
  The tops of the CRDM reactor head vessel nozzles are located 105 inches above the top of the reactor vessel flange. The CRDM housings are threaded and seal

welded to the CRDM reactor head nozzles, and the tops of the CRDM housings are located 343 inches above the top of the reactor vessel flange. The upper 8.5 inches of the control rod drive mechanism housings extend through holes in the missile shield, thus providing seismic restraint of the CRDMs. Connections for the CRDM power cables and digital rod position indication cables to the CRDM housings are located 21.3 inches below the bottom of the missile shield. These cables run under the missile shield from the CRDM housing to a circular messenger tray, which is also located below the missile shield. Figures #3, #4 and #5 provide additional details of the CRDMs. The CRDM housings are Safety Class 1, ASME III Code Class 1, Seismic Category I components. Other components of the CRDM assemblies are Safety Class NNS (non-nuclear safety).

- Thermocouple Port Columns
  Four CRDM reactor vessel head nozzles are used for reactor thermocouple port columns. Cables from the 4 reactor thermocouple columns are also run under the missile shield. Additional details of the thermocouple port columns can be seen on Figure #3.

- Head Vent Pipe
  The reactor head vent pipe line originates from a penetration in the reactor vessel head, and runs under the missile shield and out through the integrated reactor vessel head package cooling shroud. The vent pipe extends vertically out of the reactor vessel head penetration, angles 90 degrees and then continues horizontally at an elevation 92 inches above the reactor vessel head mating flange. Additional details of the head vent pipe can be seen on Figure #3. The portions of the head vent pipe located above the reactor vessel head are Seismic Category I, ASME III, Safety Class 1 or 2.

- Reactor Vessel Level Indication System Pipe
  The reactor vessel head pipe of the reactor vessel level indicating system (RVLIS) is attached to a vessel head mechanism housing adaptor plug on spare CRDM penetration nozzle #18. The line runs under the missile shield and out through the integrated reactor vessel head package cooling shroud. Figure #8 provides additional details of the reactor vessel level indicating system. The RVLIS pipe is Safety Class 2, ASME III Class 2, Seismic Category I piping.

- Spare CRDM Nozzles
  The reactor vessel head contains 9 spare CRDM nozzles that are capped using vessel head mechanism housing adaptor plugs, with "dummy cans" attached to the top of the plugs. The tops of the "dummy cans" are located 147 inches above the reactor vessel head flange mating surface. Additional details of the spare CRDM nozzles can be seen on Figure #3. The vessel head mechanism housing adaptor plugs are Safety Class 1, ASME III, Seismic Category I components. The CRDM dummy can assemblies are Safety Class NNS components.

- CRDM Cooling System
  The CRDM cooling system is supported by the cooling shroud assembly, which is mounted on the integrated reactor vessel head. Mechanical components are located outside of the missile shield. Cooling fans are supported by the middle shroud assembly which is located approximately 237 inches above the reactor vessel head flange mating surface. Electrical cabling is located in the messenger tray. The CRDM cooling system can be seen on Figure #1. The CRDM cooling system components are Safety Class NNS.

- Lift Rod Assembly
  Three lift rods extend from the reactor vessel head to the missile shield. The bottom of the lift rods are attached to the lower portion of the reactor vessel head, outside of the cooling shroud assembly. The upper portion of the lift rods are attached to the missile shield. Figures #1 and #2 provide additional details of the lift rod assembly. The lift rods are Safety Class 1, Seismic Category I components.

For further information, Section 15.4.8 of the HNP Final Safety Analysis Report provides the analysis of rod cluster control assembly ejection accidents.

NRC Requested Information Item 2:

2. If your plant has previously experienced either leakage from or cracking in VHP nozzles, addressees are requested to provide the following information:

   a. a description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;

   b. a description of the additional or supplemental inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken in response to identified cracking to satisfy applicable regulatory requirements;

   c. your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;

   d. your basis for concluding that the inspections identified in 2.c will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:

   (1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory

requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

(2) If your future inspection plans do not include volumetric examination of all VHP nozzles, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will be satisfied.

CP&L Response to Requested Information Item 2:

HNP has not previously identified either leakage from or cracking in vessel head penetrations. Therefore, this section is not applicable.

NRC Requested Information Item 3:

2. If the susceptibility ranking for your plant is within 5 EFPY of ONS3, addressees are requested to provide the following information:

   a. your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;

   b. your basis for concluding that the inspections identified in 3.a. will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:

      (1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

      (2) If your future inspection plans include only visual inspections, discuss the corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.

CP&L Response to Requested Information Item 3:

Harris Nuclear Plant is considered to be in the NRC category of plants with low susceptibility (greater than 30 effective full power years of operation relative to Oconee 3) as reported in MRP 2001-48 [Reference 1]. Therefore, this section is not applicable.

NRC Requested Information Item 4:

4. If the susceptibility ranking for your plant is greater than 5 EFPY and less than 30 EFPY of ONS3, addressees are requested to provide the following information:

a. your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;

b. your basis for concluding that the inspections identified in 4.a will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:

   (1) If your future inspection plans do not include a qualified visual examination at the next scheduled refueling outage, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

   (2) The corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.

<u>CP&L Response to Requested Information Item 4:</u>

Harris Nuclear Plant is considered to be in the NRC category of plants with low susceptibility (greater than 30 effective full power years of operation relative to Oconee 3) as reported in MRP 2001-48 [Reference 1]. Therefore, this section is not applicable.

<u>NRC Requested Information Item 5:</u>

5. Addressees are requested to provide the following information within 30 days after plant restart following the next refueling outage:

   a. a description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected.

   b. if cracking is identified, a description of the inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken to satisfy applicable regulatory requirements. This information is requested only if there are any changes from prior information submitted in accordance with this bulletin.

<u>CP&L Response to Requested Information Item 5:</u>

CP&L will provide the requested information for HNP within 30 days after plant restart following Refueling Outage 10, which is scheduled to commence in September 2001.

References

1. *PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48),* EPRI, Palo Alto, CA: August 2001. TP-1006284.

2. *PWR Materials Reliability Project Interim Alloy 600 Safety Assessments for US PWR Plants (MRP-44),* EPRI, Palo Alto, CA: May 2001. TP-1001491.

3. CP&L Letter to NRC dated July 29, 1997, Serial HNP-97-152, Response to NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations".

List of Figures

Figure #1

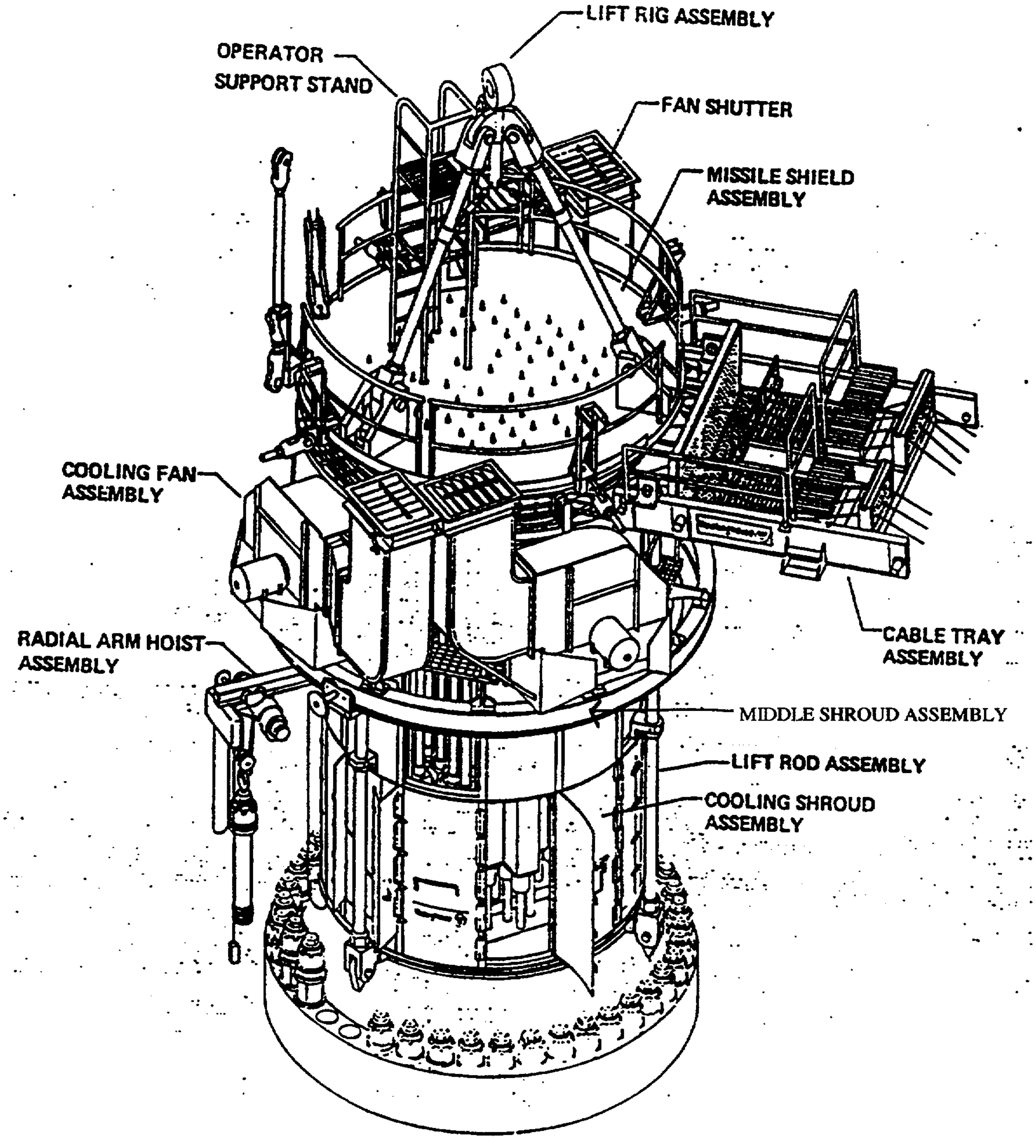


Figure 7.2 Integrated Reactor Vessel Head

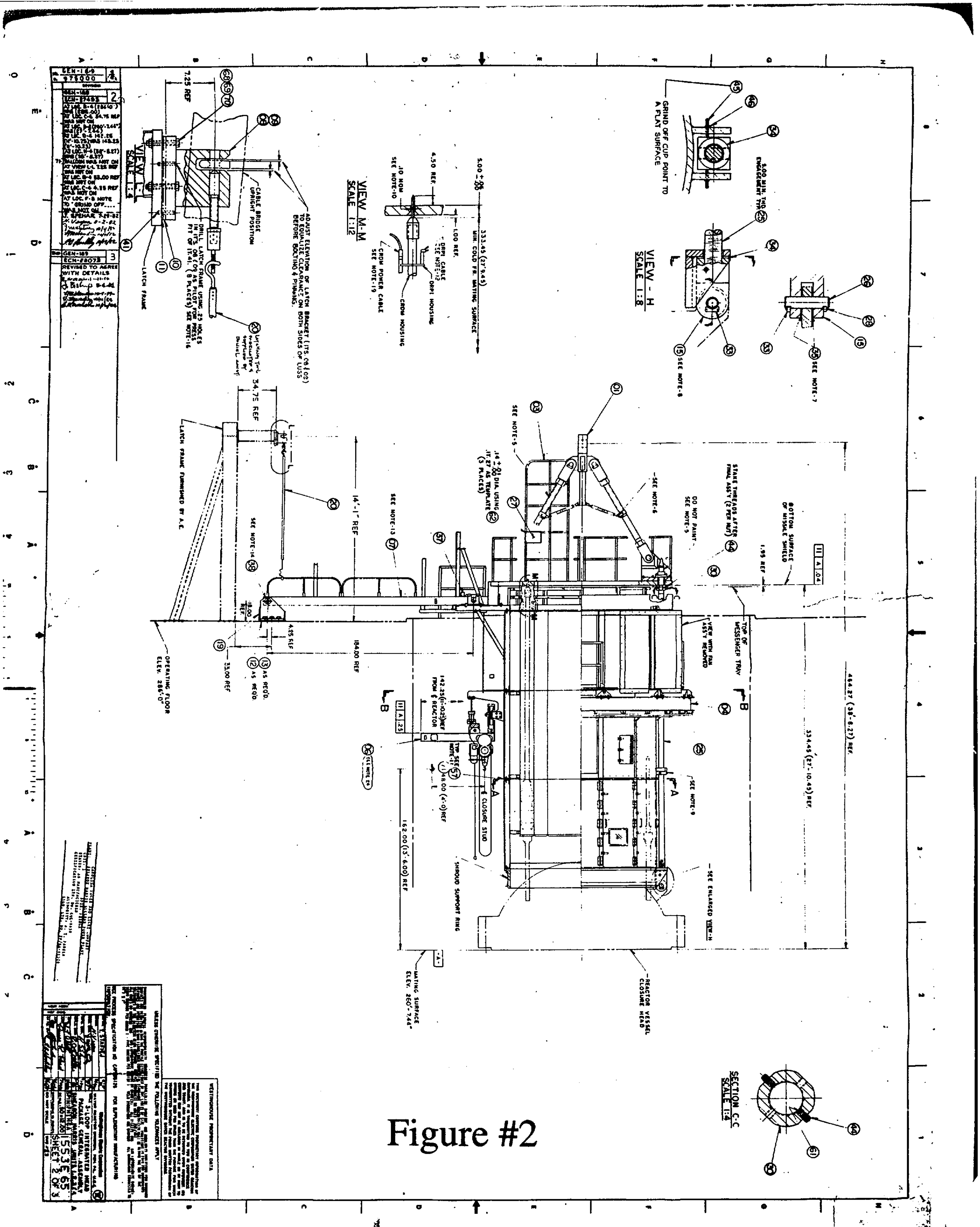
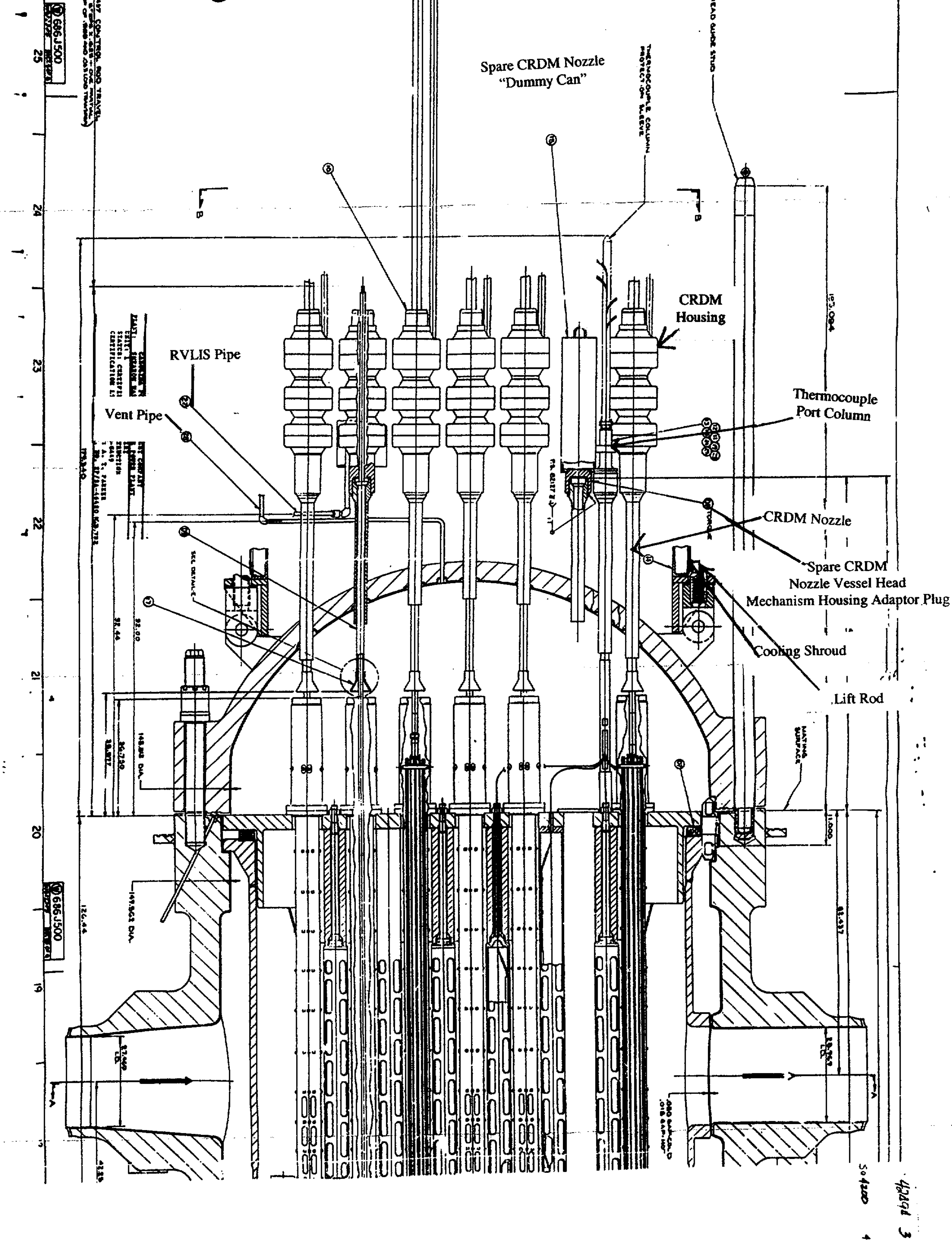
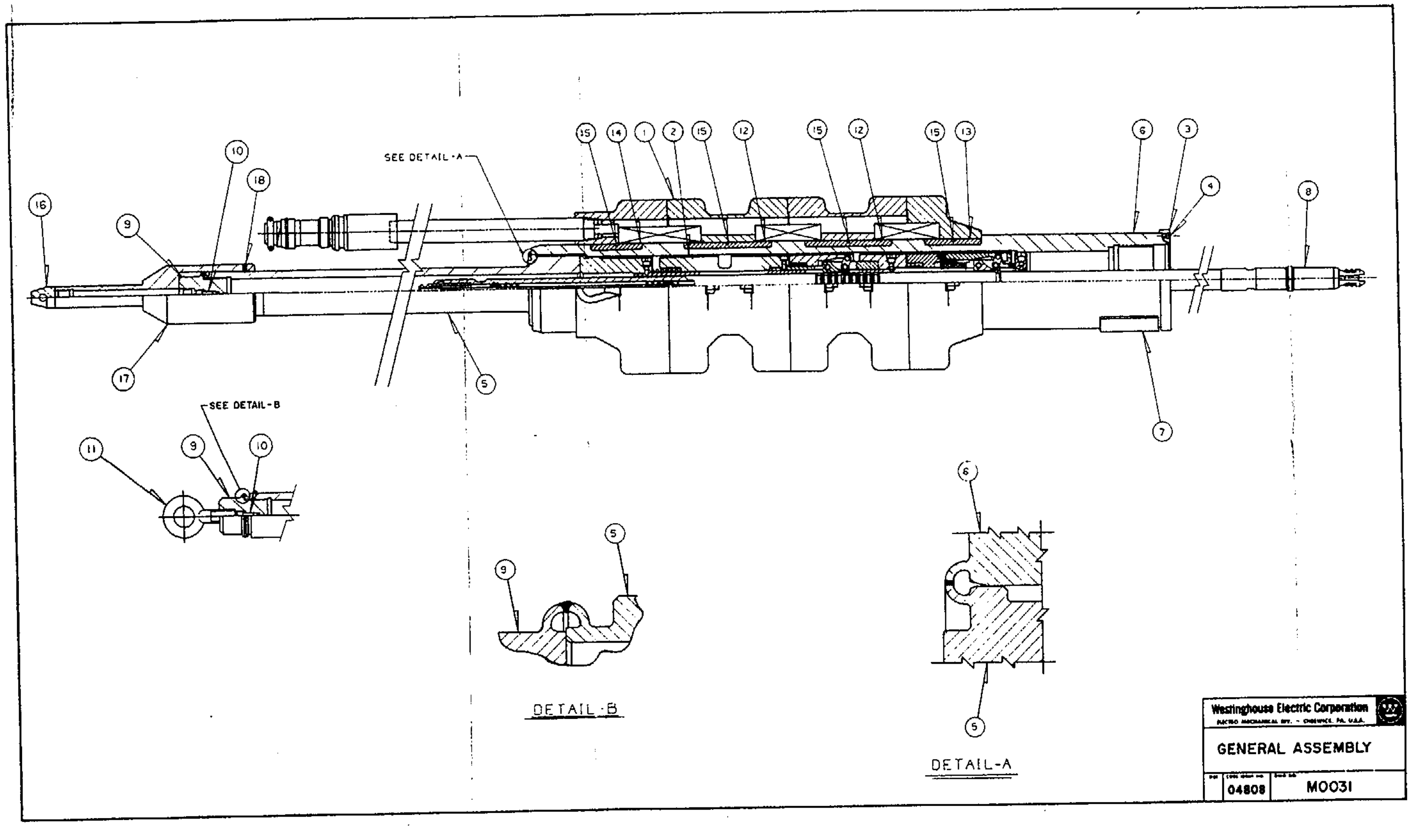


Figure #2

Figure #3



Spare CRDM Nozzle
"Dummy Can"
CRDM Housing
RVLIS Pipe
Vent Pipe
Thermocouple Port Column
CRDM Nozzle
Spare CRDM Nozzle Vessel Head Mechanism Housing Adaptor Plug
Cooling Shroud
Lift Rod



QTY.	PART NO.	REV.	DESCRIPTION	ITEM NO.
*REF.	2675C04G01	1	ROD TRAVEL HOUSING ASSEMBLY	19*
2	908A744H03	1	SET SCREW	18
1	8377D87H01	5	SEISMIC SLEEVE	17
1	1535B74H01	2	PILOT CAP	16
1	922A820H01	3	LOCKWIRE (204 IN) (5182 MM)	15
2	1748C54H01	2	FLUX RING HALF	14
2	1748C52H01	2	FLUX RING HALF	13
4	1748C53H01	2	FLUX RING HALF	12
1	620B695H02	5	EYEBOLT	11
1	1528B74H01	3	VENT PLUG	10
1	2675C02H01	2	CAP	9
1	9745D67G01	1	DRIVE ROD ASSEMBLY	8
1	131P546H01	1	NAMEPLATE	7
1	5061D14H01	4	LATCH HOUSING	6
1	9744D71H01	3	ROD TRAVEL HOUSING	5
4	380A936H05	2	SOCKET HEAD CAP SCREW	4
2	856C691H02	5	PROTECTOR RING HALF	3
1	8380D79G01	2	LATCH ASSEMBLY	2
1	9743D54G01	1	COIL STACK ASSEMBLY	1

GENERAL ASSEMBLY BILL OF MATERIAL – M0017

DRAWING NO. 9744D43G01 REV. 3 SHOP ORDER NOS. M327 M328

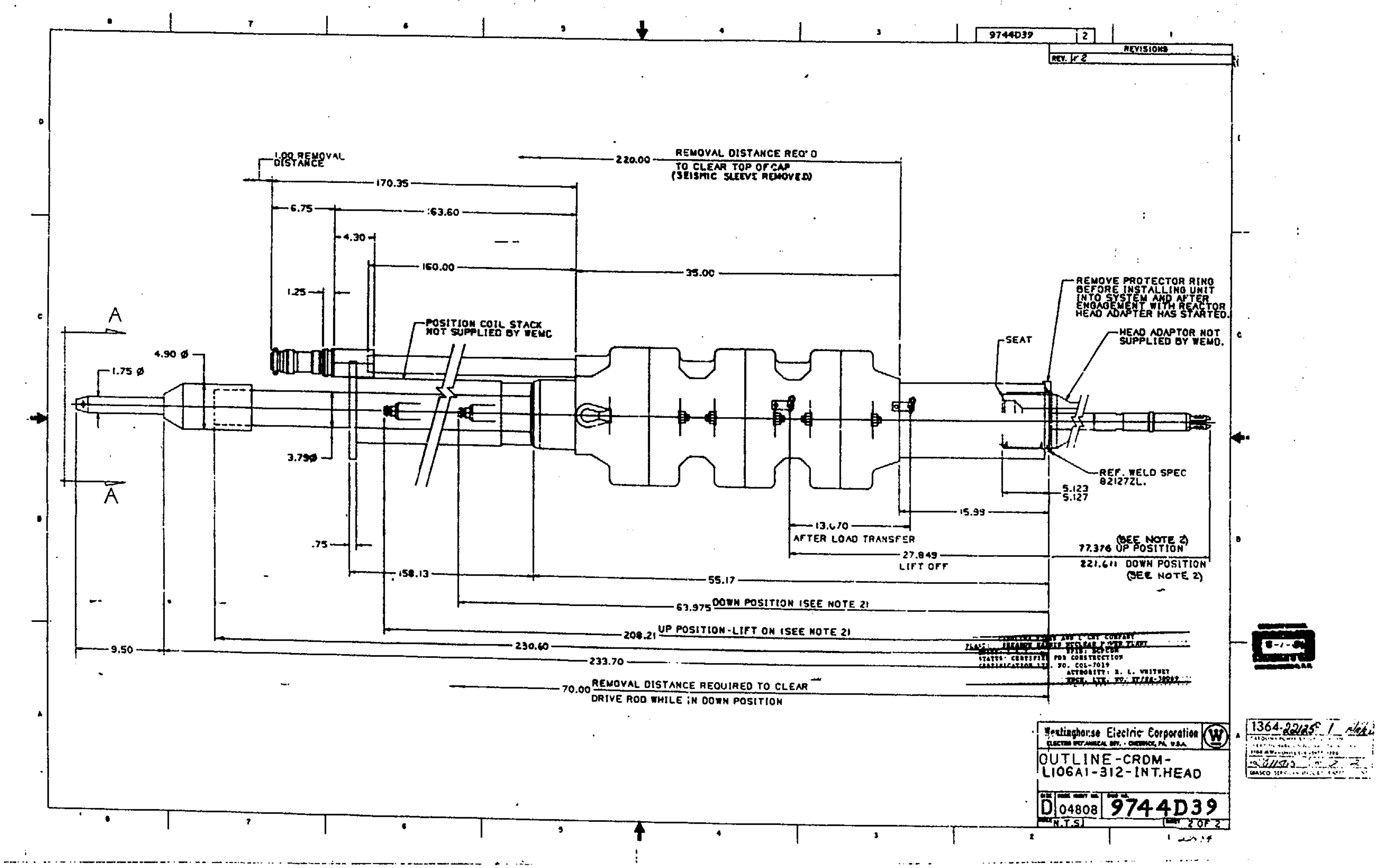
*Composed of Items 5, 9, 10, and 11

THIS DRAWING IS ON APERTURE CARD # MDS, Sect 6, Page 3

FIGURE 6-1 General Assembly/Bill of Materials · M0031

MDS 6-1, 6-2

Figure #4



9744D39
REVISIONS
1.00 REMOVAL DISTANCE
170.35
6.75
163.60
4.30
160.00
1.25
220.00
REMOVAL DISTANCE REQ'D TO CLEAR TOP OF CAP (SEISMIC SLEEVE REMOVED)
35.00
POSITION COIL STACK NOT SUPPLIED BY WEMC
A
4.90 Ø
1.75 Ø
3.790
.75
REMOVE PROTECTOR RING BEFORE INSTALLING UNIT INTO SYSTEM AND AFTER ENGAGEMENT WITH REACTOR HEAD ADAPTER HAS STARTED.
SEAT
HEAD ADAPTOR NOT SUPPLIED BY WEMC.
REF. WELD SPEC 82127ZL.
5.123
5.127
15.99
13.070
AFTER LOAD TRANSFER
27.849
LIFT OFF
(SEE NOTE 2)
77.376 UP POSITION
221.611 DOWN POSITION (SEE NOTE 2)
158.13
55.17
63.975 DOWN POSITION (SEE NOTE 2)
208.21 UP POSITION-LIFT ON (SEE NOTE 2)
230.60
9.50
233.70
70.00 REMOVAL DISTANCE REQUIRED TO CLEAR DRIVE ROD WHILE IN DOWN POSITION
Westinghouse Electric Corporation
OUTLINE-CRDM-L106A1-312-INT.HEAD
D
04808
9744D39
N.T.S.
2 OF 2
1364-

Figure #5

Figure #6

Attachment 1
Sheet 1 of 2

<u>Mirror Insulation Arrangement Diagram</u>

Reference: EMDRAC #1364-003155

✱ Panels Removed To Support Head Removal

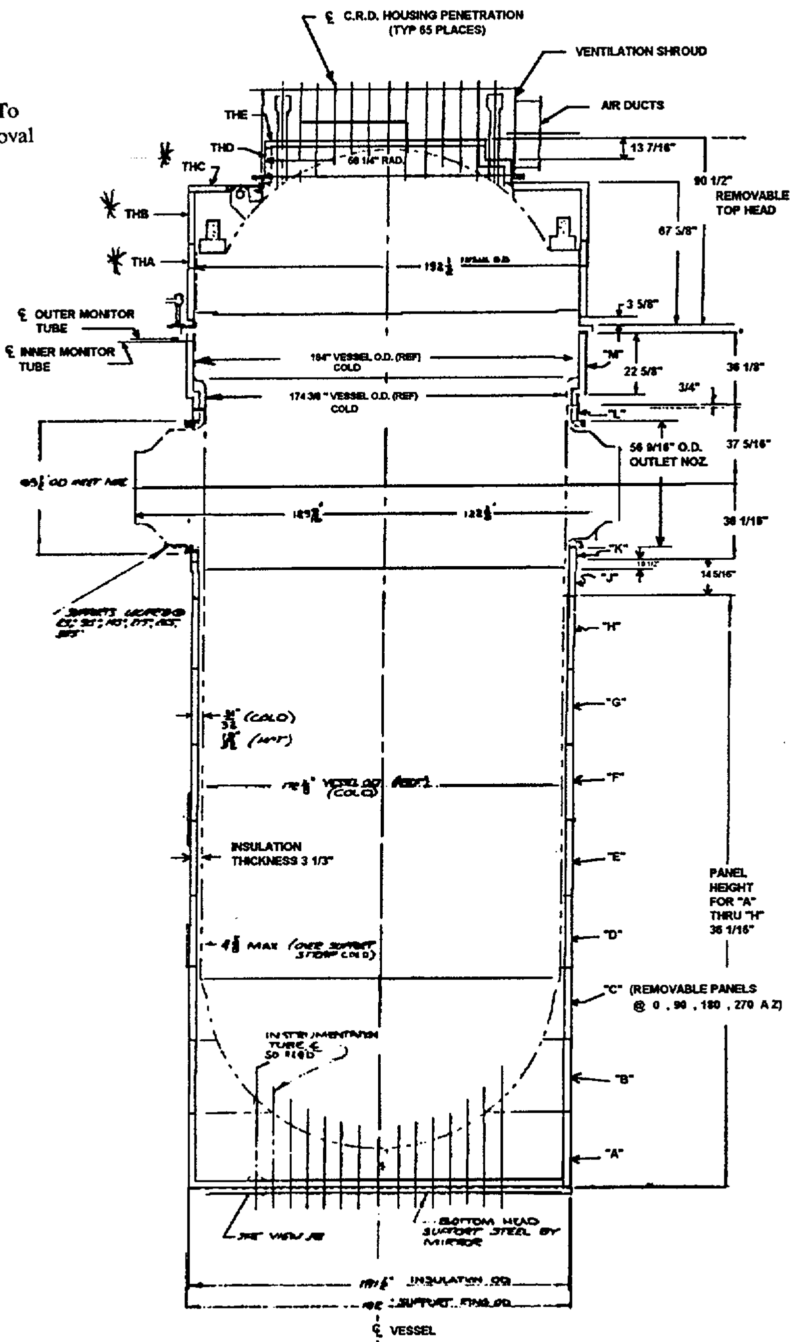


Figure #7

Attachment 1
Sheet 2 of 2

Mirror Insulation Arrangement Diagram

Reference: EMDRAC #1364-018599

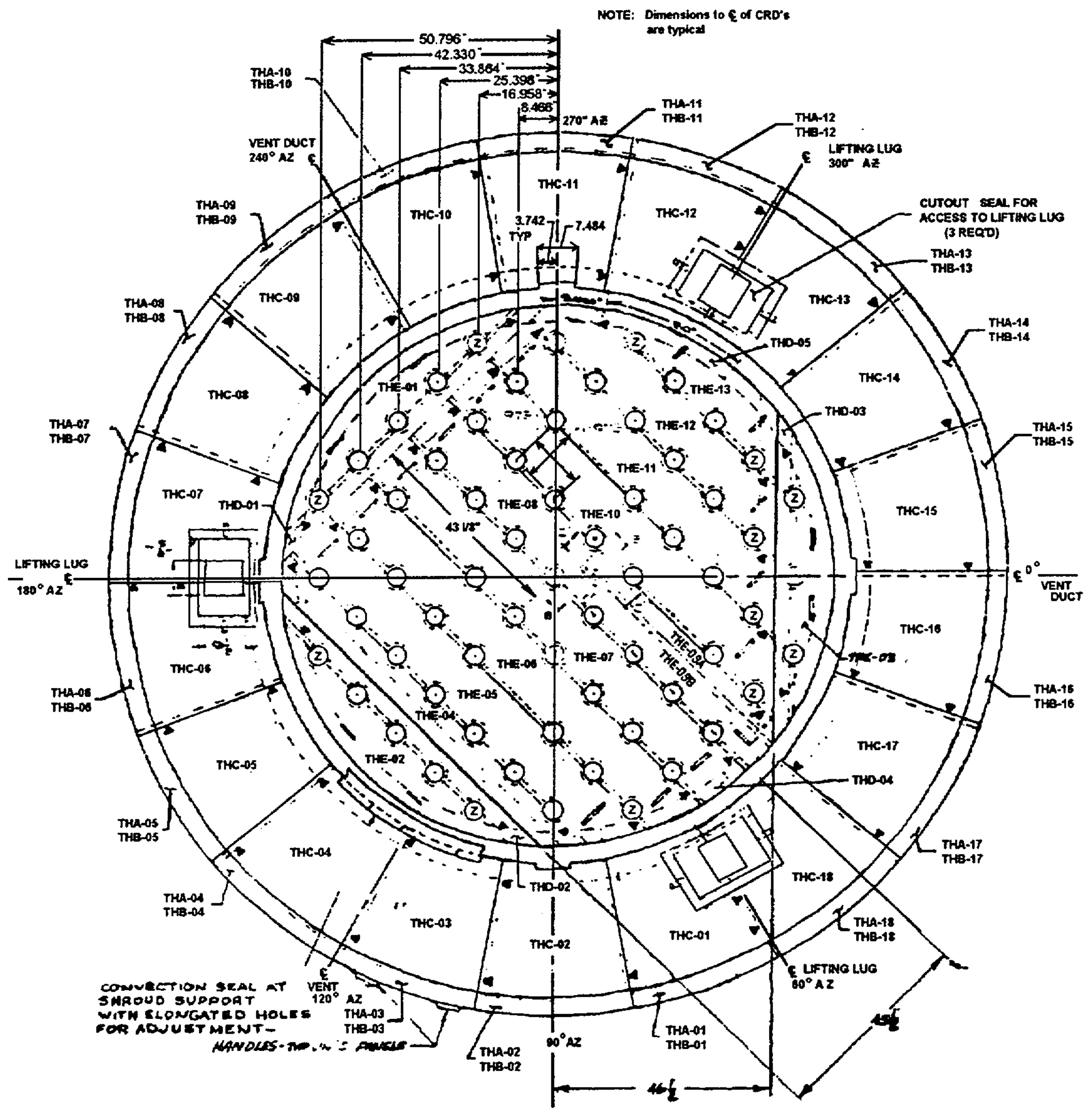
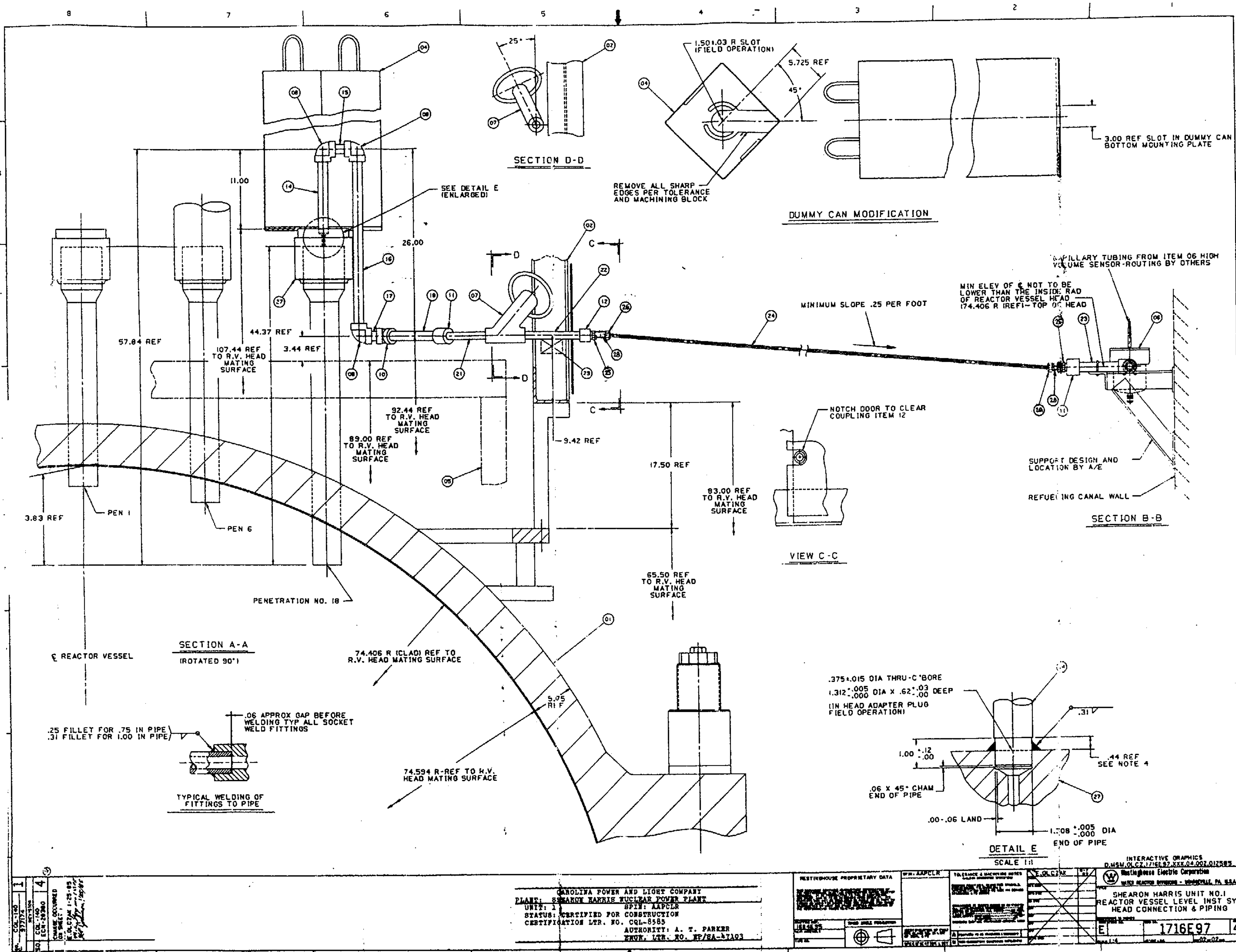


Figure #8


SECTION D-D
1.50±.03 R SLOT (FIELD OPERATION)
5.725 REF
3.00 REF SLOT IN DUMMY CAN BOTTOM MOUNTING PLATE
REMOVE ALL SHARP EDGES PER TOLERANCE AND MACHINING BLOCK
DUMMY CAN MODIFICATION
SEE DETAIL E (ENLARGED)
11.00
26.00
CAPILLARY TUBING FROM ITEM 06 HIGH VOLUME SENSOR-ROUTING BY OTHERS
MIN ELEV OF ℄ NOT TO BE LOWER THAN THE INSIDE RAD OF REACTOR VESSEL HEAD (74.406 R (REF)-TOP OF HEAD
MINIMUM SLOPE .25 PER FOOT
44.37 REF
3.44 REF
57.84 REF
107.44 REF TO R.V. HEAD MATING SURFACE
92.44 REF TO R.V. HEAD MATING SURFACE
89.00 REF TO R.V. HEAD MATING SURFACE
9.42 REF
17.50 REF
83.00 REF TO R.V. HEAD MATING SURFACE
65.50 REF TO R.V. HEAD MATING SURFACE
NOTCH DOOR TO CLEAR COUPLING ITEM 12
VIEW C-C
SUPPORT DESIGN AND LOCATION BY A/E
REFUELING CANAL WALL
SECTION B-B
3.83 REF
PEN 1
PEN 6
PENETRATION NO. 18
℄ REACTOR VESSEL
SECTION A-A
(ROTATED 90°)
74.406 R (CLAD) REF TO R.V. HEAD MATING SURFACE
5.75 REF
74.594 R-REF TO R.V. HEAD MATING SURFACE
.25 FILLET FOR .75 IN PIPE
.31 FILLET FOR 1.00 IN PIPE
.06 APPROX GAP BEFORE WELDING TYP ALL SOCKET WELD FITTINGS
TYPICAL WELDING OF FITTINGS TO PIPE
.375±.015 DIA THRU-C'BORE
1.312 +.005/-.000 DIA X .62 +.03/-.00 DEEP
(IN HEAD ADAPTER PLUG FIELD OPERATION)
1.00 +.12/-.00
.44 REF SEE NOTE 4
.06 X 45° CHAM END OF PIPE
.00-.06 LAND
1.308 +.005/-.000 DIA END OF PIPE
DETAIL E
SCALE 1:1
CAROLINA POWER AND LIGHT COMPANY
PLANT: SHEARON HARRIS NUCLEAR POWER PLANT
UNIT: 1 SPIN: AAPCLR
STATUS: CERTIFIED FOR CONSTRUCTION
CERTIFICATION LTR. NO. CQL-8585
AUTHORITY: A. T. PARKER
ENGR. LTR. NO. EP/SA-47103
WESTINGHOUSE PROPRIETARY DATA
Westinghouse Electric Corporation
SHEARON HARRIS UNIT NO.1
REACTOR VESSEL LEVEL INST SYS
HEAD CONNECTION & PIPING
1716E97
INTERACTIVE GRAPHICS