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Dalwyn R. Davidson
VICE PRESIDENT
SYSTEM ENGINEERING AND CONSTRUCTION

January 15, 1982

Mr. James G. Keppler
Director, Region III
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

RE: Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Final Report on Torquing of
Electrical Cable Tray Splice
Plate Bolts [RDC 37(81)]

Dear Mr. Keppler:

This letter serves as our Final Report in regards to the torquing of electrical cable tray splice bolts. The initial notification on this subject was made September 18, 1981, to Mr. F. Reimann of your office with interim reports filed on October 16, 1981, and November 30, 1981.

The deficiency reported pursuant to 10CFR50.55(e) concerned the adequacy of the method used by the electrical contractor to install seismic Category I cable tray splice bolts. The electrical contractor's installation practices utilized electric impact wrenches to seat and tighten these bolts without regard to the maximum torquing values specified by the cable tray vendor. The vendor recommended that the torquing should not exceed a value equal to or greater than 50% of the ultimate failure strength for the 3/8 inch carriage bolts. The 50% value was determined to be 45 ft.-lbs. As previously reported, of 160 bolts randomly selected, 126 were found to be torqued in excess of 45 ft.-lbs.

Pending disposition and resolution of this deficiency, the Contractor has recalled all electric impact wrenches and has instituted a program which addresses the use of hand-operated torque wrenches with a maximum torque not to exceed 45 ft.-lbs. for these subject tray splice plate connections.

JAN 20 1982

IE 27

The attached report, "Test Report on Installation Torques on Cable Tray Splice Bolts", outlines the test program initiated by the Architect/Engineer and CEI Engineering staff to determine the impact of the overtorquing.

Results of this test program indicate that the torquing applied and the existing installations are acceptable.

Sincerely,

Dalwyn R. Davidson

Dalwyn R. Davidson
Vice President
System Engineering and Construction

DRD:pab

Attachment

cc: NRC Site Office

Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

U.S. Nuclear Regulatory Commission
c/o Document Management Branch
Washington, D.C. 20555

TEST REPORT ON

INSTALLATION TORQUES

ON CABLE TRAY SPLICE BOLTS

Prepared By: J. J. Sherman 1/14/82

J. J. Sherman

GAI Structural Engineer

Reviewed By: C. K. Angstadt 1/14/82

C. K. Angstadt

GAI Structural Engineer

Approved By: K. R. Dech 1/14/82

K. R. Dech

Assistant Project Manager

JANUARY 14, 1982

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A INTRODUCTION

On September 18, 1981, The Cleveland Electric Illuminating Company reported a possible 10CFR50.55(e) significant deficiency concerning the potentially excessive tightening of safety-related cable tray splice bolts by the installing contractor (L. K. Comstock). The events leading up to this report as well as the ensuing evaluations and corrective actions taken are summarized in this final report.

On September 11, 1981, Nonconformance Report #CQC 2344 (see Appendix I) was written against the installation of cable tray splice bolts exceeding the manufacturer's recommended maximum torque of 45 ft-lbs. The bolts were being installed with electric impact wrenches with no control of the applied torque. The nonconformance was based on torques checked on a random sampling of 160 installed bolts by site QC personnel using calibrated manual torque wrenches. Of the 160 bolts sampled, 126 exhibited torques in excess of 45 ft-lbs. with a maximum torque of 116 ft-lbs. Also indicated by the nonconformance was one bolt that sheared off at 89 ft-lbs. prior to the nut turning and 14 bolts that were not fully seated.

Until a resolution of the nonconformance could be made, it was determined to have the installing contractor recall all electric impact wrenches from the field. A program of using calibrated manual torque wrenches was then instituted for all new work to control the applied torque on the bolts. The installation torque was set at a minimum of 20 ft-lbs. and a maximum of 50 ft.-lbs. This satisfied the manufacturer's recommendation in his letter of September 14, 1981, of 19 to 30 ft-lbs. with a maximum recommended allowable of 54 ft-lbs. (see Appendix II). The manufacturer's recommended maximum is based on 60% of the average ultimate failure torque of 91 ft-lbs. as determined by tests conducted by the manufacturer.

It was then determined that tests should be conducted to determine if the torques recorded by QC during random sampling were actual torques or "ficticiously" high breaking torques due to the type of nut used on the

bolts. The nuts are self-locking type nuts with hardened teeth to embed into the connected steel parts. The tests were conducted on December 2, 3, and 10, 1981.

This report provides the details and conclusions obtained from the tests and the corrective actions taken to assure reliability of the tray splice bolts.

B. TEST DESCRIPTION

Testing of the cable tray splice bolts was conducted on December 2, 3, and 10, 1981, in the installing contractor's (L. K. Comstock) fabrication shop. Present at the tests were:

James Sherman	GAI - Engineering
Thomas Stear	CEI - Engineering
Robert Troff	LKC - Engineering
Wayne Neuman	LKC - Engineering
George Hagler	LKC - Quality Control
Ron Gillette	LKC - Quality Control
Timothy Thompson	CEI - Quality Assurance
Noel Goodrich	CEI - Quality Assurance
Walter Page	LKC Craft Person (#4167)

The bolts for the test are the standard 3/8" x 3/4" ribbed neck carriage bolts supplied by the manufacturer (B-Line Systems Inc.). The bolts were selected at random from field stock from 5 different bags of bolts and nuts. The nut is a 3/8" serrated flange nut. The nuts are of ASTM A 307 GR.B material and the bolts of SAE J429 GR.5 material. The testing of the 3/8" x 3/4" tray splice bolts was divided into three parts. In the first part of the test, 132 bolts were installed in a manner similar to that used in the field prior to the ban on the use of electric impact wrenches using actual tray sections and splice plates. The bolts were tightened down using seven different electric impact wrenches. One of the wrenches was new and the other six impact wrenches were taken at random from existing field stock. The impact wrenches used were all Ingersol Rand Model #8005A. By the use of the above sampling of wrenches, we were able to check if there was any discrepancy between a new and used impact wrench and between various used wrenches themselves. The impact wrenches were permitted to run the bolt up to maximum torque attainable by that impact wrench and then allowed to ratchet for an additional 10-15 seconds to assure maximum applied torque. The installation torques

(called T check) were then checked using a 0 to 250 ft-lb. calibrated torque wrench. The torque was read at the point where the nut on the bolt just began to move. The results of the test are shown on attached Table I.

The second part of the test involved setting 60 bolts to a known torque (called T moving) of 30, 45, and 60 ft-lbs. (20 bolts each) and checking the torques (called T static) one day and eight days later. (It should be noted that the torque T moving was read while the nut was moving.) This test was to check if there was any torque "increase" (called T gain) from allowing the bolts to set for a period of time and to see if there was any difference between the readings for static vs. the moving condition. The results of this part of the test are shown on attached Table II.

In the third part of the test, 50 bolts were torque tested to complete failure using a calibrated manual torque wrench. This failure torque (called T failure) can then be compared to the torques attained by the electric impact wrenches (Tables I and II). The results of this part of the test are shown on attached Table III.

C. TABULATION OF TEST RESULTS

The following tabulations represent the applicable results of the various tests relating to the installation torque, the failure torque and associated parameters used as the basis for data evaluation in Section D. The tabulated results are in foot-pounds which is consistent with the manufacturer's data supplied for the bolts.

TABLE I

BOLT	T CHECK	BOLT	T CHECK	BOLT	T CHECK	BOLT	T CHECK	BOLT	T CHECK
1	50	26	65	51	50	76	65	101	70
2	60	27	70	52	60	77	65	102	75
3	50	28	70	53	55	78	65	103	60
4	45	29	65	54	45	79	75	104	65
5	60	30	60	55	50	80	65	105	70
6	55	31	55	56	55	81	70	106	75
7	45	32	55	57	55	82	65	107	70
8	55	33	55	58	55	83	65	108	70
9	60	34	60	59	50	84	65	109	70
10	50	35	60	60	45	85	65	110	60
11	Turned Wrong Way	36	65	61	50	86	65	111	60
12	50	37	65	62	60	87	60	112	70
13	55	38	65	63	55	88	65	113	60
14	60	39	60	64	55	89	70	114	70
15	50	40	60	65	55	90	85	115	60
16	50	41	55	66	45	91	75	116	60
17	50	42	50	67	55	92	75	117	50
18	55	43	50	68	50	93	70	118	50
19	55	44	60	69	55	94	75	119	50
20	50	45	55	70	55	95	70	120	45
21	50	46	60	71	50	96	55	121	65
22	60	47	60	72	60	97	70	122	70
23	Turned Wrong Way	48	60	73	65	98	60	123	60
24	55	49	55	74	70	99	65	124	70
25	50	50	55	75	55	100	70	125	60
								126	70
								127	50
								128	65
								129	55
								130	70
								131	60
								132	65

TABLE I

(Continued)

BOLTS	WRENCH NO.	WRENCH CONDITION	AVE. T CHECK
1 - 25	LKC-10-592	NEW	53
26 - 50	LKC-10-593	USED	59.6
51 - 75	LKC-11-227	USED	54.2
76 - 100	LKC-E-581	USED	67.8
101 - 108	LKC-11-229	USED	69.4
109 - 120	LKC-10-309	USED	58.8
121 - 132	LKC-11-223	USED	63.3

Ave. T Check = 60.9 ft-lbs.
Manual Torque Wrench Used to Check Torques: #LKC-6-248
Range: 0-250 ft-lbs. (±3%)
Date Due for Reinspection: 12/6/81

LKC QC R Willette 1-6-82

GAI Engineer D J Sherman 12/30/81

TABLE II

BOLT	T MOVING	T STATIC (1 Day)	T STATIC (8 Days)	T GAIN (±)	BOLT	T MOVING	T STATIC (1 Day)	T STATIC (8 Days)	T GAIN (±)
1	30	31	28	-2	31	45	47	50	+5
2	30	26	23	-7	32	45	50+	50+	-
3	30	30	28	-2	33	45	49	47	+2
4	30	26	24	-6	34	45	48	49	+4
5	30	29	24	-6	35	45½	46	48	+2½
6	30	27	26	-4	36	45	46	50	+5
7	30	28	28	-2	37	45	47	46	+1
8	30	25	24	-6	38	45	47	45	0
9	30	32	30	0	39	45	47	45	0
10	30	26	25	-5	40	45	49	48	+3
11	30	29	28	-2	41	60	70	70	+10
12	30	29	28	-2	42	60	65	65	+5
13	30	27	27	-3	43	60	65	70	+10
14	30	28	27	-3	44	60	65	60	0
15	30	27	27	-3	45	60	60	65	+5
16	30	27	25	-5	46	60	70	70	+10
17	30	29	27	-3	47	60	70	70	+10
18	30	26	23	-7	48	60	65	65	+5
19	30	25	23	-7	49	60	70	70	+10
20	30	20	19	-11	50	60	60	65	+5
21	45	45	47	+2	51	60	70	70	+10
22	45	44	43	-2	52	60	70	70	+10
23	45	46	48	+3	53	60	65	65	+5
24	45	40	40	-5	54	60	65	65	+5
25	45½	41	38	-7½	55	60	65	65	+5
26	45	45	40	-5	56	60	65	65	+5
27	45	39	36	-9	57	60	70	70	+10
28	45	44	43	-2	58	60	65	65	+5
29	45	44	44	-1	59	60	70	65	+5
30	45	50+	50+	-	60	60	65	60	+0

+Off the Scale Reading - Not Including in Ave.

Ave. T Gain

Bolts 1 - 20: -4.3 Ft-Lbs.
Bolts 21 - 40: -0.2 Ft-Lbs.
Bolts 41 - 60: +6.5 Ft-Lbs.

Manual Torque Wrench: #LKC-6-248 Reinspection 1/6/82 (0-250 Ft-Lbs.)
#LKC-6-245 Reinspection 12/15/82 (0-250 Ft-Lbs.)

LKC QC George Hagler 1-6-82

GAI Engineer JJ Sherman 12/30/81

TABLE III

BOLT	T FAILURE	BOLT	T FAILURE
1	95	26	100
2	105	27	105
3	105	28	110
4	105	29	120
5	105	30	100
6	100	31	95
7	105	32	100
8	100	33	Stripped Threads @ 100
9	105	34	100
10	100	35	110
11	90	36	110
12	100	37	105
13	105	38	110
14	100	39	100
15	115	40	100
16	97	41	105
17	100	42	105
18	105	43	105
19	97	44	110
20	110	45	95
21	115	46	100
22	95	47	105
23	100	48	100
24	105	49	105
25	Stripped Threads @ 95	50	100

T. Failure (Ave.) = 103.2 Ft-Lbs.

Manual Torque Wrench Used to Check Torque: LKC-6-284
Range: 0-250 Ft-Lbs. (±3%)
Date Due for Reinspection: 12/6/81

LKC QC R Gillette

GAI Engineer J J Sherman 12/30/81

D. DATA EVALUATION

The primary concern which led to the report of a possible significant deficiency was that the bolts being checked had torque values in excess of the average ultimate failure torque of 91 ft-lbs. The 91 ft-lbs. average ultimate torque was determined by tests conducted by the manufacturer (B-Line Systems Inc.). In Part III of the test the bolts were tested to verify the ultimate failure torque and it was determined to be an average of 103 ft-lbs.

Part II of the test indicates several important points. The first point is that if the actual installing torque (T moving) is below 45 ft-lbs., some torque loss tends to occur after installation. For this case the bolt tension caused by the applied torque is probably not high enough to cause an effective "biting" action of the flange nut teeth (see discussion below for torques greater than 45 ft-lbs.). Thus, the bolt relaxes and counteracts any torque increase which tends to occur due to the difference between moving and breaking torques (i.e., moving vs. static coefficient of friction). The net result is a loss of torque.

The second point is that above 45 ft-lbs. there tends to be an increase in torque needed to get the nut moving again. After a short time (one day), the breaking torque needed to start the nut moving again increased an average of 6.5 ft-lbs. ($\pm$ 11%). This increase can be explained by the fact that the teeth on the flange nuts are composed of hardened steel which embed into the splice plate when torque is applied. It can then be postulated that creep will occur between the nut teeth and the splice plate material as a function of time and bolt tension stress. The net result is an increase in breaking torque as compared to the installed moving torque (T moving).

From Part I of the test, it can be concluded that the average maximum torque attainable from any Ingersol Rand Model #8005A electric impact wrench on site is 61 ft-lbs. Using 60% of the average ultimate torque as an average maximum allowable torque, the average maximum allowable

torque becomes 62 ft-lbs. which is approximately the same as the average maximum torque attainable using the electric impact wrenches. Checking the maximum torque of 85 ft-lbs. obtained using the electric impact wrenches and allowing for an 11% increase in the torque due to the biting action of the nut, the maximum torque applied to any bolt in the test using the electric impact wrench is 76 ft-lbs. Although the 76 ft-lbs. is above the allowable of 62 ft-lbs., it is considered to be an adequate safety factor considering it is the absolute peak value obtained from the tests.

E. CONCLUSIONS

As mentioned before, the primary concern of this testing program was to determine if the torques applied to the cable tray splice bolts (SAE J429 GR.5) by the Ingersol Rand Model #8005A electric impact wrench were in excess of the average ultimate failure torque of 91 ft-lbs. supplied by the tray manufacturer. From the testing program, it is determined that the torques applied to the SAE J429 Grade 5 bolts using the electric impact wrenches are acceptable.

The original nonconformance also addressed two other items. The first being the 1 bolt out of 160 that sheared off prior to the nut turning. This is a very low percentage of failure and will be considered acceptable.

The final item is that 14 out of 160 bolts were not fully seated and have very low torque values. This item will be addressed in the disposition of Nonconformance Report #CQC 2344. The installing contractor (L. K. Comstock) will be instructed to back check 1000 installed plates (8000 bolts) to assure proper seating of the bolts. Further corrective action on this item, if any, will be contingent upon the results of these additional checks. The contractor's current procedure for the work requires a visual check for proper seating of all bolts and thus, future installation problems of this nature should not occur.

JS:es/AW/8768P

APPENDIX I

SEP 15 1981

RECEIVED

SEP 15 1981

PERRY NUCLEAR POWER PLANT
NONCONFORMANCE REPORT

NO. 1512 PNPP-QA-

AND QUALITY RESPONSIBILITY
Cooper 9/14/81 C.O.E.
INITIATED BY DATE DATE

1		REV. SHT.	OF	ITEM	IDENT NO.	ITEM NAME	QUANTITY
	C C C 2 3 4 (DOCUMENT CONTROL)	PNPP	1	R	3 3	TRAY BOLT	160
2	ISSUED BY	NAME: Noel Goodrich		INIT: [illegible]	ORGANIZATION: CQE (Elect.)		DATE: 0 9 1 1 8 1
3	ITEM / MATERIAL	SOURCE: B-Line Systems, Inc.		CURRENT STATUS: Installed		LOCATION: General Plant	
4	RESPONSIBLE ORGANIZATION	NAME: L. K. Comstock				SPEC. NO.: SP- 0 3 3	REV./ECN: III
5	NCR TYPE	CATEGORY: [X] 1 (POSSIBLE SIGNIF) [ ] 2 (MAJOR) [ ] 3 (MINOR)					
		TYPE: [ ] (E) EQUIP. / MAT'L. [X] (I) INSTALLATION [ ] (P) PROGRAM					
6	GOVERNING REQUIREMENT	(INCLUDE ACCEPTANCE CRITERIA AND DOC'MT. NOS.) Dwg. #SS 213-008, SH. 1 (6), B-Line Systems, Inc. letter dated 20 Dec., 1978 (Attached).					
7	DESCRIPTION OF NONCONFORMANCE	NC CODE 0 5	(RELATE TO LINE NO. 6) "Improper Installation". Surveillance/ Inspection & results of randomly selected test of 20 splice plates (160 Bolts attached) indicate SP-33 contractor failed to meet Torque requirements of 45 Ft.-Lbs. per letter (dated 20 Dec., 1978) B-Line systems, Inc. consequence being 126 of 160 Bolts checked did not meet Torque requirements.					
8	CAUSE OF NONCONFORMANCE	CAUSE CODE 0 1 7	Improper Installation				
9	PROPOSED DISPOSITION	[ ] SCRAP (1) [ ] REWORK (2) [ ] REPAIR (3) [ ] USE AS IS (4)					
	JUSTIFICATION:						
10	STEPS TO PREVENT RECURRANCE						
11	RESP. ORG. APPROVAL	ENG./CONST.		QA/QC		AIA	DATE
12	PNPP REVIEW BOARD	REVIEW REQ'D. [X] YES [ ] NO	ENGINEER	DATE	QA/QC	DECISION [ ] ACCEPT [ ] REJECT	DATE
13	CLOSEOUT VERIFIED	NAME		TITLE			DATE

COPY DISTRIBUTION 1 - DOCUMENT CENTER 2 - FOLLOW UP 3 - ORIGINATOR

Perry Nuclear Power Plant - Unit 1 and 2
Nuclear Quality Assurance Department
Inter-Department MEMO

TO: NOEL GOODRICH | CQS/CQE (Sec/Unit) | 9/10/81 (Date)

FROM: S.P. TULK | CQS/CQE (Sec/Unit) | TQ4 (Mail Zone)

[ ] Question [ ] Request for Info [ ] Request Assistance
[ ] Problem [ ] Identify Def. _____ [X] (Other) INSPECTION/DOCUMENTATION

IN ORDER TO PROPERLY DOCUMENT THE CONCERNS WITH CABLE TRAY SPLICE PLATE BOLTS, WE NEED SOME DATA. SELECT AT RANDOM IN THE CLASS 1 AREAS 20 SPLICE PLATES AND TEST THE TIGHTNESS OF THE BOLTS. (A CALIBRATED TORQUE WRENCH [0-175 FT.LB] IS AVAILABLE AT THE SITE CAL. TRAILER - PH 355)

[ ] For Your Information [ ] Please Reply
[X] For Your Action [ ] No Reply Requested

TO: S.P. TULK | CQS/CQE (Sec/Unit) | 9/11/81 (Date)

FROM: NOEL GOODRICH | CQS/CQE (Sec/Unit) | TQ4 (Mail Zone)

REPLY: RESULTS OF REQUESTED TEST DOCUMENTED ON ATTACHED LIST

Perry Nuclear Power Plant - Unit 1 and 2
Construction Quality Section

Continuation SHEET

DOCUMENT THE RESULTS ON AN SIR. IF THE RESULTS SHOW A TORQUE VALUE IN EXCESS OF THE 45 FT-lbs REFERENCED IN THE B-LINE TO ERNST-COMSTOCK LEITER (DATED - 20 DEC 1978) THEN A NONCONFORMANCE REPORT SHOULD BE WRITTEN ACCOMPANIED BY A DEVIATION ANALYSIS REPORT (DAR).

I HAVE CHECKED WITH STEVE ARMKNECHT OF INDUSTRIAL RELATIONS, AND THIS IS CONSIDERED A "TEST" WHICH WILL NOT REQUIRE ANY CONTRACTOR PERSONNEL.

L E Tulk

cc: G. LEIDICH FQ6
J. OZUGAN W250
C. ANGSTADT W260

B-Line Systems
609 WEST MONROE STREET, HIGHLAND, ILLINOIS 6224
MANUFACTURERS OF CABLE TRAY AND STRUT SYSTEMS

December 20, 1978

Ernst - Comstock
Perry Nuclear Power Plant
10 Center Road
Perry, Ohio 44081

Attention: Mr. Joe Klena

Dear Mr. Klena:

Per your request we have conducted tests on the 3/8-16 x 3/4 rib neck carriage bolts supplied to you for cable tray splice joints on Perry Nuclear Plant.

A lot sample of fifty pieces was taken from a shipment. Twenty-five samples were tested by applying torque until failure of bolt occurred and twenty-five samples were tensile tested in accordance with ASTM A 370, Paragraph S11.1.4.

The torque tests' specimens were inserted into a plate approximately the thickness of a side rail and splice plate. Torque was applied to the serrated flanged lock nut until failure, with an average failure of 91 ft.-lbs. (See test results.) Using 50% of failure would result in an allowable maximum torque of 45 ft.-lbs.

The tensile tests resulted in an average of 90 ft.-lbs. using an average ultimate load of 11,532 lbs. and a friction coefficient of K=0.25. Again using 50% the maximum allowable torque would be 45 ft.-lbs.

If the lowest values obtained by testing were used to determine allowable torque, the torque tests would be 42.5 ft.-lbs. and the tensile tests would be 41.5 ft.-lbs.

The formula used to determine torque from tensile tests is as follows:

$$T = \frac{KDW}{12}$$

T = Torque, lb.-ft.

where K = coefficient of friction

D = bolt diameter = 0.375 inches

W = bolt tension, lbs.

letter to Mr. Klena
Ernst - Comstock
dated December 20, 1978

The friction coefficient of 0.25 was determined by testing 3/8-16 x 3/4 rib neck carriage bolts and 3/8-16 serrated flange lock nuts. Bolts and nuts were electro-deposited zinc coated steel.

If we can be any further service, please let us know.

Sincerely,

B-LINE SYSTEMS, INC.

K F R

K. F. Radmer
Product Engineering Manager

KFR/mmw

cc: Tom Gold, Sr.
Tom Gold, Jr/Terry Jenne
Steve Richards

Enclosure

Perry Nuclear Power Plant - Unit 1 and 2
Construction Quality Section
Surveillance/Inspection Report (SIR) - SHEET 1 OF ____

LK COMSTOCK	033, RIII	SE-689
Contractor	Spec. No.	SIR Number
CABLE TRAY SYSTEM		R33
System/Component Name		MPL Number
GENERAL PLANT		9/10/81
Location		Date
A	5:08.14	N/A
Inspec. Type (A. B. C.)	Area of coverage (Code No.)	SIP Number-Rev.

DESCRIPTION of SURVEILLANCE/INSPECTION:
SURVEILLANCE REVEALS SP-33 CONTRACTOR FAILED TO MEET TORQUE REQUIRMENTS OF 45 FT-LBS. PER LETTER (DATED-20 DEC., 1978) B-LINE SYSTEMS, INC. (SEE ATTACHMENT) DURING INSTALLATION OF TRAY. RESULTS OF RANDOMLY SELECTED TEST OF 20 SPLICE PLATES (160 BOLTS) ARE ATTACHED.

CQC# 2344
Corrective action documentation - (NRS) - ARs - CARs)

Measuring/Inspection Tools I.D.: TORQUE WRENCH # L10R500A
SITE CAL. SHOP

Remarks: DAR WRITTEN # 068

Carol B. Bowden — Inspector

T. J. Thompson — Reviewed - Resp. QE — 9-14-81 Date

Approved - Lead QE — Date

. Torque wrench # L70R500A (SITE)
Calibrated 7/9/81
Due Date 10/9/81

Location	Tray #	Coordinates	Bolts	Torque Ft/Lbs	Verified By
620 CC	(A) 4056	Cable Chase G-13 D214-131	1 2 3 4 5 6 7 8	75 77 74 90 77 61 61 76	Noel B. Boode Kevin Linnell
620CC	(B) 1393	B-4 D214-132	1 2 3 4 5 6 7 8	30 68 42 54 66 62 74 75	Noel B. Boode Kevin Linnell
599 CC	(B) 268	G-4 D214-121	1 2 3 4 5 6 7 8	60 45 78 74 40 54 76 72	Noel B. Boode Kevin Linnell
599CC	(B) 255	G-10 D214-121	1 2 3 4 5 6 7 8	62 67 84 102 68 76 90 88	Noel B. Boode Kevin Linnell
599 IB	(B) 4232	B-4 D214-422	1 2 3 4 5 6 7 8	80 74 82 80 75 3 64 65	Noel B. Boode Kevin Linnell

Location	Tray #	Coordinates	Bolts	Ft/Lbs	Verified
599 AUX 2	(B) 3733	C-13 D 264-221	1 2 3 4 5 6 7 8	62 70 60 67 48 60 52 60	Noel B. Boo Kim Lin
579 IB	(B) 297		1 2 3 4 5 ** 6 7 8	30 40 50 25 30 8 9 15 25	Noel B. Boo Kim Lin
620 AUX 1	(B) 1841	F-9 D214-232	1 2 3 4 5 6 7 8	10 16 15 12 20 18 19 15	Noel B. Boo Kim Lin
620 IB	(B) 1836	C-6 D214-431	1 2 3 4 5 6 7 8	62 40 30 65 45 82 10 15	Noel B. Boo Kim Lin
638 CC	(B) 1338	Cable Spreading North Wall	1 2 3 4 5 6 7 8	52 77 77 75 100 64 78 63	Noel B. Boo Kim Lin

Location	Tray #	Coordinates	Bolts	Fr/Lbs.	Verified
638 CC	(B) 1830	Cable Spreading 6ft. south of North Wall	1 2 3 4 5 6 7 8	52 77 77 75 00 64 78 63	Neal B. Boudreaux Kim Linell
620 ESW	(B) 264	D-13 D226-501	1 2 3 4 5 6 7 8	90 102 90 90 64 40 90 90	Neal B. Boudreaux Kim Linell
620 ESW	△B 1305	B-13 D226-501	1 2 3 4 5 6 7 8	104 84 80 66 74 95 35 78	Neal B. Boudreaux Kim Linell
620 ESW	△B 1306	A-11 D226-501	1 2 3 4 5 6 7 8	75 80 60 54 54 90 80 68	Neal B. Boudreaux Kim Linell
593 ESW	△B 3704	B-11 D226-501	1 2 3 4 5 6 7 8	80 65 110 116 75 60 90 110	Neal B. Boudreaux Kim Linell

Location	Tray #	Coordinates	Bolts	Fills	Verified
599 AUX 1	(A) 1699	D-11 D214-222	1 2 * 3 * 4 * 5 * 6 * 7 * 8	60 2 2 2 2 4 10	Neal B. Boodi Kim Lind
599 AUX 1	(B) 1312	F-9 D214-222	1 2 3 4 5 6 7 8	54 45 80 54 77 75 75 68	Neal B. Boodi Kim Lind
599 AUX 1	(X) 425	D-7 D214-222	1 2 * 3 * 4 5 6 7 8	72 70 2 2 65 65 15 45	Neal B. Boodi Kim Lind
579 AUX 1	1E21H1A	F-8 D215-211	* 1 * 2 * 3 * 4 5 * 6 7 8	2 2 2 2 25 8 15 NA	Neal B. Boodi Kim Lind
689 CC	(A) 625	E-7 D214-161	1 2 3 4 5 6 7 8	60 50 45 40 35 50 28 20	Neal B. Boodi Kim Lind

Location	Tray #	Coordinates	Bolts	ft/lbs	Verified By
689 IB	(B) 257	B-13 D214-471	1 2 3 4 5 6 7 8	65 80 50 70 62 78 85 64	Noel B. Goodwin Kim Linell
638 CC	(X) 2241	B-4 D214-141	1 2 3 4 5 6 7 8	76 80 90 80 80 75 75 107	Noel B. Goodwin Kim Linell

NOTES: * - Splice plate bolt heads were not properly seated.

** - Bolt sheared prior to nut actually turning.

APPENDIX II

B-LINE SYSTEMS, INC.
509 West Monroe Street
Highland, Illinois 62249 U.S.A.
618-654-2184 Telex 44-7751

World Headquarters

B-Line Systems INC.

September 14, 1981

Gilbert & Associates
Site Organization
Perry Nuclear Power Plant
10 Center Road
North Perry, Ohio 44081

Attention: Mr. Curt Angstadt

Reference: Perry Nuclear Power Plant
Splice Plate Nut Torques

Dear Mr. Angstadt:

Our letter of February 12, 1979 to Mr. J. Klena of Ernst-Comstock listed the recommended torque to a variety of fasteners which included the 3/8 inch bolts used with cable tray. As we discussed over the telephone, the recommended value of 19 ft.-lbs. is not precise. This figure results from our experience which shows that in typical installations an average of 19 ft.-lbs. of torque on the nut is required to seat the bolt firmly and should be used as an installation guide.

If necessary, the bolt torque can be increased to ensure firm seating of the bolt. Values ranging from 19 to 30 ft.-lbs. are common and acceptable. Torques in excess of 30 ft.-lbs. may be employed if good industrial practices are followed. As shown in our letter to Mr. Klena dated December 20, 1978, the maximum recommended torque for the 3/8 inch carriage bolt is 45 ft.-lbs. The value results from testing and is equal to 50% of the ultimate failure load. Fastener reference manuals and texts show that in most practical applications an allowable torque equal to 60% of ultimate failure may be used. This would increase the maximum recommended allowable load to 54 ft.-lbs. of torque. However, careful consideration should be given to the use of torque loads approaching or exceeding the maximum recommended value.

Sincerely,

B-LINE SYSTEMS, INC.

B. E. Martin

Bailey E. Martin
Structural Engineer

BEM/mma

cc: Tom Gold, Sr./Tom Gold, Jr.
Ken Radmer