UNION ELECTRIC

1901 Gratiot Street, St. Louis

Donald F. Schnell
Vice President

February 17, 1988

Mr. A. Bert Davis
Regional Administrator
USNRC Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

ULNRC-1726

Dear Mr. Davis:

DOCKET NUMBER 50-483
CALLAWAY PLANT
FASTENER TESTING TO DETERMINE CONFORMANCE
WITH APPLICABLE MATERIAL SPECIFICATIONS

References: 1) NRC Compliance Bulletin No. 87-02, dated November 6, 1987
2) ULNRC-1695, dated December 17, 1987

The referenced NRC bulletin required licensees to review their receipt inspection requirements and internal controls for fasteners and to independently determine, through testing, whether fasteners in stores at their facilities meet required mechanical and chemical specification requirements. This information was to be submitted to the NRC within 60 days from receipt of the bulletin (January 18, 1988). Due to scheduling delays at the testing facility, the requested information was not available for submittal by the required date (see reference 2).

The requested information is being provided in the attachments to this letter. If you have any questions concerning this information, please contact me.

Very truly yours,

for Donald F. Schnell

WEK/tar
Attachments

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1/1

STATE OF MISSOURI)
) S S
CITY OF ST. LOUIS)

Robert J. Schukai, of lawful age, being first duly sworn upon oath says that he is General Manager-Engineering (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Robert J. Schukai
Robert J. Schukai
General Manager-Engineering
Nuclear

SUBSCRIBED and sworn to before me this 17th day of February, 1988.

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1989
ST. LOUIS COUNTY

cc: Gerald Charnoff, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, N.W.
Washington, D.C. 20037

Dr. J. O. Cermak
CFA, Inc.
4 Professional Drive (Suite 110)
Gaithersburg, MD 20879

W. L. Forney
Chief, Reactor Project Branch 1
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Bruce Little
Callaway Resident Office
U.S. Nuclear Regulatory Commission
RR#1
Steedman, Missouri 65077

Tom Alexion (2)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop 316
7920 Norfolk Avenue
Bethesda, MD 20014

Manager, Electric Department
Missouri Public Service Commission
P.O. Box 360
Jefferson City, MO 65102

Response to NRC Compliance Bulletin 87-02 Action Items

NRC Compliance Bulletin 87-02 required licensees to review their receipt inspection requirements and internal controls for fasteners and to independently determine, through testing, whether fasteners in stores at their facilities meet required mechanical and chemical specification requirements. The bulletin listed six action items to be addressed concerning the potential use of inferior fasteners. The action items and responses are as follows:

Action Item 1. Describe a) the characteristics currently examined during receipt inspection of fasteners (i.e., head markings for grade and manufacturer symbols, review of certified material test report or certificate of conformance), and b) internal controls utilized during storage and issuance from stock to assure the appropriate use of fasteners.

Response: The inspection requirements for fastener characteristics are controlled by Callaway receipt inspection procedures which are available for review upon request. The characteristics which are currently examined during the Quality Control (QC) receipt inspection are as follows:

A) A general inspection is performed on all safety-related fasteners. This inspection verifies that:

1) the threads are free of damage and debris which would restrict free movement.

2) the non-threaded areas are free from pitting or gouges deeper than 1/32".

3) there are no visual indications of cracks.

4) there are no deformities.

5) there are no detrimental gouges, dents, or scratches.

B) The fasteners are checked for identifying markings. This is accomplished by verifying one or more of the following:

1) manufacturers' ID marks and symbols for material identification (head markings).

2) fastener size (e.g.: diameter, threads/ inch, length, material type).

3) heat numbers.

C) The applicable fastener documentation is reviewed and verified. Items included in this review are:

1) that any Qualified Suppliers List restrictions are complied with, per the purchase order.

2) that the documentation requirements of the Union Electric purchase order are adhered to. This review may include as appropriate:

a) the applicable NDE requirements.

b) the Supplier's Quality System Certificate.

c) the Certificate of Compliance (C of C).

d) the Certified Material Test Report.

Internal controls are utilized during storage and issuance from stock to assure the appropriate use of fasteners. All shipments of fasteners are assigned a receiver number upon arrival from the manufacturer. Safety-related fasteners are QC inspected and, upon acceptance, are tagged with an acceptance tag showing purchase order, item, receiver number, and heat number, if applicable. Nonsafety-related fasteners receive a commercial inspection by the storekeepers for identification and damage.

The issuance of fasteners is controlled by a Storeroom Issue Requisition (SIR) which is completed by plant personnel and storekeepers for material required to perform a work activity. Plant personnel specify the work activity number on the SIR and present it to the storekeeper who enters the P.O. number, receiver number, item number, stock code number, and heat number, if applicable, on issuance of safety-related fasteners. Issuance of nonsafety-related fasteners requires only the stock code to be specified on the SIR.

All safety-related fasteners are stored in a different warehouse location than the non-safety-related fasteners.

Action Item 2. Select a minimum sample of ten (10) nonsafety-related fasteners (studs, bolts, and/or cap screws), and ten (10) safety-related fasteners (studs, bolts and/or cap screws) from current in use stock. The sample is to be obtained by the licensee with the participation of an NRC inspector. Fasteners procured to meet the following chemical and mechanical properties are of interest: A-193 grades B7, B8, and B16; SAE J429 grades 5 and 8; A-449; A-325 Types 1, 2 or 3; A-354 grades BB, BC, BD; A-490; A-320 LTM; A-307; A-563; or equivalent.

Response: The Union Electric sampling plan was developed based on the following information:

1) The majority of the fasteners that were selected for testing are safety-related based on the percentage of safety-related fasteners in stock (>95% of in-stock fasteners are safety-related).

2) Various fastener sizes were chosen to better represent the fasteners in use at the Callaway Plant.

3) The fasteners in use at the Callaway Plant, were grouped into four categories based on application;

   1) Pressure retaining
   2) Structural
   3) Whip restraints
   4) Hangers/clamps

The fastener type in each category that was present in the largest number, and the fastener type in each category that was used most often were both chosen for testing.

This sampling plan deviates from the requirements of Bulletin 87-02; however, it better represents the actual fasteners in use and in stores at the Callaway Plant.

This sampling plan was reviewed and found to be acceptable by Mr. B. H. Little, NRC Resident Inspector, Region III, who also participated in the selection of the fasteners.

Action Item 3. For the selected sample of fasteners in item 2, include a sample of typical nuts that would be used with each fastener (one-for-one). In particular, nuts purchased to the chemical and mechanical specifications of A-194 are of interest.

Response: At the time of fastener selection, a sample of nuts was also selected based on the fastener sampling plan criteria (see Action Item 2 response). Mr. B. H. Little participated in this selection process.

Action Item 4. Chemical testing shall be performed on all samples. Mechanical testing shall be performed on each safety-related fastener. Hardness testing shall be performed on each nut and nonsafety-related fastener. All testing shall be performed by a laboratory which the licensee has qualified for this type of testing and appears on the licensee's approved vendor list. Testing performed shall be done in accordance with the requirements of the fastener's specification, grade, and class, and the test shall evaluate the ultimate tensile strength, hardness and chemical properties as required by the fastener's specification, grade, and class. Each sample shall be tagged with the sample's ID number.

Response: The samples were tagged and shipped to Metlab Testing Services, Inc., in Tulsa, Oklahoma, for the required mechanical and chemical testing. Metlab is a qualified laboratory for this type of testing and is on the Union Electric Qualified Suppliers List. The testing requirements of Bulletin 87-02 were conveyed to Metlab by a Union Electric purchase order, and the testing was witnessed by a Union Electric Supplier Quality Representative.

Action Item 5. The results of all tests, together with supporting information, are to be reported to the NRC utilizing the format shown in Attachments 1 and 2 of this bulletin. Include the names and addresses of suppliers and manufacturers of safety-related fasteners and, to the extent possible, of nonsafety-related fasteners. For any fastener found out-of-specification, provide an evaluation of the safety significance including consideration of the most limiting application.

Response: The results of all the tests, together with supporting information, are provided in Attachment 2 to this letter. There were two items (1 fastener and 1 nut) found to be out-of-specification. An evaluation of the safety significance for these items has been included.

Two safety-related fasteners were found to have nominal variances from the required specifications. These fasteners are:

Sample CA-63-60-804 (See Attachment 2, Pages 20, 21, and 22 of 53)
ASTM A-490 Bolt, 1" dia-8TPI x 3½" long
Purchased on U.E. P.O. 94579 from Texas Bolt Company (through A&G Engineering)
CMTR Report No. 87-1044

The ultimate strengths for these fasteners tested at 174,695 p.s.i. and 174,187 p.s.i. (the ASTM requirement is 150,000 to 170,000 p.s.i.). The approximately 2½% variance is considered acceptable since the chemical, elongation, reduction of area, yield strength, and hardness properties were all within specification.

This specification, grade, and size of bolt is used at Callaway exclusively for isolation restraint assemblies (pipe whip restraints). These restraints see no active loads and do not bear or restrain the piping system except in the case of a catastrophic pipe break. The variance found in these particular samples would have no effect on the function, calculations or design bases for their intended use. Any disassembly of these restraints (normally for maintenance purposes) would automatically require replacement of the bolts since ASTM-A490 bolts are not re-usable after being tightened to their designated preload. A Nonconforming Material Report, No. 88-U00043, has been generated to document the "use-as-is" acceptability of the fasteners purchased on P.O. 94579.

Three nonsafety-related nuts (supplied as spare parts) were found to be out-of-specification. These nuts are:

Sample CA-76-60-368 (See Attachment 2, Pages 44, 45, and 46 of 53)

ASTM A-194, grade 2H Nut, 5/16" dia.-18TPI

These nuts were purchased as spare parts from Dresser Industries and were intended to be replacement gland packing nuts for 1"-600 lb. carbon steel gate valves.

No safety-related concern exists since the Callaway QA Program does not allow the use of non-Q fasteners or nuts in safety-related applications nor can the nuts be upgraded to safety-related. ASTM-A194 grade 2H nuts are required to have the markings of 2H or 2HB on them. Since no markings were apparent on these nuts (nor on the other nuts of this batch), it is questionable if the vendor supplied the nuts to the requirements on his bill of materials. The remaining nuts in this batch will be scrapped.

Action Item 6. Based on the results of the testing and review of current procedures, describe any further actions being taken to assure that fasteners used in the plant meet the requisite specifications and requirements and that the operability of safety-related plant components is not affected.

Response: No further actions are deemed necessary to assure that safety-related fasteners and nuts used in the plant meet the requisite specification and operability requirements.

A further review will be performed to determine if the lack of appropriate markings on the nonsafety-related ASTM-194 Grade 2H nuts is limited to this batch and/or vendor.

Appropriate action will be taken if additional unmarked fasteners or nuts are found.

Fastener Testing Data Sheet

Sample ID #

CA-63-60-350

Fastener Description:

Stud, 1"-8TPI x 6" Long

Description of Sample Stock Location:

W/S/37/E/10/D

Material Specification as Documented by Licensee Records:

SA-193 Grade B7

Head Marking (Specification and Manufacturer):

B7T, MN63

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

Texas Bolt Co.*
3233 W. 11th Street
Houston, TX 77001

Manufacturer:

Texas Bolt Co.
3233 W. 11th Street
Houston, Texas 77001

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463-A
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: A Item Type: Studs SR/NS: SR

Stock No.: 63-60-350 Spec./Grade: SA-193 Gr. B7

Description: 1"-8TPI x 6" Long ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: B7T, MN63

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
A1	16.5	60.7	131,211	142,288
A2	19.0	61.8	131,757	143,347
A3	17.0	61.5	130,977	143,295
A4	18.0	60.8	130,670	142,113
A5	17.5	59.3	134,536	146,340
Min. Requirements SA193-83 Grade B7	16.0	50.0	105,000	125,000

*Gage Length: 2"

METLAB

MLTS 87-5463-A
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	A1	A2	A3	A4	A5	Requirements
Carbon	.36	.36	.37	.35	.35	.35 - .51
Manganese	.88	.90	.90	.91	.90	.61 - 1.10
Phosphorus	.013	.014	.015	.014	.014	.40 Max.
Sulfur	.029	.030	.033	.031	.030	.045 Max.
Silicon	.27	.28	.30	.29	.28	.13 - .37
Copper	.23	.24	.24	.23	.24	---
Nickel	.23	.24	.25	.24	.24	---
Chromium	.92	.93	.96	.95	.95	.70 - 1.25
Molybdenum	.26	.25	.26	.26	.26	.13 - .27
Columbium + Tantalum	---	---	---	---	---	---

IMPACT TEST (SA/A-370-E23)

Available Impact Energy:	264 Ft-Lbs
Impact Velocity:	17 Ft-Lbs
Specimen Type:	Charpy "V" Notch
Specimen Size:	10mm x 10mm
Test Temperature	+30°F

Coupon No.	Ft-Lbs.	Lateral Expansion (mils)
1	65	40
2	75	44
3	72	55
Requirement	-----None-per NB-2330---	

Conformance or Non-Conformance: Mechanical and chemical analysis results on all five samples conform to the requirements for SA-193-83, Grade B7.

Witnessed By: Joseph J Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-353

Fastener Description:

Stud, 7/8"-9TPI x 5-1/2" Long

Description of Sample Stock Location:

W/S/37/D/13/D

Material Specification as Documented by Licensee Records:

SA-564 Grade 630 H1100

Head Marking (Specification and Manufacturer):

630R, NND

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

R.E.C. Corporation *
47 Cedar St.
New Rochelle, NY 10801

Manufacturer:

Ugine Aciers
France

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hardness Measurements:

Coupon No.	Rockwell Hardness
B1	C33.5, C34.0
B2	C33.0, C33.4
B3	C34.0, C34.0

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463 -B
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: B Item Type: Stud SR/NS: SR

Stock No.: 63-60-353 Spec./Grade: SA-564 Grade 630H1100

Description: 7/8"-9TPI x 5 1/2" Long ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: 630R, NND

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
B1	19.0	59.7	156,832	167,805
B2	17.0	58.3	158,660	166,753
B3	17.5	58.7	147,945	165,348
Min. Requirements: for SA/A-564-83 Grade 630H110	14.0	45.0	115,000	140,000

*Gage Length: 2"

METLAB

MLTS 87-5463 -B
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	B1	B2	B3	Requirements
Carbon	.04	.05	.05	.07 Max.
Manganese	.80	.84	.85	1.00 Max.
Phosphorus	.018	.020	.021	.040 Max.
Sulfur	.007	.008	.009	.030 Max.
Silicon	.34	.39	.41	1.00 Max.
Copper	3.24	3.19	3.28	3.00 - 5.00
Nickel	4.05	4.06	4.16	3.00 - 5.00
Chromium	15.77	16.18	16.89	15.00 - 17.50
Molybdenum	<.01	<.01	<.01	---
Columbium + Tantalum	.33	.37	.39	.15 - .45

Conformance or Non-Conformance All three coupons tested conform to the mechanical and chemical analysis requirement of SA-564-83 for Grade 630H1100.

Witnessed By: Joseph D Jaegers
Union Electric Co.
Joe Jaegers

Approved By: Dan M. Lawson
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-242

Fastener Description:

Stud, 5/8" x 6" Long

Description of Sample Stock Location:

W/S/37/C/12/F

Material Specification as Documented by Licensee Records:

SA-193 Grade B8M Class 2

Head Marking (Specification and Manufacturer):

RB8M, 1

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

R.E.C. Corporation
10 Beach Street
Mt. Vernon, NY 10550

Manufacturer:

Carpenter Technology Corp.
P.O. Box 662
Reading, PA 19603

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hardness Measurements:

Coupon No.	Rockwell Hardness
C1	C30.0, C28.2
C2	C29.5, C27.8

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463-C
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: C Item Type: Stud SR/NS: SR

Stock No.: 63-60-242 Spec./Grade: SA-193 Grade B8M Class 2

Description: 5/8" x 6" Length ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: RB8M, 1

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
C1	29.0	66.0	113,013	134,729
C2	27.0	66.8	112,439	142,175
Min. Requirements: for SA/A-193-83 Grade B8M Class 2	15.0	45.0	95,000	110,000

*Gage Length: 1.4"

METLAB

MLTS 87-5463 -C
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	C1	C2	Requirements
Carbon	.04	.04	0.09 Max.
Manganese	1.60	1.57	2.04 Max.
Phosphorus	.021	.021	.055 Max.
Sulfur	.022	.022	.035 Max.
Silicon	.61	.61	1.05 Max.
Copper	.71	.70	---
Nickel	11.87	11.97	9.85 - 14.15
Chromium	17.47	17.32	15.80 - 18.20
Molybdenum	2.11	2.14	1.90 - 3.10
Columbium + Tantalum	<.01	<.01	---

Conformance or Non-Conformance Both specimens tested conform to the mechanical and chemical analysis requirements of SA-193-83 for Grade B8M, Class 2.

Witnessed By: Joseph G Jaegers
Edison Electric Co.
Joe Jaegers

Approved By: [signature]
Bob M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-77-60-735

Fastener Description:

Stud, 1/2"-13TPI x 2-3/4" Long

Description of Sample Stock Location:

W/S/03/H/06/D

Material Specification as Documented by Licensee Records:

ASTM-A-193 Grade B7

Head Marking (Specification and Manufacturer):

D1-$\frac{M}{B7}$; D-2 HB, B7 (See Attached photo, Page 13 of 53)

Class/Procurement Level:

Non-Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

Metro East Ind.
Supply Inc.
P.O. Box 578
Granite City, IL 62040

Manufacturer:

Unknown

QA Requirements Imposed on Vendor:

None

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 5, 1988

MLTS 87-5463-D
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: D Item Type: Stud SR/NS: NS

Stock No.: 77-60-735 Spec./Grade: ASTM-A193 Grade B7

Description: 1/2"-13TPI x 2 3/4" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: D1 -$\overset{\wedge}{\underset{B7}{}}$; D-2 HB, B7 (See Attached Photo)

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
D1	C28.6	C29.2
D2	C28.2	C29.7
3		
4		
5		
Requirements for ASTM-A193-83	None	

METLAB

MLTS 87-5463-D
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	D 1	D 2	3	4	5	Requirement
Carbon	.35	.40				.35 - .51
Manganese	.98	.86				.61 - 1.1
Phosphorus	.011	.012				.040 Max.
Sulfur	.026	.030				.045 Max.
Silicon	.24	.24				.13 - .37
Copper	.04	.14				---
Nickel	.02	.03				---
Chromium	.98	.90				.70 - 1.2
Molybdenum	.26	.19				.13 - .27
Columbium + Tantalum	---	---				---

Conformance or Non-Conformance: Both samples tested conform to the chemical analysis requirements of ASTM-A193-83 for Grade B7

Witnessed By: Joseph G Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

METLAB

MLTS 87-5463-D

Manufacturers marking on Stock No. 77-60-735 studs

Fastener Testing Data Sheet

Sample ID #

CA-63-60-646

Fastener Description:

Bolt, 5/8" - 11 TPI x 3" Long

Description of Sample Stock Location:

I/P/10/D/00/AB

Material Specification as Documented by Licensee Records:

SA-307 Grade B

Head Marking (Specification and Manufacturer):

TB, LW71

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Hangers/Clamps

Vendor:

Texas Bolt Co.*
3233 W. 11th Street
Houston, TX 77001

Manufacturer:

Texas Bolt Co.
3233 W. 11th Street
Houston, TX 77001

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hardness Measurements:

Coupon No.	Rockwell Hardness
E1	B92, B90
E2	B81, B84.5
E3	B83, B84.2

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463-E
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: E Item Type: Bolt SR/NS: SR

Stock No.: 63-60-646 Spec./Grade: SA-307 Grade B

Description: 5/8"-11TPI x 3" Long ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: TB, LW71

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
E1	20.0	58.5	74,297	87,373
E2	18.0	57.3	72,357	85,563
E3	20.0	54.5	68,968	82,316
Min. Requirements: for SA/A-307-86 Grade B	18.0	---	---	60,000-100,000

*Gage Length: 1"

METLAB

MLTS 87-5463-E
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	E1	E2	E3	Requirements
Carbon	.17	.16	.18	---
Manganese	.76	.77	.76	---
Phosphorus	.009	.007	.010	.040 Max.
Sulfur	.017	.017	.032	.050 Max.
Silicon	.13	.13	.12	---
Copper	.08	.08	.03	---
Nickel	.03	.03	.04	---
Chromium	.05	.05	.02	---
Molybdenum	<.01	<.01	<.01	---
Columbium + Tantalum	---	---	---	---

Conformance or Non-Conformance All three coupons tested conform to the mechanical and chemical analysis requirements of SA-307-86 for Grade B.

Witnessed By: Joseph D Jaegers
Union Electric Co
Joe Jaegers

Approved By: Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-624

Fastener Description:

Bolt, 7/8" - 9 TPI x 4" Long

Description of Sample Stock Location:

I/P/10/A/00/BB

Material Specification as Documented by Licensee Records:

ASTM-A-325

Head Marking (Specification and Manufacturer):

A325, H

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Structural

Vendor:

A&G Engineering Co.
4640 E. LaPalma Ave.
Anaheim, CA 92807

Manufacturer:

A&G Engineering Co.
4640 E. LaPalma Ave.
Anaheim, CA 92807

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 East 30th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463 -F
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: F Item Type: Bolt SR/NS: SR

Stock No.: 63-60-624 Spec./Grade: ASTM-A325, Type 1

Description: 7/8"-9TPI x 4" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: A325, ⟷

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
F1	26.0	60.9	128,871	143,057
F2	25.0	59.7	128,141	143,418
F3	25.0	58.8	136,364	148,452
Min. Requirements: for ASTM-A325-86, Type 1	14.0	35.0	81,000	105,000

*Gage Length: 1.40"

METLAB

MLTS 87-5463-F
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	F1	F2	Fe	Requirements
Carbon	.33	.30	.34	.25 - .58
Manganese	1.00	.99	1.02	.57 Min.
Phosphorus	.015	.013	.013	.048 Max.
Sulfur	.013	.012	.012	.058 Max.
Silicon	.30	.30	.32	---
Copper	.11	.10	.10	---
Nickel	.10	.10	.11	---
Chromium	1.02	1.00	1.02	---
Molybdenum	.24	.23	.29	---
Columbium + Tantalum	---	---	---	---

Conformance or Non-Conformance: All three coupons tested conform to the mechanical and chemical analysis requirements of ASTM-A325 for Type 1.

Witnessed By: Joseph G Jaegers
Union Electric Co.

Approved By: Dan M Lawson
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-804

Fastener Description:

Bolt, 1" - 8 TPI x 3-1/2" Long

Description of Sample Stock Location:

W/S/37/K/10/A

Material Specification as Documented by Licensee Records:

ASTM-A-490, Type 1

Head Marking (Specification and Manufacturer):

TB, A490

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Restraints

Vendor:

A&G Engineering Co.
4640 E. LaPalma Ave.
Anaheim, CA 92807

Manufacturer:

Texas Bolt Co.
3233 W. 11th Street
Houston, TX 77001

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hareness Measurements:

Coupon No.	Rockwell Hardness
G1	C36, C37
G2	C34, C34

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463 -G
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: G Item Type: Bolt SR/NS: SR

Stock No.: 63-60-804 Spec./Grade: ASTM-A490, Type 1

Description: 1"-8TPI x 3 1/2" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: TB, A490

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
G1	20.0	55.2	161,585	174,695
G2	20.0	55.6	160,061	174,187
Min. Requirements: for ASTM-A490-85, Type 1	14.0	40.0	130,000	150,000-170,

*Gage Length: 1.400"

METLAB

MLTS 87-5463-G
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	G1	G2	Requirements
Carbon	.29	.29	.28 - .50
Manganese	.87	.88	---
Phosphorus	.010	.010	.045 Max.
Sulfur	.022	.023	.045 Max.
Silicon	.27	.27	---
Copper	.06	.06	---
Nickel	.12	.12	---
Chromium	.97	.98	---
Molybdenum	.25	.26	---
Columbium + Tantalum	---	---	---

Conformance or Non-Conformance Both coupons tested are in non-conformance with respect to ultimate strength. Both coupons conform to the chemical analysis requirements of ASTM-A490-85 for Type 1. Note that elongation, reduction of area and yield strength values conform to ASTM-A490-85 Type 1.

Witnessed By: Joseph J Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: Dan M. Lawson
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-21-56-123

Fastener Description:

Bolt, 1/4" - 20 TPI x 2" Long

Description of Sample Stock Location:

W/S/31/A/01/CA

Material Specification as Documented by Licensee Records:

ASTM-A-307, Grade B

Head Marking (Specification and Manufacturer):

None

Class/Procurement Level:

Non-Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Hanger/Clamps

Vendor:

Unknown

Manufacturer:

Unknown

QA Requirements Imposed on Vendor:

None

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463 -H
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: H Item Type: Bolt SR/NS: NS

Stock No.: 21-56-123 Spec./Grade: ASTM-307 Grade B

Description: 1/4"-20TPI x 2" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: None

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
	Surface	Core
H1	B98, B100	B89.5, B82.5
H2	B99, B94	B83.2, B87.6
3		
4		
5		

Requirements for
ASTM-A307-86 Grade B
B69 to B95

METLAB

MLTS 87-5463 -H
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	H 1	H 2	3	4	5	Requiremen
Carbon	.07	.07				---
Manganese	.47	.47				---
Phosphorus	.013	.013				.040 Max.
Sulfur	.021	.019				.050 Max.
Silicon	.16	.16				---
Copper	.03	.03				---
Nickel	.02	.02				---
Chromium	.02	.02				---
Molybdenum	.05	.05				---
Columbium + Tantalum	---	---				---

Conformance or Non-Conformance: Surface hardness exceeded the maximum specification requirement slightly; therefore, the referee method of core hardness was performed. Both samples tested have a core hardness and chemical analysis conforming to the requirements of ASTM-A307-86 for Grade B

Witnessed By: Joseph D Jaegers
Union Electric Co.
Joe Jaegers

Approved By: Dan H Lawson
Dan H. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-21-56-127

Fastener Description:

Bolt, 1/2" - 20 TPI x 3-1/2" Long

Description of Sample Stock Location:

W/S/31/E/02/EC

Material Specification as Documented by Licensee Records:

ASTM-A-325, Type 1

Head Marking (Specification and Manufacturer):

Multi-C, A325, A8

Class/Procurement Level:

Non-Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Structural

Vendor:

Unknown

Manufacturer:

Unknown

QA Requirements Imposed on Vendor:

None

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 5, 1988

MLTS 87-5463-I
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: I Item Type: Bolt SR/NS: NS

Stock No.: 21-56-127 Spec./Grade: ASTM-A325, Type I

Description: 1/2"-20TPI x 3 1/2" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: Multi-C, A325, A8

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
I1	C24.4	C26.1
I2	C27	C26
3		
4		
5		
Requirements for ASTM-A325-86	C24 to C35	

METLAB

MLTS 87-5463 -I
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	I1	I2	3	4	5	Requiremen
Carbon	.38	.39				.25 - .58
Manganese	.86	.86				.57 Min.
Phosphorus	.014	.014				.048 Max.
Sulfur	.013	.013				.058 Max.
Silicon	.25	.25				---
Copper	.01	.01				---
Nickel	.02	.02				---
Chromium	.94	.94				---
Molybdenum	.18	.19				---
Columbium + Tantalum	---	---				---

Conformance or Non-Conformance: Both samples tested conform to the hardness and chemical analysis requirements of ASTM-A325-86 for Type 1.

Witnessed By: Joseph G Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-387

Fastener Description:

Bolt, 1/2" - 13 TPI x 4" Long

Description of Sample Stock Location:

W/S/37/C/12/F

Material Specification as Documented by Licensee Records:

ASTM-A-449, Type 1

Head Marking (Specification and Manufacturer):

LE

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Various

Vendor:

Cardinal Industrial
Products Corp.
3873 West Oquendo
Las Vegas, NV 89118

Manufacturer:

Cardinal Industrial
Products Corp.
3873 West Oquendo
Las Vegas, NV 89118

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hardness Measurements:

Coupon No.	Rockwell Hardness
J1	C27.5, C27.5
J2	C26.5, C28

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 19[illegible]

MLTS 87-5463-J
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: J Item Type: Bolt SR/NS: SR

Stock No.: 63-60-387 Spec./Grade: ASTM-A449, Type 1

Description: 1/2"-13TPI x 4" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: LE

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
J1	19.0	48.5	127,438	143,079
J2	20.0	55.3	129,480	144,802
Min. Requirements: for ASTM-A449-86 Type 1	14.0	35.0	92,000	120,000

*Gage Length: 1"

METLAB

MLTS 87-5463-J
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	J1	JR	Requirements
Carbon	.39	.37	.25 - .58
Manganese	.95	.96	.57 Min.
Phosphorus	.013	.011	.048 Max.
Sulfur	.015	.015	.058 Max.
Silicon	.24	.25	---
Copper	<.01	<.01	---
Nickel	.02	.02	---
Chromium	.04	.04	---
Molybdenum	.01	.01	---
Columbium + Tantalum	---	---	---

Conformance or Non-Conformance: Both coupons tested conform to the mechanical and chemical analysis requirements of ASTM-A449 for Type 1.

Witnessed By: Joseph F Jaegers
Union Electric Co.
Joe Jaegers

Approved By: Dan M. Lawson
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-125

Fastener Description:

Nut, 1/2" - 13 TPI

Description of Sample Stock Location:

W/S/37/I/10/A

Material Specification as Documented by Licensee Records:

SA-194 Grade 2H

Head Marking (Specification and Manufacturer):

2H, 9H,

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

Cardinal Industrial
Products Corp.*
3873 West Oquendo
Las Vegas, NV 89118

Manufacturer:

Cardinal Industrial
Products Corp.
3873 West Oquendo
Las Vegas, NV 89118

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 5, 1988

MLTS 87-5463-K
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: K Item Type: Nuts SR/NS: SR

Stock No.: 63-60-125 Spec./Grade: SA-194 Grade 2H

Description: 1/2"-13TPI ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: 2H, 9H, C

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
K1	C31	C31
K2	C30.8	C30.8
K3	C30.6	C30.4
K4	C28.8	C29
K5	C30.9	C30
Requirements for SA/A-194-82	C24 to C38	

METLAB

MLTS 87-5463-K
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	K 1	K 2	K 3	K 4	K 5	Requirement
Carbon	.43	.41	.41	.41	.42	.40 Min
Manganese	.80	.78	.79	.80	.80	---
Phosphorus	.012	.011	.011	.012	.011	.040 Max.
Sulfur	.029	.027	.026	.029	.028	.050 Max.
Silicon	.24	.23	.24	.24	.25	---
Copper	.01	.01	.01	.01	.01	---
Nickel	.02	.02	.02	.02	.02	---
Chromium	.17	.17	.17	.17	.18	---
Molybdenum	.05	.06	.06	.05	.05	---
Columbium + Tantalum	---	---	---	---	---	---

Conformance or Non-Conformance: All five samples tested conform to the hardness and chemical composition requirements of SA-194-82 for Grade 2H.

Witnessed By: Joseph H Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-62-293

Fastener Description:

Nut, 5/8" - 11 TPI

Description of Sample Stock Location:

W/S/37/I/10/B

Material Specification as Documented by Licensee Records:

SA-194 Grade 6

Head Marking (Specification and Manufacturer):

6, H

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Pressure Boundary

Vendor:

A&G Engineering Co.
4640 E. LaPalma Ave.
Anaheim, CA 92807

Manufacturer:

Hamanaka Nut Mfg. Co., Inc.
Himeji, Japan

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 E[illegible] Street Tulsa, Oklahoma 741[illegible]
(918) 664-7767

January 6, 1988

MLTS 87-54[illegible]-L
NUCLEAR
P.O. [illegible]

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc. QA Manual, Rev. A, dated 2/28/84.

Metlab Item: L Item Type: Nuts SR/NS: SR

Stock No.: 63-62-29[illegible] Spec./Grade: SA-194 Grade 6

Description: 5/8"-11TP[illegible] ASME SA-[illegible] II (Y/N): Y

Manufacturers Marking on [illegible]astener: 6, [illegible]

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
L1	C25.2	C25.8
L2	C25.2	C25.8
L3	C24.9	C25
4		
5		
Requirements for SA/A-194-84 Grade 6	C20 to C28	

METLAB

MLTS 87-5463-L
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	L1	L2	L3	4	5	Requirements
Carbon	.13	.13	.10			.15 Max.
Manganese	.70	.79	.79			1.00 Max.
Phosphorus	.024	.023	.024			.040 Max.
Sulfur	.010	.008	.008			.030 Max.
Silicon	.26	.33	.31			1.00 Max.
Copper	.05	.03	.02			---
Nickel	.48	.42	.41			---
Chromium	11.65	11.54	11.51			11.50-13.50
Molybdenum	<.01	<.01	<.01			---
Columbium + Tantalum	<.01	<.01	<.01			---

Conformance or Non-Conformance: All three coupons tested met the hardness and chemical analysis requirements of SA-194-82 for Grade 6.

Witnessed By: Joseph G Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: Dan M. Lawson
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-682

Fastener Description:

Nut, 1" - 8 TPI

Description of Sample Stock Location:

I/P/10/D/04/B

Material Specification as Documented by Licensee Records:

SA-307 Grade B

Head Marking (Specification and Manufacturer):

LW88, |——

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Hangers/Clamps

Vendor:

Texas Bolt Co.*
3233 W. 11th Street
Houston, TX 77001

Manufacturer:

Texas Bolt Co.
3233 W. 11th Street
Houston, TX 77001

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 5, 1988

MLTS 87-5463-M
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: M Item Type: Nuts SR/NS: SR

Stock No.: 63-60-682 Spec./Grade: SA-307 Grade B

Description: 1"-8TPI ASME Sec. III (Y/N): Y

Manufacturers Marking on the Fastener: LW88, ⊢

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness
M1	B85.1 B85.9
M2	B87.8 B88.6
M3	B85.8 B86
4	
5	
Requirements for SA/A-307-86	B69 to B95

METLAB

MLTS 87-5463-M
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	M1	M2	M3	4	5	Requirements
Carbon	.42	.40	.43			---
Manganese	.82	.82	.82			---
Phosphorus	.013	.013	.013			.040 Max.
Sulfur	.022	.021	.022			.050 Max.
Silicon	.25	.26	.25			---
Copper	.02	.02	.02			---
Nickel	.02	.02	.02			---
Chromium	.10	.10	.10			---
Molybdenum	.04	.04	.04			---
Columbium + Tantalum	---	---	---			---

Conformance or Non-Conformance: The three samples tested conform to the hardness and chemical composition requirements of SA-307-36 for Grade B.

Witnessed By: Joseph G Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: [illegible]
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-621

Fastener Description:

Nut, 1" - 8TPI

Description of Sample Stock Location:

I/P/10/A/04/BB

Material Specification as Documented by Licensee Records:

ASTM-A-194 Grade 2H

Head Markin (Specification and Manufacturer):

2H, ⊥

Class/Procurement Level:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Structural/Restraints

Vendor:

Texas Bolt Co.*
3233 W. 11th Street
Houston, TX 77001

Manufacturer:

Texas Bolt Co.
3233 W. 11th Street
Houston, TX 77001

* Items purchased by Daniel International Corporation as agent for UE.

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

MLTS 88-140

NUCLEAR
PO #94870 N/C-4

January 15, 1988

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry:

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documentated per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: 1 Item Type: Nuts SR/NS: SR

Stock No: 63-60-621 Spec./Grade: ASTM-A194 Grade 2H

Description: 1"-8TPI ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: 2H, |

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness
1	C31.0, C31.2
2	C31.3, C31.5
3	C30.6, C31.2
Requirements for: ASTM-A-194-85 Grade 2H	C24, C38

METLAB

MLTS 88-140
NUCLEAR
P.O. #94870 N/C-4

CHEMICAL ANALYSIS - VACUUM EMI N SPECTROGRAPH (in %)

Constituent	1	2	3	Requirements
Carbon	.43	.44	.42	.40 Min.
Manganese	.71	.72	.72	---
Phosphorus	.012	.013	.012	.040 Max.
Sulfur	.020	.021	.019	.050 Max.
Silicon	.24	.26	.25	---
Copper	.02	.02	.02	---
Nickel	.06	.06	.06	---
Chromium	.03	.04	.04	---
Molybdenum	.01	.01	.01	---
Columbium + Tantalum	---	---	---	---

Conformance or Non-Conformance: All three coupons tested met the hardness and chemical analysis requirements of ASTM-A194-85 Grade 2H.

Approved By: Dan M. Lawson, QA Manager

cc: J. Jaegers-M.C.-470
Union Electric Co.
P.O. Box 149
St. Louis, MO 63166

Fastener Testing Data Sheet

Sample ID #

CA-76-60-368

Fastener Description:

Nut, 5/16" - 18 TPI

Description of Sample Stock Location:

W/S/02/G/10/AB

Material Specification as Documented by Licensee Records:

ASTM-A-194 Grade 2H

Head Marking (Specification and Manufacturer):

None

Class/Procurement Level:

Non-Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Non-Pressure Boundary

Vendor:

Dresser Industries
Industrial Valve Div.
P.O. Box 1430
Alexandria, LA 71301

Manufacturer:

Unknown

QA Requirements Imposed on Vendor:

None

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 5, 1988

MLTS 87-5463 - N
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: N Item Type: Nuts SR/NS: NS

Stock No.: 76-60-368 Spec./Grade: ASTM-A194 Grade 2H

Description: 5/16"-18TPI ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: None

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
N1	B89.8	B94
N2	B88.9	B90.2
N3	B89.8	B92
4		
5		

Note: "B" Scale readings were taken as ASTM-E18 does not recommend using "C" values of less than 20. Values obtained would be less than C15.

Requirements for ASTM-A194-85 C24 to C38

METLAB

MLTS 87-5463-N
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	N1	N2	N3	4	5	Requirement
Carbon	.09	.08	.09			.40 Min.
Manganese	.38	.47	.39			---
Phosphorus	.011	.022	.018			.035 Max.
Sulfur	.010	.019	.015			.040 Max.
Silicon	.05	.21	.16			---
Copper	<.01	<.01	<.01			---
Nickel	.02	.02	.02			---
Chromium	<.01	<.01	<.01			---
Molybdenum	.02	.01	.01			---
Columbium + Tantalum	---	---	---			---

Conformance or Non-Conformance: All three samples tested were in non-conformance of ASTM-A194-85 for Grade 2H.

Witnessed By: Joseph D Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: [illegible]
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-21-61-160

Fastener Description:

Nut, 1-3/4" - 5 TPI

Description of Sample Stock Location:

I/P/10/B/04/AF

Material Specification as Documented by Licensee Records:

A-307

Head Marking (Specification and Manufacturer):

None

Class/Procurement Level:

Non-Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Hangers/Clamps

Vendor:

Service Supply Co.
3715 Pennridge Dr.
Bridgeton, MO 63044

Manufacturer:

Unknown

QA Requirements Imposed on Vendor:

None

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463-0
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: 0 Item Type: Nuts SR/NS: NS

Stock No.: 21-61-160 Spec./Grade: ASTM-A307 Grade B

Description: 1 3/4"-5TPI ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: None

HARDNESS TEST (SA/A-370-77)

Coupon Number	Rockwell Hardness	
	Surface	.015" Below Surface
01	B71.1, 372.3	B72.3, B74.0
02	B64.5, B68.0	B71.0, B72.0
03	B73.0, B70.0	B74.5, B75.0
4		
5		

Requirements
ASTM-A307-86 Grade B
B69 to B95

METLAB

MLTS 87-5463-0
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	01	02	03	4	5	Requirement
Carbon	.15	.16	.15			---
Manganese	.53	.51	.53			---
Phosphorus	.012	.012	.011			.04 Max.
Sulfur	.028	.028	.027			.05 Max.
Silicon	.25	.25	.25			---
Copper	.02	.02	.02			---
Nickel	.02	.02	.02			---
Chromium	<.01	<.01	<.01			---
Molybdenum	.05	.05	.05			---
Columbium + Tantalum	---	---	---			---

Conformance or Non-Conformance: Initial hardness test showed some values below the B69 minimum specification limit. As parts were heavily scaled from heat treating 0.015" was surface ground from the top surface of all three nuts and the hardness test was repeated. At 0.015" below the surface all three nuts conform to the hardness and chemical analysis requirements of ASTM-A307-86 for Grade B.

Witnessed By: Joseph D Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

Fastener Testing Data Sheet

Sample ID #

CA-63-60-598

Fastener Description:

Capscrew, 3/4" - 10 TPI x 2" Long

Description of Sample Stock Location:

W/S/13/C/00/BA

Material Specification as Documented by Licensee Records:

A-574

Head Marking (Specification and Manufacturer):

See Attached Photo (Page 53 of 53)

Class/Procurement Lovel:

Safety-Related

General Plant Application (e.g., Pressure Boundary, Structural)

Various

Vendor:

Cardinal Industrial
Products, Inc.
3873 West Oquendo
Las Vegas, NV 89118

Manufacturer:

Cardinal Industrial
Products, Inc.
3873 West Oquendo
Las Vegas, NV 89118

QA Requirements Imposed on Vendor:

QA Program meeting the applicable requirements of Appendix B

Hardness Requirements:

Coupon No.	Rockwell Hardness
P1	C37, C37
P2	C38, C37.5
P3	C37.5, C37

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

January 6, 1988

MLTS 87-5463-P
NUCLEAR
P.O. #94870

Union Electric Co.
P.O. Box 620
Fulton, MO 65251

Attn: Mr. M. G. Cherry

In accordance with P.O. #94870, the chemical analysis and mechanical tests were performed on the item described below and documented per Metlab Testing Services, Inc., QA Manual, Rev. A, dated 2/28/84.

Metlab Item: P Item Type: Capscrew SR/NS: SR

Stock No.: 63-60-598 Spec./Grade: ASTM-A574

Description: 3/4"-10TPI x 2" Long ASME Sec. III (Y/N): N

Manufacturers Marking on the Fastener: See Attached Photo

MECHANICAL TESTS (SA/A-370-77)

Coupon No.	Elongation* (%)	Reduction of Area (%)	Yield Strength 0.2% Offset, (psi)	Ultimate Strength (psi)
P1	18.0	53.6	171,429	181,366
P2	22.0	56.4	171,357	179,541
P3	22.0	56.7	167,134	176,008
Min. Requirements: for ASTM-574-82	---	---	---	170,000

*Gage Length: 2"

METLAB

MLTS 87-5463-P
NUCLEAR
P.O. #94870

CHEMICAL ANALYSIS - VACUUM EMISSION SPECTROGRAPH (in %)

Constituent	P1	P2	P3	Requirements
Carbon	.34	.34	.34	0.31 Min.
Manganese	.77	.76	.76	---
Phosphorus	.016	.018	.015	.045 Max.
Sulfur	.014	.014	.013	.045 Max.
Silicon	.26	.25	.27	---
Copper	.06	.07	.06	---
Nickel	.08	.08	.08	---
Chromium	1.05	1.02	1.00	---
Molybdenum	.20	.19	.19	---
Columbium + Tantalum	---	---	---	---

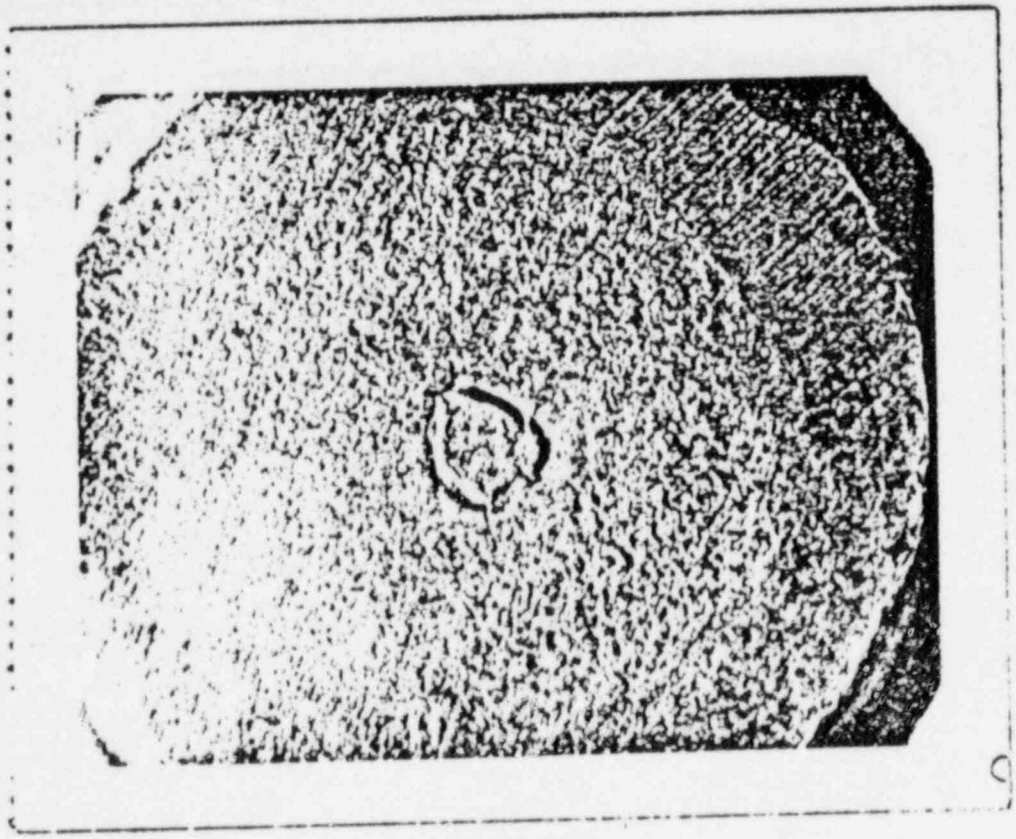
Conformance or Non-Conformance All three coupons tested conform to the mechanical and chemical analysis requirements of ASTM-A574-82.

Witnessed By: Joseph G Jaegers
Union Electric Co.
Joseph Jaegers

Approved By: _____
Dan M. Lawson, QA Manager

METLAB

MLTS 87-5463-P



Capscrew, Stock No. 63-60-598