



# Pennsylvania Power & Light Company

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June 8, 1982

Mr. R. C. Haynes  
Regional Administrator  
Region I  
U. S. Nuclear Regulatory Commission  
631 Park Avenue  
King of Prussia, PA 19406

SUSQUEHANNA STEAM ELECTRIC STATION  
FINAL REPORT ON A DEFICIENCY RELATING TO  
INADEQUATE DOCUMENTATION FOR MISCELLANEOUS STEEL  
ERs 100450/100508 FILE 821-10  
PLA-1121

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Reference: PLA-859 dated June 23, 1981

Dear Mr. Haynes:

This letter contains information which serves to provide the Commission with a final report on the deficiency involving inadequate documentation for miscellaneous steel.

This condition was originally reported in a telephone conversation between Mr. L. Narrow of NRC Region I and Mr. A. R. Sabol of PP&L on May 13, 1981. At that time, the condition was considered to be potentially reportable under the provisions of 10CFR50.55(e). Our interim report (referenced above) described the condition.

The attached report outlines the evaluation undertaken to determine whether the condition identified is reportable under the provision of 10CFR50.55(e). Our conclusion is that it is not reportable.

We trust the Commission will find this report to be satisfactory.

Very truly yours,

N. W. Curtis  
Vice President-Engineering & Construction-Nuclear

BMS:sab

Attachment

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SSES

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File 821-10

Mr. R. C. Haynes

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Mr. R. C. Haynes

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SP&E Correspondence File	- N3
QA Clerk	- N4
8.1.2A #81-21 File	- N4

PENNSYLVANIA POWER & LIGHT COMPANY  
NUCLEAR DEPARTMENT  
NUCLEAR PLANT ENGINEERING  
FINAL REPORT

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## 1.0 SUBJECT

Inadequate documentation of steel supplied by Bloomsburg Metal Company to Susquehanna Steam Electric Station (SSES), Units 1 and 2, under Specification 8856-C-16 (Furnishing and Delivery of Miscellaneous Metal). The subsequent review of this problem has resulted in the disposition that the inadequate documentation does not represent a reportable condition under the provisions of 10CFR50.55(e).

## 2.0 DESCRIPTION

Bloomsburg Metal Company (Wilkes Barre, PA) supplied steel to SSES between September 1974 and April 1981. All of this material was delivered unfabricated under Specification 8856-C-16 and was later fabricated and installed throughout the plant by Bechtel Power Corporation (A/E) field personnel under Bechtel QA/QC programs. This material was purchased under a provision in the specification that allows procurement of unfabricated, miscellaneous steel from suppliers who are not required by other sections of the procurement documents to maintain and/or implement a Quality Assurance Program.

Specification 8856-C-16 Paragraph 12.6 requires that Mill Test Reports be furnished for all material except A36 sheet and strip 3/16 inch and under in thickness. There are other minor exceptions to this requirement such as nuts, washers, A307 bolts and aluminum products.

During a Bechtel QC review of supporting documentation for a shipment of Bloomsburg Metal Company steel, it was noted that the total quantity of material shown on a Mill Test Report for a specific heat was less than the total quantity of material received under that heat. Upon this discovery, Bechtel QC performed further investigation of their documentation files and found additional discrepancies of a similar nature. This resulted in Bechtel QC documenting (via NCR 7561 reported on April 15, 1981) that the quality of all materials supplied by Bloomsburg Metal Company was indeterminate. The material for which Mill Test Reports were not required is not of concern because high assurance of the quality of this material is not essential to the safe operation of the plant.

Mill Test Reports were required for all material listed in Table 1. The A325 bolts listed in Table 1 are easily recognized by a designation (A325) on the head of the bolt. The stainless steel bar under Purchase Order 44204 is not of concern because high assurance of the quality of this material is not required. The application of the stainless steel bar used from Purchase Order 38598 was investigated and is discussed in Section 6.0. Therefore, the deficiencies are confined to the A36 and A500 steel for which Mill Test Reports were required. Table 2 is a summary of the quantities of steel purchased from Bloomsburg Metal Co. between 1974 and April, 1981 and the scope of the material covered by NCR 7561.

### 3.0 CAUSE

After discovery of the deficiencies, Bechtel QA conducted an audit on May 21, 1981 at Bloomsburg Metal Company in which representatives from Bechtel Resident Engineering and PP&L QA were in attendance. The storage areas were inspected. In addition, 235 Mill Test Reports, as well as, vendor and subtier vendor documentation were reviewed. It was determined that the discrepancies were caused by Bloomsburg's method of matching the appropriate Mill Test Report with the steel to be shipped.

On February 11 and 12, 1982, PP&L QA performed a verification activity at Bloomsburg Metal Company. The investigating team consisted of representatives from PP&L QA and Engineering as well as Bechtel QA. The team first toured the supplier's facility. They then reviewed all available Mill Test Reports and Purchase Orders (between Bloomsburg Metal Company and its' suppliers) from 1974 through August 1981 for all items that could have been placed in the A36 or A500 storage area. The results of this activity reinforced Bechtel's conclusion concerning the cause of the documentation discrepancies.

Bloomsburg assigns a Mill Test Report to a piece of steel to be shipped by the following method:

- a. From an inventory card, the approximate date and source of an item received by Bloomsburg Metal Company is selected.
- b. An invoice is selected based on this date and source; not from an invoice number. A specific tie-in between the inventory card and the invoice does not exist.
- c. A Mill Test Report is selected according to the date which matches that of the invoice; not by matching heat numbers. A specific tie-in between the invoice and the Mill Test Report does not exist.
- d. The heat number from the Mill Test Report is then painted on the steel to be shipped.

This method does not assure that the proper Mill Test Report is shipped with the steel selected from the storage area. Therefore, the quality of all steel shipped by Bloomsburg Metal Company during the referenced time period was considered indeterminate and an investigation was initiated to review the technical implications of the deficiency in assigning Mill Test Reports.

### 4.0 TECHNICAL EVALUATION

All potential substitutes for the Bloomsburg Metal Company steel supplied to SSES were evaluated based on the results of the Bechtel audit and the PP&L verification activity. In addition, Bechtel

performed a sampling program comprised of 51 samples from separate heats (Bloomsburg assigned). These samples were obtained from various locations (constructed and in material laydown area) and shapes selected at random from Bloomsburg material received at SSES. Mill Test Reports furnished by Bloomsburg indicate that all the material delivered to SSES came from approximately 200 heats.

The results of all evaluations conducted to disposition this potentially reportable deficiency indicate that the only potential problems are the questionable weldability characteristics of the following steels:

- a. Abrasion resisting (AR) grades of steel plates substituted for A36 steel in thicknesses of 3/8" and over.

No ASTM standard exists for AR steels. Most have higher allowable carbon limits than A36, usually over 0.40%. Therefore, for plate thicknesses of 3/8" and over, weld heat affected zone (HAZ) cracking could occur if this material were substituted for A36, because of insufficient preheating if it were welded using A36 procedures. Plates thinner than approximately 3/8" have a relatively small heat sink effect on the HAZs. Thus, the undesirable untempered martensite phase (brittle) is not likely to form, because of the lack of a rapid quench effect that would be present in thicker plates (refer to Fig. 3, Pg. 188, Vol. 6, 8th edition of the Metals Handbook by the American Society for Metals). Furthermore, thin plates do not usually have excessively high restraint in weldments, which is a major cause of cracking, and they are almost certainly loaded under the favorable plane stress condition rather than the more severe plane strain condition.

- b. A514 steel plates substituted for A36 steel.

The welding code in effect at the time of construction was the 1972 edition of the American Welding Society (AWS) (D1.1-72). It has the following preheat requirements:

<u>Thickness</u>	<u>A514</u>	<u>A36</u>	<u>Difference</u>
up to 3/4"	50°F	*	18° (Max)
3/4" to 1-1/2"	125°F	70°	55°
1-1/2" to 2-1/2"	175°F	150°	25°
over 2-1/2"	225°F	225°	0°

\*None (unless base metal < 32°F then it must be preheated to at least 70°F and maintained at this temperature during welding).

The minimal differences for the required preheat temperatures, together with the low carbon limits (.21 max.) would not be



expected to result in any detrimental amounts of untempered martensite in the HAZs of welds in A514 plates [see 3rd paragraph of "High-Strength Plate and Structural Steels (As-Rolled or Normalized), Pg. 205, Vol. 6, 8th edition of the Metals Handbook by the American Society for Metals].

The PP&L NQA Verification Activity determined, based on available documentation at Bloomsburg Metal Co., that Bloomsburg stocked A514 plate primarily in thicknesses no greater than 1/2 inch. This, coupled with the negligible difference in preheat temperatures (at thicknesses less than 5/8 inch), leads to the conclusion that A514, if substituted by Bloomsburg for A36 plate, would not result in an unacceptable constructed condition.

c. Heat Treated, Quenched and Tempered Steel

A typical certified mill test report of this type steel that was supplied to Bloomsburg Metals reveals that it complies with Type A514, Grade A. Thus, the above stated reasons (Para.b.) also apply to these steels.

5.0 SAFETY IMPLICATIONS

PP&L informed the NRC on May 13, 1981 (as documented in PLA-859 dated June 23, 1981), that the situation as described in NCR 7561 represented a potentially reportable condition under the provisions of 10CFR50.55(e).

The only material for which potentially deficient substitutions could have occurred is A36 plate thicker than 1/4 inch. No substitutions of this type have been discovered for any erected steel at SSES based on the results of the first sampling program (performed by Bechtel). However, one sample from the laydown area at SSES was determined to be AR steel. Further investigation has been performed to properly evaluate the safety implications of this problem. PP&L considers this condition to be not reportable under 10CFR50.55(e) based on the findings of the investigation undertaken in Section 6.0 of this report.

6.0 CORRECTIVE ACTION

The following actions were taken to prevent recurrence of the problem:

- a. No steel has been purchased from Bloomsburg Metal Company under Specification 8856-C-16 since October, 1981.
- b. PP&L has initiated an investigation of additional control measures to assure the validity of documentation received in conjunction with procurements.



In addition, a second sampling program was performed to identify possible problems caused by the documentation deficiency. Since all of the Bloomsburg Metal Company steel could not be traced to its erected location, the sampling program was designed to sample critical locations (installed) where miscellaneous steel plate (supplied under Specification 8856-C-16) greater than 1/4 inch thick had been welded. The sampling base would include steel supplied by all known suppliers under Specification C-16.

To accomplish the review of installed locations, it was decided by Nuclear Plant Engineering (NPE) to test accessible locations in the drywell of Unit 1. The decision to limit testing to the Unit 1 drywell was made for two reasons: 1) all C-16 steel in the drywell was required to be "Q" listed or safety related, and 2) schedule restrictions required that the program be done on a scale representative of those locations within the plant where C-16 plate could have been used. The test performed was a non-destructive, controlled reluctance eddy current test procedure which has been developed and patented by Reluxtrol, Inc. This procedure identified A36 and similar steels based on a repeatable output on the Reluxtrol scope. The reading was then compared with that from samples of AR and AISI 1045 steels. The oscilloscope was calibrated using the following: 1) a sample of A36 steel with carbon content of approximately 0.20% (ASTM 0.25% max. allow.); and 2) a sample of 1045 steel with a 0.46% carbon content. By calibrating to these two standards, it was assured that A36 steel would be properly identified during the testing program.

The second C-16 Sampling Program was developed to identify installed locations of plate material equal to or greater than 3/8 inch in thickness which was not of the A36 family of steel. Numerous organizations were involved in this project to properly coordinate and supervise the actual testing. Below is listed the scope of the activities covered by the sampling program along with the responsible organization:

<u>Activity</u>	<u>Responsible Organization</u>
1) Provide program management and necessary administrative support.	NPE-Civil
2) Develop acceptable procedure to properly identify the A36 steel family.	Reluxtrol, Inc.
3) Perform review of engineering drawings for locations of A36 plate in the Unit 1 drywell.	Bechtel-Civil/SFO
4) Review Field Work Orders (FWOs) prepared by Civil, Electrical, I&C and Piping	Bechtel Field Eng.

<u>Activity</u>	<u>Responsible Organization</u>
groups for use of C-16 A36 plate 3/8 inch or thicker.	
5) Provide field support to direct Reluxtrol personnel to plate locations to be tested.	Bechtel Field Eng.
6) Provide means of documenting (form) test results in the field.	PLNQA
7) Supply sufficient personnel to witness and verify Reluxtrol tests.	PLQC/Field
8) Provide necessary liason with field supervision to assure that necessary craft personnel are available.	PL Project Construction
9) Ensure that the depth of the ground area is in conformance with Bechtel FCR C-5442 and that the coating is repaired in accordance with FCR A-1047.	Bechtel Quality Control (see note)

NOTE: QC function under Item 9 was performed using Bechtel Field Welding Engineers with surveillance provided by Bechtel Quality Assurance (field).

Prior to being authorized to start the testing program in the Unit 1 drywell, Reluxtrol, Inc. was required to prepare an acceptable procedure to identify the A36 steel plate in constructed locations. In addition, Reluxtrol, Inc. was instructed to prepare a procedure to be used for failed (non-A36) locations where it would be necessary to test the weld for surface cracks. A copy of the identification procedure is included in the appendix to this report. Due to the results of this sampling program, it was not necessary to utilize the procedure for surface crack detection. A more detailed description of the testing philosophy can be found in the Sampling Program Document, PLI-18335.

Figure 1 is a flowchart of the steps followed in the C-16 Sampling Program. Prior to performing the eddy current test on the installed plate, it was necessary to prepare the metal surface by grinding the base metal to a depth of at least 0.010 inch over an area of at least 0.25 square inches. After the ground area was checked for proper depth, Reluxtrol, Inc. performed the eddy current test. If the tested location was dispositioned in the gray zone (greater than 1.0 unit above A36 standard but below AR standard), a hardness test was

performed to identify plate material which was acceptable as A36 plate. Any material rejected as AR plate would then be checked for surface and underbead cracking to determine if repair was necessary. An engineering evaluation would then be performed to determine the criticality of the installed plate and a schedule for the completion of any necessary repairs.

Documentation of the test results was accomplished by the use of a PP&L Quality Control Checklist modified for use in this testing program. Checklist SM-2, Revision 0, included a list of instructions on how to use the form and the flowchart given in Figure 1 of this report. PP&L QC representatives were present at all times during the grinding and testing periods. All of the completed checklists have been placed in the permanent PP&L QC files as Quality Control Inspection Reports (QCIRs).

The review of applicable drawings and Field Work Orders (FWOs) resulted in a sampling population of approximately 1000 plate locations in the Unit 1 drywell where C-16 plate of the desired thickness was identified. A total of 403 pieces of plate were tested using the Reluxtrol eddy current procedure. Twelve (12) of these plates were dispositioned as being in the gray zone and required further testing. The remaining 391 plate locations were dispositioned as being A36 steel. Table 3 contains a list of the twelve plates with readings in the gray zone on the Reluxtrol Scope. Included in this table is information describing the location of the plates, as well as the CREG<sup>TM</sup> reading, Equotip hardness reading, and the final disposition of the plate material.

As presented in Table 3, all twelve plate locations which initially failed the Reluxtrol scope test, passed the hardness test. Based on a technical evaluation of the acceptable hardness levels for A36 plate, any value below 433 on the Equotip hardness tester (Brinell hardness of 165 max.-3000 Kg Scale) was considered indicative of A36 plate. In the final analysis, none of the tested locations were classified as being AR steel.

The zero percent failure rate, in a sample which represented approximately 40 percent of the identified population, has led NPE to the conclusion that the problem with substitute steel provided under Specification 8856-C-16 is not of sufficient magnitude to affect the safety of installed plate at Susquehanna SES. No further corrective action is required based on the results of this investigation.

The stainless steel purchased under P.O. 38598 was located in the field and is presently inaccessible to perform magnetic property tests. However, a review of the design which utilizes this steel indicated its use as being that of a spacer material in the construction of a jet impingement barrier. Under design conditions, the stainless steel blocks would be in compression and would perform

their intended function. No further testing of this material is required.

7.0 CONCLUSION

Based on the results of the investigation described in this report, the documentation deficiencies related to Bloomsburg Metal Co. are considered to be not reportable under the provisions of 10CFR50.55(e).

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TABLE 1

LIST OF PURCHASE ORDERS FOR WHICH TEST REPORTS WERE REQUIRED  
(Specification 8855-C-16 Material from Bloomsburg)

<u>P.O. No.</u>	<u>Page</u>	<u>Date of Order</u>	<u>Material</u>	<u>Material Specification</u>
51231	1	4/22/81	Steel PL	A36
50584	5,7	2/26/81	Steel L,W	A36
50104	9	2/17/81	Steel TS	A500
50301	12	2/16/81	Steel TS	A500
49452	14	1/26/81	Steel TS	A500
49366	15	1/9/81	Steel PL	A36
48249	19	11/6/80	Steel C	A36
48053	21	10/22/80	Steel W,L	A36
47518	22,23	10/3/80	Steel PL,Shapes	A36
48344	25,27	1/23/81	Steel PL, Bar	A36
46220	41	7/31/80	Steel Bar	A36
45246	50	6/11/80	Steel Bar	A36
44570	58	5/13/80	Steel W,L	A36
44570	58	5/13/80	Steel TS	A500
44366	60	5/5/80	Steel C	A36
44046	62	4/16/80	Steel W	A36
44083	64	4/21/80	Steel PL	A36
43413	70	3/19/80	Steel L	A36
44204	72	4/25/80	Stainless Bar	A276/479
			Steel	
43346	74,75	3/17/80	Steel PL	A36
43691	78,79	4/2/80	Steel Bar,PL,L	A36
43027	81	2/22/80	Steel TS	A500
42639	86	2/7/80	Steel TS	A500
42639	88	2/1/80	Steel L	A36
42433	90,92	1/18/80	Steel PL,C	A36
42157	94	1/17/80	Steel PL	A36
40946	97	11/19/79	Steel L	A36
40530	99	10/25/79	Steel W	A36
41832	102	1/3/80	Steel W,PL	A36
41832	102	1/3/80	Steel Bolt	A325
41681	104	12/16/79	Steel PL	A36
40386	110	10/18/79	Steel PL	A36
40036	114	10/9/79	Steel W	A36
39830	116	9/29/79	Steel L	A36
40034	118	10/5/79	Steel PL	A36
35548	121	3/8/79	Steel PL	A36
30953	123	8/17/78	Steel Bar	A36
30957	124	8/17/78	Steel C,Bar	A36
30729	125	8/8/78	Steel W	A36
30596	126	8/7/78	Steel C	A36
30581	127	7/31/78	Steel PL	A36
29998	128	7/19/78	Steel W	A36
29532	129	6/22/78	Steel L	A36

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TABLE 1 (CONT'D)

<u>P.O. No.</u>	<u>Page</u>	<u>Date of Order</u>	<u>Material</u>	<u>Material Specification</u>
29752	131	6/26/78	Steel L	A36
28094	133	4/28/78	Steel WT	A36
27133	135	3/10/78	Steel L	A36
28092	137	4/26/78	Steel PL,L	A36
27132	139	3/8/78	Steel PL	A36
26821	141	3/6/78	Steel C	A36
26823	143	3/3/78	Steel L	A36
26822	145	2/27/78	Steel C	A36
26868	147	2/27/78	Steel C	A36
26808	149	2/24/78	Steel C,L	A36
26812	151,153	2/21/78	Steel PL,Bar	A36
26865	155	2/9/78	Steel WT	A36
27177	157	2/16/78	Steel W	A36
27176	159,161	2/16/78	Steel C,PL	A36
26491	163	2/14/78	Steel PL	A36
26485	165	1/31/78	Steel C	A36
26486	166	2/2/78	Steel PL	A36
26285	168	2/1/78	Steel Bar	A36
26497	170	2/1/78	Steel L,Bar	A36
26277	172	1/30/78	Steel PL	A36
26813	174	1/31/78	Steel PL	A36
26274	176	1/27/78	Steel PL	A36
26270	178	1/25/78	Steel TS	A500
25845	180	1/18/78	Steel PL	A36
25690	182	1/9/78	Steel C,L	A36
25431	186	12/21/77	Steel PL	A36
25678	188	12/15/77	Steel PL	A36
25166	191	12/16/77	Steel PL	A36
25165	193	12/16/77	Steel PL	A36
25158	195	11/30/77	Steel PL	A36
24744	198	11/14/77	Steel C	A36
23335	200	9/28/77	Steel L	A36
22684	202	9/7/77	Steel L,C,Bar	A36
22672	203	8/31/77	Steel L	A36
23341	205	2/14/78	Steel L	A36
22376	206	8/24/77	Steel PL	A36
20685	210	6/13/77	Steel PL	A36
20263	212	5/11/77	Steel L	A36
19899	214	4/18/77	Steel C	A36
19905	216	4/26/77	Steel L	A36
19354	218	3/30/77	Steel PL	A36
19340	220	3/21/77	Steel W	A36
19049	222	3/11/77	Steel W	A36
18425	224	1/25/77	Steel L,Bar	A36
16905	226,229	11/15/76	Steel L,C,PL	A36
22990	232	1/12/76	Steel PL	A36
22992	234	1/12/76	Steel PL	A36



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TABLE 1 (CONT'D)

<u>P.O. No.</u>	<u>Page</u>	<u>Date of Order</u>	<u>Material</u>	<u>Material Specification</u>
10793	237	1/20/76	Steel W	A36
10733	238	1/16/76	Steel L	A36
10577	243	12/17/75	Steel Bar	A36
10576	245	12/17/75	Steel Bar	A36
10294	246	12/5/75	Steel L	A36
7838	249	8/25/75	Steel L	A36
23161	260	10/3/77	Steel L	A36
40729	265	11/7/79	Steel C	A36
28031	266	4/14/78	Steel Bar	A36
36752	268	4/25/79	Steel C,PL	A36
44759	272	4/25/79	Steel PL	A36
38598	275	7/26/79	Stainless Bar	A304
			Steel	

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TABLE 2

SUMMARIES OF STEEL QUANTITIES FROM PURCHASE ORDERS  
(Specification 8856-C-16 Steel from Bloomsburg)

Total Steel, all types . . . . .	1,114,000 lb.
Total Steel, ASTM A36 . . . . .	1,002,000 lb.
Total Steel, ASTM A36 for which material test reports were required . . . . .	949,000 lb.
Total Steel, ASTM A36 which is indeterminate because of improper or missing test reports . . . . .	604,000 lb.
Total Steel, ASTM A500/501 for which material test reports were required . . . . .	13,000 lb.
Total Steel, ASTM A500/501 which is indeterminate because of improper or missing test reports . . . . .	13,000 lb.

TABLE 3

RESULTS OF SAMPLING PROGRAM FOR TWELVE LOCATIONS  
IDENTIFIED AS POSSIBLE AR PLATE SUBSTITUTIONS

FCI#	Item#	Azim	Grating Elevation*	Item Elevation*	CREG <sup>TM</sup> Reading (Units above A-36 Standard) (AR Steels are $\geq 2.0$ Units)	Equotip Hardness**	Material Disposition
C-1002-1	7A	165°	719	724	1.7	394	A36 Plate
C-1002-1	8B	165°	719	724	1.2	425	A36 Plate
C-1002-1	2A	90°	719	724	1.2	397	A36 Plate
C-1003-1	109A	205°	719	723	1.8	400.6	A36 Plate
C-1003-1	211B	210°	719	723	1.8	394	A36 Plate
C-1003-1	211A	210°	719	723	1.7	393.2	A36 Plate
E-26-3	E10	160°	719	723	1.8	362.7	A36 Plate
C-1001-2	231B	37°	738	747	1.5	417.3	A36 Plate
C-1001-2	232A	34°	738	746	1.5	399	A36 Plate
C-1075-2	2	195°	752	761	1.5	394.3	A36 Plate
C-1075-2	3	195°	752	752	1.4	303.7	A36 Plate
C-1075-2	4	195°	752	752	1.6	419.7	A36 Plate
AR Sample	N/A	N/A	N/A	N/A	2.0	465	AR Plate

\*Elevations are approximate values; refer to drawing listed for exact elevations.

\*\*Corrected for plate angle at which test was performed; any value below 433 ( $R_b = 85$  or BHN 165) represents acceptable A36 plate.

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```

graph TD
    A[Identify Sample] --> B[Grind]
    B --> C[Verify Depth]
    C --> D[Reluxtrol Exam]
    D --> E[Below/on Centerline]
    D --> F[Above Centerline]
    E --> G[ACCEPT]
    F --> H[Recheck two more places]
    H --> I[Above & *]
    H --> J[Below/on & *]
    I --> K[2.0 units or more]
    I --> L[<2.0 units]
    J --> K
    J --> L
    K --> M[AR Steel *]
    L --> N[Gray Zone *]
    M --> O[Reluxtrol to Check for longit. cracks surface, toe of the weld]
    N --> P[Hardness Test]
    O --> Q[No Cracks]
    O --> R[Cracks]
    Q --> S[UT of Welds]
    R --> T[Cracks]
    P --> U[If Rb > 85]
    P --> V[If Rb < 85]
    U --> S
    V --> G
    S --> W[Eng. Eval. - Applications, Loading, Safety Impact]
    T --> W
    W --> X[Non-Critical]
    W --> Y[Critical]
    X --> Z[Fixes after FUEL LOAD]
    Y --> AA[Fixes before FUEL LOAD]
    Z --> G
    AA --> G

```

- o above AR (1045) standard - AR steel
- o below/on centerline - A36 Type struct. steel
- o Between & and AR (1045) standard - gray zone

\* Plate to be dispositioned as A36, AR or Gray Zone based on majority of results from 3 locations

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#### APPENDIX

Procedure Developed by Reluxtrol, Inc.  
to Identify Installed A-36 Plate

## PROCEDURE

### CONTROLLED RELUCTANCE EDDY CURRENT (CREG<sup>TM</sup>) INSPECTION FOR IDENTIFICATION OF A-36 TYPE STRUCTURAL STEEL AND ABRASION RESISTANT (AR) GRADES SIMILAR TO 1045 STEEL (4/20/82)

#### 1.0 Test Equipment

The inspection will be performed using a CREG<sup>TM</sup> 401 eddy current generator and an impedance plane display eddy current instrument.

#### 2.0 Instrument Settings

Frequency	-	50 KHz
Sensitivity	-	Approximately 0.5 (See Section 3)
Vertical	-	0.2 V/Div.
Horizontal	-	2.0 V/Div.
Storage	-	On

#### 3.0 Calibration

Set-up on standard blocks A-36 (Bechtel N or Bechtel O) and AR (1045) Bechtel 8 or Bechtel K). Note: Standards are Bechtel supplied with certified mill test reports.

3.1 Balance on A-36 standard.

3.2 Adjust phase such that initial lift-off is horizontal and to the right on A-36.

3.3 Adjust position so that full-on A-36 signal is  $-3.0 \pm 1.0$  divisions horizontal and  $0.0 \pm 1.0$  division vertical.

3.4 Adjust sensitivity such that the difference between A-36 standard and AR (1045) standard is  $2.0 \pm 0.2$  div. vertical at horizontal center of screen.

3.5 Calibration shall be re-checked every hour and when unit has been left unattended.

## 4.0 Inspection Procedure

4.1 Prior to inspection, surface shall be prepared as specified in Section 5.0.

4.2 Grinding shall be performed at least one minute prior to inspection.

4.3 Place probe in center of grind area on A-36 standard, check for signal tolerance.

NOTE: If out of tolerance, adjust per Section 3.3

4.4 Place probe in center of grind area on test piece and check that trace moves to left of center

4.5 Compare signals from A-36 standard and test piece. If test piece signal is more than one division above A-36 standard signal, check calibration per Section 3. If, after re-calibration, the test piece signal remains more than one division above the A-36 standard signal, record vertical amplitude of the signal at horizontal center of screen.

## 5.0 Grinding Procedure

Grinding will be performed using an aluminum oxide or silicon carbide grinding wheel.

Care shall be taken not to over-heat grind area. Grinder shall be moved at a rate of 2 inches per second or greater and only light pressure applied.

Grind area shall not exceed a depth of 0.031", but must exceed 0.010" over an area of 0.25" in diameter. Grind area shall be smooth and contain no sharp corners.

NOTE: Test will be performed by a minimum of Level II Inspector.