Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P.O. BOX 2046, MILWAUKEE, WI 53201

March 19, 1984

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Attention: Mr. J. R. Miller, Chief
Operating Reactors, Branch 3

Gentlemen:

DOCKET 50-266
SAFETY EVALUATION OF DAMAGED CRGT SUPPORT PINS
POINT BEACH NUCLEAR PLANT, UNIT 1

During a meeting with members of your staff on March 8, 1984, Messrs. Burstein and Fay provided a copy of Wisconsin Electric's safety evaluation of damaged control rod guide tube (CRGT) support pins at the Point Beach Nuclear Plant, Unit 1. In response to a request from Mr. Colburn of your staff, we are formally providing an additional copy of this evaluation as an attachment to this letter.

Very truly yours,

C W Fay

Vice President-Nuclear Power

C. W. Fay

Attachment

Copy to NRC Resident Inspector

A001
1/1

March 6, 1984

Mr. R. A. Newton/NES File PT 3.2.2

SAFETY EVALUATION OF DAMAGED CRGT SUPPORT PINS AT POINT BEACH NUCLEAR PLANT, UNIT 1

The thirty-seven (37) control rod guide tubes (CRGTs) at PBNP, Unit 1, each contain two support pins (also called "split" pins) located at the bottom flange of the lower guide tube. The support pins horizontally align the bottom end of the guide tube at the upper core plate relative to the fuel assembly and provide lateral support for the guide tube against reactor coolant system flow and other forces (see Figures 1, 2, 3, and 4). The CRGTs provide lateral alignment and support for the Rod Cluster Control Assemblies (RCCAs) when the RCCAs are withdrawn from the core (see Figure 5). The support pin design allows removal of the CRGT from the upper internals and accommodates axial thermal expansion relative to the upper internal support columns (see Figure 6). The support pins each consist of a partially threaded shank, a collar, and a dual-leaf spring. The pins are bolted into the lower CRGT flange using a sleeve nut with a locking disk and pin. The leaf spring of each pin fits into a hole in the upper core support plate. The support pin assemblies are constructed of Inconel X-750 material, which has been heat treated and age hardened.

In Westinghouse letter WEP-79-524 dated April 4, 1979, it was reported that a CRGT support pin was found broken and a significant number of pins had UT indications of cracks at a Japanese PWR plant built by Mitsubishi Heavy Industries. No problem with support pins at Westinghouse plants had been reported at that time, and Westinghouse judged the failures not to be a safety issue. In Westinghouse letters WEP-82-536 and 543 dated July 1 and 22, 1982, it was reported that support pin cracking occurred at a domestic Westinghouse plant (North Anna 1) for the first time and the potential existed for stress corrosion cracking of the support pins at PBNP, Unit 1, due to the heat treatment of the pins at less than 1800°F. In NRC IE Information Notice 82-29, "Control Rod Drive (CRD) Guide Tube Support Pin Failures at Westinghouse PWRs," dated July 23, 1982, similar support pin failures were reported at Westinghouse-designed plants in Japan and France. Westinghouse's position was that a cracked or broken support pin did not constitute a safety concern, however, an inspection of the pins was recommended at the next convenient outage for PBNP, Unit 1.

An ultrasonic inspection of the CRGT support pins at PBNP, Unit 1, was recently completed. The inspection revealed UT indications in the shank-to-collar region of 67 of 74 support pins (i.e., ~90%) (see Figure 7). No indications were found in the support pin leaves. A subsequent visual inspection of the sleeve nuts and threaded shank portion of the support pin assembly revealed three missing nuts and shanks (one each on the CRGTs above core positions G-3, I-5 and K-7) (see Figure 8). Visual inspection of the peripheral portion of the upper core support plate (the inner portions are essentially inaccessible), the core former plate just below the upper core support plate, the lower core plate, the lower portion of the reactor vessel, (see Figure 9) and all upper nozzles of fuel assemblies (see Figure 10) discharged during this outage (the full core) and the previous outage did not locate the missing portions of the pins. Visual inspections of the

hot leg side of both steam generator channel heads to search for the missing parts are planned prior to Unit 1 startup.

Westinghouse has performed an evaluation of the ability of both Point Beach units to start up and continue safe operation with broken CRGT support pins. I believe that two potential safety concerns must be addressed to justify safe startup and continued operation with the three missing CRGT support pin nuts and shanks and the potential for additional support pin breakage during operation. These potential concerns are missalignment of the CRGT which could prevent RCCA insertion and adverse effects on safety-related components resulting from loose support pin parts in the reactor coolant and connected auxiliary systems.

The first potential safety concern is that broken CRGT support pins could prevent RCCA insertion due to lateral misalignment of the bottom of the CRGT with respect to the upper core plate. Westinghouse analysis shows that, if both support pins in the same guide tube are broken at the shank-to-collar interface and at both leaves (where previous experience at the other plants has shown cracking) "no safety concern with respect to control rod guide tube misalignment is identified relative to safe shutdown of the reactor with control rod insertion." Westinghouse analysis shows that, even if all support pin assemblies are completely missing, the CRGT alignment will be maintained sufficiently by the adjacent support columns, flow mixers, and orifice plates on the upper core plate such that "the required Technical Specification rod drop time of 1.8 seconds will be met." In addition, a review of RCCA rod wear and rod scram time trends over eleven fuel cycles have not indicated any CRGT misalignment problem. The biweekly rod stepping tests performed during operation per Technical Specifications should indicate any significant CRGT misalignment during the next fuel cycle. Therefore, the potential for the misalignment of CRGTs resulting from broken support pins preventing RCCA insertion is judged not to be a safety concern.

The second potential safety concern is that loose parts from broken support pins may cause adverse effects on safety-related components in or connected to the reactor coolant system. Westinghouse has analyzed a loose support pin part effecting RCCA insertion and stated that "it is considered an extremely remote possibility that any loose part could effect all the movements and placements necessary to affect RCCA movement." In addition, the reactor can be safely shutdown with the highest worth control rod stuck in the fully withdrawn position. If loose support pin parts enter the steam generator channel heads, the only scenario which could effect safety is the extremely remote possibility that a support pin shank separates from the nut, enters a row 1 tube (~3% of the tubes), gets captured in the U-bend, and vibrates over time causing fretting and eventual small localized tube leakage. The plant is designed for a single double-ended tube rupture so the above scenario is judged not to be a safety concern. Adverse effects of loose parts on the reactor coolant pumps are not expected, since the loose parts should pass through the pump. The remote possibility of a locked rotor accident resulting from a loose part has already been analyzed in the PBNP FSAR. The adverse effects of loose parts on the reactor internals would only be a concern if large numbers of broken support pin shanks separate from the nut, travel to the lower part of the reactor vessel and land under the secondary core support energy absorbers during cold conditions.

The resulting wedging effects on the lower internals during heatup were found by Westinghouse to be acceptable using conservative criteria unless an incredible number of shanks were wedged there simultaneously (six under each support or ten under one support). Note that only three shanks are now missing and they are not located in the bottom of the vessel as verified by a visual search.

The effects of loose parts on auxiliary systems or components was also reviewed (see attached table) and the RHR system was the only connected system which could be significantly affected. The RHR system valves could not be held shut by loose parts so RHR system startup could be initiated by opening valves. RHR isolation valves held open by loose parts would be detected upon heatup. The RHR pumps are expected to pass loose parts through without seizure but the parts could cause some damage to the impeller. Loose parts in a heat exchanger could result in a tube leak but this would be detected by leakage into the component cooling water system. Since redundant RHR pumps and heat exchangers are provided, the components are accessible for repair if degraded system operation is detected and safety injection pumps or the steam generators are available for alternate methods of core decay heat removal, the potential effects of loose parts in the RHR system are judged not to be a safety concern. Therefore, the potential effects of loose CRGT support pins parts is judged not be a concern for any safety function.

In conclusion, the UT indications on the shank-to-collar region of the CRGT support pins and the three missing support pin nuts and shanks at PBNP, Unit 1, are judged not to be a safety concern due either to CRGT misalignment preventing RCCA insertion or the adverse effects of loose parts on safety systems and components. This problem does not represent a violation or require a change to the PBNP Technical Specifications or involve an unreviewed safety question. I believe that the above evaluation with the attached evaluation from Westinghouse justifies the safe startup and continued operation of PBNP, Unit 1, for at least one additional fuel cycle. It is assumed that the normal startup RCCA tests (rod drops and stepping tests) and the biweekly RCCA stepping tests required by the Technical Specifications continue to show free RCCA movement. It is also assumed that RHR system isolation is verified during plant heatup to ensure that loose parts are not captured in the isolation valves. Although the results of this evaluation generally apply to PBNP, Unit 2, also, the support pins on Unit 2 had a higher heat treatment temperature of 1950°F and stress corrosion cracking of these pins is not expected.

R. K. Hanneman

RKH:mm R. K. Hanneman

Attachments

cc: Messrs. C. W. Fay
J. J. Zach

Approved: R. A. Newton

R. A. Newton

TABLE

PENETRATIONS AND COMPONENTS IN REACTOR COOLANT LOOPS AND THE POTENTIAL EFFECTS OF LOOSE PARTS IN THE RCS

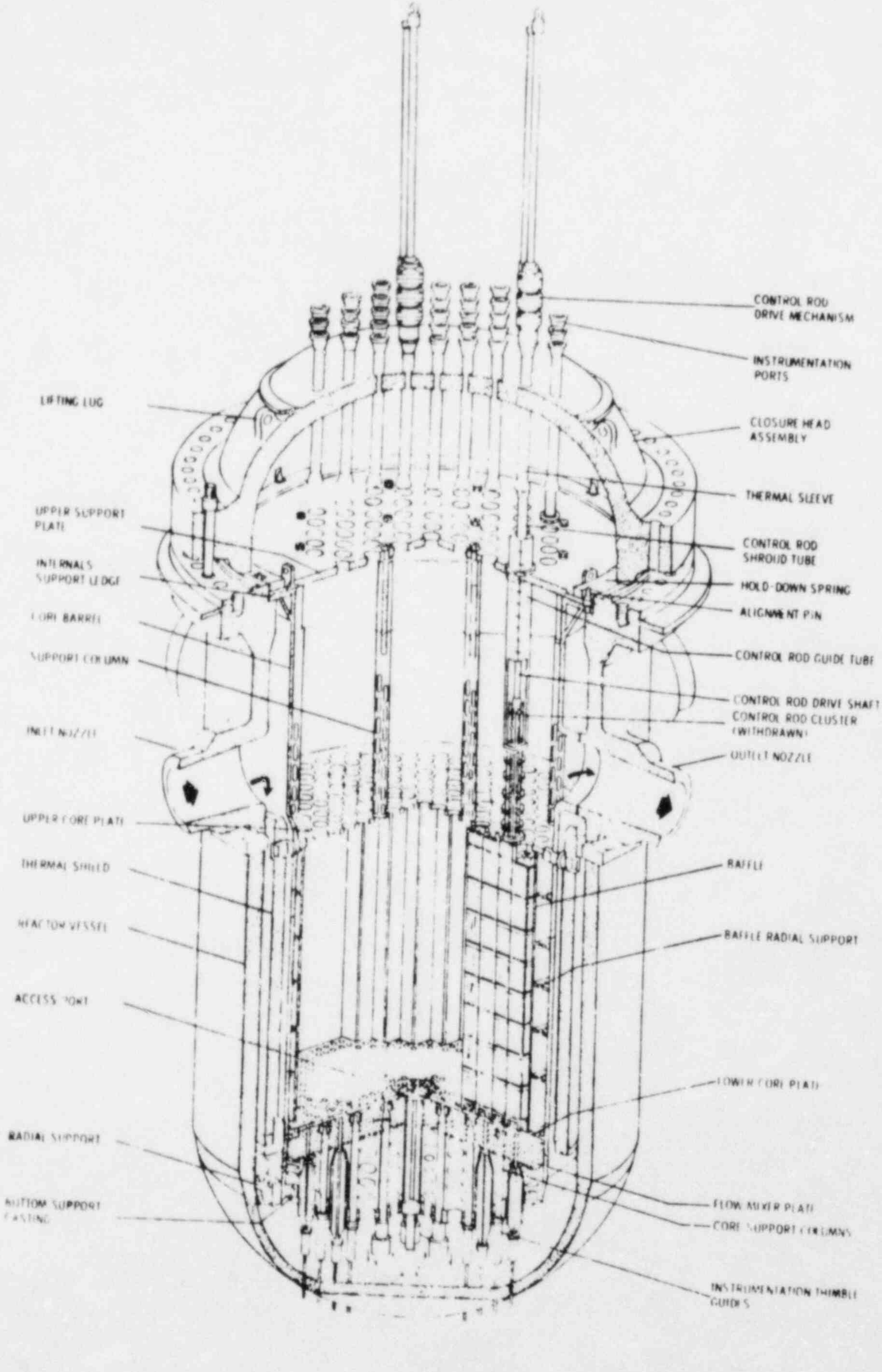
Penetration	Description	Comments
I. Hot Leg		
A. 1-TW450B & 451B (loops A&B, resp.)	Hot Leg Loop RTD Thermowell	No opening to coolant; Not a loose parts concern
B. 6"-RC-2501R-6&9 (Loops A&B, resp.)	Capped Vent Pipe; Taps into top of pipe	No safety function and capped; Not a loose parts concern
C. 10"-RC-2501R-16 (Loop A only)	RHR Suction Line; Taps into bottom of pipe at 45° angle; 2' vertical run downward (1-PT420 taps off here); 8' horizontal run (Excess Letdown taps off bottom), 18' vertical run upward	Loose parts could travel to RHR pumps and/or HXs; No loose part problem expected on 1-PT420 since no flow exists into that small horizontal tap; Excess Letdown is not safety related so this is not a loose parts concern
D. 10"-RC-2501R-2 (Loop B only)	Pressurizer Surge Line; Tops into top of pipe; 3' vertical run upward	Loose part not expected to travel upward into this tap since flow into pipe is usually low or nonexistent; No safety related function function could be affected anyway.
E. 2"-RC-2501-14 (Loops A&B)	Hot Leg Bypass RTD Supply Lines; 3 1" taps into pipe 120° apart.	Inlet nozzles with a number of small holes are used for each tap; Not a loose parts concern.
F. 1"-RC-2501R-14 (Loop B only)	Hot Leg Sample Connection; Taps into top of pipe	Taps into top of pipe, flow-rate is low and not safety-related; Not a loose parts concern
G. 4"-RC-2501R-14 (Loops A&B)	Isolated and Blank-Flanged Vent/Drain Line	Isolated and not safety-related; Not a loose parts concern
H. Steam Generator (Loops A&B)	U-tubes are 3/4" I.D.; 3/4" drain lines are	Loose parts (∼3/4") should pass right through U-tubes

	isolated	without causing significant damage; PBNP is designed for tube rupture; Drain lines are not safety related
II. Crossover Leg		
A. 3"-RC-2501R-14 (Loops A&B)	Hot and Cold Leg By-pass RTD Return; Taps into top of pipe	Flow is into pipe from top; Not a loose parts concern
B. 8" 2"-RC-2501R-10 (Loop B only)	CVCS Letdown Line; Taps into bottom of pipe	Loose flexure head would probably get trapped by a letdown orifice; Not safety-related; Not a loose parts concern
C. 2"-RC-2501R-14 (Loops A&B)	Excess Letdown Line; 1-LT447 taps into line	Not safety-related; Not a loose parts concern
D. 3/4"-RC-2501R-14 (Loops A&B)	Taps (4) for RCS Flow and Wide Range Pressure Transmitters; Taps come off either side of 90° elbow perpendicular to flow stream	Taps are perpendicular to the flow stream; no flow into the small taps; Loose part would probably be detected by unusual flow or pressure readings; Redundant flow transmitters are provided off each loop (only one loop required for Rx trip); Not a loose parts concern
E. Reactor Coolant Pumps	Centrifugal Pump; Control Leakage Seal	Loose parts are expected to to pass through; Potential locked rotor due to loose part has been analyzed; Parts are too large to go through seal; Not a loose parts concern
III. Cold Leg		
A. 3" RC-2501R-1 (Loops A&B)	Pressurizer Spray Line; Taps into the top of the pipe and has at least a 3' vertical run upward	Not expected to collect loose parts since it taps in top and flow rate is low; Not safety related; Not a ward loose parts concern.
B. 3"-RC-2501R-12 (Loop A only)	CVCS Charging Line; Taps into top (45° off vertical)	Flow is into top of loop piping; Not a loose parts concern
C. 10"-RC-2501R-7&8 (Loops A&B, respectively)	Safety Injection Accumulator Supply Line (also RHR return on Loop B); Taps into top	Flow is into top of pipe; Not a loose parts connection

		of the pipe, has at least a 1' vertical run and a check valve in horizontal run	
D.	2"-RC-2501R-14 (Loops A&B)	Cold Leg Bypass RTD Supply Line; Taps off top (approximately 45° off vertical)	Taps off top of pipe and flow rate is low; Not a loose parts concern
E.	2"-RC-2501R-11	Auxiliary Charging Line	Flow is into pipe and not safety related; Not a loose parts concern
F.	1-TE450A & 451A	Cold Leg Loop RTD Thermowell	No opening to coolant; Not a loose parts concern

IV. Reactor Vessel

A.	Instrument Thimble Guide Penetration	Thimble guide tube penetrations into bottom of vessel	Penetrations are always filled with guide tubes; Not safety related; Not a loose parts concern
B.	4"-RC-2501R	Safety Injection Vessel Injection Lines; Taps into side of reactor vessel	Flow is into vessel; Taps horizontally into vessel well above the core; Not a loose parts concern
C.	3/4"-RC-2501R-14	Reactor Coolant System Gas Vent; Taps into top of reactor vessel head	Taps into top of reactor; Flows are too low to pull loose part into line; Not a loose parts concern



REACTOR VESSEL INTERNALS

FIGURE 1

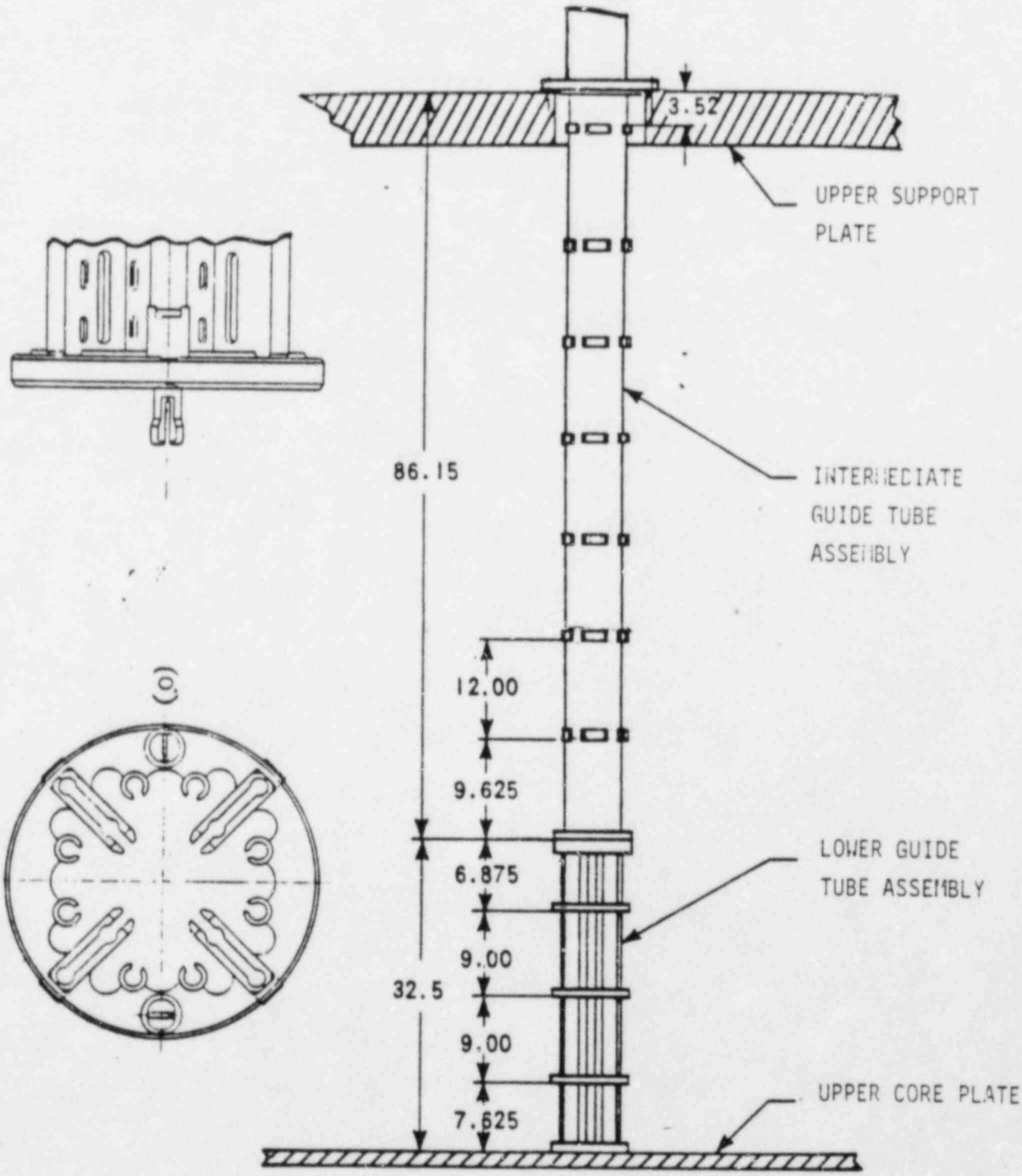
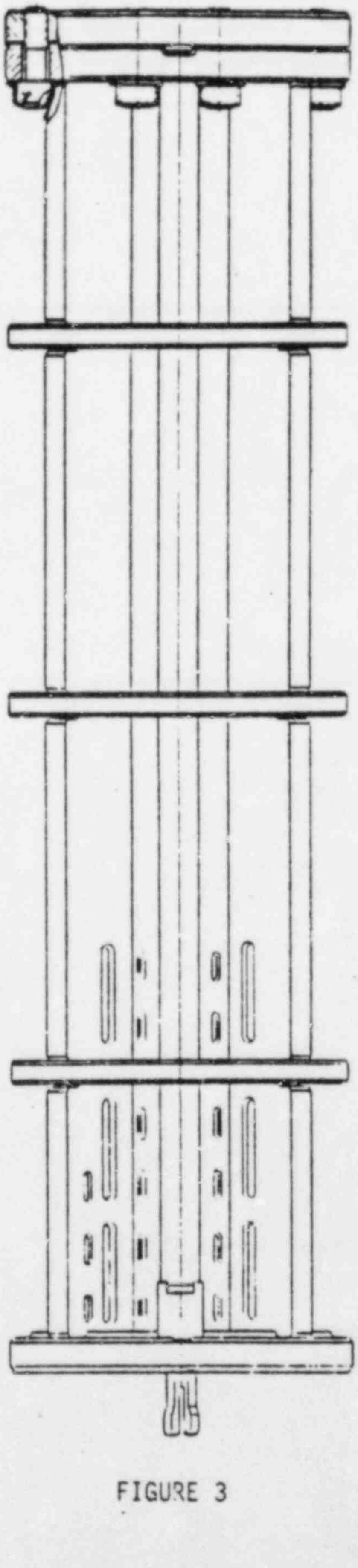
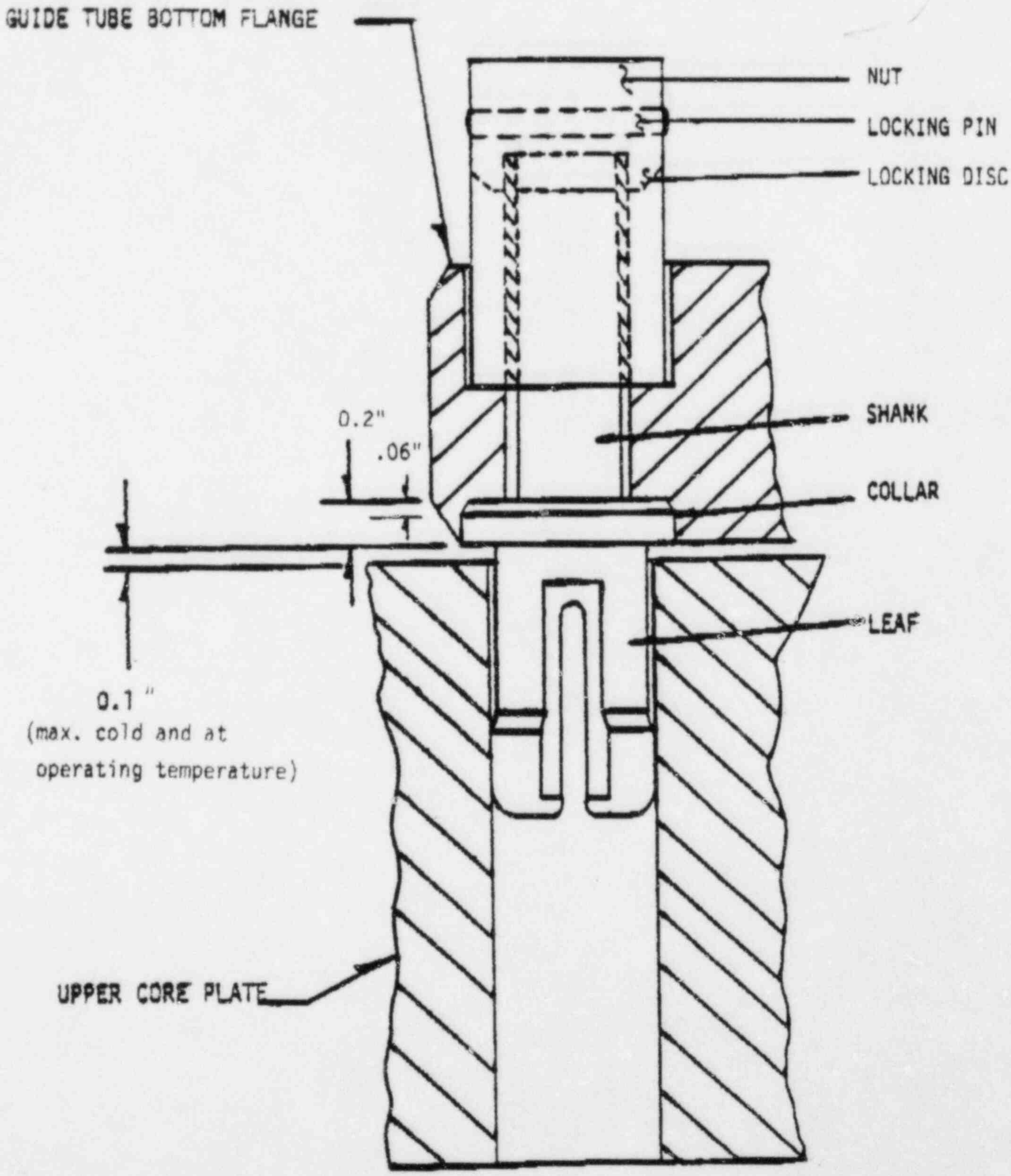

3.52
UPPER SUPPORT PLATE
86.15
INTERMEDIATE GUIDE TUBE ASSEMBLY
12.00
9.625
6.875
LOWER GUIDE TUBE ASSEMBLY
9.00
32.5
9.00
UPPER CORE PLATE
7.625

FIGURE 2



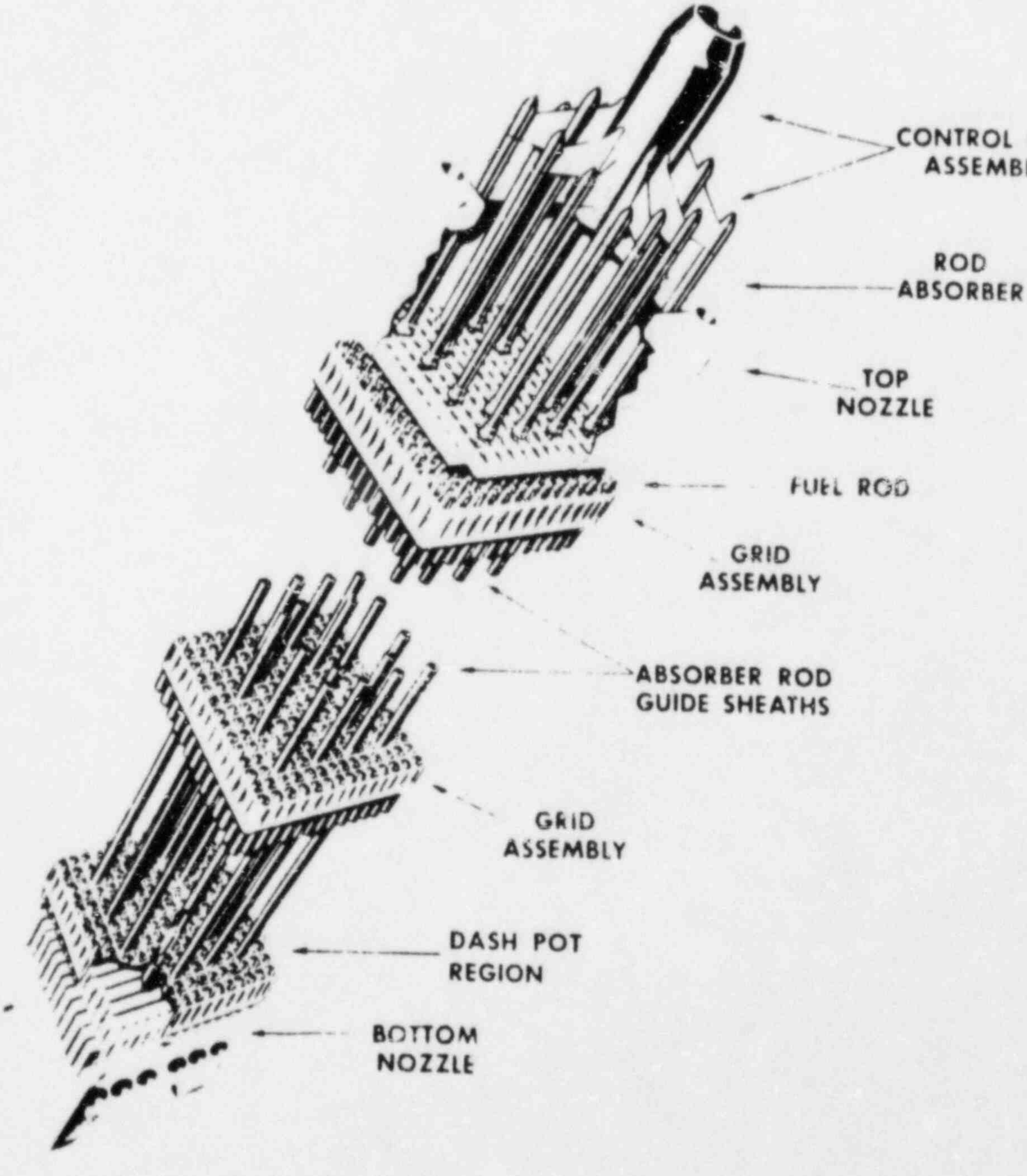
LOWER GUIDE TUBE
ASSEMBLY SECTION

FIGURE 3

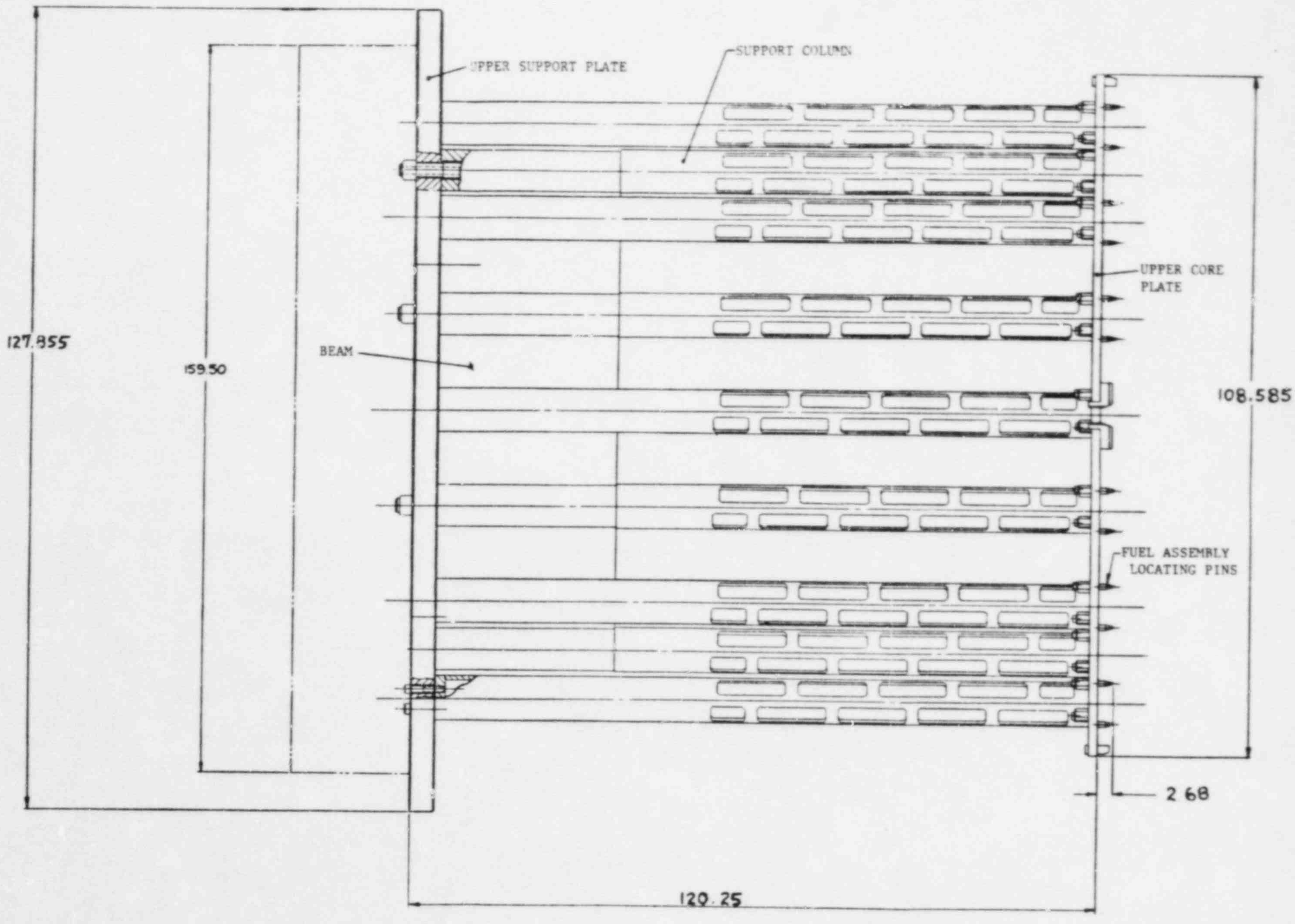


GUIDE TUBE SUPPORT PIN

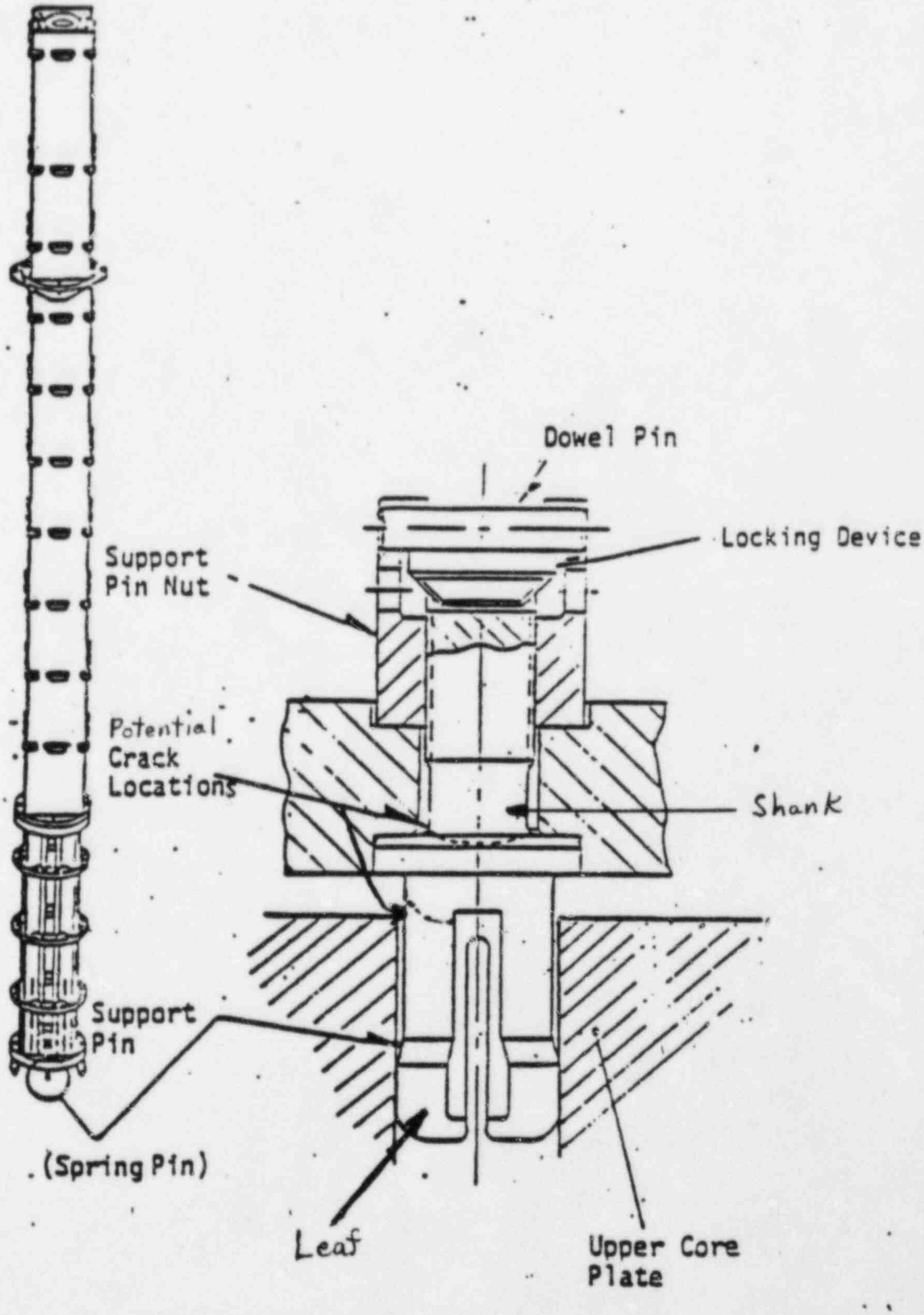
FIGURE 4



TYPICAL ROD CLUSTER CONTROL ASSEMBLY
FIGURE 5



UPPER CORE SUPPORT ASSEMBLY
FIGURE 6



GUIDE TUBE ASSEMBLY

FIGURE 7

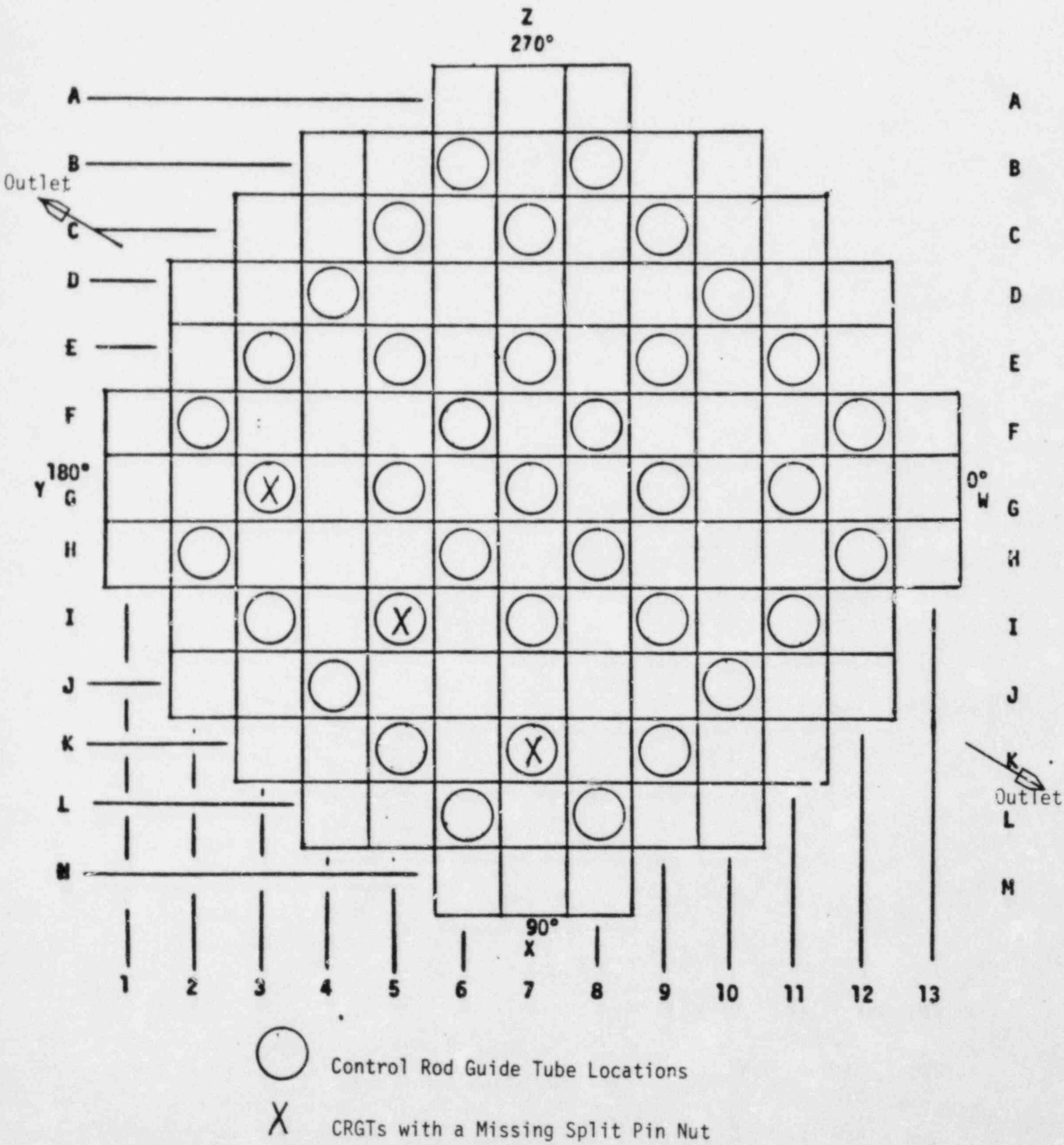
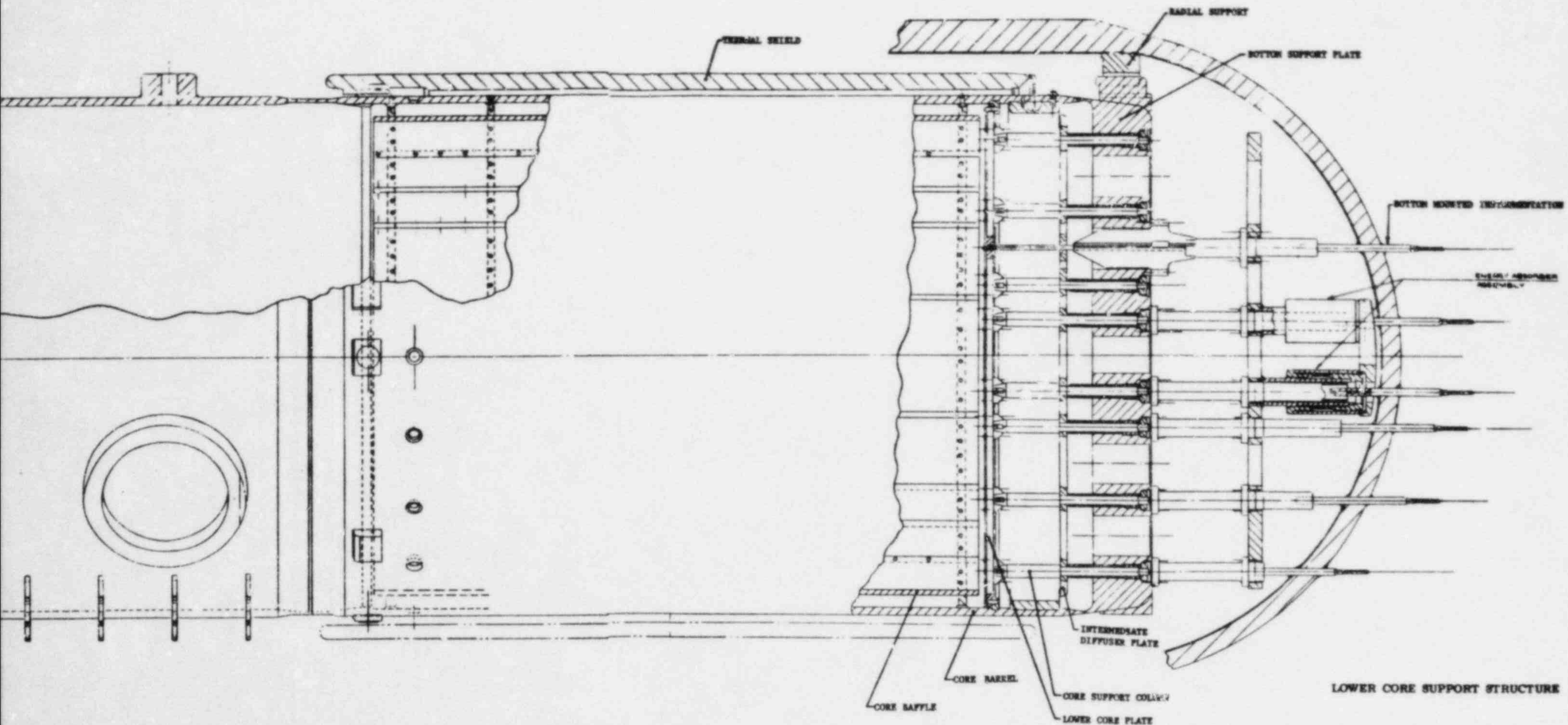
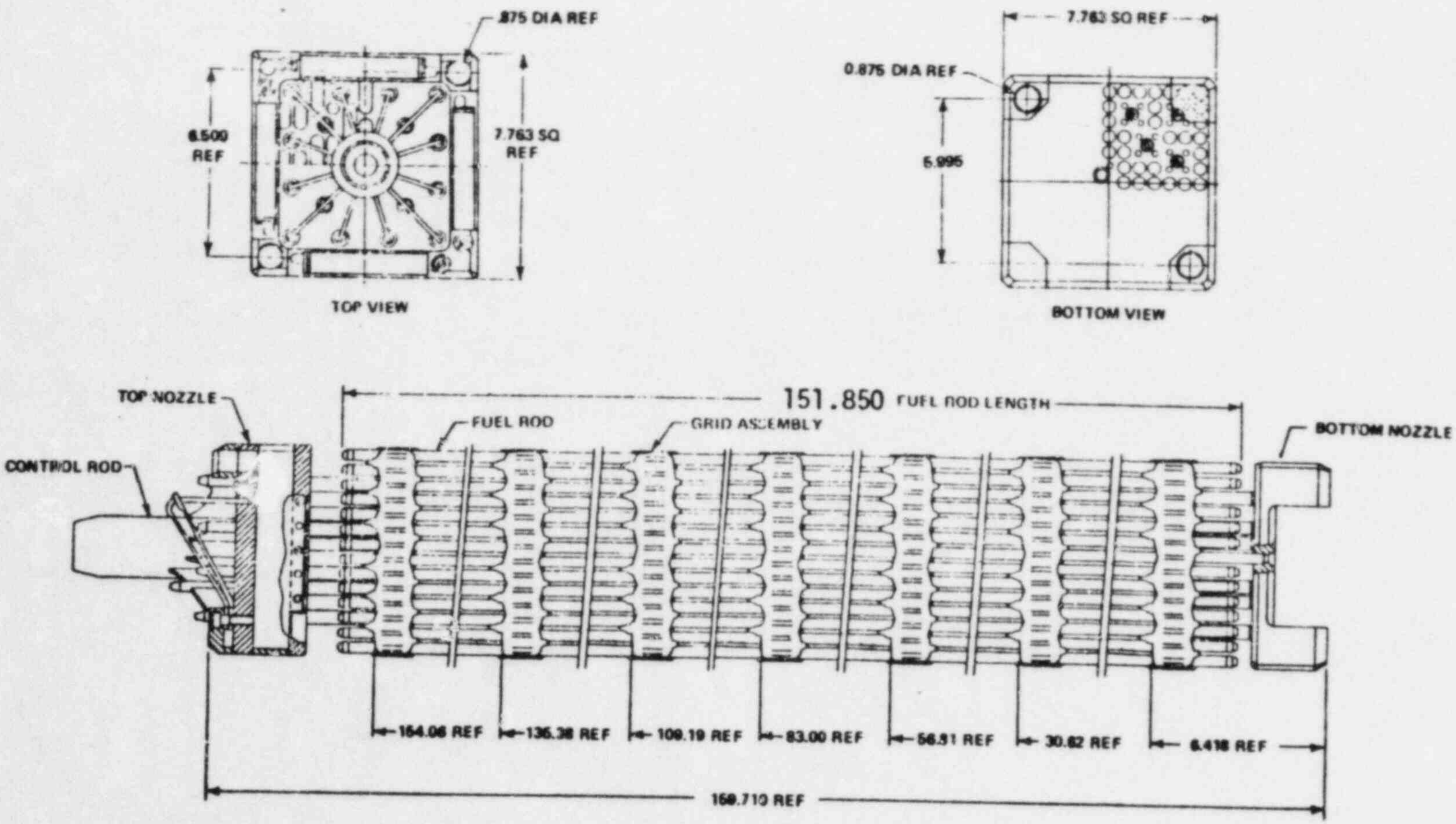

Z
270°
A
B
C
D
E
F
G
H
I
J
K
L
M
Outlet
Outlet
180°
Y
0°
W
90°
X
1
2
3
4
5
6
7
8
9
10
11
12
13
Control Rod Guide Tube Locations
CRGTs with a Missing Split Pin Nut

FIGURE 8



LOWER CORE SUPPORT STRUCTURE

FIGURE 9



Standard 14x14 Fuel Assembly Outline

FIGURE 10