

INVESTIGATIVE TESTING FOR RESOLUTION OF PETITIONERS' ALLEGATION,
SECTION III, ITEM A, PAGE 14
(UNDERCUT TOLERANCES ON MAXIBOLT ANCHORS)

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SCOPE:

The purpose of this report is to document the testing conducted in response to petitioner's allegations of inspection failure to check undercut tolerances on Maxibolt expansion anchors.

BACKGROUND:

On October 17, 1986, petitioners CASH and Wells Eddleman alleged that inspection personnel failed to check the undercut tolerances on Maxibolt expansion anchors. In order to fully address any concerns as to the integrity of installed Maxibolts, a test program was initiated. The testing program was designed to simulate the worst postulated case where no undercut was made in the Maxibolt hole.

TEST PROCEDURE:

A review of subject anchor placements revealed that a large percentage of the Maxibolts installed to date were 3/4" diameter. Thus, 3/4" diameter anchors were chosen for the test.

The anchors were installed in the elevation 236' concrete slab just west of the intersection of N line and 44 line. Prior to anchor drilling, the area was scanned by the Radar Rebar Locator to determine the location of top mat rebar. The anchor holes were then drilled to avoid contact with the top mat rebar. The anchor holes were then drilled to avoid contact with the top mat rebar. In addition, prior to drilling, the Maxibolt drill bit was checked and found to be within allowable tolerances.

A total of three anchor holes were drilled. The holes were drilled in complete compliance with WP-42 using the proper size drill bit. However, the holes were not undercut in order to provide the worst possible scenario for anchor performance.

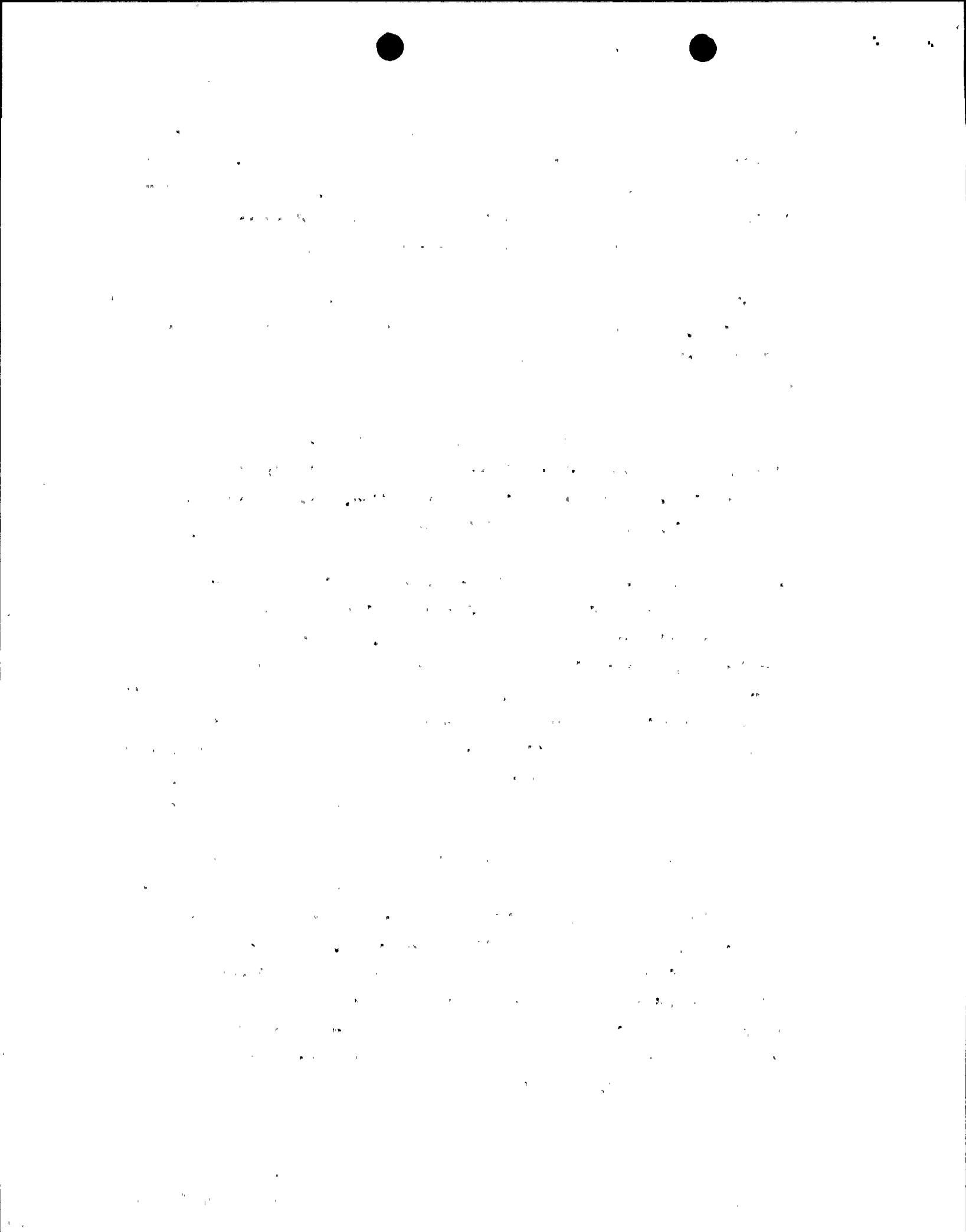
The 3/4" diameter anchors were then preset in the drilled holes using a hydraulic ram as outlined in WP-42. The ram gauge pressure was steadily increased until a pressure of 4350 psi was attained. A 3" x 3" x 1/2" A-36 bearing plate was then placed over the anchor and a nut and washer were also placed on top of the plate over the anchor.

The anchor was then tensioned per WP-42 until a gauge pressure of 4350 psi was obtained. The nut was snugged down on the washer by hand and then the load on the anchor was released such that the anchor was fully pre-loaded.

Two of the anchors were allowed to set undisturbed for a period of 24 hours in order for anchor relaxation to occur. The third anchor was tested immediately after the initial pre-loading. The anchors were tension tested as prescribed in WP-42 and TP-39, Appendix B.

The anchors were tension tested by applying a tensile load on the anchors via a hydraulic ram and threaded rod couples that attached to the top threads above the nut on the expansion anchor. The ram was supported on a rigid stand. The ram hydraulic pressure was measured using a calibrated pressure gauge (gauge number CPL-5889B). Per Appendix B of TP-39, a 3/4" diameter anchor is considered to be acceptable if it can withstand a tension load of 12002 lbs. This equates to a hydraulic ram gauge pressure of 2540 psi using a hydraulic ram having an effective area of 4.725 in^2 . See Figure 1 for a depiction of the entire tension testing assembly.

A uniformly increasing load was applied to the expansion anchor via the hydraulic ram until the minimum tensile static test load gauge pressure of 2540 psi was obtained. At this time the washer under the expansion anchor nut was tested to see if slip had occurred. Slip is defined as the point at which the washer can be rotated using only finger pressure. No slip occurred at the minimum tensile static test load on any of the three anchors tested. The tensile load was then uniformly increased (with the concurrent test for anchor slip) until a gauge pressure of 3000 psi was obtained. No slip of any anchor was noted.



In addition, Anchor No. 1 was loaded to the maximum gauge pressure of 5000 psi at the request of the NRC Resident Inspector. No slip was noted at the maximum gauge pressure.

CONCLUSION:

This testing demonstrated that there was no loss of anchor performance as a result of the failure to undercut the drilled hole. The test results are provided in Table 2. The three anchors installed tested to the minimum required gauge pressure 2540 psi without slip. The anchors were tested as required in TP-39, Appendix B, for 3/4" diameter Maxibolt expansion anchors. At the request of the NRC Resident Inspector, George Maxwell, the anchors were then further loaded as indicated in the test results. This additional loading was not required and was performed strictly for the purposes of demonstrating the reserve factors of safety available.

The test results achieved on 3/4" diameter anchors will be equally applicable to the other anchor diameters. The test results of the anchor having a gauge pressure of 5000 psi show that no slip occurred at a load of approximately 23,000 lbs. This load actually exceeds the average slip load of 20,000 lbs that can normally be expected from a properly undercut and preset 3/4" Ø anchor. Thus, the absence of an undercut does not appear to detrimentally affect the anchor performance. Similar results can be expected on the other anchor diameters as all anchor diameters are loaded to a uniform stress of 81 percent of yield.

In conclusion, the test conditions represent a worst case postulation of Maxibolt undercut tolerances where no undercut exists. Thus, the alleged failure of inspection to check undercut tolerances would in no way have affected the anchor quality.

TABLE 1

TEST RESULTS

<u>ANCHOR I.D.</u>	<u>GAUGE PRESSURE (PSI)</u>	<u>REMARKS</u>
1	5000	no slip
2	3000	no slip
3	3000	no slip

NOTES:

Anchor No. 1 was tested initially to a gauge pressure of 2540 psi and then allowed to relax for 24 hours. It was subsequently tested to the maximum pressure reading of 5000 psi.

Anchor Nos. 2 and 3 were allowed to relax for 24 hours and the tested to a gauge pressure of 3000 psi.

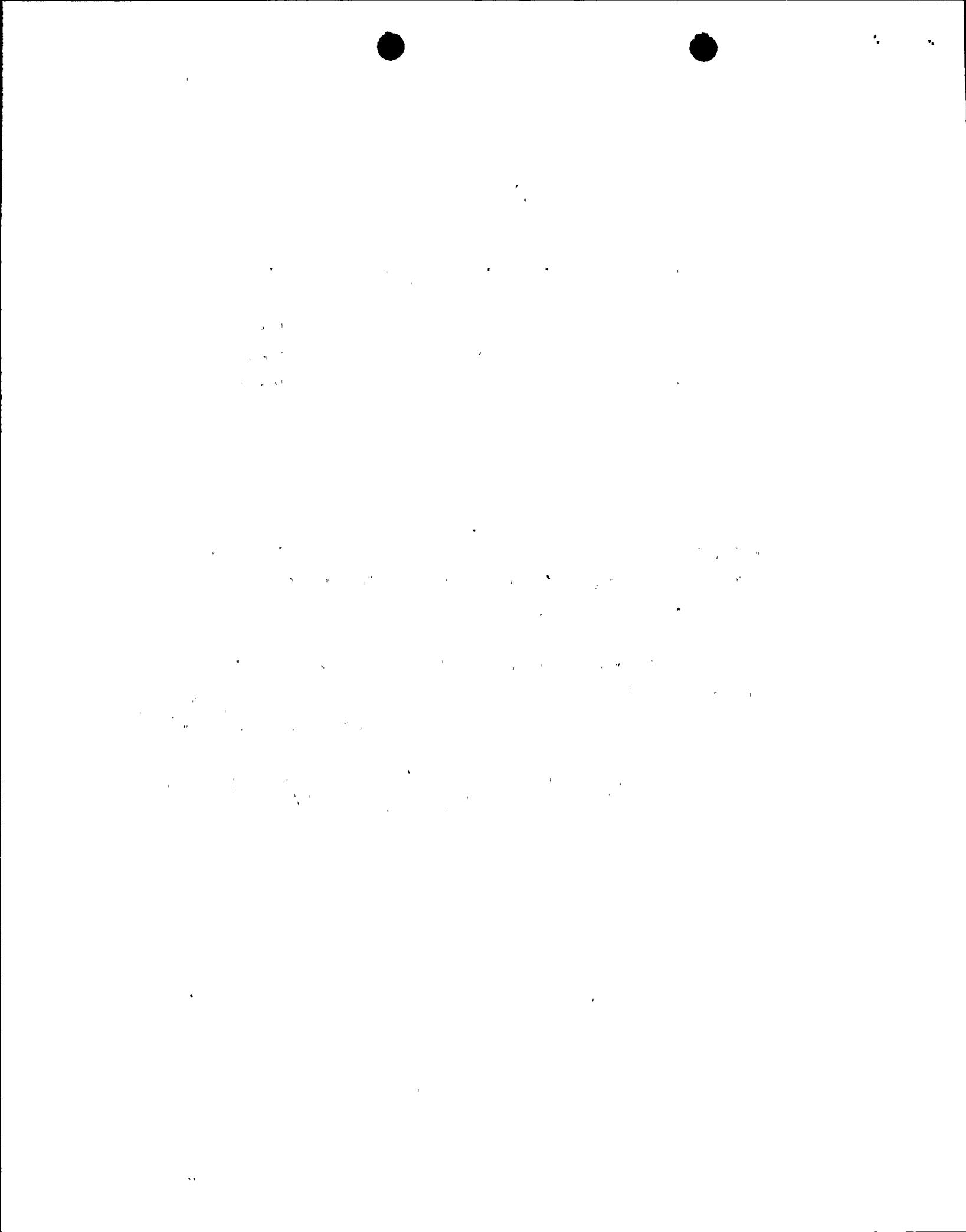
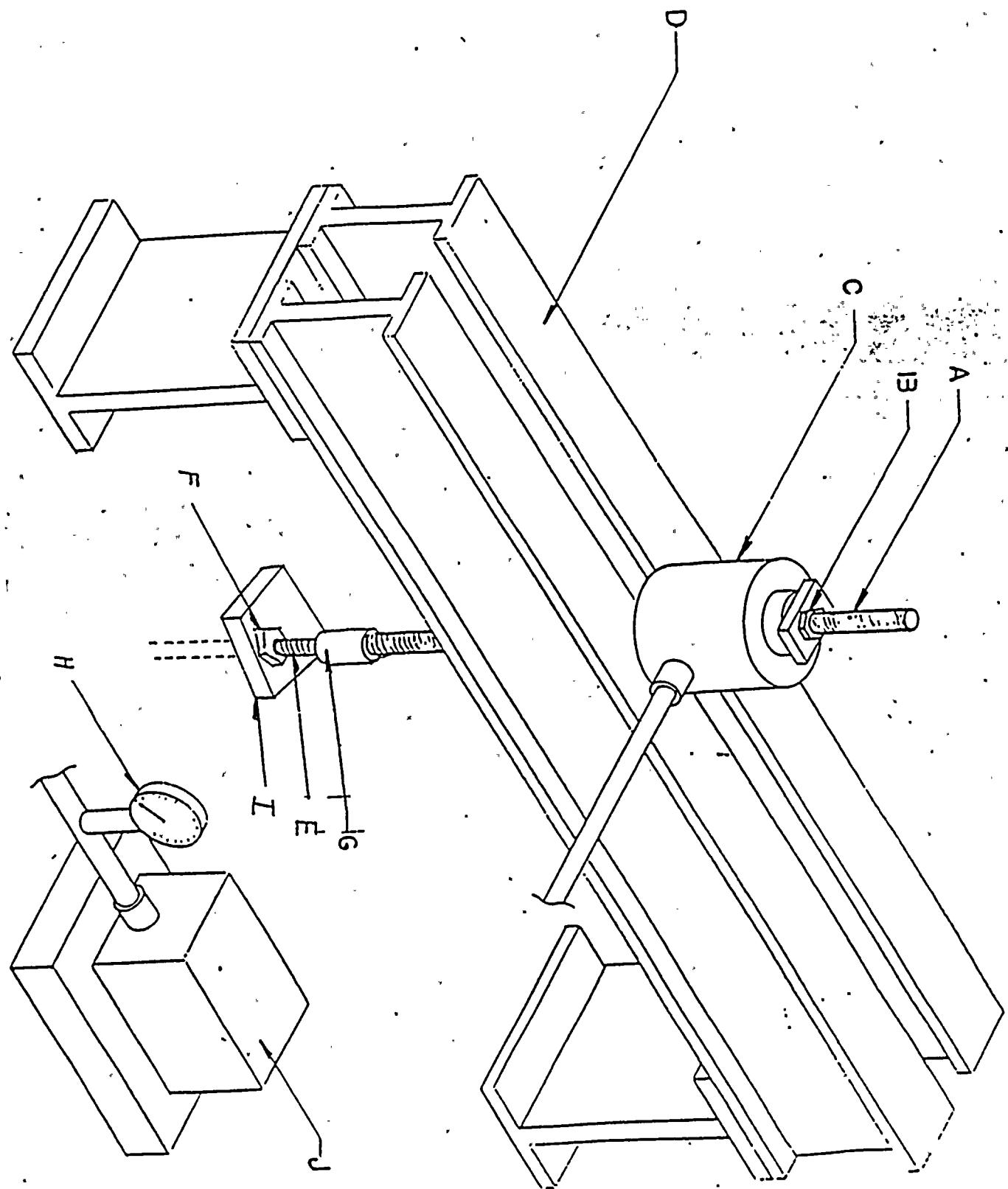


FIGURE 1



NOTES FOR FIGURE 1

- A. Threaded Tensioning Rod
- B. Tensioning Nut
- C. Hydraulic Ram (Area = 4.725 in²)
- D. Rigid Support Stand
- E. Expansion Anchor
- F. Expansion Anchor Nut and Washer
- G. Internally Threaded Coupler
- H. Calibrated Pressure Gauge
- I. Bearing Base Plate
- J. Hydraulic Pump (Hand Operated)

