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AUTH.NAME AUTHOR AFFILIATION
CURTIS,N.W. Pennsylvania Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: Interim deficiency re potential deficiency in amphenol connectors & Cutler Hammer E-30 switches.Defective conditions not fully analyzed for safety implications.GE 791210 ltr encl.

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NORMAN W. CURTIS
Vice President-Engineering & Construction
821-5381

January 11, 1980

Mr. Boyce H. Grier
Director, Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

SUSQUEHANNA STEAM ELECTRIC STATION
UPDATE IN THE STATUS OF POTENTIAL DEFICIENCY IN
AMPHENOL CONNECTORS AND CUTLER HAMMER E-30 SWITCHES
ERs 100450/100508 FILE 840-4
PLA-438

Dear Mr. Grier:

The defects and conditions outlined in our PLA-399 of September 11, 1979 and updated in PLA-409 of October 11, 1979 are still under review for a final determination of their reportability under 10 CFR 50.55(e). Our Nuclear Steam System Supplier, General Electric, has provided an evaluation of the subject conditions in an attachment to their letter GB-79-283 dated December 10, 1979. The GE evaluation detailed the steps it has taken to analyze the amphenol connector conditions originally reported in Bechtel's MCAR 1-37 of August 22, 1979.

The GE Quality Study, done on the sample amphenol connectors in question, is under Bechtel and PP&L Engineering evaluation. GE has stated in GB-79-283 (attached) that the condition identified in conjunction with the connectors is not reportable.

The defective conditions identified in regard to the E-30 switches have not been fully analyzed for their safety implications, as indicated in the same GE letter.

We are continuing to pursue these problems and will advise the Commission of our position once the evaluations are completed by General Electric and Bechtel.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction

Attachments 1 & 2
FLW/ARS:mcb
cc: Mr. Robert M. Gallo
U. S. Nuclear Regulatory Commission
P. O. Box 52
Shickshinny, Pennsylvania 18655

Mr. G. McDonald
Office of Management Information & Program Control
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Victor Stello (15)
Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SBM ~~H.V. OTTEN~~ MS

GENERAL ELECTRIC

NUCLEAR POWER

RECEIVED DIVISION
DEC 17 1979
SUSQUEHANNA PROJ.

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
MC 394, (408) 925-3005

December 10, 1979
Responds to: BLG-2164 & BLG-2204
GB- 79-283

SUSQUEHANNA SES
ER 100450
FILE No. 536-238

	Proj. Director
X	Asst. Proj. Director
X	Mgr. Proj. Services
X	Cost & Schedule
X	Contracts
	Licensing
	Nuc. Plt. Engr. Mgr.
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	Spare Parts
	Containment
	Services
	Plant Suat.
	S&I Supv.
	Field C&S
X	Proj. Const. Mgr.
X	LF

Mr. E. B. Poser
Bechtel Corporation
P. O. Box 3965
San Francisco, CA 94119

Dear Ed:

SUBJECT: SUSQUEHANNA 1 & 2
DEFECIENCIES IN AMPHENOL CONNECTORS AND ELECTRO SWITCHES

We had considerable difficulty over the past months in obtaining examples from the site of amphenol connectors that were supposed to exhibit the pin retention problem. Some examples were obtained and evaluated by our QC personnel. We are attaching a copy of the special quality study that was performed on these connectors. It is dated November 29, 1979, Rev. 0.

The reports concludes that none of the connectors provided can be determined to substantiate the conditions reported in your letter BLG-2164. In the report Items IIIB and IIID include comments items that may require more careful attention at the site in the process of inspecting and reworking cables using these connectors.

We find that no corrective action plan by GE is required. In addition, there is no indication that safe operation of the plant would have been adversely affected if the reported condition had gone undiscovered.

We have made arrangements with Cutler Hammer to provide appropriate personnel to visit the site and inspect the electro switches which you have reported with various problems. A. Lileck, stationed at the GE Site Office is in direct contact with Cutler Hammer and making arrangements for a mutually acceptable date for a visit to the site. Please make the necessary Bechtel and PP&L personnel available to work with the vendor representatives. In addition, we would appreciate any problems which are a concern with these switches being brought up during that visit.

If you have any further questions, please contact Dick Lockett.

Very truly yours,

J. W. Millard
Project Manager
Susquehanna Project

JWM:bjr/1085-86

Attachment

cc: E. A. Gustafson
R. J. Shovlin
File: 16.14

GENERAL ELECTRIC

Rev.: 0
Issued: 11/29/79

CONTROL & INSTRUMENTATION DEPT.

QUALITY ASSURANCE
SAN JOSE, CALIFORNIA

SPECIAL QUALITY STUDY

SIZE 16 AMPHENOL PIN RETENTION

I. PURPOSE: The purpose of this four (4) part study was to evaluate the current quality of Amphenol 16AWG female pin retention in connector inserts by:

Test A: Evaluating four (4) connectors which were identified by the Susquehanna Site as having recessed pins and, therefore, suspected of being non-conformances with regard to pin extraction specifications.

Test B: Evaluating six (6) connectors which were identified by the Susquehanna Site as having low pin extraction values during their pull test inspections of PGCC cables.

Test C: The preparation of one (1) Amphenol connector with the pins inserted at varying amounts less than the specified depth and the subsequent evaluation of the extraction values of these prepared pins.

Test D: Evaluation of three (3) connectors which were identified by the Susquehanna Site as having recessed pins and, therefore, suspected of being non-conformances with regard to pin extraction specifications.

II. DETAILS OF TEST:

A. Details of Test A

The connectors were selected at the site and cut off behind the cable clamp leaving pins/crimps intact. They were selected because there was some variability in pin insertion depths, making them suspect regarding pin retention. These four (4) connectors were tested for pin extraction by attaching Hemostats to individual wires near the connector insert and pulling smoothly and axially to extract each pin from the insert. Maximum extraction force was recorded by pin letter location. Measurements were made with an Ametek L-30 force gage using a minimum of three (3) seconds to reach extraction force.

Extraction Force vs Population histogram is attached as Appendix "A". Every pin in each connector was tested.

B. Details of Test B

The six (6) Amphenol connectors were replaced at the site due to low retention of pins and sent to San Jose as examples of the pin retention problem. They were reassembled using new 16AWG female Amphenol pins crimped and inserted with 20AWG wire. The only exception was one (1) forty eight (48) pin Amphenol connector that was reassembled using site supplied 20AWG pre-crimped wires in 16AWG pins. Subject connectors after assembly were allowed to sit untouched for two (2) days. All connectors were assembled using standard cable assembly methods and tools.

These connectors were tested for maximum extraction force as in "A" and the data recorded by pin letter location.

An Extraction Force vs Population histogram is attached as Appendix "B". Every pin was tested.

C. Details of Test C

One connector was selected from the group of six (6) site supplied connectors and twenty (20) pins were reinserted to previously determined depths. These insertion depths were .010" to .100 thousandths below full pin seating specification, in .010" steps. Less than one hour elapsed between insertion and extraction. Maximum extraction force was recorded by pin letter location.

Extraction Force vs Depth histogram attached as Appendix "C".

D. Details of Test D

These connectors were selected by site and cut off behind the cable clamp leaving pins/crimps intact. Their selection was based on some variability in pin insertion depths and therefore suspect regarding pin retention. These three (3) connectors were first tested by checking for varying pin seating depths. One cable was found to have six (6) recessed pins varying from sixty thousandths of an inch (.060") to two hundred fifty thousandths of an inch (.250"). The suspect connectors were then mated with appropriate male connectors and observed for pin movement, no movement was observed. These three (3) connectors were then tested for pin extraction by attaching Hemostats to individual wires near the connector insert and pulling smoothly and axially to extract each pin from the insert. Maximum extraction force was recorded by pin letter location. Measurements were made with an Ametek L-30 force gage using a minumum of three (3) seconds to reach extraction force.

Upon completion of pull testing these three (3) connectors, one (1) connector (with six (6) recessed pins) was returned to PGCC Cable Shop and all pins/wires were reinserted into connection insert in same locations as previously inserted, allowed to sit untouched one (1) day and re pull tested.

Extraction Force vs Population histogram is attached as Appendix "D" and "E".

E. Connectors to be tested

Test A - Four (4) Susquehanna Site supplied prepinned 16AWG Amphenol connectors.

Test B - Six (6) Susquehanna Site supplied 16AWG, Amphenol connectors.

Test C - One (1) Susquehanna Site supplied 16AWG, Amphenol connector. This connector was selected from a group of the six (6) connectors in Test B.

Test D - Three (3) Susquehanna Site supplied prepinned 16AWG Amphenol connectors.

F. Test Equipment

Ametek L-30 Force tester No. 26118 (Calibration due date 79-49-1) and Hunter Hemostats.

III. Conclusion

A. All pins evaluated for pin retention values (size 16 contacts) in the four (4) tests (above) were found acceptable and no site action is required (except as noted in B below).

Acceptance Criteria	10 lbs. minimum
Minimum Value Tested	10.5 lbs.
Mean Value Tested (Test A, B, & D)	20.9 lbs.

B. All six of the Test B connectors (rejected during site inspection of pin crimps strength) were expected to have a least one pin each with a retention value under eight (8) pounds if they were assembled with a 20AWG cable. Three of the six connectors were 48-pin size, all of which have 20AWG cables. The fact that they did not have low values suggests that some electricians are pulling with a greater force than specified or that some Ametek L-30 spring testers are not set or calibrated correctly. Both of these possibilities should be investigated at the site, with corrective action taken as appropriate.

C. The Amphenol connector design utilizes a plastic disc with thin molded collars which snap onto each pin when it is inserted to design depth in the connector insert. Test C was designed to investigate the possibility that pins not fully inserted might have low retention forces. Indirectly it would also check whether a defective or damaged collar would result in a low retention force.

The test demonstrated that pins inserted to less than the full specified depth did have substantially lower retention forces but were still above the required ten (10) pounds. The results varied from 11 pounds for a pin backed out 0.100" to a maximum of 20 pounds for pins backed out to a smaller degree (See Appendix C).

Our conclusion is that the locking collar aids pin retention but is not necessary to meet the minimum requirements of the MIL-STD.

D. These three connectors were received from the site in mid-November and the issue of this report was delayed to incorporate the results from them. There were six (6) pins in one (1) connector found to be recessed more than the allowed fifty thousandths of an inch (.050") as received. None of these pins showed low retention force as previously suspected.

This particular connector was of interest because the pin location of the conductors required a "basket weave" to get them from their location in the cable to their required location in the connector. After the first extraction test of this cable, a shop operator was asked to repin the connector to the original configuration. She admitted having a difficult time with one pin but was successful in achieving evenly seated pins. This connector had been reworked at the site prior to being cut off and returned to San Jose. It is probable that the six uneven pins were due to difficulty experienced in assembly by a less experienced electrician after site reinspection.

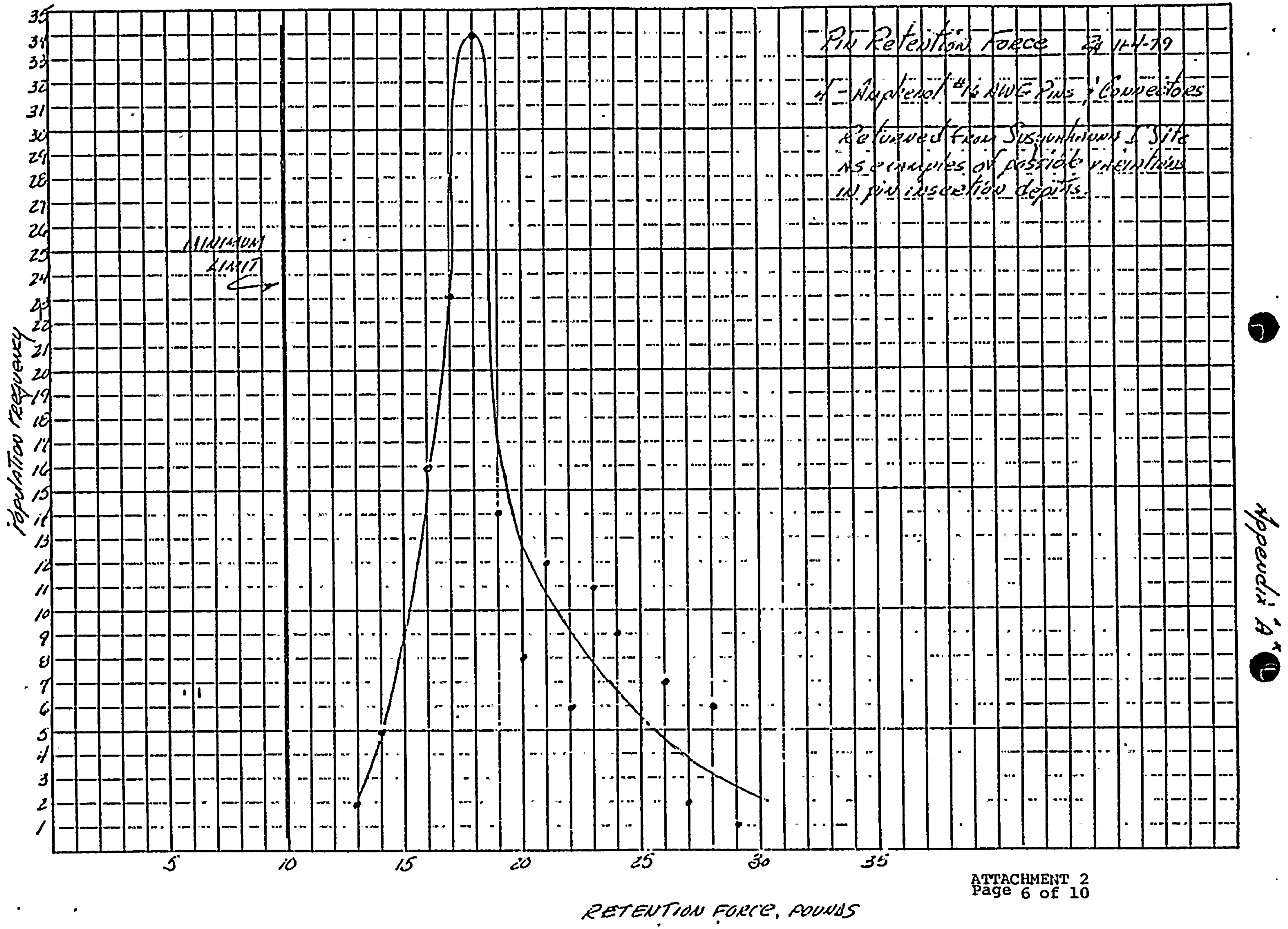
All the pins in the three (3) connectors met the minimum acceptable ten pound (10 lb.) retention force requirements by a wide six pound (6 lb.) margin. Some pins were bent but none to a degree which interfered with the mating connectors or which caused any noticable vertical movement when mated.

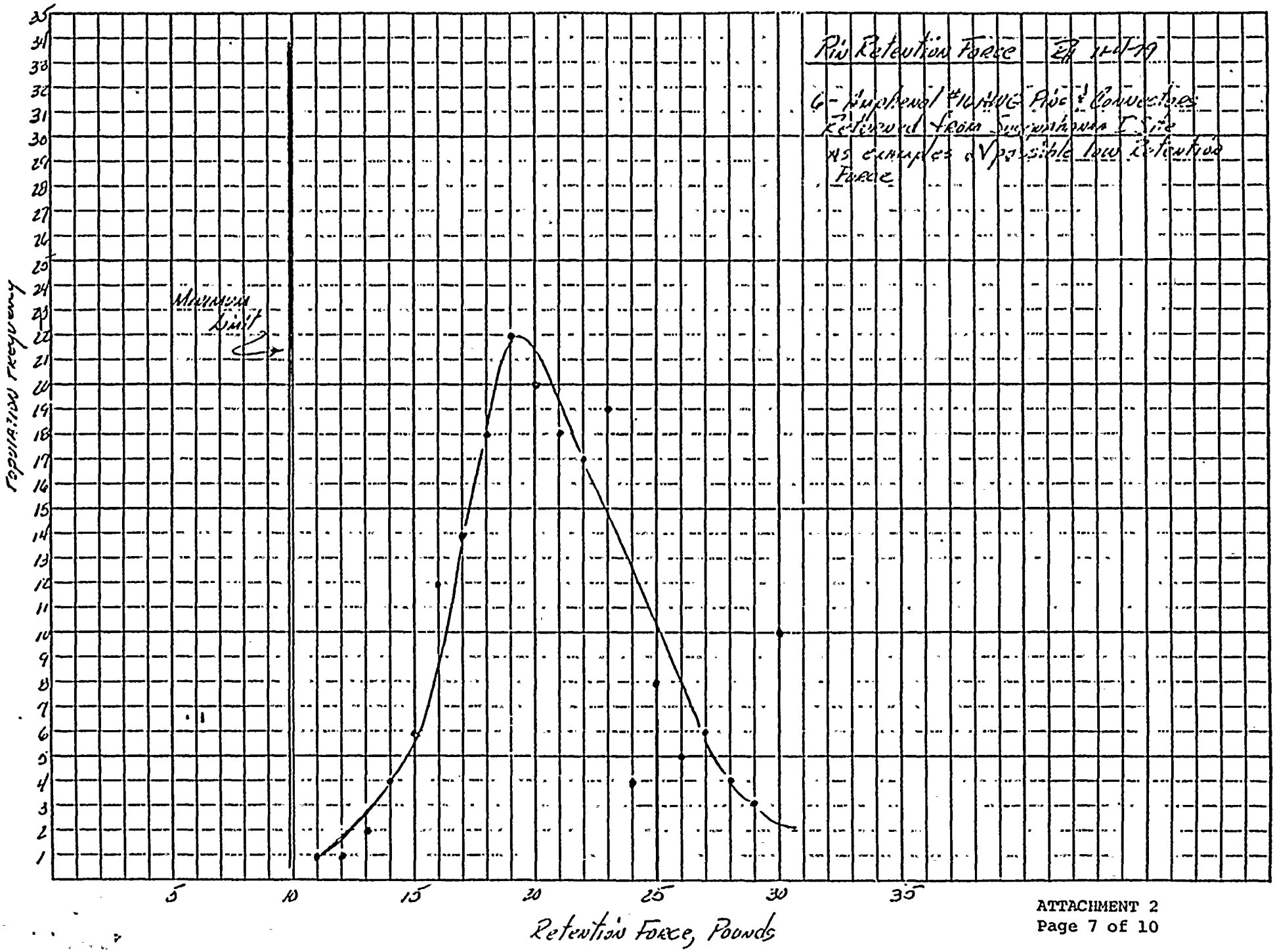
Probable cause of pin seating nonconformance was due to causes not related to these connectors (i.e. damaged mating connector, errors during assembly or rework at the site, etc.).

Procedure Approved by: D M Bunyan

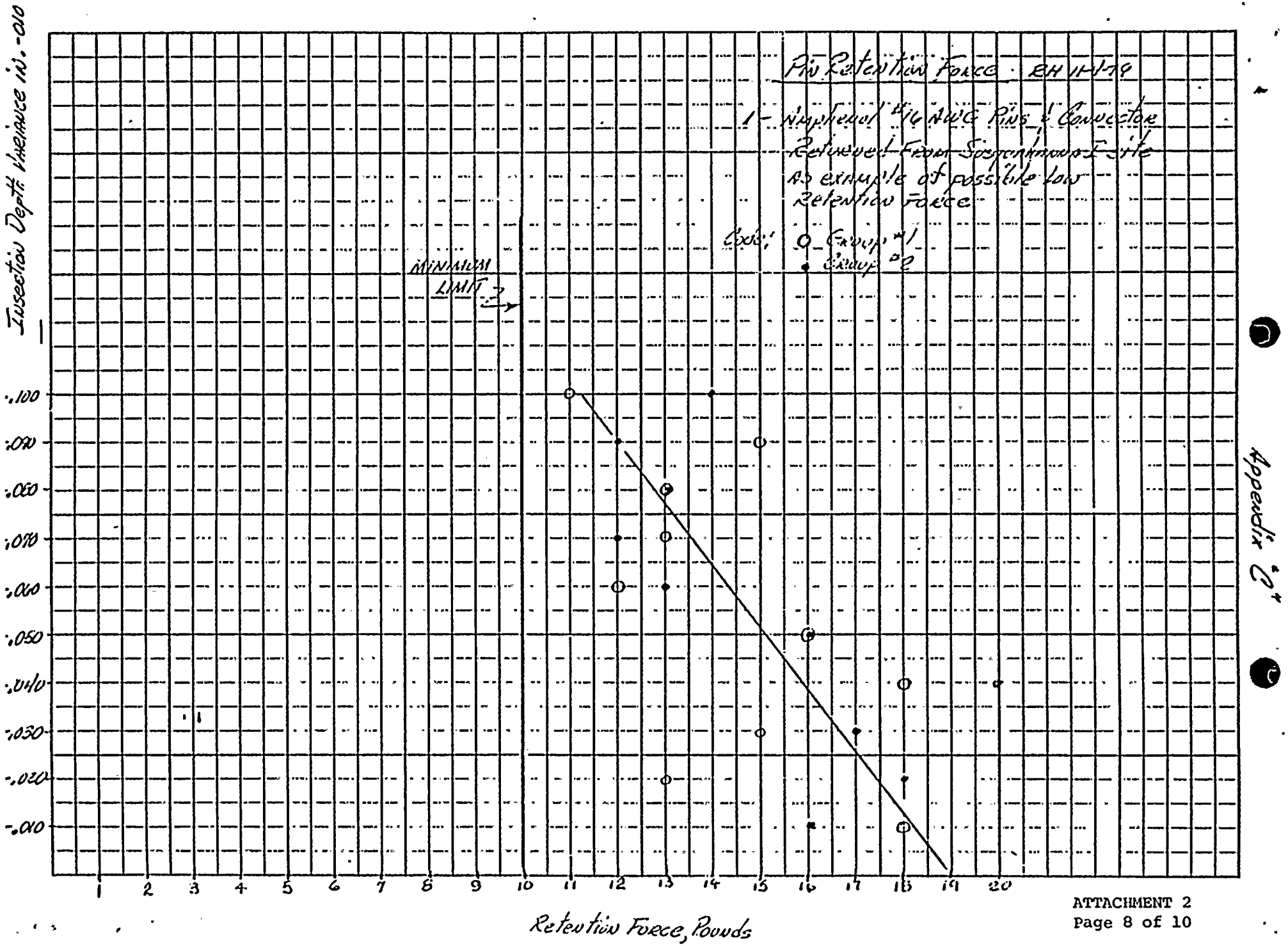
Test Performed and Documented by: Robert B Clauss

Conclusions Approved by: D M Bunyan 11/29/79

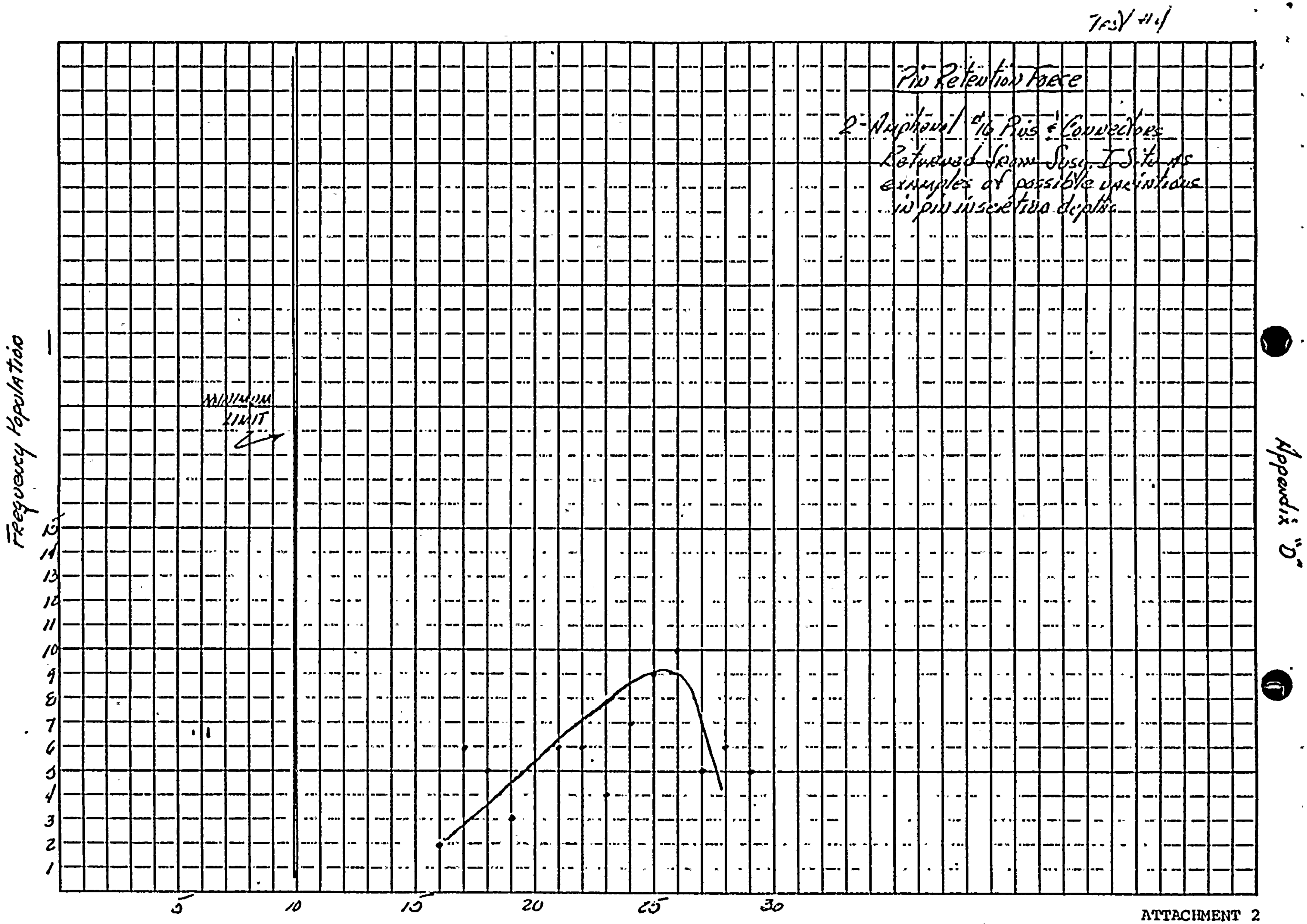

Pin Retention Force 11-4-79
4 - Amphenol #16 AWG Pins & Connectors
Returned from Susquehanna I Site
as examples of possible variations
in pin insertion depths.
MINIMUM LIMIT
POPULATION FREQUENCY
RETENTION FORCE, POUNDS
Appendix "A"


Pin Retention Force
Minimum Limit
Number Pins Retained
Retention Force, Pounds
5
10
15
20
25
30
35

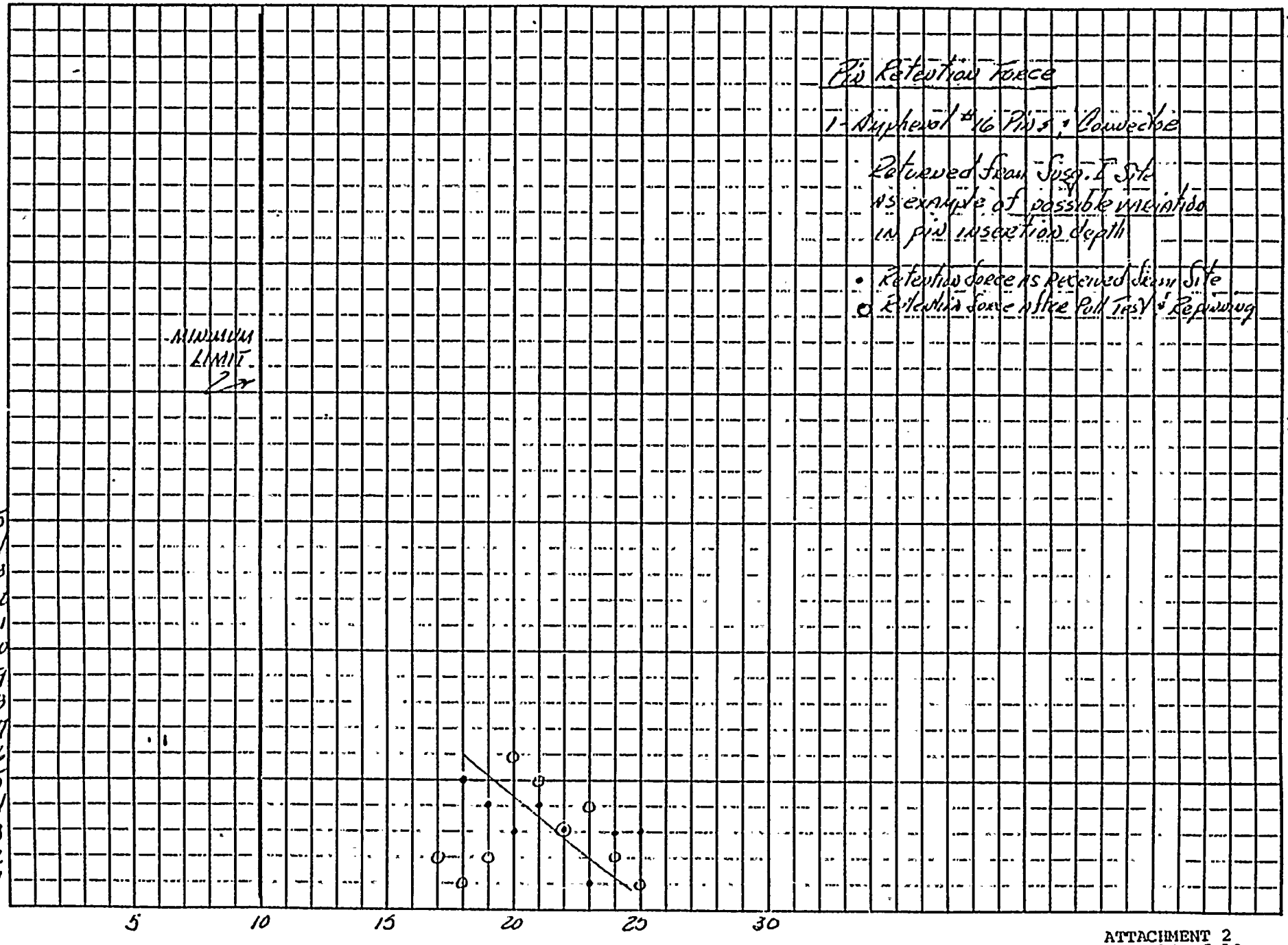
Appendix "B"


Pin Retention Force - EH IH-19
1 - Unplated 16 AWG Pin & Connector
Retrieved From Scrap Site
As example of possible low
Retention Force
Group #1
Group #2
MINIMUM
LIMIT
Insertion Depth Variance in. - 010
.100
.090
.080
.070
.060
.050
.040
.030
.020
.010
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Retention Force, Pounds

Appendix C



Retention Force Lbs.



Test #1

Appendix E

ATTACHMENT 2
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