

STATUS OF INVESTIGATION AND CORRECTIVE  
ACTION FOR MCAR 34 (DROP-IN ANCHORS)

The design loads listed for drop-in anchors in Specification 7220-C-305, Table 3.2 were established by project engineering based on ultimate loads determined by Hilti, the manufacturer, through its own testing program. These design loads are one fifth of the ultimate load.

Project engineering met with a representative of Hilti at the Midland site to witness onsite testing and installation practices used for the drop-in anchors. Only the electrical group used the drop-in anchor bolts for substantial loads; the other groups have limited their usage to loads of less than approximately 200 pounds.

The Hilti representative verified that the testing procedure used is consistent with Hilti's own test procedure. He emphasized that, if the plug which expands the anchor is not driven in completely with the Hilti tool, the full capacity will not be attained. The design of the Hilti drop-in anchors and the method of setting are illustrated in Figure 1. Based on a preliminary investigation on August 23, 1979, some of the installed plugs were found to be not fully driven into the anchor; however, the extent to which this contributed to the cause of the anchor failures was not established. It was determined that further testing would be needed to establish the specific cause(s) and extent of the anchor's failure to pass the test.

It was decided to test a random sample of 100 anchors (consisting of 3/8", 1/2" and 5/8" sizes) to evaluate the adequacy of those which were fully set and of those which were only partially set. The results of the testing were as follows:

1. Of 101 anchors, 20 were found to be properly set.
2. It was possible to complete setting an additional 24 of the remaining 81 anchors which had not been completely set when first installed.
3. The 44 anchors which were completely set were tension tested using test loads which were two times the design allowable tension loads, and one of these 44 exhibited slippage.\*
4. Some of the remaining 57 anchors were tension tested, but due to the fact that they were not properly set, the test results were deemed to be meaningless.

To adequately evaluate the installation of the 5/8-inch anchors, additional information was necessary. This was obtained from the testing of 8 more 5/8-inch anchors (in addition to those which were among the 44 previously tested--20 which were set properly from the outset and 24 which were reset properly). Of the 8, 4 exhibited slippage. Therefore, of the 52, in toto, 5 exhibited slippage.

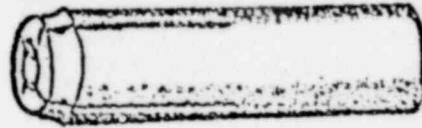
\*Slippage is defined as the ability to manually rotate the washer with one's fingertips while the anchor is under the test load.

The testing criteria may be conservative in requiring no slippage for the test load. Further testing will be done on a limited number of anchors to determine their actual ultimate capacity.

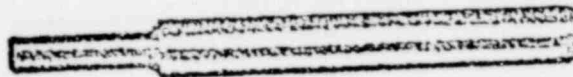
The field verified that all attempts to completely set the remaining 57 drop-in anchors were unsuccessful. The manufacturer and construction have not yet determined the reason some anchors previously installed incompletely cannot be completely set at a later date.

Drop-in anchor installation has been suspended until the investigation is complete. Additional corrective actions will be determined at the conclusion of the testing program.

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TYPICAL HILTI DROP-IN ANCHOR

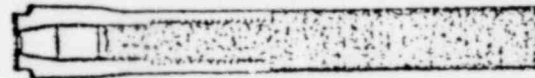


HILTI SETTING TOOL

POOR ORIGINAL



BEFORE EXPANSION



AFTER EXPANSION

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FIGURE 1.