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December 28, 1987
4410-87-L-0189/0328P

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sirs:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Use of Core Bore Machine for Dismantling the Lower Core Support Assembly

As discussed with the NRC TMICPD staff, GPU Nuclear has revised the concept for dismantling and defueling the Lower Core Support Assembly (LCSA). The original concept was submitted to the NRC via GPU Nuclear letter 4410-87-L-0160 dated December 3, 1987. However, based on further equipment testing, it has become necessary to revise the sequence of operations to be performed during LCSA dismantling and defueling. This letter supercedes the December 3, 1987, submittal.

GPU Nuclear will use the core bore machine in conjunction with the Automatic Cutting Equipment System (ACES) to dismantle the LCSA to facilitate defueling. (Attachment 1 is a cross-sectional drawing of the LCSA.) The dismantling of the LCSA will also provide access to the Reactor Vessel (RV) lower head for defueling. This letter requests NRC approval for the use of the core bore machine during the first phase of this defueling concept.

The first phase of LCSA dismantling and defueling will consist of using the core bore machine to first bore through all 52 incore spiders and then completely bore (i.e., sever from the LCSA) up to 15 outer periphery incore guide tubes. Upon completion of guide tube boring, the severed guide tubes will be flushed and removed from the RV in defueling canisters or in special storage containers based on an inspection of the guide tube. Next, the support posts will be bored through to the lower grid forging with 16 outer periphery supports posts being completely bored through the lower grid forging. The 16 outer periphery support posts will then be removed using the same criteria as the guide tubes. With these operations completed the LCSA

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will be ready for cutting with the ACES. However, ACES cutting operations are not within the scope of this submittal. ACES cutting operations are bounded by Reference 1. A future revision to Reference 1 will address all remaining issues regarding Lower Core Support Assembly and Lower Head Defueling activities.

Core Bore Machine

The core bore machine is the same machine that was utilized during the Core Stratification Sample Acquisition activities and also for the drilling of the core region. A general description of the core bore machine is provided in Section 2.4(a) of the Core Stratification Sample Acquisition Safety Evaluation Report (SER) Revision 4 (Reference 2). For this operation, the core bore machine will be modified, however, the modifications will not have any safety significance in regards to the proposed operation. These modifications include the addition of an underwater tool assembly changer, a spacer platform between the work platform and the existing interface platform, and changing from the existing 6 gpm flush pump to a 20 gpm flush pump for the drill string.

Previous core bore machine operations were performed with drill string components with a welded collar attached to limit the maximum drilling depth to the 293'-0 1/8" elevation. During LCSA core bore operations the maximum allowable drilling depth (i.e. drill string length) will be controlled to prevent the drill bit/cutter from getting closer than 3" vertically from any incore nozzle. The 52 incore nozzles terminate at various elevations relative to the radius from the RV center as do the drill depths required to complete boring of the incore guide tubes. Consequently six (6) different drill strings lengths are available for drilling operations. The drill string lengths are calculated using the following bases.

1. The length of each individual drill string section will be measured and verified to be within 0.125 inch of the nominal length specified.

2. The maximum gap at each of the drill string sections/tool assembly joints, which could increase the drill string length accordingly, is 0.125 inch.

3. The elevation of the drill unit chuck clamp is used as the reference elevation for the drill string.

A collar welded to the top of the top casing section of the drill string will physically stop the drill bit/cutter from being lowered beyond a predetermined elevation. In addition, the drilling depth required to complete a cut/drill sequence at a particular location will be specified on the data sheet of the operating procedure. The installation and use of drill strings will be administratively controlled via the operating procedure.

To sever the incore guide tubes, two (2) different tool assemblies (i.e., drill bits) must be used. The first drill bit [6 3/4" outside diameter (OD) x 1 15/16" Inside Diameter (ID)]* will bore a hole through the lower grid rib section and distributor plate. A second drill bit (6 1/2" OD x 5" ID) will pass through the forging, and then bore through the incore guide support plate, and the flow distributor head. This will sever the incore guide tubes. Only one (1) drill bit (6 3/4" OD x 5 1/4" ID) is necessary to sever the support posts. This drill bit will bore the support posts by passing through the lower grid rib section and the distributor plate and lower grid forging.

Safety Concerns

Safety concerns related to this operation such as the potential releases of radioactive material, criticality within the RV, and the potential for a pyrophoric event, have been previously addressed in the Core Stratification Sample Acquisition SER. The consequences of these issues are not altered by the use of the core bore machine on the LCSA. Consequently, operating procedures will incorporate the following restrictions:

1. An alarming water level instrument for the internals indexing fixture (IIF)/RV shall be operable.

2. The IIF/RV water level shall be determined and logged every hour.

3. The BWST shall be maintained at a minimum of 390,000 gallons and 4950 ppm Boron.

4. The Reactor Building sump shall be limited to a maximum of 70,000 gallons of water.

5. The weight on the drill bit shall be limited to 9000 lbs.

Reactor Vessel Integrity

The only unique safety issue associated with this activity is in regards to RV integrity, specifically the integrity of the incore nozzle welds. Previous GPU Nuclear and NRC correspondence (Reference 3 and 4) established two (2) possible incore nozzle configurations as a result of the 1979 accident. In the worst case, the damage to the RV lower head would consist of an incore nozzle melted to the inside diameter of the RV lower head with a nozzle to vessel weld thickness of only 0.030". The significance of this configuration is that if the weld experienced significant damage, the incore nozzle above the weld would have melted. The other possible configuration is that the incore nozzle was undamaged. Attachment 2 is a drawing of an intact incore guide tube/nozzle. The static load bearing capabilities (based on 70% of the ultimate strength) of the two (2) nozzle configurations were established as:

*NOTE: Drill bit sizes may change. Dimensions are approximate.

Undamaged Incore Nozzle

Axial (tension and compression)	158,000 lbs
Bending (moment)	42,000 in-lbs
Twisting (torque)	87,000 in-lbs

0.030 Thick Nozzle Weld (damaged)

Axial	5,400 lbs
Bending	1,400 in-lbs
Torque	5,800 in-lbs

Severed incore guide tubes will appear as in Attachment 3. Severing of the 15 incore guide tubes from the LCSA will cause them to drop when the flow distributor head is cut. The potential for hangup within the tool assembly is extremely remote because up to the time the incore guide tube is free to fall, the tool assembly has been moving and the tube has been stationary. It will drop essentially straight down as a result of being confined within the tool assembly and cutter head and will impact either the RV lower head debris bed, an intact incore nozzle, or the lower head proper.

The maximum weight of a severed guide tube is approximately 250 lbs and could drop a maximum of 20" assuming the tapered nozzle section has been melted off. If the incore guide tube is undamaged, it will drop only 8 1/2". A 250 lbs incore guide tube dropped a maximum of 20" may impact the hypothetically melted nozzle and weld imparting a dynamic compressive stress of approximately 18,700 psi on the nozzle and weld structure. This stress is approximately one-half of the yield strength and one-quarter of the ultimate strength of the weld material (Reference 5).

If the RV lower head debris bed is present at this time, the above calculated loads will be further reduced. In fact, if the tapered end of the incore guide tube is able to penetrate the debris bed only one foot, the impact would be totally absorbed by the debris bed. Further, if an incore guide tube is already buried in the debris bed, it will most likely not drop at all.

If an incore nozzle is undamaged, a configuration may be postulated in which the incore nozzle and incore guide tube are bridged together by solidified debris. In this configuration torque from the core bore machine could be transmitted directly to the incore nozzle once the guide tube is severed from the incore guide support plate. However, as mentioned previously guide tube hangup within the tool holder is extremely remote. Therefore, the transmission of torque from the core bore machine to the incore nozzle is not likely. In addition, the core bore machine has a torque limit of 6000-36,000 in-lbs. This is less than the torque required to damage an intact nozzle weld. Thus, even if torque is transmitted from the core bore machine to an intact incore nozzle, failure will not occur. If the incore nozzle weld experienced significant damage, the incore nozzle above the weld would have melted to the RV lower head inside diameter and such a bridge is not possible.

After completion of guide tube boring, the severed guide tubes will be removed from the RV. The removal of guide tubes will provide a 6 1/2" diameter pathway to the lower head for load drops. However, this potential load drop pathway can be qualitatively addressed. Video inspections of the lower head during the past years have provided an opportunity to visually observe eight (8) incore nozzles. Five (5) of these 8 nozzles are below one of the incore guide tubes that are to be bored. The video inspections reveal that all but one of the nozzles are undamaged with the one incore nozzle slightly melted at the upper end. Therefore it may be concluded that the incore nozzle to RV weld of these 8 nozzles are undamaged. The 8 nozzles that have been observed are in close proximity to the incore nozzles that are under the 15 incore guide tubes that are to be severed (e.g., as stated previously five (5) incore nozzles are below incore guide tubes that are to be severed). Therefore, it is unlikely that any of the incore nozzles are significantly damaged. Consequently, should a dropped object pass through one of the 6 1/2" diameter holes, it would most likely impact a strong, relatively undamaged nozzle and would not result in any incore nozzle to RV weld failure.

The severed support posts will appear as in Attachment 4. The majority of support posts, when boring is complete, will have a cruciformed piece of the lower grid rib section attached to its upper end. When the boring is complete, these support posts will not drop any distance since the lower grid forging will not be bored. The 16 outer periphery support posts will have a cruciformed piece of lower grid rib section attached to its upper end and a piece of the forging attached to its lower end. The outside diameter of this piece will be 5 1/4" and it will weigh approximately 120 lbs. When the boring is complete, the piece will drop out of the drill bit and fall onto the incore guide support plate; a distance of 1/2". The total energy imparted to the incore guide support plate is 126 lbs. If the support post is filled with core rubble, the maximum impact to the incore guide support plate would be approximately 175 lbs. These forces will not damage the incore guide support plate. Consequently, the boring of the support posts is completely isolated from the RV lower head and the incore nozzles.

Conclusion

The above discussion demonstrates that the loads imparted to an incore nozzle weld will remain below the minimum loads necessary to cause a failure of the weld. Therefore, it may be concluded that this proposed operation does not represent an unreviewed safety question. The operation does not increase the consequences or the probability of an accident previously evaluated, create the possibility for an accident of a different type then those previously evaluated, or reduce the margin of safety as defined in the Technical Specifications. In addition, this operation does not require a change to the

Plant's Technical Specifications. GPU Nuclear believes that the core bore machine can be used for the operations described without presenting an undue risk to the health and safety of the public.

Sincerely,

Thomas F. Demmitt

for F. R. Standerfer
Director, TMI-2

CJD/eml

Attachment

cc: Regional Administrator, Region 1 - W. T. Russell
Director, TMI-2 Cleanup Project Directorate - Dr. W. D. Travers

REFERENCES

1. Safety Evaluation Report for Core Support Assembly and Lower Head Defueling, Revision 2, 4710-3221-86-011, November, 1987.

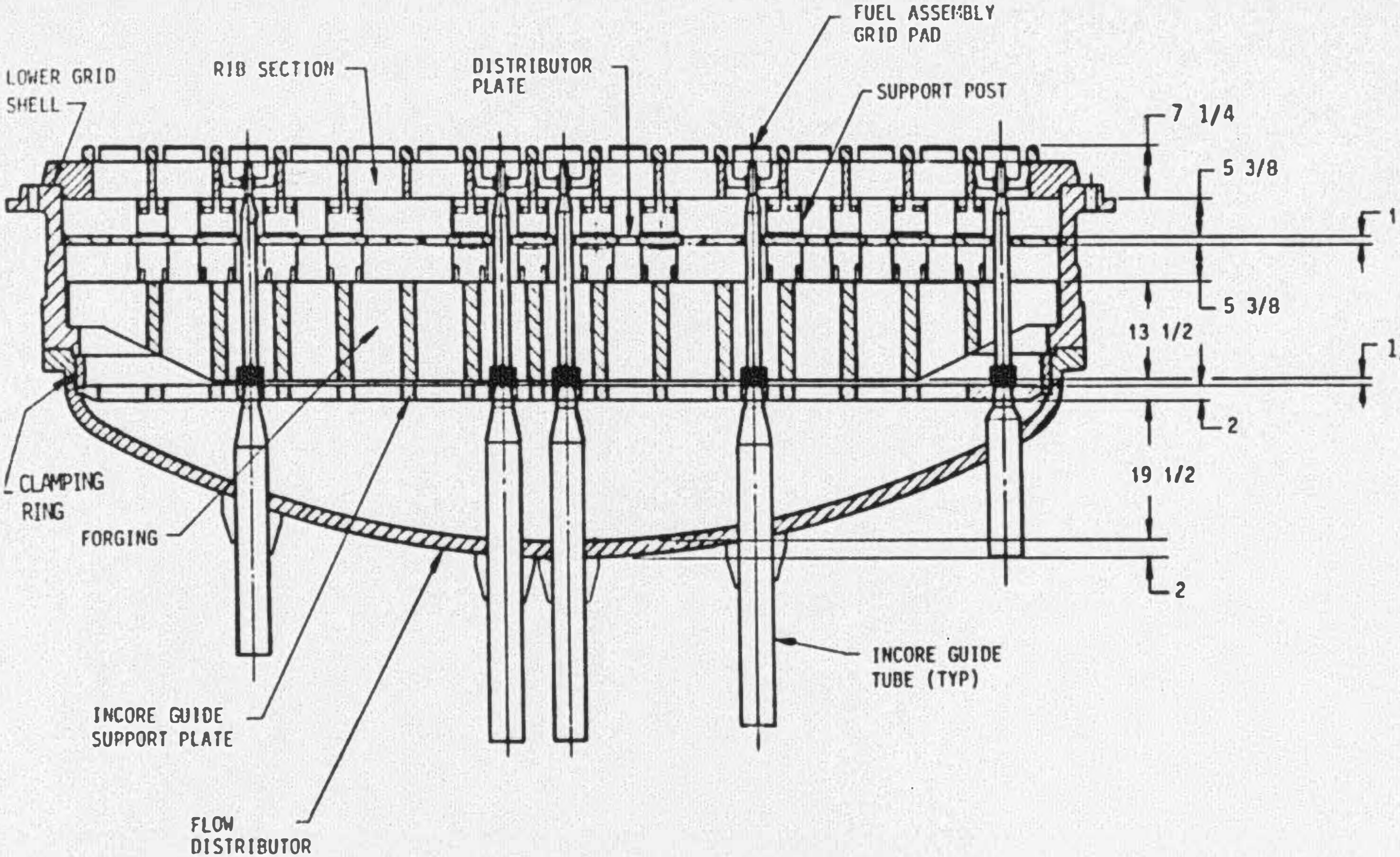
2. Safety Evaluation Report for Core Stratification Sample Acquisition, Revision 4, 15737-2-G07-109, July 3, 1986.

3. GPU Nuclear letter 4410-87-L-0162, dated September 19, 1987, "Core Bore Operations," to W. D. Travers from F. R. Standerfer.

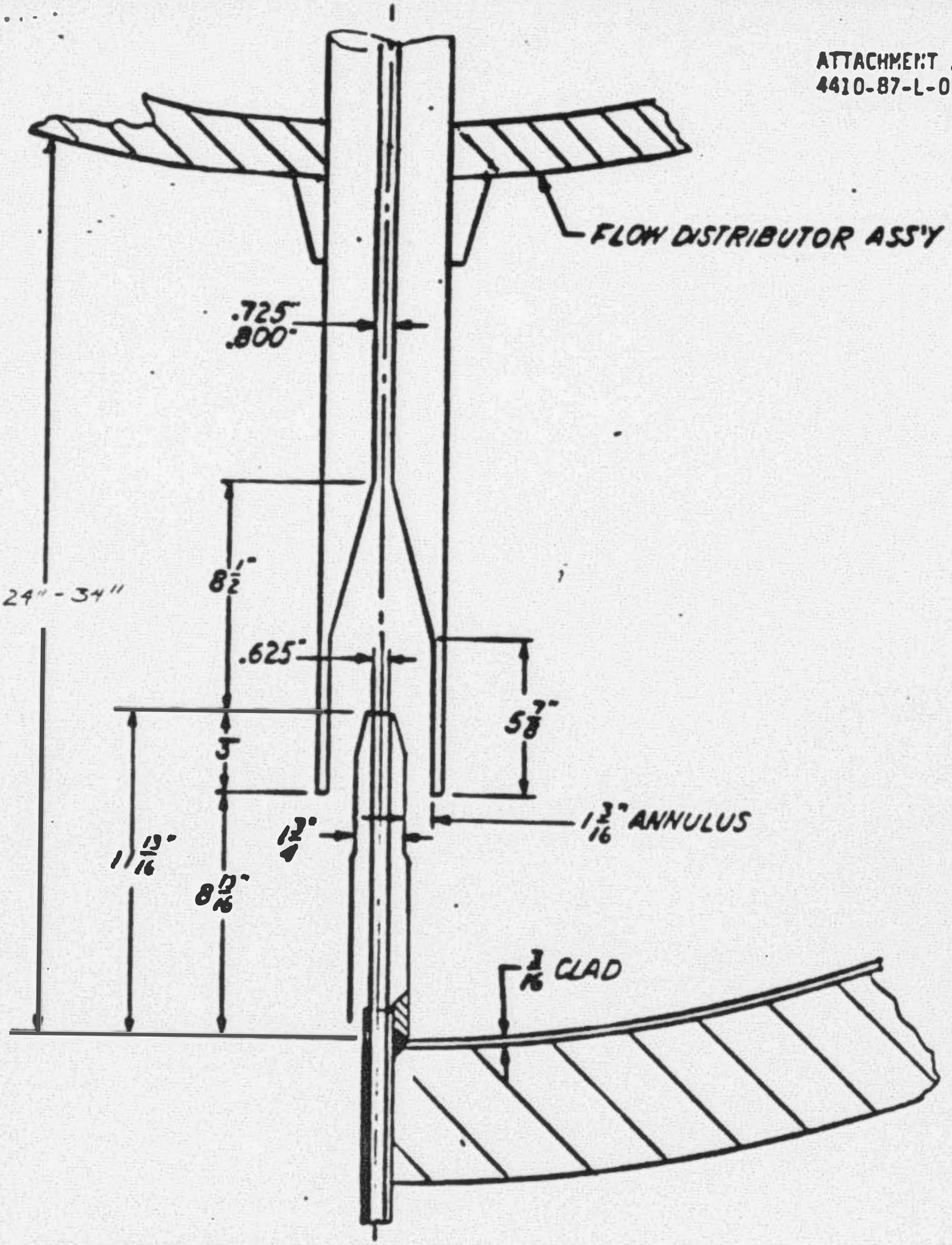
4. NRC Letter NRC/TMI-86-01, dated October 16, 1987, "Core Bore Operations," to F. R. Standerfer from W. D. Travers.

5. ASME Boiler and Pressure Vessel Code, 1983 Edition, Section III, Appendices.

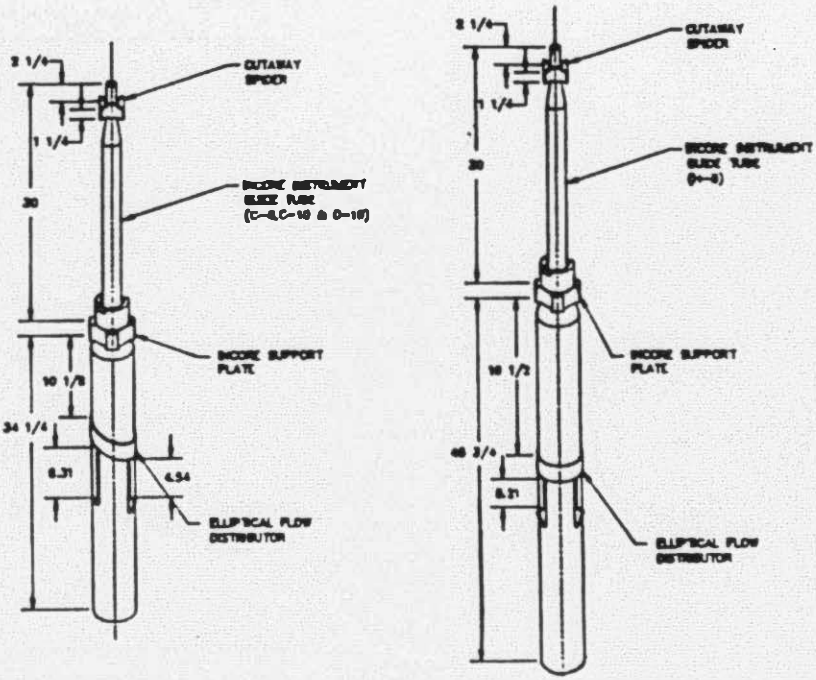
Cross Section of Lower Grid, Flow Distributor and Guide Tube Assembly



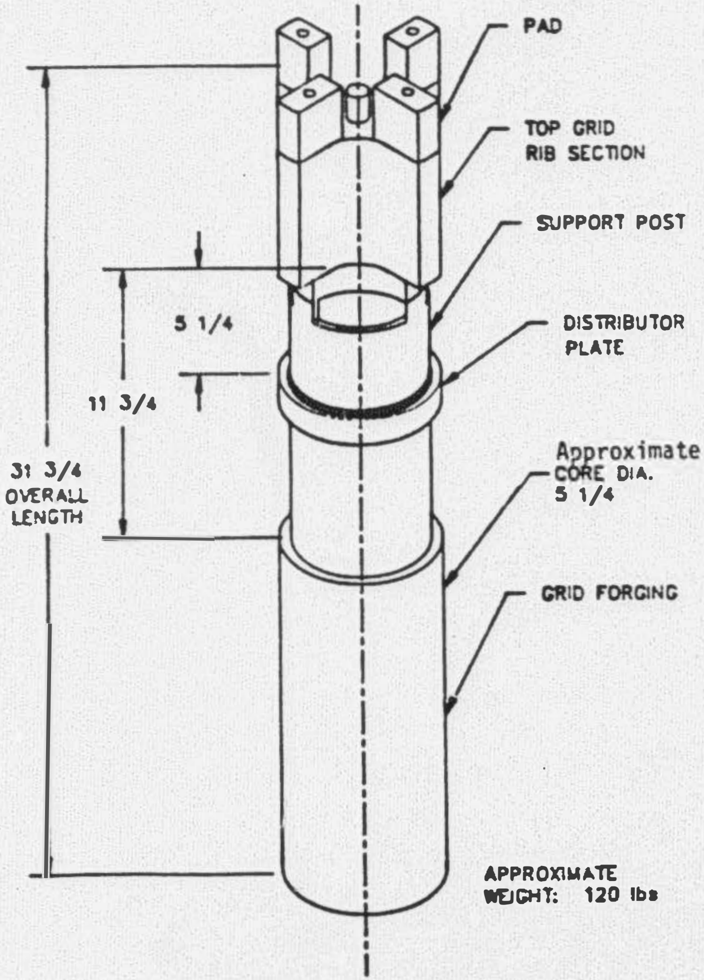
ATTACHMENT 1
4410-87-L-0160



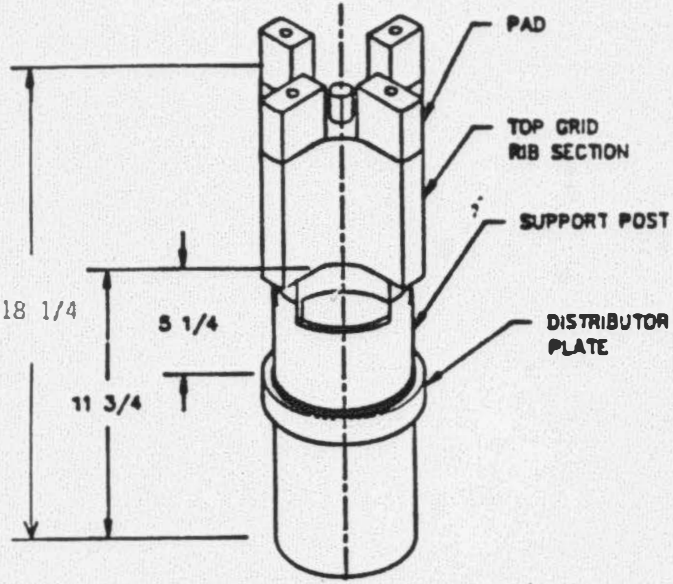
LOWER GRID FLOW DISTRIBUTOR &
GUIDE TUBE ASSEMBLY



BORED INCORE GUIDE TUBE



Support Post Bored Through
The Grid Forging



Support Post Bored To
The Grid Forging

ATTACHMENT 4
4410-87-L-0160