Duke Power Company
Oconee Nuclear Station
McGuire Nuclear Station
Catawba Nuclear Station

RESPONSE TO
NRC BULLETIN 88-05

DUKE POWER COMPANY

RESPONSE TO NRC BULLETIN 88-05

NONCONFORMING MATERIALS SUPPLIED BY PIPING SUPPLIES, INC. AT FOLSOM, NEW JERSEY AND WEST JERSEY MANUFACTURING COMPANY AT WILLIAMSTOWN, NEW JERSEY

FOR

OCONEE NUCLEAR STATION
MCGUIRE NUCLEAR STATION
CATAWBA NUCLEAR STATION

Revision 0

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1. INTRODUCTION

1.1 OVERVIEW

The purpose of this document is to provide the Duke Power Company response to the U.S. Nuclear Regulatory Commission Bulletin 88-05 for Oconee, McGuire, and Catawba Nuclear Stations. The contents of this document are also based upon the clarifications given to licensees in Supplements 1 and 2 to Bulletin 88-05. In regard to Supplement 2, the contents of this Duke response are inclusive of all actions taken in our investigation into Bulletin 88-05 through August 5, 1988.

Upon receipt of NRC Bulletin 88-05, Duke Power assembled an interdepartmental task force to pursue the investigation into the bulletin. This task force was composed of personnel from each of the company departments primarily concerned with the Duke nuclear power program. These departments include the Design Engineering Department, Purchasing Department, Nuclear Production Department, and the Quality Assurance Department. On site support was also provided by the Duke Construction and Maintenance Department.

An action plan was developed by the task force to define the initial interface with vendors possibly supplying Duke with WJM and PSI components in order to identify these items as expeditiously as possible. Subsequent actions in the areas of documentation search, identification of component locations, testing (both laboratory and in-situ), analysis and evaluation, and documentation were also developed by the task force. Problem Investigation Reports (PIR) were written for each nuclear station to cover Bulletin 88-05 and Supplement 1. The PIR is the Duke administrative process for identifying and evaluating nuclear station problems. The PIR also serves as the mechanism used by Duke to document the problem evaluation (including generic considerations), to prescribe corrective action, and to initiate any applicable reporting requirements.

Duke Power also participated in the NUMARC/EPRI cooperative efforts to address Bulletin 88-05 on a generic basis. We have attended the NUMARC sponsored industry meetings, contributed to the exchange of information through the NUCLEAR NETWORK and the Materials Data Base, and attended the EPRI sponsored training for the in-situ hardness testing program.

Section 1 of this document also contains discussions of the plan utilized by Duke to identify WJM and PSI components and the techniques used to test these items both in the lab and in the station.

Sections 2, 3, and 4 of this document contain station specific information from the Bulletin 88-05 investigation.

1.2 IDENTIFICATION

After receipt of NRC Bulletin 88-05, the Duke Quality Assurance Department's Vendors Division began to determine the potential suppliers of this type material. It was determined early that Duke had not purchased any materials directly from WJM or PSI.

The determination was made by reviewing the Duke approved vendors' lists back to 1976. Very loose parameters were used for identifying the vendors in order to prevent inadvertently leaving out a potential supplier. This resulted in 240 vendors being identified.

These vendors were contacted by letter asking for their input concerning the use of material manufactured by WJM or PSI. Approximately 80 vendors failed to respond to this letter.

After further research Duke was able to eliminate some vendors who would not have supplied this type material.

Duke then began a review of purchase orders written to those vendors that failed to respond and to those who responded in the affirmative. This list consisted of approximately 60 vendors. Purchase orders were reviewed through 1976 and forwarded to the applicable plant sites for further review of the vendor documentation to determine if the item was manufactured by WJM or PSI.

When research was stopped, as prescribed by Supplement 2 to NRC Bulletin 88-05, 20 vendors were left to review.

1.3 TESTING

All identified flanges found instock and not connected to other components (i.e. spare Delaval diesel generator or Westinghouse motor coolers) were removed from stock and sent to the Duke Power Metallurgy Laboratory. For each heat and size of flange received from one to four were examined by chemical analysis, hardness testing, tensile testing, and macro etching. Chemical analysis was performed by Chicago Spectro Service Laboratory, Inc. 4848 South Kedzie Ave. Chicago IL 60632. Tensile test samples were machined by Law Engineering Services, Charlotte, NC. Both companies are approved vendors for providing the above services under the Duke Power QA program. The hardness tests, pulling of the tensile samples, and macro etching were performed inhouse under the QA program of the Metallurgy Laboratory of the Production Support Department of Duke Power Company. Hardness tests were performed using a Rockwell B Hardness Tester and were taken on a flat surface where the sample for chemical analysis was removed. EQUOTIP Hardness Tests were also taken on some of the samples in order to provide a correlation between EQUOTIP Hardness Tests, the Rockwell B Tests, and the tensile tests. Only one tensile test specimen was obtained from each flange and was either 1/4 or 1/2 inch in diameter depending on the size of the flange. Also, due to the size of the flanges, the axis of the tensile specimens were not necessarily in the same direction as grain flow.

In-situ EQUOTIP Hardness Tests were performed using the procedure given in the Appendix or an earlier rendition. Approximately 40 - 60 mils of material was removed from the edge of the flange to negate detrimental edge effects from decarburization, cold working, or flame cutting. The surface finish was equivalent to a 240 grit surface or better. In order to confirm the correctness of hardness readings, two sets of 10 readings were taken. The second set was taken after a second grinding. If the mean hardness value of the second set was within ± 10 Leeb Hardness units of the mean value of the first, then all 20 readings were averaged and the value reported. Since this differs from the method recommended by EPRI, an additional requirement was

included in the procedure that the first or second set of 5 consecutive hardness readings for any group of 10 should be within a range of ± 10 Leeb Hardness units. This insures that the EPRI value is contained in the Duke Power test date.

1.4 CORRECTIVE ACTIONS

WJM/PSI flanges identified in warehouse stock will not be installed in the Duke nuclear stations. Upon final resolution of NRC Bulletin 88-05, these flanges will be scrapped if not used for laboratory testing.

At this time Duke does not plan any further corrective actions for installed flanges, pending industry's generic resolution of this bulletin. Flanges installed in safety related applications that failed the in-situ hardness testing have justifications for continued operation written as described in Sections 2.4 and 4.4 of this document. There were no deviations determined from the Duke laboratory testing which affected any flanges installed in safety related applications. Further, Duke has not experienced any unusual problems directly attributable to flanges at either of its seven operating nuclear units.

2. OCONEE NUCLEAR STATION - NRC BULLETIN 88-05 INVESTIGATION

2.1 OVERVIEW

Through August 5, 1988 nine (9) WJM/PSI flanges had been identified as ordered for Oconee Nuclear Station. Two flanges were transferred from Catawba for use at Oconee. Each of these flanges was given a unique sample number designation and tabulated as appropriate behind either Tab 2.1, 2.2, or 2.3 depending on the installation or safety/non-safety related status.

2.2 TEST RESULTS

Eight flanges were tested in-situ using an EQUOTIP hardness tester. The Leeb hardness values obtained were corrected for temperature using a correlation factor developed by EPRI and then converted to Brinell hardness numbers using conversion tables provided by EQUOTIP. The tables used to determine the temperature correction factor and convert to Brinell hardness (BH) are included in the Appendix. Only one installed flange at Oconee was found to be out of the hardness range of 137-187 BH. It was Sample No. ONS-004-A and its corrected hardness value was 189 BH.

Three flanges from one heat were found in stock and sent to the Metallurgy laboratory where they underwent tensile tests, hardness tests, and chemical analysis. All three flanges ONS-002-A, ONS-002-B, and ONS-002-C met the requirements of ASME SA 105 for chemistry and hardness. Two flanges ONS-002-A and ONS-002-C did not meet the values given in the specification for % reduction in area and tensile strength respectively, but SA 105 allows for the use of hardness tests instead of tensile tests when (as in this case) the forging is not large enough to obtain a tensile specimen parallel to the direction of maximum working.

The test data is given behind Tab 2.4 in the form which was provided for the NUMARC survey. This consists of two types of data sheets. The "Materials Worksheet" lists general information about the particular line item ie. size, type, material, supplier, quantity ordered, etc. The "Test Data Worksheet" has space provided for the test data obtained by the utility as well as the test data from the Certified Materials Test Report (CMTR). This makes for easy comparison between chemical analysis and tensile test done by Duke to those which are listed on the CMTR. In comparing Duke test data to the CMTR data for line item ONS-002 it can be seen that it differs. ONS-002-A was macro etched and determined to be a forging.

2.3 REPORTABLE ITEMS

One flange (ONS-004A) installed in a safety related application at Oconee Nuclear Station failed the in-situ hardness test. This flange was reported to the NRC Operations Center as required by Supplement 1 to NRC Bulletin 88-05. The details of this report are contained in the Data Report for Nonconforming or Inaccessible Flanges and the Memorandum for File located behind Tab 2.5.

2.4 JUSTIFICATION FOR CONTINUED OPERATION (JCO)

A JCO for flange ONS-004A reported to the NRC as having failed the in-situ hardness test was performed by the Duke Design Engineering Department. This JCO is located behind Tab 2.6 and is identified as Design Engineering Calculation OSC-3190.

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN SAFETY RELATED SYSTEMS (Oconee)

SAMPLE	PO*	HEAT*	SIZE	TYPE	LOCATION
ONS-001-A	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-001-B	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-001-C	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-001-D	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-001-E	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-001-F	G54783	ETNF	6"	RF, WN	Standby shutdown facility
ONS-003-A	J05092	6061273	12"	BL, RF	Low Pressure Service Water
ONS-004-A	H08878	25904	1"	RF, TH	Emergency FWPT Oil Cooler

RF = Raised Face
WN = Weld Neck
BL = Blind
TH = Threaded

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN NONSAFETY RELATED SYSTEMS
(Oconee)

To date, no WJM or PSI flanges have been identified as being installed in nonsafety related systems.

LIST OF KNOWN WJM & PSI FLANGES
NON INSTALLED
(Oconee)

SAMPLE	PO#	HEAT#	SIZE	RATING	SCHEDUAL	TYPE
ONS-002-A	N63503	COP	1"	900#	80	RF, WN
ONS-002-B	N63503	COP	1"	900#	80	RF, WN
ONS-002-C	N63503	COP	1"	900#	80	RF, WN

RF = Raised Face
WN = Weld Neck

LIST OF KNOWN WJM &PSI FLANGES
(Oconee)

LINE ITEM	PO#	HEAT#	TAG#	#ORDERED	#INSTALLED		#AT LAB	#OTHER
					QA	Non QA		
ONS-001	G54783	ETNF	ON-34530	6	6[1]	0	0	0
ONS-002	N63503	COP	ONS-55630	3	0	0	3	0
ONS-003-A	Transfer	6061273	ON-40830	0	1[2]	0	0	0
ONS-004-A	Transfer	25904	ON-46611	0	1[3]	0	0	0
			Total	9	8	0	3	0

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[1]Installed in the Auxiliary Service Water System which is QA Condition 1.

[2]Transferred from Catawba, original PO# J05092, Transfer Rec.#7310 835534, NSM 2193, LPSW 356 repair.

[3]Transferred from Catawba, original PO#H08878, Transfer Rec.#7310 852771, to repair the EFW PT Oil Coller-RW#22842D.

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MATERIALS WORKSHEET

Plant Oconee
Unit Standby Shutdown Facility (1,2 & 3)
Line Item ONS-001
Transaction (A/C/D) C
Heat-Lot ETNF
ASME Class 3
Commodity FLG
Diameter 6
Schedual 80
Rating 900
Type RF, WN
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 01/11/82
NCA-3800 (Y/N) Y
Supplier 1 HUB Inc.
Supplier 2 -
Quanity 6
Quanity In Stock 0
Installed-Acess 6
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

The six flanges are located in the Standby Shutdown facility, on an ASME Class 3 system. All flanges were marked 6-WJ-900-SA-105-ETNF-S-80.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **--Specimen ID** ONS-001-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction In Area	-	64.0
Hardness (BHN)	151	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphorous	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 415 L_D for flange ONS-001-A. The temperature of the flange was ambient and there was no vibration or magnetic field.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **Specimen ID** ONS-001-B

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction in Area	-	64.0
Hardness (BHN)	144	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphorous	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 406 L_D for flange ONS-001-B. The temperature of the flange was ambient and there was no vibration or magnetic field.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **--Specimen ID** ONS-001-C

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction In Area	-	64.0
Hardness (BHN)	148	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphorous	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 412 L_D for flange ONS-001-C. The temperature of the flange was ambient and there was no vibration or magnetic field.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **--Specimen ID** ONS-001-D

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction In Area	-	64.0
Hardness (BHN)	150	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphoreus	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 414 L_D for flange ONS-001-D. The temperature of the flange was ambient and there was no vibration or magnetic field.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **--Specimen ID** ONS-001-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction In Area	-	64.0
Hardness (BHN)	151	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphorous	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 416 L_D for flange ONS-001-E. The temperature of the flange was ambient and there was no vibration or magnetic field.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-001 **--Specimen ID** ONS-001-F

	Test Data	CMTR Data
Tensile Strength (psi)	-	80,671
Yield Strength (psi)	-	51,652
% Elongation	-	28.0
% Reduction in Area	-	64.0
Hardness (BHN)	150	
% Carbon	-	0.20
% Manganese	-	1.15
% Silicon	-	0.27
% Phosphorous	-	0.018
% Sulfur	-	0.010
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 414 L_D for flange ONS-001-F. The temperature of the flange was ambient and there was no vibration or magnetic field.

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MATERIALS WORKSHEET

Plant Oconee
Unit Warehouse
Line Item ONS-002
Transaction (A/C/D) C
Heat-Lot COP
ASME Class 2
Commodity FLG
Diameter 1
Schedual 40
Rating 600
Type RF,SW
Spec. 105
Grade NA
Source PSI
Vendor (WJM or PSI) PSI
CMTR Date 01/28/88
NCA-3800 (Y/N) Y
Supplier 1 DuBose Steel, Inc.
Supplier 2 -
Quanity 3
Quanity In Stock 3
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

ONS-002-A was examined metallographically and found to be a forging. All flanges were marked 1 600 PS SA 105 CL 2 COP S/40 B16.5.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-002 **--Specimen ID** ONS-002-A

	Test Data	CMTR Data
Tensile Strength (psi)	73,000	88,079
Yield Strength (psi)	48,100	55,674
% Elongation	24	24.0
% Reduction In Area	26	52.0
Hardness (BHN)	137	
% Carbon	0.20	0.27
% Manganese	0.86	0.99
% Silicon	0.19	0.31
% Phosphorous	0.017	0.010
% Sulfur	0.020	0.023
% Chromium	0.05	-
% Nickel	0.03	-
% Molybdenum	<0.01	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (75 for ONS-002-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (408 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (413 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-002 **--Specimen ID** ONS-002-B

	Test Data	CMTR Data
Tensile Strength (psi)	70,300	88,079
Yield Strength (psi)	46,400	55,674
% Elongation	37	24.0
% Reduction In Area	61	52.0
Hardness (BHN)	139	
% Carbon	0.20	0.27
% Manganese	0.85	0.99
% Silicon	0.19	0.31
% Phosphorous	0.017	0.010
% Sulfur	0.021	0.023
% Chromium	0.05	-
% Nickel	0.03	-
% Molybdenum	<0.01	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (76 for ONS-002-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (405 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (406 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

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TEST DATA WORKSHEET

Test Results for Line Item ONS-002 **--Specimen ID** ONS-002-C

	Test Data	CMTR Data
Tensile Strength (psi)	68,900	88,079
Yield Strength (psi)	47,500	55,674
% Elongation	30	24.0
% Reduction in Area	52	52.0
Hardness (BHN)	147	
% Carbon	0.23	0.27
% Manganese	0.84	0.99
% Silicon	0.20	0.31
% Phosphoreus	0.014	0.010
% Sulfur	0.015	0.023
% Chromium	0.03	-
% Nickel	0.03	-
% Molybdenum	<0.01	-

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (79 for ONS-002-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (404 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (396 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

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MATERIALS WORKSHEET

Plant Catawba
Line Item CNS-005
Heat-Lot 6061273
Commodity FLG
Schedual 80
Type BL, RF
Grade NA
Vendor (WJM or PSI) WJM
NCA-3800 (Y/N) Y
Supplier 1 McJunkin Corporation
Quanity 4
Installed-Acess 1
Add Test Results (Y/N) Y

Unit 2 (Oconee) ONS-003-A
Transaction (A/C/D) C
ASME Class 2
Diameter 12
Rating 150
Spec. 105
Source WJM
CMTR Date 03/30/83

Supplier 2 -
Quanity In Stock 0
Installed-Not Acess 0
Add Remarks (Y/N) Y

One was transfered to Oconee, and is installed in the Low Pressure Service Water System which is safety related. The other three were used in a flush and then discarded. The one at Oconee was marked 12" WJ 150 SA 105 CL2 6061273

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TEST DATA WORKSHEET

Test Results for Line Item CNS-005 **--Specimen ID** ONS-003-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,000
Yield Strength (psi)	-	44,900
% Elongation	-	32.0
% Reduction In Area	-	61.0
Hardness (BHN)	153	
% Carbon	-	0.24
% Manganese	-	1.18
% Silicon	-	0.23
% Phosphorous	-	0.006
% Sulfur	-	0.022
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 410 L_D for flange CNS-005-A. The temperature of the flange was 100.4^{O} F. There was slight to moderate vibration and no magnetic field. Adding the EPRI developed correction factor for temperature (+8) gives a corrected value of 418 L_D.

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MATERIALS WORKSHEET

Plant Catawba
Unit 1(Oconee) ONS-004-A
Line Item CNS-019
Transaction (A/C/D) C
Heat-Lot 25904
ASME Class 2
Commodity FLG
Diameter 1
Schedual N/A
Rating 150
Type RF,TH
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 15
Quanity In Stock 4
Installed-Acess 12
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-019-A was examined metallographically and found to be a forging. WJM gave the Heat No. as 25904 and the Test or Code No. as GDDE. One flanges was transfered to Oconee, and installed on the Emergency Feedwater PT Oil Cooler a safety related system. The flanges were marked 1"-WJ-150-SA-105-GDDE.

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TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** ONS-004-A

	Test Data	CMTR Data
Tensile Strength (psi)	99,200	96,970
Yield Strength (psi)	68,000	69,370
% Elongation	21	23.5
% Reduction In Area	52	51.0
Hardness (BHN)	205	
% Carbon	.30	0.31
% Manganese	.75	0.76
% Silicon	.22	0.25
% Phosphorous	.020	0.018
% Sulfur	.024	0.024
% Chromium	0.16	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.068	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (94 for CNS-019-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Oconne Nuclear Station has found a 1 inch, 150 pound, raised face, threaded flange, Heat # GDDE made from SA105 material that was above maximum hardness (187 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 462 L_D which converts to 187 Brinell. The temperature of the flange was 80^0 F. Using the temperature correction factor developed by EPRI (+2), the corrected value is 464 L_D which converts to189 Brinell. The flange is located on the Unit 1 Emergency Feedwater PT Oil Cooler Pump and is classified as Duke Class F, QA Condition 1, ANSI B31.1, (Reference Drawing OFD-133A-1.2). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. ONS-004-A
LOCATION Unit 1, EFWPT Oil Cooler Pump, Duke Class F (QA 1).
SIZE 1 Inch, 150 Pound
TYPE Raised Face, Threaded
HEAT NO. GDDE
MATERIAL ASME SA105 (Allowable Max. Hardness 187 Brinell)
IN-SITU HARDNESS TEST 462 L_D (187 Brinell)
TEMPERATURE 80.0^0 F (EPRI Correction Factor +2)
CORRECTED HARDNESS 464 L_D (189 Brinell)
DATE FOUND 07/26/88 **TIME** 15:00
DATE REPORTED 07/28/88 **TIME** 14:45

July 28, 1988

MEMORANDUM FOR FILE

Subject: NRC Bulletin 88-05, Supplement 1
Nonconforming Materials Supplied By
Piping Supplies, Inc. at Folsom, New
Jersey and West Jersey Manufacturing
Company at Williamstown, New Jersey
Report of Deviation from Specification
Based on In-Situ Hardness Testing (EQUOTIP)
Report Number 3 (Oconee Unit 1)

This memorandum documents a report made to the NRC Operations Center in accordance with NRC Bulletin 88-05, Supplement 1.

Date Found:	July 26, 1988
Time Found:	15:00
Date of Call:	July 28, 1988
Time of Call:	14:45
Duke Personnel Participating:	S.G. Benesole, C.L. Harlin, D.E. Whitaker and J.S. Warren
NRC Duty Person:	Reckley
Unit(s) Affected:	Oconee 1
Power Level - Unit 1:	100%
Power Level - Unit 2:	100%
Power Level - Unit 3:	100%

The following information (except sample number and ISO number) on one flange installed at Oconee was given to the NRC:

Sample (ISO #):	ONS - 004A (OFD-133A-1.2)
Size:	1 inch
Rating:	150 #
Type:	Raised Face, Threaded
Heat Code #:	25904
Test or Code #:	GDDE
Maximum Allowable Hardness Reading:	187 Brinell
Material:	SA 105
Actual Hardness Reading:	187 Brinell (189 Brinell with temperature correlation)

Location:	EFWPT Oil Cooler Pump, Unit 1 Only
Class:	Duke Class F (QA 1) ANSI B31.1
Temperature:	80 degrees-F

J.S. Warren
Licensing

JSW/218/bhp

xc: S.G. Benesole
R.D. Ivey
R.L. Williams
C.L. Harlin
D.E. Whitaker
N.A. Rutherford
P.F. Guill
CN-801.01
CN-815.02
(9)

Form 01077 (R3-88)

FORM 101.1 | REVISION 11

CERTIFICATION OF ENGINEERING CALCULATION

STATION AND UNIT NUMBER Oconee 1, 2 & 3

TITLE OF CALCULATION Operability Evaluation on P/R No. 4-088-0150

CALCULATION NUMBER OSC-3190

ORIGINALLY CONSISTING OF:

PAGES 1 THROUGH _____

TOTAL ATTACHMENTS _____ TOTAL MICROFICHE ATTACHMENTS _____

TOTAL VOLUMES 1

THESE ENGINEERING CALCULATIONS COVER QA CONDITION 1 ITEMS. IN ACCORDANCE WITH ESTABLISHED PROCEDURES, THE QUALITY HAS BEEN ASSURED AND I CERTIFY THAT THE ABOVE CALCULATION HAS BEEN ORIGINATED, CHECKED OR APPROVED AS NOTED BELOW:

ORIGINATED BY R. L. Villiam DATE 8/23/88

CHECKED BY [illegible] Lefler DATE 8/24/88

APPROVED BY D M Collins DATE 8/24/88

ISSUED TO GENERAL SERVICES DIVISION _____ DATE _____

RECEIVED BY GENERAL SERVICES DIVISION _____ DATE _____

MICROFICHE ATTACHMENT LIST: ☐ Yes ☒ No SEE BACK OF FORM

REV. NO.	CALCULATION PAGES (VOL)			ATTACHMENTS (VOL)			VOLUMES		ORIG	CHKD	APPR	ISSUE DATE
	REVISED	DELETED	ADDED	REVISED	DELETED	ADDED	DELETED	ADDED	DATE	DATE	DATE	REC'D DATE

OSC - 3190
pg. 1 of 5

By: R. L. Williams 8/23/88
Chkd. By: [illegible] Lellouch 8/24/88

DOCUMENTATION SUMMARY

1.1 Design Procedure utilized in the preparation of these calculations based on internal ☐ ; external ☐ pressure criteria

a. Calculation for required pipe wall thickness: ☐

b. Calculation for overpressure capability for prespecified pipe wall thicknesses: ☐

c. Method utilized for calculations: Manual ☐ Computer ☐

Mark "X" in all applicable blocks.

1.2 Brief Statement of Problems: See body of calculation

1.3 Statement of the Relation to Nuclear Safety: Duke Class F, Q.A. Condition 1

1.4 Applicable Codes and Standards Utilized:

(Sponsor Soc.)	(Unique Identity No. & Date)	(Subsection or Paragraph No.)
ANSI	B31.1	

1.5 List All Other Design Criteria Utilized: None

1.6 List Design Criteria in the PSAR/FSAR bearing on these calculations, including page, paragraph, and revision date as applicable:

None

1.7 List all Other Design Assumptions Utilized: No

1.8 Statement of General or Specific Conclusions, As Applicable: The flange does not impact plant operability.

1.9 The complete calculation(s) and necessary supporting documents shall be bound together with an appropriate cover sheet properly labeled. The completed presentation of these calculations shall be such that an appropriately qualified person can review the documentation.

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Oconee Unit — File No. OSC-3190

Subject Operability Evaluation for PIR # 4-088-0150

By R. L. Wilson Date 8/23/88

Sheet No. 2 of 5 Problem No. Checked By [illegible] Date 8/24/88

Purpose: This calculation documents Design Engineering's operability evaluation for PIR No. 4-088-0150.

Problem = NRC Bulletin 88-05 required identification, testing and evaluation of flanges made by WJM/PSI and used in Safety Related Systems. The subject PIR was written to track our work. One flange did not pass hardness test requirements. This was reported to Design Engineering by the Report form on pg. 3 of this calculation.

In this case the 1"-150# Forged Steel Screwed Flange tested out at 189 Brinell as opposed to the maximum allowable of 187.

Evaluation: In our evaluation, we considered such things as, but not limited to, the following:

1. Service environment
2. Bolting preload
3. Welding or absence of
4. Piping stress levels (by Stress Analysis Gr.)
5. Design margin (design pressure vs. code allowable pressure)

In this case, Stress Analysis Review is documented by their Memo of Aug. 9, 1988 which is page 4 of this calculation. Our Flange Evaluation Summary is on page 5 of this calculation.

Conclusion: Based on our evaluation, it is our judgement that this flange has no impact on plant operability.

OSC-3190
pg. 3 of 5

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Oconne Nuclear Station has found a 1 inch, 150 pound, raised face, threaded flange, Heat # GDDE made from SA105 material that was above maximum hardness (187 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 462 L_D which converts to 187 Brinell. The temperature of the flange was 80° F. Using the temperature correction factor developed by EPRI (+2), the corrected value is 464 L_D which converts to189 Brinell. The flange is located on the Unit 1 Emergency Feedwater PT Oil Cooler Pump and is classified as Duke Class F, QA Condition 1, ANSI B31.1, (Reference Drawing OFD-133A-1.2). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. ONS-004-A
LOCATION Unit 1, EFWPT Oil Cooler Pump, Duke Class F (QA 1).
SIZE 1 Inch, 150 Pound
TYPE Raised Face, Threaded
HEAT NO. GDDE
MATERIAL ASME SA105 (Allowable Max. Hardness 187 Brinell)
IN-SITU HARDNESS TEST 462 L_D (187 Brinell)
TEMPERATURE 80.0° F (EPRI Correction Factor +2)
CORRECTED HARDNESS 464 L_D (189 Brinell)
DATE FOUND 07/26/88 **TIME** 15:00
DATE REPORTED _____ **TIME** ~~9:45~~

OSC-3190
pg. 4 of 5

August 9, 1988

Memo to File

Re: Oconee Nuclear Station, Unit 1
PIR #4-88-150
Piping Analysis Review for 1"
Flange on EFWPT Oil Cooler Pump
File No.: OS-27B

PIR #4-88-150 was written as an "umbrella" type PIR in response to NRC Bulletin 88-05 (including Supplement 1 to NRCB 88-05). The Bulletin concerns nonconforming materials supplied by West Jersey Manufacturing Company and Piping Supplies, Incorporated.

The one inch flange attached to the outlet of the Emergency Feedwater Pump Turbine Oil Cooler Pump was identified as one of the components not conforming to the required material specification. The flange was purchased as SA-105 material which specifies a maximum hardness of 187 Brinell. The flange was found to have an actual hardness of 189 Brinell.

The flange is located in piping problem 1-13-8, calculation OSC-1635. An evaluation of this nonconforming condition is contained in Revision 6 to OSC-1635.

The slight increase in hardness was concluded not to be significant considering the mild service environment, the low level of mechanical piping loads and the satisfactory performance with existing bolting preloads.

The calculation concluded that the system was operable with the 189 Brinell flange. The flange was determined to be suitable for its intended service, and the calculation recommends that the flange not be replaced.

Robert L. Morgan, Jr.

By: Robert L. Morgan, Jr.
Design Engineer I

R L Cope, Jr.

Approved by: Robert L. Cope, Jr.
Supervising Design Engineer

RLM/hrt

cc: M. S. Sills
Central Records

OSC-3190
pg. 5 of 5

FLANGE EVALUATION

SUMMARY

- Sample No. ONS-004-A Heat No. GDDE
- Flange Description 1" - 150# Forged Steel Screwed Flange to SA-105
- Construction Isometric System 13 Sht. 7, Rev. 19 (3/19/86)
- Design Iso. and Flow Diagram O-400A, B & H and OFD-133A-1.2
- Design Conditions 50 psig @ 100°F Code & Class B31.1
- Corrected Brinell Hardness 189 Brinell
- Equivalent Strength Approx. 90,000 psi Tensile
- Piping Analysis Calculation No. OSC-1635 (problem 1-13-8)
- Conclusions: The flange is in a system with a mild service environment. The mechanical loads are low. The design pressure is 50 psig compared to an allowable working pressure of 275 psig. The flange withstood the bolting preload. Base on the foregoing, we consider the flange suitable for continued operation.

Prepared by: R. L. Williams Date: 8/23/88

Checked by: [illegible] Date: 8/24/88

3. MCGUIRE NUCLEAR STATION - NRC BULLETIN 88-05 INVESTIGATION

3.1 OVERVIEW

Through August 5, 1988, 84 WJM/PSI flanges had been identified as ordered for use at McGuire Nuclear Station. Each of these flanges was given an unique sample number designation and tabulated as appropriate behind either Tab 3.1, 3.2 or 3.3 depending on the installation or safety/non-safety related status.

3.2 TEST RESULTS

No in-situ testing was done at McGuire. The locations of installed safety related flanges were not identified until after Supplement 2 of NRC Bulletin 88-05 was issued.

Forty-four flanges from five different line items were found in stock and sent to the Duke Metallurgy Laboratory. Four flanges from each line item underwent tensile tests, hardness tests, and chemical analysis. Sample A of each line item was micro etched and determined to be a forging. The samples tested, heat number, size, and any deviations from the ASME materials specification are given in the table below. All the test data is given behind Tab 3.4.

SAMPLE	HEAT#	SIZE	DEVIATIONS FROM SPECIFICATION
MNS-001-A	CMP	6"	None
MNS-001-B	CMP	6"	None
MNS-001-C	CMP	6"	None
MNS-001-D	CMP	6"	None
MNS-002-A	1533	1"	Yield Strength Low
MNS-002-B	1533	1"	None
MNS-002-C	1533	1"	None
MNS-002-D	1533	1"	None
MNS-003-A	CKS	1"	Hardness Low
MNS-003-B	CKS	1"	Hardness and Tensile Strength Low
MNS-003-C	CKS	1"	Hardness Low
MNS-003-D	CKS	1"	Hardness and Tensile Strength Low
MNS-004-A	6X11375	8"	None
MNS-004-B	6X11375	8"	None
MNS-004-C	6X11375	8"	None
MNS-004-D	6X11375	8"	None
MNS-005-A	AAZ-84	1 1/2"	None
MNS-005-B	AAZ-84	1 1/2"	% Elongation Low
MNS-005-C	AAZ-84	1 1/2"	% Elongation Low
MNS-005-D	AAZ-84	1 1/2"	None

*When evaluating the tensile test data it should be taken into account that only one specimen was obtained from each flange and that because of the flange size the tensile specimen may not have been parallel to the direction of maximum working.

3. MCGUIRE NUCLEAR STATION - NRC BULLETIN 88-05 INVESTIGATION

3.1 OVERVIEW

Through August 5, 1988, 84 WJM/PSI flanges had been identified as ordered for use at McGuire Nuclear Station. Each of these flanges was given an unique sample number designation and tabulated as appropriate behind either Tab 3.1, 3.2 or 3.3 depending on the installation or safety/non-safety related status.

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Forty-four flanges from five different line items were found in stock and sent to the Duke Metallurgy Laboratory. Four flanges from each line item underwent tensile tests, hardness tests, and chemical analysis. Sample A of each of the line item was micro etched and determined to be a forging. The samples tested, heat number, size, and any deviations from the ASME materials specification are given in the table below. All the test data is given behind Tab 3.4.

SAMPLE	HEAT#	SIZE	DEVIATIONS FROM SPECIFICATION
MNS-001-A	CMP	6"	None
MNS-001-B	CMP	6"	None
MNS-001-C	CMP	6"	None
MNS-001-D	CMP	6"	None
MNS-002-A	1533	1"	Yield Strength Low
MNS-002-B	1533	1"	None
MNS-002-C	1533	1"	None
MNS-002-D	1533	1"	None
MNS-003-A	CKS	1"	Hardness Low
MNS-003-B	CKS	1"	Hardness and Tensile Strength Low
MNS-003-C	CKS	1"	Hardness Low
MNS-003-D	CKS	1"	Hardness and Tensile Strength Low
MNS-004-A	6X11375	8"	None
MNS-004-B	6X11375	8"	None
MNS-004-C	6X11375	8"	None
MNS-004-D	6X11375	8"	None
MNS-005-A	AAZ-84	1 1/2"	None
MNS-005-B	AAZ-84	1 1/2"	% Elongation Low
MNS-005-C	AAZ-84	1 1/2"	% Elongation Low
MNS-005-D	AAZ-84	1 1/2"	None

*When evaluating the tensile test data it should be taken into account that only one specimen was obtained from each flange and that because of the flange size the tensile specimen may not have been parallel to the direction of maximum working.

3.3 REPORTABLE ITEMS

Through August 5, 1988 no reportable items had been identified at McGuire Nuclear Station.

3.4 JUSTIFICATIONS FOR CONTINUED OPERATION

None required.

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN
SAFETY RELATED SYSTEMS
(McGuire)

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-007-?	F33884	80508	1"	RF, SW	Steam Supply to Aux. Equipment
MNS-008-?	H47078	?	3/4"	RF, SW	Unknown

The location of the six flanges ordered (Line Item MNS-008) was not determined at the time Supplement 2, which suspended work, was issued.

? = Indicated activity was not complete at issuance of Supplement 2 to NRC Bulletin 88-05
RF = Raised Face
SW = Socket Weld

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN
NONSAFETY RELATED SYSTEMS
(McGuire)

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
MNS-002-?	K07833	1533	1"	RF, SW	2B1 Feedwater Heater
MNS-002-?	K07833	1533	1"	RF, SW	1C2 Heater Drain Tank Pump
MNS-002-?	K07833	1533	1"	RF, SW	1C2 Heater Drain Tank Pump
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 1 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Feedwater Relief Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Turbine Exhaust System
MNS-006-?	F21954	A23	3/4"	RF, SW	Unit 2 Turbine Exhaust System
MNS-006-?	F21954	A23	3/4"	RF, SW	1B FWP Turbine Stop Valve
MNS-006-?	F21954	A23	3/4"	RF, SW	1B FWP Turbine Stop Valve
MNS-007-?	F33884	80508	1"	RF, SW	Unknown Or Sold As Surplus
MNS-007-?	F33884	80508	1"	RF, SW	Unknown Or Sold As Surplus
MNS-007-?	F33884	80508	1"	RF, SW	Unknown Or Sold As Surplus

? = Indicated activity was not complete at issuance of Supplement 2 to NRC Bulletin 88-05
RF = Raised Face
SW = Socket Weld

LIST OF KNOWN WJM & PSI FLANGES
NON INSTALLED
(McGuire)

SAMPLE	PO#	HEAT#	SIZE	RATING	SCHEDULE	TYPE
MNS-001-A	N51903	CMP	6"	150#	40	RF, WN
MNS-001-B	N51903	CMP	6"	150#	40	RF, WN
MNS-001-C	N51903	CMP	6"	150#	40	RF, WN
MNS-001-D	N51903	CMP	6"	150#	40	RF, WN
MNS-002-A	K07833	1533	1"	1500#	80	RF, SW
MNS-002-B	K07833	1533	1"	1500#	80	RF, SW
MNS-002-C	K07833	1533	1"	1500#	80	RF, SW
MNS-002-D	K07833	1533	1"	1500#	80	RF, SW

Thirteen additional flanges (Line Item MNS-002) will be held held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

MNS-003-A	N54234	CKS	1"	600#	40	RF, SW
MNS-003-B	N54234	CKS	1"	600#	40	RF, SW
MNS-003-C	N54234	CKS	1"	600#	40	RF, SW
MNS-003-D	N54234	CKS	1"	600#	40	RF, SW

Five additional flanges (Line Item MNS-003) will be held held at the laboratory until the resolution of NRC Bulletin 88-05 is complete. One flange was rejected due to lack of marking.

MNS-004-A	N51903	6X11375	8"	150#	40	RF, WN
MNS-004-B	N51903	6X11375	8"	150#	40	RF, WN
MNS-004-C	N51903	6X11375	8"	150#	40	RF, WN
MNS-004-D	N51903	6X11375	8"	150#	40	RF, WN
MNS-005-A	N54248	AAZ-84	1 1/2"	300#	40	RF, WN, Orifice
MNS-005-B	N54248	AAZ-84	1 1/2"	300#	40	RF, WN, Orifice
MNS-005-C	N54248	AAZ-84	1 1/2"	300#	40	RF, WN, Orifice
MNS-005-D	N54248	AAZ-84	1 1/2"	300#	40	RF, WN, Orifice

Six additional flanges (Line Item MNS-005) will be held held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

RF = Raised Face
WN = Weld Neck
SW = Socket Weld

LIST OF KNOWN WJM &PSI FLANGES
(McGuire)

LINE ITEM	PO#	HEAT#	TAG#	#ORDERED	#INSTALLED		#AT LAB	#OTHER
					QA	Non QA		
MNS-001	N51903	CMP	MC-27750	4	0	0	4	0
MNS-002	K07833	1533	MC-21367	20	0	3[1]	17	0
MNS-003	N54234	CKS	MC-27705	10	0	0	9	1[2]
MNS-004	N51903	6X11375	MC-27751	4	0	0	4	0
MNS-005	N54248	AAZ-84	TD-08604	10	0	0	10	0
MNS-006	F21954	A23	MC-10827	20	0	20	0	0
MNS-007	F33884	80508	N/A	10	7	?[3]	0	?
MNS-008	H47078	-	N/A	6	?[4]	?	0	?
			TOTAL	84			44	

[1]Used in non-QA applications, 2B1 Feedwater Heater and 1C2 Heater Drain Tank Pump.
[2]One was rejected due to lack of marking.
[3]Three have either been used in non-QA applications or discarded.
[4]May be difficult to determine location because of way traceability was maintained during construction. Would involve hand search of weld tickets.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire
Unit Warehouse
Line Item MNS-001
Transection (A/C/D) C
Heat-Lot CMP
ASME Class 2
Commodity FLG
Diameter 6
Schedual 40
Rating 150
Type RF, WN
Spec. 105
Grade NA
Source PSI
Vendor (WJM or PSI) PSI
CMTR Date 01/06/88
NCA-3800 (Y/N) Y
Supplier 1 DuBose Steel, Inc.
Supplier 2
Quanity 4
Quanity In Stock 4
Installed-Access 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

MNS-001-A was examined metallographically and found to be a forging. All flanges were marked 6 PS 150 SA 105 CMP STD.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-001 --Specimen ID MNS-001-A

	Test Data	CMTR Data
Tensile Strength (psi)	74,800	70,676
Yield Strength (psi)	48,000	36,150
% Elongation	32	25.0
% Reduction In Area	64	53.3
Hardness (BHN)	150	
% Carbon	0.18	0.23
% Manganese	0.87	0.90
% Silicon	0.21	0.22
% Phosphorous	0.009	0.011
% Sulfur	0.013	0.022
% Chromium	0.16	-
% Nickel	0.10	-
% Molybdenum	0.02	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (80 for MNS-001-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (379 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (399 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-001 --Specimen ID MNS-001-B

	Test Data	CMTR Data
Tensile Strength (psi)	76,600	70,676
Yield Strength (psi)	46,700	36,150
% Elongation	31	25.0
% Reduction In Area	64	53.3
Hardness (BHN)	150	
% Carbon	0.19	0.23
% Manganese	0.93	0.90
% Silicon	0.20	0.22
% Phosphorous	0.011	0.011
% Sulfur	0.012	0.022
% Chromium	0.12	-
% Nickel	0.13	-
% Molybdenum	0.02	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (80 for MNS-001-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (396 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (400 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-001 **--Specimen ID** MNS-001-C

	Test Data	CMTR Data
Tensile Strength (psi)	75,900	70,676
Yield Strength (psi)	45,400	36,150
% Elongation	32	25.0
% Reduction In Area	63	53.3
Hardness(BHN)	150	
% Carbon	0.19	0.23
% Manganese	0.91	0.90
% Silicon	0.20	0.22
% Phosphorous	0.010	0.011
% Sulfur	0.016	0.022
% Chromium	0.18	-
% Nickel	0.14	-
% Molybdenum	0.04	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (80 for MNS-001-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (396 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (398 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-001 **--Specimen ID** MNS-001-D

	Test Data	CMTR Data
Tensile Strength (psi)	74,800	70,676
Yield Strength (psi)	43,800	36,150
% Elongation	32	25.0
% Reduction In Area	63	53.3
Hardness (BHN)	147	
% Carbon	0.19	0.23
% Manganese	0.95	0.90
% Silicon	0.20	0.22
% Phosphorous	0.011	0.011
% Sulfur	0.011	0.022
% Chromium	0.12	-
% Nickel	0.13	-
% Molybdenum	0.03	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (79 for MNS-001-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (393 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (399 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire	**Unit** 1, 2 & Warehouse
Line Item MNS-002	**Transaction (A/C/D)** C
Heat-Lot 1533	**ASME Class** 2
Commodity FLG	**Diameter** 1
Schedual 80	**Rating** 1500
Type RF, SW	**Spec.** 105
Grade NA	**Source** WJM
Vendor (WJM or PSI) WJM	**CMTR Date** 03/20/84
NCA-3800 (Y/N) Y	
Supplier 1 McJunkin Corporation	**Supplier 2** -
Quanity 20	**Quanity In Stock** 17
Installed-Acess 3	**Installed-Not Acess** 0
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

MNS-002-A was examined metallographically and found to be a forging. The three installed flanges are used in non-safety applications, two are located on the 1C2 Heater Drain Tank, and one was used to replace a valve on the 2B1 Feedwater Heater. CFW is shown as the "Test or Code No." on the CMTR. The seventeen flanges in stock were marked 1-WJ-1500-SA-105-CL 2 CFW S-40.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-002 **--Specimen ID** MNS-002-A

	Test Data	CMTR Data
Tensile Strength (psi)	71,300	84,623
Yield Strength (psi)	35,900	54,084
% Elongation	35	32.5
% Reduction In Area	63	64.5
Hardness (BHN)	139	
% Carbon	0.21	0.21
% Manganese	1.28	1.31
% Silicon	0.25	0.24
% Phosphorous	0.018	0.018
% Sulfur	0.018	0.014
% Chromium	0.07	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (76 for MNS-002-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (387 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (380 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-002 --Specimen ID MNS-002-B

	Test Data	CMTR Data
Tensile Strength (psi)	71,700	84,623
Yield Strength (psi)	39,500	54,084
% Elongation	34	32.5
% Reduction in Area	64	64.5
Hardness (BHN)	141	
% Carbon	0.21	0.21
% Manganese	1.25	1.31
% Silicon	0.24	0.24
% Phosphorous	0.018	0.018
% Sulfur	0.017	0.014
% Chromium	0.07	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment NORM

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (77 for MNS-002-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (392 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (386 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-002 --Specimen ID MNS-002-C

	Test Data	CMTR Data
Tensile Strength (psi)	74,900	84,623
Yield Strength (psi)	36,500	54,084
% Elongation	32	32.5
% Reduction in Area	64	64.5
Hardness(BHN)	150	
% Carbon	0.21	0.21
% Manganese	1.24	1.31
% Silicon	0.24	0.24
% Phosphorous	0.018	0.018
% Sulfur	0.017	0.014
% Chromium	0.07	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment NORM

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (80 for MNS-002-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (398 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (398 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-002 --Specimen ID MNS-002-D

	Test Data	CMTR Data
Tensile Strength (psi)	78,100	84,623
Yield Strength (psi)	44,400	54,084
% Elongation	31	32.5
% Reduction In Area	59	64.5
Hardness (BHN)	159	
% Carbon	0.23	0.21
% Manganese	1.25	1.31
% Silicon	0.24	0.24
% Phosphorous	0.018	0.018
% Sulfur	0.018	0.014
% Chromium	0.07	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment NORM

Another Test For This Line Item? N Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (83 for MNS-002-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (408 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (410 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire
Unit Warehouse
Line Item MNS-003
Transaction (A/C/D) C
Heat-Lot CKS
ASME Class 2
Commodity FLG
Diameter 1
Schedual 40
Rating 600
Type RF, SW
Spec. 105
Grade NA
Source PSI
Vendor (WJM or PSI) PSI
CMTR Date 11/10/87
NCA-3800 (Y/N) Y
Supplier 1 Consolidated Power Supply
Supplier 2 -
Quanity 10
Quanity In Stock 9
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

One was rejected due to lack of marking. The nine flanges in stock were marked 1-600-PS-SA 105-CKS-S/40-B16.5. MNS-003-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-003 --Specimen ID MNS-003-A

	Test Data	CMTR Data
Tensile Strength (psi)	72,700	80,923
Yield Strength (psi)	40,300	58,888
% Elongation	35	28.7
% Reduction In Area	63	59
Hardness (BHN)	135	
% Carbon	0.18	0.20
% Manganese	0.83	1.35
% Silicon	0.22	0.35
% Phosphorous	0.026	0.021
% Sulfur	0.016	0.016
% Chromium	0.06	-
% Nickel	0.02	-
% Molybdenum	<0.01	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (74 for MNS-003-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (383 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (384 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-003 --Specimen ID MNS-003-B

	Test Data	CMTR Data
Tensile Strength (psi)	69,600	80,923
Yield Strength (psi)	41,700	58,888
% Elongation	40	28.7
% Reduction In Area	63	59
Hardness (BHN)	132	
% Carbon	0.18	0.20
% Manganese	0.79	1.35
% Silicon	0.21	0.35
% Phosphorous	0.024	0.021
% Sulfur	0.013	0.016
% Chromium	0.06	-
% Nickel	0.02	-
% Molybdenum	<0.01	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (73 for MNS-003-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (380 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (383 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-003 --Specimen ID MNS-003-C

	Test Data	CMTR Data
Tensile Strength (psi)	72,200	80,923
Yield Strength (psi)	44,000	58,888
% Elongation	35	28.7
% Reduction In Area	65	59
Hardness (BHN)	132	
% Carbon	0.18	0.20
% Manganese	1.03	1.35
% Silicon	0.31	0.35
% Phosphorous	0.022	0.021
% Sulfur	0.022	0.016
% Chromium	0.05	-
% Nickel	0.02	-
% Molybdenum	<0.01	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (73 for MNS-003-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (383 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (374 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-003 --Specimen ID MNS-003-D

	Test Data	CMTR Data
Tensile Strength (psi)	67,800	80,923
Yield Strength (psi)	40,000	58,888
% Elongation	34	28.7
% Reduction In Area	64	59
Hardness (BHN)	132	
% Carbon	0.17	0.20
% Manganese	0.79	1.35
% Silicon	0.21	0.35
% Phosphorous	0.023	0.021
% Sulfur	0.012	0.016
% Chromium	0.06	-
% Nickel	0.02	-
% Molybdenum	<0.01	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? N Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (73 for MNS-003-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (386 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (379 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire	**Unit** Warehouse
Line Item MNS-004	**Transaction (A/C/D)** C
Heat-Lot 6X11375	**ASME Class** 2
Commodity FLG	**Diameter** 8
Schedual 40	**Rating** 150
Type RF, WN	**Spec.** 105
Grade NA	**Source** PSI
Vendor (WJM or PSI) PSI	**CMTR Date** 01/06/88
NCA-3800 (Y/N) Y	
Supplier 1 DuBose Steel, Inc.	**Supplier 2** -
Quanity 4	**Quanity In Stock** 4
Installed-Acess 0	**Installed-Not Acess** 0
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** N

The four flanges were sent to the Materials Laboratory. All flanges were marked 8"-150-PS-SA 105 CL 2 6X11375 STD. MNS-004-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-004 --Specimen ID MNS-004-A

	Test Data	CMTR Data
Tensile Strength (psi)	75,500	81,700
Yield Strength (psi)	43,000	52,800
% Elongation	29	33.0
% Reduction In Area	69	60.0
Hardness (BHN)	153	
% Carbon	0.18	0.28
% Manganese	1.18	0.91
% Silicon	0.23	0.19
% Phosphorous	0.013	0.012
% Sulfur	0.008	0.020
% Chromium	0.16	-
% Nickel	0.08	-
% Molybdenum	0.02	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (81 for MNS-004-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (406 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (413 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-004 --Specimen ID MNS-004-B

	Test Data	CMTR Data
Tensile Strength (psi)	77,600	81,700
Yield Strength (psi)	46,000	52,800
% Elongation	30	33.0
% Reduction in Area	58	60.0
Hardness (BHN)	153	
% Carbon	0.21	0.28
% Manganese	0.90	0.91
% Silicon	0.21	0.19
% Phosphorous	0.008	0.012
% Sulfur	0.010	0.020
% Chromium	0.14	-
% Nickel	0.12	-
% Molybdenum	0.03	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (81 for MNS-004-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (409 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (411 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-004 --Specimen ID MNS-004-C

	Test Data	CMTR Data
Tensile Strength (psi)	76,200	81,700
Yield Strength (psi)	44,300	52,800
% Elongation	29	33.0
% Reduction in Area	58	60.0
Hardness (BHN)	156	
% Carbon	0.20	0.28
% Manganese	0.89	0.91
% Silicon	0.21	0.19
% Phosphorous	0.009	0.012
% Sulfur	0.013	0.020
% Chromium	0.20	-
% Nickel	0.12	-
% Molybdenum	0.05	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (82 for MNS-004-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (413 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (413 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-004 --Specimen ID MNS-004-D

	Test Data	CMTR Data
Tensile Strength (psi)	79,400	81,700
Yield Strength (psi)	45,000	52,800
% Elongation	29	33.0
% Reduction In Area	61	60.0
Hardness (BHN)	162	
% Carbon	0.22	0.28
% Manganese	0.88	0.91
% Silicon	0.21	0.19
% Phosphorous	0.009	0.012
% Sulfur	0.015	0.020
% Chromium	0.20	-
% Nickel	0.20	-
% Molybdenum	0.05	-

Heat Treatment None shown on CMTR.

Another Test For This Line Item? N Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (84 for MNS-004-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (422 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (427 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire	**Unit** Warehouse
Line Item MNS-005	**Transaction (A/C/D)** C
Heat-Lot AAZ-84	**ASME Class** 2
Commodity FLG	**Diameter** 1 1/2
Schedual 40	**Rating** 300
Type RF, WN, Orifice	**Spec.** 105
Grade NA	**Source** PSI
Vendor (WJM or PSI) PSI	**CMTR Date** 12/01/87
NCA-3800 (Y/N) Y	
Supplier 1 Consolidated Power Supply	**Supplier 2** -
Quanity 10	**Quanity In Stock** 10
Installed-Acess 0	**Installed-Not Acess** 0
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

The flanges in stock were marked 1-1/2 300-PS-SA 105-CL. 2 AAZ 84 S/40. MNS-005-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-005 --Specimen ID MNS-005-A

	Test Data	CMTR Data
Tensile Strength (psi)	88,000	73,538
Yield Strength (psi)	45,300	38,538
% Elongation	24	25.0
% Reduction In Area	35	47.0
Hardness (BHN)	172	
% Carbon	0.34	0.25
% Manganese	0.81	0.73
% Silicon	0.21	0.21
% Phosphorous	0.012	0.015
% Sulfur	0.023	0.010
% Chromium	0.02	-
% Nickel	0.02	-
% Molybdenum	<0.01	-
% Vanadium	0.009	-

Heat Treatment NORM

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (87 for MNS-005-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (438 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-005 --Specimen ID MNS-005-B

	Test Data	CMTR Data
Tensile Strength (psi)	83,300	73,538
Yield Strength (psi)	42,400	38,538
% Elongation	20	25.0
% Reduction In Area	35	47.0
Hardness (BHN)	159	
% Carbon	0.35	0.25
% Manganese	0.78	0.73
% Silicon	0.21	0.21
% Phosphorous	0.010	0.015
% Sulfur	0.020	0.010
% Chromium	0.02	-
% Nickel	0.02	-
% Molybdenum	<0.01	-
% Vanadium	0.008	-

Heat Treatment NORM

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (83 for MNS-005-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (424 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-005 --Specimen ID MNS-005-C

	Test Data	CMTR Data
Tensile Strength (psi)	85,300	73,538
Yield Strength (psi)	44,800	38,538
% Elongation	16	25.0
% Reduction In Area	30	47.0
Hardness (BHN)	165	
% Carbon	0.34	0.25
% Manganese	0.81	0.73
% Silicon	0.22	0.21
% Phosphorous	0.012	0.015
% Sulfur	0.021	0.010
% Chromium	0.02	-
% Nickel	0.02	-
% Molybdenum	<0.009	-
% Vanadium	0.009	-

Heat Treatment NORM

Another Test For This Line Item? Y Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (85 for MNS-005-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (435 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-005 --Specimen ID MNS-005-D

	Test Data	CMTR Data
Tensile Strength (psi)	83,200	73,538
Yield Strength (psi)	40,800	38,538
% Elongation	23	25.0
% Reduction In Area	37	47.0
Hardness (BHN)	156	
% Carbon	0.34	0.25
% Manganese	0.80	0.73
% Silicon	0.21	0.21
% Phosphorous	0.011	0.015
% Sulfur	0.020	0.010
% Chromium	0.02	-
% Nickel	0.02	-
% Molybdenum	<0.01	-
% Vanadium	0.009	-

Heat Treatment NORM

Another Test For This Line Item? N Add Remarks? Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (82 for MNS-005-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (431 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire	**Unit** 1, 2
Line Item MNS-006	**Transaction (A/C/D)** A
Heat-Lot A23	**ASME Class** 2
Commodity FLG	**Diameter** 3/4
Schedual STD.	**Rating** 1500
Type RF, SW	**Spec.** 105
Grade NA	**Source** WJM
Vendor (WJM or PSI) WJM	**CMTR Date** 11/03/80
NCA-3800 (Y/N) Y	
Supplier 1 Capitol Pipe & Steel Prod./ Inc	**Supplier 2** -
Quanity 20	**Quanity In Stock** 0
Installed-Acess ?	**Installed-Not Acess** ?
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

All twenty flanges were installed in non QA applications under Work Request Numbers 91569, 113921, 117636, 119062, 120274, 119061, 56955, 129205, and 132414.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item MNS-006 --Specimen ID MNS-006-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness(BHN)	-	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? N Add Remarks? N

NRC 88-05
MATERIALS WORKSHEET

Plant McGuire
Unit 2?
Line Item MNS-007
Transaction (A/C/D) A
Heat-Lot 80508
ASME Class ?
Commodity FLG
Diameter 1
Schedual 80
Rating 1500
Type RF,SW
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date ?
NCA-3800 (Y/N) Y
Supplier 1 ?
Supplier 2 -
Quanity 10
Quanity in Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) N
Add Remarks (Y/N) Y

Worksheet is incomplete because CMTR was not obtained before work was stoped due to Supplement 2 of NRC Bulletin 88-05.

NRC 88-05

MATERIALS WORKSHEET

Plant McGuire	**Unit** ?
Line Item MNS-008	**Transaction (A/C/D)** A
Heat-Lot ?	**ASME Class** 2
Commodity FLG	**Diameter** 3/4
Schedual 40	**Rating** 150
Type RF,SW	**Spec.** 105
Grade NA	**Source** ?
Vendor (WJM orPSI) ?	**CMTR Date** ?
NCA-3800 (Y/N) Y	
Supplier 1 ?	**Supplier 2** -
Quanity 6	**Quanity In Stock** 0
Installed-Acess ?	**Installed-Not Acess** ?
Add Test Results (Y/N) N	**Add Remarks (Y/N)** Y

Worksheet is incomplete because CMTR was not obtained before work was stoped due to Supplement 2 of NRC Bulletin 88-05.

4. CATAWBA NUCLEAR STATION - NRC BULLETIN 88-05 INVESTIGATION

4.1 OVERVIEW

Through August 5, 1988, 413 WJM/PSI flanges had been identified as ordered for Catawba Nuclear Station. Each of these flanges was given an unique sample identification number designation and tabulated as appropriate behind either Tab 4.1, 4.2 or 4.3 depending on the installation or safety/non-safety related status.

4.2 TEST RESULTS

Twenty-two flanges from eight different line items were tested in-situ using an EQUOTIP hardness tester. The samples tested, heat number, size, and hardness are listed in the following table:

SAMPLE	HEAT #	SIZE	BRINELL HARDNESS
CNS-004-E	COP	2"	150
CNS-004-F	COP	2"	145
CNS-012-A	44036	12"	138
CNS-013-A	A23	1"	142
CNS-013-B	A23	1"	140
CNS-013-C	A23	1"	176
CNS-013-D	A23	1"	156
CNS-013-E	A23	1"	178
CNS-014-A	A23	3/4"	136 (Low)
CNS-014-B	A23	3/4"	147
CNS-014-C	A23	3/4"	147
CNS-014-D	A23	3/4"	138
CNS-014-E	A23	3/4"	138
CNS-014-F	A23	3/4"	138
CNS-014-G	A23	3/4"	146
CNS-014-H	A23	3/4"	137
CNS-016-A	GDEB	4"	157
CNS-016-B	GDEB	4"	151
CNS-017-B	T8834	2"	168
CNS-017-C	T8834	2"	175
CNS-017-D	T8834	2"	158
CNS-017-E	T8834	2"	166
CNS-018-A	56245	3/4"	155
CNS-025-A	UE	1"	211 (High)

* The Leeb hardness values obtained in the field were corrected for temperature using a correlation factor developed by EPRI and then converted to Brinell hardness numbers using conversion tables provided by EQUOTIP.

Eighty-six flanges from thirteen different line items were found in stock and sent to the Duke Metallurgy Laboratory. Thirty-six flanges underwent a tensile test, hardness test, and chemical analysis. At least one sample from each line item was macro etched in an attempt to determine if it was a forging.

CNS-001-A and CNS-001-B appeared to be made from plate. The grains in CNS-027-A were equiaxial and a determination could not be made. The rest of the flanges all apeared to be forgings. The samples tested, heat number, size, and any deviations from the ASME materials specification are given in the table below. All the test data is given behind Tab 4.4.

SAMPLE	HEAT #	SIZE	DEVIATIONS FROM SPECIFICATION
CNS-001-A	6579	1"	Plate
CNS-001-B	6579	1"	Plate
CNS-002-A	A91	2"	% Elongation & Reduction in Area Low
CNS-002-B	A91	2"	% Elongation & Reduction in Area Low
CNS-002-C	A91	2"	% Elongation & Reduction in Area Low
CNS-002-D	A91	2"	% Elongation & Reduction in Area Low
CNS-003-A	1G5129	10"	None
CNS-004-A	COP	2"	None
CNS-004-B	COP	2"	None
CNS-007-A	56245	1"	None
CNS-007-B	56245	1"	None
CNS-007-C	56245	1"	None
CNS-007-D	56245	1"	None
CNS-008-A	6072802	2"	% Elongation Low
CNS-008-B	6072802	2"	% Elongation Low
CNS-008-C	6072802	2"	% Elongation & Reduction in Area Low
CNS-008-D	6072802	2"	% Elongation Low
CNS-009-A	6X11237	4"	% Elongation & Reduction in Area Low
CNS-009-B	6X11237	4"	% Elongation Low
CNS-010-A	6X11237	12"	None
CNS-010-B	6X11237	12"	None
CNS-010-C	6X11237	12"	None
CNS-015-A	2095	2"	None
CNS-015-B	2095	2"	% Elongation & Reduction in Area Low
CNS-015-C	2095	2"	% Carbon High
CNS-015-D	2095	2"	Low Tensile Strength (Broke Outside Marks)
CNS-017-A	T8834	2"	None
CNS-019-A	25904	1"	% Elongation Low, Hardness High
CNS-019-B	25904	1"	Hardness High
CNS-019-C	25904	1"	% Elongation Low, Hardness High
CNS-020-A	25904	1"	% Elongation Low, Hardness High
CNS-020-B	25904	1"	% Elongation Low, Hardness High
CNS-027-A	GDKD	2"	None
CNS-027-B	GDKD	2"	None
CNS-027-C	GDKD	2"	None
CNS-027-D	GDKD	2"	None

*When evaluating the tensile test data it should be taken into account that only one specimen was obtained from each flange and that because of the flange size the tensile specimen may not have been parallel to the direction of maximum working.

4.3 REPORTABLE ITEMS

Ten flanges: CNS-004E, CNS-004F, CNS-013A, CNS-013B, CNS-014A, CNS-014D, CNS-014E, CNS-014F, CNS-014G, and CNS-025A installed in safety related or seismic applications at Catawba Nuclear Station initially failed the in-situ hardness test. These flanges were reported to the NRC Operations Center as required by Supplement 1 to NRC Bulletin 88-05.

When these flanges were initially reported, NUMARC/EPRI temperature correlation had not been applied. Based upon a later interpretation from the NRC/ONRR technical contact for Bulletin 88-05, allowing application of temperature correction factors prior to determining reportability, only samples CNS-014A and CNS-025A failed the in-situ hardness test and were thereby reportable.

The details of the reports for samples CNS-014A and CNS-025A are contained in the Data Reports for nonconforming or inaccessible flanges and the Memorandum for File located behind Tab 4.5.

4.4 JUSTIFICATIONS FOR CONTINUED OPERATION (JCO)

A JCO for flanges CNS-014A and CNS-025A reported to the NRC as having failed the in-situ hardness tests was performed by the Duke Design Engineering Department. This JCO is located behind Tab 4.6 and is identified as Design Engineering Calculation CNC-1232.00-00-0096.

4.5 CORRECTIVE ACTIONS

In addition to the corrective actions described in section 1.4, Catawba Sample CNS-025 will be further tested using liquid dye penetrant. This sample, a blind flange with a welded attachment, will undergo this additional testing to further ascertain the acceptability of this flange.

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN SAFETY RELATED SYSTEMS (Catawba)

SAMPLE	PO*	HEAT*	SIZE	TYPE	LOCATION
CNS-004-E	K54259	80508	2"	RF, SW	Unit 1 Aux Feedwater (Seismic)
CNS-004-F	K54259	80508	2"	RF, SW	Unit 1 Aux Feedwater (Seismic)
CNS-012-A	K10226	44036	12"	RF, SO	2B Diesel Gen. Lub Oil System
CNS-013-A	G04551	A23	1"	RF, SW	Unit 2 Diesel Gen. Starting Air
CNS-013-B	G04551	A23	1"	RF, SW	Unit 2 Diesel Gen. Starting Air
CNS-013-C	G04551	A23	1"	RF, SW	Unit 2 Diesel Gen. Starting Air
CNS-013-D	G04551	A23	1"	RF, SW	Unit 2 Diesel Gen. Starting Air
CNS-013-E	G04551	A23	1"	RF, SW	Unit 2 Diesel Gen. Starting Air
CNS-014-A	G04551	A23	3/4"	RF, SW	Unit 2 Aux. FDWP Turbine
CNS-014-B	G04551	A23	3/4"	RF, SW	Unit 2 Aux. FDWP Turbine
CNS-014-C	G04551	A23	3/4"	RF, SW	Unit 2 Aux. FDWP Turbine
CNS-014-D	G04551	A23	3/4"	RF, SW	Unit 1 Aux. FDWP Turbine
CNS-014-E	G04551	A23	3/4"	RF, SW	Unit 1 Aux. FDWP Turbine
CNS-014-F	G04551	A23	3/4"	RF, SW	Unit 1 Aux. FDWP Turbine
CNS-014-G	G04551	A23	3/4"	RF, SW	Unit 1 Aux. FDWP Turbine
CNS-014-H	G04551	A23	3/4"	RF, SW	Unit 2 Aux. FDWP Turbine
CNS-016-A	G04551	GDEB	4"	RF, WN	Unit 2 Aux. Feedwater System
CNS-016-B	G04551	GDEB	4"	RF, WN	Unit 2 Aux. Feedwater System
CNS-017-B	H08878	T8834	2"	RF, WN	2A Diesel Gen. Cooling Water
CNS-017-C	H08878	T8834	2"	RF, WN	2A Diesel Gen. Cooling Water
CNS-017-D	H08878	T8834	2"	RF, WN	2B Diesel Gen. Cooling Water
CNS-017-E	H08878	T8834	2"	RF, WN	2B Diesel Gen. Cooling Water
CNS-018-A	H08878	56245	3/4"	RF, SW	Unit 1 Component Cooling System
CNS-025-A	G53724	UE	1"	BL, RF	1B Diesel Gen. Lub Oil System
CNS-025-?	G53724	UE	1"	BL, RF	1A Diesel Gen. Lub Oil System
CNS-025-?	G53724	UE	1"	BL, RF	2B Diesel Gen. Lub Oil System

? = Indicated activity was not complete at issuance of Supplement 2 to NRC Bulletin 88-05
RF = Raised Face
WN = Weld Neck
BL = Blind
SW = Socket Weld
SO = Slip On

LIST OF KNOWN WJM & PSI FLANGES INSTALLED IN NONSAFETY RELATED SYSTEMS (Catawba)

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
CNS-001-?	F31659	6579	1"	RF, WN, Orifice	Unknown
CNS-001-?	F31659	6579	1"	RF, WN, Orifice	Unknown

Two flanges (Line Item CNS-001) were sold as surplus.

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus
CNS-002-?	F31659	A91	2"	RF, WN Orifice	Unknown, or Sold as Surplus

The isometric drawings for seven flanges (Line Item CNS-002) have been deleted indicating that the flanges have been discarded.

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
CNS-004-?	K54259	COP	2"	RF, SW	Work Request # 4577MNT

Two flanges (Line Item CNS-004) were deleted during inventory adjustment.

Three flanges (Line Item CNS-005) were used in a flush of the LT System and then discarded. One was transferred to Oconee.

SAMPLE	PO#	HEAT#	SIZE	TYPE	LOCATION
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted
CNS-007-?	H45250	56245	1"	RF, TH	Unknown, Surplused, or Deleted

Six flanges (Line Item CNS-008) were sold as surplus.

Three flanges (Line Item CNS-009) were sold as surplus.

Two flanges (Line Item CNS-010) were sold as surplus.

Five flanges (Line Item CNS-011) were installed in temporary piping or sold as surplus.

For Line Items CNS-013 thru CNS-027 the determination of how many of the flanges may have been installed in nonsafety related systems, sold as surplus, or deleted during inventory adjustment was not made at the time NRC Bulletin 88-05 Supplement 2 was issued. Items installed in nonsafety related systems are only traceable by material identification numbers which are unique to the type of item but may consist of several different heats from different purchase orders. The materials identification numbers are recorded on tickets at the time items are issued from the warehouse. The tickets for these particular items are not stored on computers and must be obtained from archives.

At Catawba, the heat number of items installed in safety related systems are entered into a computer along with the installed location. This enabled the location of the above suspect flanges installed in safety related systems to be identified by the issuance of Supplement 2.

RF = Raised Face
WN = Weld Neck
BL = Blind
SW = Socket Weld
SO = Slip On
TH = Threaded

LIST OF KNOWN WJM & PSI FLANGES
NON INSTALLED
(Catawba)

SAMPLE	PO#	HEAT#	SIZE	RATING	SCHEDULE	TYPE
CNS-001-A	F31659	6579	1"	1500#	80	RF, WN, Orifice
CNS-001-B	F31659	6579	1"	1500#	80	RF, WN, Orifice

Four additional flanges (Line Item CNS-001) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-002-A	F31659	A91	2"	300#	40	RF, WN, Orifice
CNS-002-B	F31659	A91	2"	300#	40	RF, WN, Orifice
CNS-002-C	F31659	A91	2"	300#	40	RF, WN, Orifice
CNS-002-D	F31659	A91	2"	300#	40	RF, WN, Orifice

Ten additional flanges (Line Item CNS-002) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-003-A	N55031	1G5129	10"	150#	40	RF, WN
CNS-004-A	K54259	COP	2"	1500#	80	RF, SW
CNS-004-B	K54259	COP	2"	1500#	80	RF, SW

Three additional flanges (Line Item CNS-004) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-007-A	H45250	56245	1"	150#	-	RF, TH
CNS-007-B	H45250	56245	1"	150#	-	RF, TH
CNS-007-C	H45250	56245	1"	150#	-	RF, TH
CNS-007-D	H45250	56245	1"	150#	-	RF, TH

One additional flange (Line Item CNS-007) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-008-A	J32195	6072802	2"	2500#	XXH	RF, WN, Orifice
CNS-008-B	J32195	6072802	2"	2500#	XXH	RF, WN, Orifice
CNS-008-C	J32195	6072802	2"	2500#	XXH	RF, WN, Orifice
CNS-008-D	J32195	6072802	2"	2500#	XXH	RF, WN, Orifice
CNS-009-A	J32195	6X11237	4"	900#	-	RF, BL
CNS-009-B	J32195	6X11237	4"	900#	-	RF, BL
CNS-010-A	J32195	6X11237	12"	300#	Std.	RF, WN
CNS-010-B	J32195	6X11237	12"	300#	Std.	RF, WN
CNS-010-C	J32195	6X11237	12"	300#	Std.	RF, WN
CNS-015-A	G04551	2095	2"	300#	40	RF, SW
CNS-015-B	G04551	2095	2"	300#	40	RF, SW
CNS-015-C	G04551	2095	2"	300#	40	RF, SW
CNS-015-D	G04551	2095	2"	300#	40	RF, SW

Ten additional flanges (Line Item CNS-015) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-017-A	H08878	T8834	2"	150#	40	RF, WN
CNS-019-A	H08878	25904	1"	150#	-	RF, TH
CNS-019-B	H08878	25904	1"	150#	-	RF, TH
CNS-019-C	H08878	25904	1"	150#	-	RF, TH

One additional flange (Line Item CNS-019) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

CNS-020-A	H08878	25904	1"	150#	-	RF, BL
CNS-020-B	H08878	25904	1"	150#	-	RF, BL
CNS-027-A	G53724	GDKD	2"	150#	-	RF, TH
CNS-027-B	G53724	GDKD	2"	150#	-	RF, TH
CNS-027-C	G53724	GDKD	2"	150#	-	RF, TH
CNS-027-D	G53724	GDKD	2"	150#	-	RF, TH

Twenty-one additional flanges (Line Item CNS-015) will be held at the laboratory until the resolution of NRC Bulletin 88-05 is complete.

? = Indicated activity was not complete at issuance of Supplement 2 to NRC Bulletin 88-05
RF = Raised Face
WN = Weld Neck
BL = Blind
SW = Socket Weld
TH = Threaded

LIST OF KNOWN WJM &PSI FLANGES
(Catawba)

LINE ITEM	PO#	HEAT#	TAG#	#ORDERED	#INSTALLED		#AT LAB	#OTHER
					QA	Non QA		
CNS-001	F31659	6579	CC-03096	10	0	2[1]	6	2
CNS-002	F31659	A91	N/A	30	0	?[2]	14	?
CNS-003	N55031	1G5129	CC-10578	1	0	0	1	0
CNS-004	K54259	COP	CC-09460	10	2[3]	1	5	2
CNS-005	J05092	6061273	CC-03096	4	0	0	0	3[4]
CNS-006	M04431	COX	N/A	10[5]	0	0	0	0
CNS-007	H45250	56245	N/A	20	0	?[6]	5	?
CNS-008	J32195	6072802	CC-03099	10	0	0	4	6[7]
CNS-009	J32195	6X11237	CC-00384	5	0	0	2	3[8]
CNS-010	J32195	6X11237	CC-00343	5	0	0	3	2[9]
CNS-011	J32195	6X11237	N/A	5	0	0	0	5[10]
CNS-012	K10226	44036	N/A	1	1	0	0	0
CNS-013	G04551	A23	N/A	25	5	?	0	?
CNS-014	G04551	A23	N/A	10	8	?	0	?
CNS-015	G04551	2095	N/A	100	0	?	14	?
CNS-016	G04551	GDEB	N/A	2	2	0	0	?

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[1]Two were surplused and two were downgraded to non-QA.

[2]For seven the ISOs have been deleted indicating that the piping has been removed and the flanges discarded. The other nine are installed in non-QA systems or have been surplused.

[3]Two are installed a QA Condition 4 (seismic) systems (Auxiliary Feedwater). One in a non-QA system under WR# 4577MNT. The other two were deleted during inventory adjustment.

[4]One transferred to Oconee (Transfer Requisition 7310 835534, NSM 2193, LPSW 356 repair). The other three were used in a flush of LT and then discarded.

[5]Located on tube side inlet and outlet of 5 coolers which are used with 3 Westinghouse motors which have not been installed and are in the warehouse on hold.

[6]Fifteen are either installed in non-QA systems (2YV, 4 tickets missing), were sold as surplus or deleted during inventory adjustment.

[7]Six were sold as surplus.

[8]Three were sold as surplus.

[9]Two were sold as surplus.

[10]Five were sold as surplus.

LINE ITEM	PO#	HEAT#	TAG#	#ORDERED	#INSTALLED QA	#INSTALLED Non QA	#AT LAB	#OTHER
CNS-017	H08878	T8834	N/A	25	4	?	1	?
CNS-018	H08878	56245	N/A	5	1[1]	?	0	?
CNS-019	H08878	25904	N/A	15	0[2]	?	4	?
CNS-020	H08878	25904	N/A	5	0	?	2	?
CNS-021	H08878	85148	N/A	10	0	?	0	?
CNS-022	H08878	220821	N/A	23	0	?	0	?
CNS-023	H08878	6028835	N/A	1	0	?	0	?
CNS-024	H08878	213158	N/A	1	0	?	0	?
CNS-025	G53724	UE	N/A	5	3[3]	?	0	?
CNS-026	G53724	GDAT	N/A	3	0	?	0	?
CNS-027	G53724	GDKD	N/A	72	0	?	25	?
			Total	413	26	?	86	?

* This list does not include 16 different Heats of WJM flanges which came with a spare Delaval Emergency Diesel Generator purchased from Carolina Power and Light.

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[1]One is installed in Component Cooling (1KC017 Weld#19) a QA Condition 1 system.

[2]One was sent to Oconee, Transfer Rec.#7310 852771, to repair the EFW PT Oil Cooler-RW#22842D.

[3]One on 1B diesel was tested. Two found in the same location on the 1A and 2B diesel after NRC 88-05 Supplement 2 had gone into effect were not tested.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Warehouse
Line Item CNS-001
Transaction (A/C/D) C
Heat-Lot 6579
ASME Class 2
Commodity FLG
Diameter 1
Schedual 80
Rating 1500
Type RF, WN, Orifice
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 01/26/81
NCA-3800 (Y/N) Y
Supplier 1 HUB, Inc.
Supplier 2 -
Quanity 10
Quanity In Stock 6
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-001-A and CNS-001-B were examined metallographically and were found to be made from plate. Two flanges were surplused and two were downgraded to non-QA. The ones in stock were marked 1" WJ 1500 SA 105 6579 S 80.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-001 **--Specimen ID** CNS-001-A

	Test Data	CMTR Data
Tensile Strength (psi)	74,600	85,482
Yield Strength (psi)	43,700	53,053
% Elongation	30	26
% Reduction In Area	63	40
Hardness (HBN)	156	
% Carbon	0.15	0.28
% Manganese	1.07	0.62
% Silicon	0.21	0.26
% Phosphorous	0.017	0.013
% Sulfur	0.029	0.050
% Chromium	0.23	-
% Nickel	0.14	-
% Molybdenum	0.04	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (82 for CNS-001-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (413 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (409L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-001 **--Specimen ID** CNS-001-B

	Test Data	CMTR Data
Tensile Strength (psi)	76,100	85,482
Yield Strength (psi)	44,900	53,053
% Elongation	29	26
% Reduction In Area	61	40
Hardness (BHN)	156	
% Carbon	0.16	0.28
% Manganese	1.06	0.62
% Silicon	0.21	0.26
% Phosphorous	0.016	0.013
% Sulfur	0.025	0.050
% Chromium	0.23	-
% Nickel	0.14	-
% Molybdenum	0.04	-

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (82 for CNS-001-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (415 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (415 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ? & Warehouse
Line Item CNS-002
Transaction (A/C/D) C
Heat-Lot A91
ASME Class 2
Commodity FLG
Diameter 2
Schedual 40
Rating 300
Type RF, WN, Orifice
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 01/26/81
NCA-3800 (Y/N) Y
Supplier 1 HUB, Inc.
Supplier 2 -
Quanity 30
Quanity In Stock 14
Installed-Acess -
Installed-Not Acess -
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

The Isometric Drawings which eight of the flanges were listed as being on have been deleted, indicating that the piping has been removed and the flanges discarded. The eight other flanges are installed in non-safety applications or surplused. The flanges in stock were all marked 2" WJ 300 SA 105-A91-S-40. CNS-002-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-002 **--Specimen ID** CNS-002-A

	Test Data	CMTR Data
Tensile Strength (psi)	85,300	87,000
Yield Strength (psi)	43,100	56,000
% Elongation	18	26
% Reduction In Area	20	58
Hardness (BHN)	156	
% Carbon	0.34	0.35
% Manganese	0.61	0.62
% Silicon	0.17	0.19
% Phosphorous	0.006	0.008
% Sulfur	0.016	0.021
% Chromium	0.13	-
% Nickel	0.07	-
% Molybdenum	0.02	-

Heat Treatment None given on CMTR.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (84 for CNS-002-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (435 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (432 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-002 **--Specimen ID** CNS-002-B

	Test Data	CMTR Data
Tensile Strength (psi)	81,600	87,000
Yield Strength (psi)	39,800	56,000
% Elongation	17	26
% Reduction In Area	25	58
Hardness (BHN)	165	
% Carbon	0.35	0.35
% Manganese	0.64	0.62
% Silicon	0.19	0.19
% Phosphorous	0.007	0.008
% Sulfur	0.021	0.021
% Chromium	0.13	-
% Nickel	0.07	-
% Molybdenum	0.02	-

Heat Treatment None given on CMTR.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (82 for CNS-002-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (428 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (422 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-002 **--Specimen ID** CNS-002-C

	Test Data	CMTR Data
Tensile Strength (psi)	82,300	87,000
Yield Strength (psi)	40,800	56,000
% Elongation	17	26
% Reduction In Area	18	58
Hardness (BHN)	156	
% Carbon	0.34	0.35
% Manganese	0.63	0.62
% Silicon	0.19	0.19
% Phosphorous	0.006	0.008
% Sulfur	0.018	0.021
% Chromium	0.13	-
% Nickel	0.07	-
% Molybdenum	0.02	

Heat Treatment None given on CMTR.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (82 for CNS-002-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (428 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (426 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-002 **--Specimen ID** CNS-002-D

	Test Data	CMTR Data
Tensile Strength (psi)	86,400	87,000
Yield Strength (psi)	43,700	56,000
% Elongation	16	26
% Reduction In Area	18	58
Hardness (BHN)	165	
% Carbon	0.35	0.35
% Manganese	0.63	0.62
% Silicon	0.18	0.19
% Phosphorous	0.006	0.008
% Sulfur	0.019	0.021
% Chromium	0.13	-
% Nickel	0.07	-
% Molybdenum	0.02	-

Heat Treatment None given on CMTR.

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (85 for CNS-002-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (440 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (437 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba	**Unit** Warehouse
Line Item CNS-003	**Transaction (A/C/D)** C
Heat-Lot 1G5129	**ASME Class** 2
Commodity FLG	**Diameter** 10
Schedual 40	**Rating** 150
Type RF,WN	**Spec.** 182
Grade F304	**Source** PSI
Vendor (WJM or PSI) PSI	**CMTR Date** 11/05/87
NCA-3800 (Y/N) Y	
Supplier 1 Consolidated Power Supply	**Supplier 2** -
Quanity 1	**Quanity In Stock** 1
Installed-Acess 0	**Installed-Not Acess** 0
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

The flange was marked 10 150 PS SA 182-F304 CL 2 1G5129 S/40 B16.5. CNS-003-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-003 **--Specimen ID** CNS-003-A

	Test Data	CMTR Data
Tensile Strength (psi)	86,500	82,100
Yield Strength (psi)	44,800	37,200
% Elongation	53	57.2
% Reduction In Area	72	63
Hardness (BHN)	176	
% Carbon	0.06	0.055
% Manganese	1.51	1.62
% Silicon	0.67	0.58
% Phosphorous	0.024	0.027
% Sulfur	0.017	0.026
% Chromium	18.70	18.27
% Nickel	9.17	8.90
% Molybdenum	0.43	-

Heat Treatment ANN (Solution)

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (88 for CNS-003-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (450 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (453 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 1 & Warehouse
Line Item CNS-004
Transaction (A/C/D) C
Heat-Lot COP
ASME Class 2
Commodity FLG
Diameter 2
Schedual 80
Rating 1500
Type RF, SW
Spec. 105
Grade NA
Source Dallas Forge, Inc.
Vendor (WJM or PSI) WJM
CMTR Date 02/22/84
NCA-3800 (Y/N) Y
Supplier 1 Capital Pipe & Steel Products
Supplier 2 -
Quanity 10
Quanity In Stock 5
Installed-Acess 3
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

Dallas Forges CMTR shows Heat Number of 75065 typed in and Heat Code of COP written in. Two flanges are installed in seismicly qualified ststems (Auxiliary Feedwater). One was installed in a non-QA system under Work Request #4577MNT. The other two were deleted during inventory adjustment. The five in stock and the flanges tested in-situ were all marked 2-WJ 1500 SA105 CL 2 COP X H. CNS-004-A was examined metallographically and found to be a forging.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-004 **--Specimen ID** CNS-004-A

	Test Data	CMTR Data
Tensile Strength (psi)	75,700	88,079
Yield Strength (psi)	47,300	55,674
% Elongation	30	24
% Reduction In Area	55	52
Hardness (BHN)	147	
% Carbon	0.24	0.27
% Manganese	1.01	0.99
% Silicon	0.28	0.31
% Phosphorous	0.005	0.010
% Sulfur	0.016	0.023
% Chromium	0.08	-
% Nickel	0.12	-
% Molybdenum	0.04	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (79 for CNS-004-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (402 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (404 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-004 **--Specimen ID** CNS-004-B

	Test Data	CMTR Data
Tensile Strength (psi)	75,700	88,079
Yield Strength (psi)	45,900	55,674
% Elongation	28	24
% Reduction In Area	52	52
Hardness (BHN)	141	
% Carbon	0.24	0.27
% Manganese	0.97	0.99
% Silicon	0.24	0.31
% Phosphorous	0.006	0.010
% Sulfur	0.017	0.023
% Chromium	0.09	-
% Nickel	0.12	-
% Molybdenum	0.04	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B and EQUOTIP hardness testers. The Rockwell B Hardness (77 for CNS-004-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. One EQUOTIP Hardness Value (394 L_D) was obtained from at the same location as the Rockwell B, a flat surface where the sample for chemical analysis was removed. A second EQUOTIP Hardness Value (404 L_D) was obtained after removing approximatly 60 mils of metal from the rim of the flange. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-004 **--Specimen ID** CNS-004-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	88,079
Yield Strength (psi)	-	55,674
% Elongation	-	24
% Reduction In Area	-	52
Hardness (BHN)	150	
% Carbon	-	0.27
% Manganese	-	0.99
% Silicon	-	0.31
% Phosphorous	-	0.010
% Sulfur	-	0.023
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and tgen hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L- units of the average of the first set, the data was valid. The average value of the two sets data was 362 L_D for flange CNS-004-E. The temperature of the flange was 323^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+52) gives a corrected value of 414 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-004 **--Specimen ID** CNS-004-F

	Test Data	CMTR Data
Tensile Strength (psi)	-	88,079
Yield Strength (psi)	-	55,674
% Elongation	-	24
% Reduction In Area	-	52
Hardness (BHN)	145	
% Carbon	-	0.27
% Manganese	-	0.99
% Silicon	-	0.31
% Phosphorous	-	0.010
% Sulfur	-	0.023
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 355 L_D for flange CNS-004-F. The temperature of the flange was 323^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+52) gives a corrected value of 407 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 2 (Oconee) ONS-003-A
Line Item CNS-005
Transaction (A/C/D) C
Heat-Lot 6061273
ASME Class 2
Commodity FLG
Diameter 12
Schedual 80
Rating 150
Type BL, RF
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 03/30/83
NCA-3800 (Y/N) Y
Supplier 1 McJunkin Corporation
Supplier 2 -
Quanity 4
Quanity In Stock 0
Installed-Acess 1
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

One was transfered to Oconee, and is installed in the Low Pressure Service Water System which is safety related. The other three were used in a flush and then discarded. The one at Oconee was marked 12" WJ 150 SA 105 CL2 6061273

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-005 **--Specimen ID** ONS-003-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,000
Yield Strength (psi)	-	44,900
% Elongation	-	32.0
% Reduction In Area	-	61.0
Hardness (BHN)	153	
% Carbon	-	0.24
% Manganese	-	1.18
% Silicon	-	0.23
% Phosphorous	-	0.006
% Sulfur	-	0.022
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 410 L_D for flange CNS-005-A. The temperature of the flange was 100.4° F. There was slight to moderate vibration and no magnetic field. Adding the EPRI developed correction factor for temperature (+8) gives a corrected value of 418 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Warehouse
Line Item CNS-006
Transaction (A/C/D) A
Heat-Lot COX
ASME Class 3
Commodity FLG
Diameter 1 1/2 X 6
Schedual N/A
Rating 150
Type RED, SO
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 11/29/85
NCA-3800 (Y/N) Y
Supplier 1 Chicago Tube & Iron
Supplier 2 Sentry Equipment Corp.
Quanity 10
Quanity In Stock 10
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

The ten flanges were supplied by Westinghouse Electric Corp. and are located on the tube side inlet and outlet of 5 coolers which are used with 3 moters which have not been installed and are on hold in the warehouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-006 **--Specimen ID** CNS-006-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	87,663
Yield Strength (psi)	-	50,575
% Elongation	-	22.0
% Reduction In Area	-	43.0
Hardness (BHN)	-	
% Carbon	-	0.28
% Manganese	-	0.75
% Silicon	-	0.22
% Phosphorous	-	0.017
% Sulfur	-	0.027
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ?, Warehouse
Line Item CNS-007
Transaction (A/C/D) C
Heat-Lot 56245
ASME Class 2
Commodity FLG
Diameter 1
Schedual N/A
Rating 150
Type RF, TH
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 01/05/83
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 20
Quanity In Stock 5
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-007-A was examined metallographically and found to be a forging. WJM shows the Heat No. as 56245 and the Test or Code No. as GDKG. The flanges not in stock have either been sold as surplus or installed in a non-QA system. All flanges examined were marked 1"- WJ-150-SA-105- CL.2 -GDKG - H45250-13.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-007 **--Specimen ID** CNS-007-A

	Test Data	CMTR Data
Tensile Strength (psi)	84,000	83,620
Yield Strength (psi)	51,000	56,240
% Elongation	25	31.0
% Reduction In Area	60	59.7
Hardness (BHN)	172	
% Carbon	0.24	0.24
% Manganese	0.86	0.90
% Silicon	0.25	0.26
% Phosphorous	0.007	0.010
% Sulfur	0.027	0.020
% Chromium	0.09	-
% Nickel	0.06	-
% Molybdenum	0.01	-
% Vanadium	0.029	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (87 for CNS-007-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-007 **--Specimen ID** CNS-007-B

	Test Data	CMTR Data
Tensile Strength (psi)	83,100	83,620
Yield Strength (psi)	50,500	56,240
% Elongation	25	31.0
% Reduction In Area	60	59.7
Hardness (BHN)	169	
% Carbon	0.25	0.24
% Manganese	0.84	0.90
% Silicon	0.24	0.26
% Phosphorous	0.007	0.010
% Sulfur	0.019	0.020
% Chromium	-	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.028	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (86 for CNS-007-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-007 **--Specimen ID** CNS-007-C

	Test Data	CMTR Data
Tensile Strength (psi)	83,800	83,620
Yield Strength (psi)	52,600	56,240
% Elongation	26	31.0
% Reduction In Area	57	59.7
Hardness (BHN)	169	
% Carbon	0.25	0.24
% Manganese	0.83	0.90
% Silicon	0.24	0.26
% Phosphorous	0.007	0.010
% Sulfur	0.018	0.020
% Chromium	0.09	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.027	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (86 for CNS-007-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-007 **--Specimen ID** CNS-007-D

	Test Data	CMTR Data
Tensile Strength (psi)	86,100	83,620
Yield Strength (psi)	52,600	56,240
% Elongation	27	31.0
% Reduction In Area	57	59.7
Hardness (BHN)	172	
% Carbon	0.24	0.24
% Manganese	0.85	0.90
% Silicon	0.23	0.26
% Phosphorous	0.007	0.010
% Sulfur	0.018	0.020
% Chromium	0.10	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.028	-

Heat Treatment None given on CRTM.

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (87 for CNS-007-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Warehouse
Line Item CNS-008
Transaction (A/C/D) C
Heat-Lot 6072802
ASME Class 2
Commodity FLG
Diameter 2
Schedual XXH
Rating 2500
Type RF, WN, Orifice
Spec. 105
Grade NA
Source Republic Steel
Vendor (WJM or PSI) WJM
CMTR Date 08/11/83
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 10
Quanity In Stock 4
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-008-A was examined metallographically and found to be a forging. The material was purchased as forged bars from Republic Steel by Gulf Coast Machine and Supply Company where they were rough forged. The rough forgings were then sold to WJM. Six flanges have been sold as surplus. The flanges in stock were marked 2 WJ 2500 SA 105 CL 2 6072802 XXH.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-008 **--Specimen ID** CNS-008-A

	Test Data	CMTR Data
Tensile Strength (psi)	79,100	78,400
Yield Strength (psi)	55,500	51,600
% Elongation	18	31.0
% Reduction In Area	30	55.0
Hardness (BHN)	156	
% Carbon	0.26	0.26
% Manganese	1.17	1.23
% Silicon	0.20	0.20
% Phosphorous	0.010	0.010
% Sulfur	0.021	0.024
% Chromium	0.14	0.13
% Nickel	0.08	0.07
% Molybdenum	0.06	0.05

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (82 for CNS-008-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (416 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-008 **--Specimen ID** CNS-008-B

	Test Data	CMTR Data
Tensile Strength (psi)	78,100	78,400
Yield Strength (psi)	54,500	51,600
% Elongation	19	31.0
% Reduction in Area	31	55.0
Hardness (BHN)	156	
% Carbon	0.26	0.26
% Manganese	1.22	1.23
% Silicon	0.21	0.20
% Phosphorous	0.010	0.010
% Sulfur	0.027	0.024
% Chromium	0.15	0.13
% Nickel	0.08	0.07
% Molybdenum	0.06	0.05

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (82 for CNS-008-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (409 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-008 **--Specimen ID** CNS-008-C

	Test Data	CMTR Data
Tensile Strength (psi)	78,100	78,400
Yield Strength (psi)	55,300	51,600
% Elongation	19	31.0
% Reduction In Area	28	55.0
Hardness (BHN)	156	
% Carbon	0.25	0.26
% Manganese	1.23	1.23
% Silicon	0.21	0.20
% Phosphorous	0.010	0.010
% Sulfur	0.026	0.024
% Chromium	0.14	0.13
% Nickel	0.08	0.07
% Molybdenum	0.06	0.05

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (82 for CNS-008-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (409 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-008 **--Specimen ID** CNS-008-D

	Test Data	CMTR Data
Tensile Strength (psi)	77,700	78,400
Yield Strength (psi)	53,000	51,600
% Elongation	20	31.0
% Reduction In Area	35	55.0
Hardness (BHN)	153	
% Carbon	0.25	0.26
% Manganese	1.31	1.23
% Silicon	0.24	0.20
% Phosphorous	0.012	0.010
% Sulfur	0.031	0.024
% Chromium	0.15	0.13
% Nickel	0.08	0.07
% Molybdenum	0.06	0.05

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (81 for CNS-008-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (419 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Warehouse
Line Item CNS-009
Transaction (A/C/D) C
Heat-Lot 6X11237
ASME Class 2
Commodity FLG
Diameter 4
Schedual N/A
Rating 900
Type BL, RF
Spec. 105
Grade NA
Source Republic Steel
Vendor (WJM or PSI) WJM
CMTR Date 05/31/83
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 5
Quanity In Stock 2
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-009-A was examined metallographically and found to be a forging. The material was purchased as forged bars from Republic Steel by Gulf Coast Machine and Supply Company where they were rough forged. The rough forgings were then sold to WJM. Three flanges have been sold as surplus. The flanges in stock were marked 4 WJ 900 SA 105 CL 2 6X11237.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-009 **--Specimen ID** CNS-009-A

	Test Data	CMTR Data
Tensile Strength (psi)	75,800	78,400
Yield Strength (psi)	48,700	48,700
% Elongation	19	33.0
% Reduction in Area	28	63.0
Hardness (BHN)	147	
% Carbon	0.27	0.27
% Manganese	0.94	0.94
% Silicon	0.19	0.20
% Phosphorous	0.016	0.016
% Sulfur	0.021	0.021
% Chromium	0.06	0.06
% Nickel	0.01	0.02
% Molybdenum	0.01	0.01

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (79 for CNS-009-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (410 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-009 **--Specimen ID** CNS-009-B

	Test Data	CMTR Data
Tensile Strength (psi)	75,500	78,400
Yield Strength (psi)	48,000	48,700
% Elongation	20	33.0
% Reduction In Area	31	63.0
Hardness (BHN)	141	
% Carbon	0.27	0.27
% Manganese	0.94	0.94
% Silicon	0.19	0.20
% Phosphorous	0.014	0.016
% Sulfur	0.019	0.021
% Chromium	0.06	0.06
% Nickel	0.01	0.02
% Molybdenum	0.01	0.01

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (77 for CNS-009-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (416 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Warehouse
Line Item CNS-010
Transaction (A/C/D) C
Heat-Lot 6X11237
ASME Class 2
Commodity FLG
Diameter 12
Schedual Standard
Rating 300
Type RF, WN
Spec. 105
Grade NA
Source Republic Steel
Vendor (WJM orPSI) WJM
CMTR Date 05/31/83
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 5
Quanity In Stock 3
Installed-Acess 0
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-0010-A was examined metallographically and found to be a forging.The material was purchased as forged bars from Republic Steel by Gulf Coast Machine and Supply Company where they were rough forged. The rough forgings were then sold to WJM. Two flanges have been sold as surplus. The flanges in stock were marked 12" WJ 300 SA 105 6X11237 STD CL 2.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-010 **--Specimen ID** CNS-010-A

	Test Data	CMTR Data
Tensile Strength (psi)	78,400	78,400
Yield Strength (psi)	51,000	48,700
% Elongation	26	33.0
% Reduction In Area	52	63.0
Hardness (BHN)	147	
% Carbon	0.27	0.27
% Manganese	1.02	0.94
% Silicon	0.22	0.20
% Phosphorous	0.017	0.016
% Sulfur	0.027	0.021
% Chromium	0.07	0.06
% Nickel	0.01	0.02
% Molybdenum	0.01	0.01

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (79 for CNS-010-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (421 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-010 **--Specimen ID** CNS-010-B

	Test Data	CMTR Data
Tensile Strength (psi)	77,300	78,400
Yield Strength (psi)	49,700	48,700
% Elongation	27	33.0
% Reduction In Area	54	63.0
Hardness (BHN)	144	
% Carbon	0.27	0.27
% Manganese	0.97	0.94
% Silicon	0.20	0.20
% Phosphorous	0.016	0.016
% Sulfur	0.024	0.021
% Chromium	0.06	0.06
% Nickel	0.01	0.02
% Molybdenum	0.01	0.01

Heat Treatment NORM

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (78 for CNS-010-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (412 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-010 **--Specimen ID** CNS-010-C

	Test Data	CMTR Data
Tensile Strength (psi)	77,300	78,400
Yield Strength (psi)	51,500	48,700
% Elongation	26	33.0
% Reduction in Area	51	63.0
Hardness (BHN)	150	
% Carbon	0.27	0.27
% Manganese	0.95	0.94
% Silicon	0.19	0.20
% Phosphorous	0.015	0.016
% Sulfur	0.023	0.021
% Chromium	0.06	0.06
% Nickel	0.01	0.02
% Molybdenum	0.01	0.01

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (80 for CNS-010-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (412 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/2 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit N/A
Line Item CNS-011
Transaction (A/C/D) A
Heat-Lot 6X11237
ASME Class 2
Commodity FLG
Diameter 16
Schedual Standard
Rating 150
Type RF, WN
Spec. 105
Grade NA
Source Republic Steel
Vendor (WJM or PSI) WJM
CMTR Date 05/31/83
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 5
Quanity in Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

The material was purchased as forged bars from Republic Steel by Gulf Coast Machine and Supply Company where they were rough forged. The rough forgings were then sold to WJM. Flanges have been sold as surplus or are installed as temporary piping.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-011 --Specimen ID CNS-011-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	78,400
Yield Strength (psi)	-	48,700
% Elongation	-	33.0
% Reduction In Area	-	63.0
Hardness (BHN)	-	
% Carbon	-	0.27
% Manganese	-	0.94
% Silicon	-	0.20
% Phosphorous	-	0.016
% Sulfur	-	0.021
% Chromium	-	0.06
% Nickel	-	0.02
% Molybdenum	-	0.01

Heat Treatment NORM

Another Test For This Line Item? N Add Remarks? N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit Diesel Generator
Line Item CNS-012
Transaction (A/C/D) A
Heat-Lot 44036
ASME Class 3
Commodity FLG
Diameter 12
Schedual N/A
Rating 150
Type RF,SO
Spec. 105
Grade NA
Source WJM
Vendor (WJM orPSI) WJM
CMTR Date 05/08/85
NCA-3800 (Y/N) Y
Supplier 1 Transamerica Delaval
Supplier 2 -
Quanity 1
Quanity In Stock 0
Installed-Acess 1
Installed-Not Acess 0
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

The flange was located in the LD system (Lube Oil-Emergency Diesel Generator) and was marked 12" WJ 150 SA-105 CL 3 44036.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-012 **--Specimen ID** CNS-012-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	74,500
Yield Strength (psi)	-	45,500
% Elongation	-	36.0
% Reduction In Area	-	71.0
Hardness (BHN)	138	
% Carbon	-	0.18
% Manganese	-	1.04
% Silicon	-	0.22
% Phosphorous	-	0.014
% Sulfur	-	0.016
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment NORM

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 380 L_D for flange CNS-012-A. The temperature of the flange was 134^0 F. There was no vibration and the magnetic field was 2.5 Gauss. Adding the EPRI developed correction factor for temperature (+18) gives a corrected value of 398 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 2, ?
Line Item CNS-013
Transaction (A/C/D) A
Heat-Lot A23
ASME Class 2
Commodity FLG
Diameter 1
Schedual 40
Rating 300
Type RF, SW
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 04/03/81
NCA-3800 (Y/N) Y
Supplier 1 Capitol Pipe & Steel Prod./ Inc
Supplier 2 -
Quanity 25
Quanity In Stock 0
Installed-Acess 5?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

Five flanges are located in the YG system which is ASME Class 3. They were marked 1"-WJ-300-SA-105-A23-S-40.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-013 **--Specimen ID** CNS-013-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	142	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 391 L_D for flange CNS-013-A. The temperature of the flange was 111.2^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+12) gives a corrected value of 403 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-013 **--Specimen ID** CNS-013-B

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	140	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 391 L_D for flange CNS-013-B. The temperature of the flange was 102° F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+9) gives a corrected value of 400 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-013 **--Specimen ID** CNS-013-C

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHM)	176	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 440 L_D for flange CNS-013-C. The temperature of the flange was 103^0 F and there was no vibration or megnetic field. Adding the EPRI developed correction factor for temperature (+9) gives a corrected value of 449 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-013 **--Specimen ID** CNS-013-D

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction in Area	-	50
Hardness (BHN)	156	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 408 L_D for flange CNS-013-D. The temperature of the flange was 118.7^{o} F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+14) gives a corrected value of 422 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-013 **--Specimen ID** CNS-013-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction in Area	-	50
Hardness (BHN)	178	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment None given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 438 L_D for flange CNS-013-E. The temperature of the flange was 115.1^{o}F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+13) gives a corrected value of 451 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba	**Unit** 1,2
Line Item CNS-014	**Transaction (A/C/D)** A
Heat-Lot A23	**ASME Class** 2
Commodity FLG	**Diameter** 3/4
Schedual 80	**Rating** 1500
Type RF,SW	**Spec.** 105
Grade NA	**Source** WJM
Vendor (WJM or PSI) WJM	**CMTR Date** 05/08/81
MCA-3800 (Y/N) Y	
Supplier 1 Capitol Pipe & Steel Prod./ Inc	**Supplier 2** -
Quanity 10	**Quanity In Stock** 0
Installed-Acess 8?	**Installed-Not Acess** ?
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

Six flanges are located in the SA system which is ASME Class 2. Two are in the TE system which is ASME Class 3. The flanges were marked 3/4-WJ-1500-SA-105-A23-S-80.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness(BHN)	136	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 387 L_D for flange CNS-014-A. The temperature of the flange was 97^{O} F. There was no vibration and the magnetic field was 0.5 Gauss. Adding the EPRI developed correction factor for temperature (+7) gives a corrected value of 394 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-B

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness(BHN)	147	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 400 L_D for flange CNS-014-B. The temperature of the flange was 105.1^{o}F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+10) gives a corrected value of 410 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 **--Specimen ID** CNS-014-C

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction in Area	-	50
Hardness (BHN)	147	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of reedings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 400 L_D for flange CNS-014-C. The temperature of the flange was 107.3^{O} F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+10) gives a corrected value of 410 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-D

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	138	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 382 L_D for flange CNS-014-D. The temperature of the flange was 126^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+16) gives a corrected value of 398 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 **--Specimen ID** CNS-014-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	138	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 378 L_D for flange CNS-014-E. The temperature of the flange was 139^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+19) gives a corrected value of 397 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-F

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	138	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 384 L_D for flange CNS-014-F. The temperature of the flange was 118^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+14) gives a corrected value of 398 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-G

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	146	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 394 L_D for flange CNS-014-G. The temperature of the flange was 123^0 F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+15) gives a corrected value of 409 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-014 --Specimen ID CNS-014-H

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,500
Yield Strength (psi)	-	41,500
% Elongation	-	28
% Reduction In Area	-	50
Hardness (BHN)	137	
% Carbon	-	0.28
% Manganese	-	0.77
% Silicon	-	0.24
% Phosphorous	-	0.010
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment ANN

Another Test For This Line Item? N Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 379 L_D for flange CNS-014-H. The temperature of the flange was 125^{0} F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+16) gives a corrected value of 395 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba	**Unit** ?
Line Item CNS-015	**Transaction (A/C/D)** C
Heat-Lot 2095	**ASME Class** 2
Commodity FLG	**Diameter** 2
Schedual 40	**Rating** 300
Type RF, SW	**Spec.** 105
Grade NA	**Source** WJM
Vendor (WJM or PSI) WJM	**CMTR Date** 06/05/81
NCA-3800 (Y/N) Y	
Supplier 1 Capitol Pipe & Steel Prod./ Inc	**Supplier 2** -
Quanity 100	**Quanity In Stock** 14
Installed-Acess ?	**Installed-Not Acess** ?
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

CNS-0015-A was examined metallographically and found to be a forging. All flanges in stock were marked 2"-WJ-300-SA-105-2095-STD.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-015 **--Specimen ID** CNS-015-A

	Test Data	CMTR Data
Tensile Strength (psi)	73,200	77,944
Yield Strength (psi)	37,700	49,924
% Elongation	25	31.6
% Reduction In Area	53	40
Hardness (BHN)	144	
% Carbon	0.25	0.23
% Manganese	0.74	0.78
% Silicon	0.19	0.33
% Phosphorous	0.029	0.016
% Sulfur	0.034	0.029
% Chromium	0.18	-
% Nickel	0.09	-
% Molybdenum	0.02	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (78 for CNS-015-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (401 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-015 **--Specimen ID** CNS-015-B

	Test Data	CMTR Data
Tensile Strength (psi)	78,900	77,944
Yield Strength (psi)	46,400	49,924
% Elongation	12	31.6
% Reduction in Area	18	40
Hardness (BHN)	159	
% Carbon	0.29	0.23
% Manganese	0.78	0.78
% Silicon	0.21	0.33
% Phosphorous	0.026	0.016
% Sulfur	0.025	0.029
% Chromium	0.21	-
% Nickel	0.07	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (83 for CNS-015-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (410 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-015 **--Specimen ID** CNS-015-C

	Test Data	CMTR Data
Tensile Strength (psi)	97,500	77,944
Yield Strength (psi)	55,200	49,924
% Elongation	23	31.6
% Reduction In Area	38	40
Hardness (BHN)	185	
% Carbon	0.42	0.23
% Manganese	0.77	0.78
% Silicon	0.30	0.33
% Phosphorous	0.031	0.016
% Sulfur	0.029	0.029
% Chromium	0.12	-
% Nickel	0.10	-
% Molybdenum	0.02	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (90 for CNS-015-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (453 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-015 **--Specimen ID** CNS-015-D

	Test Data	CMTR Data
Tensile Strength (psi)	66,000	77,944
Yield Strength (psi)	40,000	49,924
% Elongation	(Broke outside	31.6
% Reduction In Area	gage marks)	40
Hardness (BHN)	147	
% Carbon	0.22	0.23
% Manganese	0.83	0.78
% Silicon	0.21	0.33
% Phosphorous	0.032	0.016
% Sulfur	0.031	0.029
% Chromium	0.22	-
% Nickel	0.07	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (79 for CNS-015-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (396 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba	**Unit** 2
Line Item CNS-016	**Transaction (A/C/D)** A
Heat-Lot GDEB	**ASME Class** 2
Commodity FLG	**Diameter** 4
Schedual 160	**Rating** 900
Type RF,WN	**Spec.** 105
Grade NA	**Source** WJM
Vendor (WJM or PSI) WJM	**CMTR Date** 07/19/81
NCA-3800 (Y/N) Y	
Supplier 1 Capitol Pipe & Steel Prod./ Inc	**Supplier 2** -
Quanity 2	**Quanity in Stock** 0
Installed-Acess 2	**Installed-Not Acess** 0
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** Y

The two flanges are located in the Auxiliary Feedwater System, on an ASME Class 3 system. All flanges were marked 4"-WJ-900-SA-105-GDEB S-160.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-016 **--Specimen ID** CNS-016-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	76,300
Yield Strength (psi)	-	55,080
% Elongation	-	31.5
% Reduction In Area	-	52.2
Hardness (BHN)	157	
% Carbon	-	0.27
% Manganese	-	0.85
% Silicon	-	0.15
% Phosphorous	-	0.009
% Sulfur	-	0.029
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 418 L_D for flange CNS-016-A. The temperature of the flange was 89.7^{O} F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+5) gives a corrected value of 423 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-016 --Specimen ID CNS-016-B

	Test Data	CMTR Data
Tensile Strength (psi)	-	76,300
Yield Strength (psi)	-	55,080
% Elongation	-	31.5
% Reduction In Area	-	52.2
Hardness (BHN)	151	
% Carbon	-	0.27
% Manganese	-	0.85
% Silicon	-	0.15
% Phosphorous	-	0.009
% Sulfur	-	0.029
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 409 L_D for flange CNS-016-B. The temperature of the flange was 93.1^{o}F and there was no vibration or magnetic field. Adding the EPRI developed correction factor for temperature (+6) gives a corrected value of 415 L_D.

NRC 88-05
MATERIALS WORKSHEET

Plant Catawba
Unit 2,?
Line Item CNS-017
Transaction (A/C/D) C
Heat-Lot T8834
ASME Class 2
Commodity FLG
Diameter 2
Schedual 40
Rating 150
Type RF,WN
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 25
Quanity In Stock 1
Installed-Acess 4?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-017-A was examined metallographically and found to be a forging. WJM gave the Heat No. as T8834 and the Test or Code No. as GDFO. Four flanges are located in the Diesel Generator Engine Cooling Water System, which is ASME Class 3. They were marked 2"-WJ-150-SA-105-GDFO-SDT.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-017 --Specimen ID CNS-017-A

	Test Data	CMTR Data
Tensile Strength (psi)	84,200	82,795
Yield Strength (psi)	48,700	48,232
% Elongation	24	28.0
% Reduction In Area	56	58.3
Hardness (BHN)	165	
% Carbon	0.27	0.29
% Manganese	0.98	0.92
% Silicon	0.23	0.20
% Phosphorous	0.016	0.012
% Sulfur	0.015	0.014
% Chromium	0.04	-
% Nickel	0.02	-
% Molybdenum	<0.01	-
% Vanadium	0.009	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y Add Remarks? Y

The Rockwell B Hardness (85 for CNS-017-A) was converted to Brinnell using Table 2 from ASTM E 140 and entered into test Data Worksheet.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-017 --Specimen ID CNS-017-B

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,795
Yield Strength (psi)	-	48,232
% Elongation	-	28.0
% Reduction In Area	-	58.3
Hardness (BHN)	168	
% Carbon	-	0.29
% Manganese	-	0.92
% Silicon	-	0.20
% Phosphorous	-	0.012
% Sulfur	-	0.014
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 419 L_D for flange CNS-017-B. The temperature of the flange was 137.8^0 F. There was no vibration and the magnetic field was 0.5 Gauss. Adding the EPRI developed correction factor for temperature (+19) gives a corrected value of 438 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-017 --Specimen ID CNS-017-C

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,795
Yield Strength (psi)	-	48,232
% Elongation	-	28.0
% Reduction in Area	-	58.3
Hardness (BHN)	175	
% Carbon	-	0.29
% Manganese	-	0.92
% Silicon	-	0.20
% Phosphorous	-	0.012
% Sulfur	-	0.014
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 427 L_D for flange CNS-017-C. The temperature of the flange was 142.2° F. There was no vibration and the magnetic field was 1 Gauss. Adding the EPRI developed correction factor for temperature (+20) gives a corrected value of 447 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-017 --Specimen ID CNS-017-D

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,795
Yield Strength (psi)	-	48,232
% Elongation	-	28.0
% Reduction in Area	-	58.3
Hardness (BHN)	158	
% Carbon	-	0.29
% Manganese	-	0.92
% Silicon	-	0.20
% Phosphorous	-	0.012
% Sulfur	-	0.014
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 411 L_D for flange CNS-017-D. The temperature of the flange was 122.5° F. There was no vibration and the magnetic field was 0.5 Gauss. Adding the EPRI developed correction factor for temperature (+15) gives a corrected value of 426 L_D.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-017 --Specimen ID CNS-017-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	82,795
Yield Strength (psi)	-	48,232
% Elongation	-	28.0
% Reduction In Area	-	58.3
Hardness (BHN)	166	
% Carbon	-	0.29
% Manganese	-	0.92
% Silicon	-	0.20
% Phosphorous	-	0.012
% Sulfur	-	0.014
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N Add Remarks? Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 419 L_D for flange CNS-017-E. The temperature of the flange was 128.0° F. There was no vibration and the magnetic field was 0.5 Gauss. Adding the EPRI developed correction factor for temperature (+17) gives a corrected value of 436 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 1,2
Line Item CNS-018
Transaction (A/C/D) A
Heat-Lot 56245
ASME Class 2
Commodity FLG
Diameter 3/4
Schedual 40
Rating 300
Type RF, SW
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 5
Quanity in Stock 0
Installed-Acess 1?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

WJM gave the Heat No. as 56245 and the Test or Code No. as GDKG. One flanges is located in the Unit 1 Component Cooling System, and is ASME Class 3. The flange was marked WJ 300 SA 105 GDKG STD (need to remove more paint).

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-018 **--Specimen ID** CNS-018-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	83,620
Yield Strength (psi)	-	56,240
% Elongation	-	31.0
% Reduction In Area	-	59.7
Hardness (BHN)	155	
% Carbon	-	0.24
% Manganese	-	0.90
% Silicon	-	0.26
% Phosphorous	-	0.010
% Sulfur	-	0.020
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 416 L_D for flange CNS-018-A. The temperature of the flange was 90.1^{o}F. There was no vibration and only a slight magnetic field. Adding the EPRI developed correction factor for temperature (+5) gives a corrected value of 421 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 1(Oconee) ONS-004-A
Line Item CNS-019
Transaction (A/C/D) C
Heat-Lot 25904
ASME Class 2
Commodity FLG
Diameter 1
Schedual N/A
Rating 150
Type RF, TH
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 15
Quanity In Stock 4
Installed-Acess 1?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-019-A was examined metallographically and found to be a forging. WJM gave the Heat No. as 25904 and the Test or Code No. as GDDE. One flanges was transfered to Oconee, and installed on the Emergency Feedwater PT Oil Cooler a safety related system. The flanges were marked 1"-WJ-150-SA-105-GDDE.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** ONS-004-A

	Test Data	CMTR Data
Tensile Strength (psi)	99,200	96,970
Yield Strength (psi)	68,000	69,370
% Elongation	21	23.5
% Reduction In Area	52	51.0
Hardness (BHN)	205	
% Carbon	.30	0.31
% Manganese	.75	0.76
% Silicon	.22	0.25
% Phosphorous	.020	0.018
% Sulfur	.024	0.024
% Chromium	0.16	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.068	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (94 for CNS-019-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** CNS-019-B

	Test Data	CMTR Data
Tensile Strength (psi)	96,300	96,970
Yield Strength (psi)	67,600	69,370
% Elongation	22	23.5
% Reduction In Area	52	51.0
Hardness (BHN)	195	
% Carbon	.31	0.31
% Manganese	.73	0.76
% Silicon	.22	0.25
% Phosphorous	.020	0.018
% Sulfur	.024	0.024
% Chromium	0.10	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.066	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (92 for CNS-019-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** CNS-019-C

	Test Data	CMTR Data
Tensile Strength (psi)	98,000	96,970
Yield Strength (psi)	63,800	69,370
% Elongation	19	23.5
% Reduction In Area	52	51.0
Hardness (BHN)	195	
% Carbon	.30	0.31
% Manganese	.75	0.76
% Silicon	.22	0.25
% Phosphorous	.020	0.018
% Sulfur	.025	0.024
% Chromium	0.10	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.066	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (92 for CNS-019-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** CNS-019-D

	Test Data	CMTR Data
Tensile Strength (psi)	-	96,970
Yield Strength (psi)	-	69,370
% Elongation	-	23.5
% Reduction In Area	-	51.0
Hardness (BHN)	-	
% Carbon	-	0.31
% Manganese	-	0.76
% Silicon	-	0.25
% Phosphorous	-	0.018
% Sulfur	-	0.024
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** N

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-019 **--Specimen ID** CNS-019-E

	Test Data	CMTR Data
Tensile Strength (psi)	-	96,970
Yield Strength (psi)	-	69,370
% Elongation	-	23.5
% Reduction In Area	-	51.0
Hardness (BHN)	189	
% Carbon	-	0.31
% Manganese	-	0.76
% Silicon	-	0.25
% Phosphorous	-	0.018
% Sulfur	-	0.024
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 462 L_D for flange CNS-019-A. The temperature of the flange was 80.0^{O} F. There was slight vibration and no magnetic field. Adding the EPRI developed correction factor for temperature (+2) gives a corrected value of 464 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ?
Line Item CNS-020
Transaction (A/C/D) C
Heat-Lot 25904
ASME Class 2
Commodity FLG
Diameter 1
Schedual N/A
Rating 150
Type BL, RF
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 5
Quanity In Stock 2
Installed-Acess 1?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-020-A was examined metallographically and found to be a forging. WJM gave the Heat No. as 25904 and the Test or Code No. as GDDE. All flanges in stock were marked 1"- WJ-150-SA-105-GDDE.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-020 **--Specimen ID** CNS-020-A

	Test Data	CMTR Data
Tensile Strength (psi)	91,400	96,970
Yield Strength (psi)	60,200	69,370
% Elongation	19	23.5
% Reduction In Area	51	51.0
Hardness (BHN)	200	
% Carbon	0.31	0.31
% Manganese	0.76	0.76
% Silicon	0.22	0.25
% Phosphorous	0.021	0.018
% Sulfur	0.025	0.024
% Chromium	0.10	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.070	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (93 for CNS-020-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-020 **--Specimen ID** CNS-020-B

	Test Data	CMTR Data
Tensile Strength (psi)	92,400	96,970
Yield Strength (psi)	57,900	69,370
% Elongation	21	23.5
% Reduction in Area	51	51.0
Hardness (BHN)	195	
% Carbon	0.31	0.31
% Manganese	0.77	0.76
% Silicon	0.23	0.25
% Phosphorous	0.019	0.018
% Sulfur	0.021	0.024
% Chromium	0.10	-
% Nickel	0.07	-
% Molybdenum	0.01	-
% Vanadium	0.070	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (92 for CNS-020-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. Tensile specimens were approximatly 1/4 inch in diameter and the tests were performed inhouse.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ?
Line Item CNS-021
Transaction (A/C/D) C
Heat-Lot 85148
ASME Class 2
Commodity FLG
Diameter 6
Schedual N/A
Rating 150
Type RF,SO
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/19/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 10
Quanity In Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

WJM gave the Heat No. as 85148 and the Test or Code No. as GDBA.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-021 **--Specimen ID** CNS-021-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	72,430
Yield Strength (psi)	-	37,090
% Elongation	-	25.5
% Reduction In Area	-	41.7
Hardness (BHN)	-	
% Carbon	-	0.25
% Manganese	-	.83
% Silicon	-	0.20
% Phosphorous	-	0.006
% Sulfur	-	0.021
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ?
Line Item CNS-022
Transaction (A/C/D) A
Heat-Lot 220821
ASME Class 2
Commodity FLG
Diameter 12
Schedual N/A
Rating 900
Type RF,BL
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 07/19/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 23
Quanity In Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) N

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-022 **--Specimen ID** CNS-022-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	74,000
Yield Strength (psi)	-	46,700
% Elongation	-	36.0
% Reduction In Area	-	63.0
Hardness (BHN)	-	
% Carbon	-	0.20
% Manganese	-	1.07
% Silicon	-	0.20
% Phosphorous	-	0.013
% Sulfur	-	0.022
% Chromium	-	.10
% Nickel	-	.07
% Molybdenum	-	.02

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 2
Line Item CNS-023
Transaction (A/C/D) A
Heat-Lot 6028835
ASME Class 2
Commodity FLG
Diameter 12
Schedual N/A
Rating 900
Type RF,BL
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 09/21/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 1
Quanity In Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) N

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-023 **--Specimen ID** CNS-023-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	81,000
Yield Strength (psi)	-	53,000
% Elongation	-	32.0
% Reduction In Area	-	66.0
Hardness (BHN)	-	
% Carbon	-	0.23
% Manganese	-	1.19
% Silicon	-	0.20
% Phosphorous	-	0.019
% Sulfur	-	0.023
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba	**Unit** ?
Line Item CNS-024	**Transaction (A/C/D)** A
Heat-Lot 213158	**ASME Class** 2
Commodity FLG	**Diameter** 12
Schedual N/A	**Rating** 900
Type RF,BL	**Spec.** 105
Grade NA	**Source** WJM
Yendor (WJM orPSI) WJM	**CMTR Date** 09/21/82
NCA-3800 (Y/N) Y	
Supplier 1 Guyon Alloys, Inc.	**Supplier 2** -
Quanity 1	**Quanity In Stock** 0
Installed-Acess ?	**Installed-Not Acess** ?
Add Test Results (Y/N) Y	**Add Remarks (Y/N)** N

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-024 **--Specimen ID** CNS-024-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	79,000
Yield Strength (psi)	-	51,500
% Elongation	-	35.0
% Reduction in Area	-	66.0
Hardness (BHN)	-	
% Carbon	-	0.22
% Manganese	-	1.16
% Silicon	-	0.23
% Phosphorous	-	0.012
% Sulfur	-	0.019
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 1,2
Line Item CNS-025
Transaction (A/C/D) A
Heat-Lot UE
ASME Class 2
Commodity FLG
Diameter 1
Schedual N/A
Rating 150
Type RF,BL
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 02/17/81
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 5
Quanity In Stock 0
Installed-Acess 3?
Installed-Not Access ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) N

The flange located in the Lube Oil System of the 1B Emergency Diesel Generator and was marked 1"-WJ-150-SA-105-UE.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-025 **--Specimen ID** CNS-025-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	78,800
Yield Strength (psi)	-	44,200
% Elongation	-	28.0
% Reduction in Area	-	54.0
Hardness (BHN)	211	
% Carbon	-	0.28
% Manganese	-	.76
% Silicon	-	0.18
% Phosphorous	-	0.010
% Sulfur	-	0.019
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

The hardness testing was performed in-situ using an EQUOTIP Hardness Tester. Approximately 40-60 mils of metal was removed from the outside edge of the flange and ten hardness readings were taken. The surface was then reground and a second set of ten hardness readings was taken. If the average of the second set of readings was within 10 L-units of the average of the first set, the data was valid. The average value of the two sets data was 477 L_D for flange CNS-025-A. The temperature of the flange was 117^0 F. There was sight vibration and the magnetic field was 1 Gauss. Adding the EPRI developed correction factor for temperature (+13) gives a corrected value of 490 L_D.

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit ?
Line Item CNS-026
Transaction (A/C/D) A
Heat-Lot GDAT
ASME Class 2
Commodity FLG
Diameter 2
Schedual N/A
Rating 150
Type RF,TH
Spec. 105
Grade NA
Source WJM
Vendor (WJM or PSI) WJM
CMTR Date 01/18/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 3
Quanity In Stock 0
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) N

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-026 **--Specimen ID** CNS-026-A

	Test Data	CMTR Data
Tensile Strength (psi)	-	81,210
Yield Strength (psi)	-	48,625
% Elongation	-	28.5
% Reduction in Area	-	56.0
Hardness (BHN)	-	
% Carbon	-	0.28
% Manganese	-	.90
% Silicon	-	0.23
% Phosphorous	-	0.010
% Sulfur	-	0.018
% Chromium	-	-
% Nickel	-	-
% Molybdenum	-	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** N

NRC 88-05

MATERIALS WORKSHEET

Plant Catawba
Unit 2
Line Item CNS-027
Transaction (A/C/D) C
Heat-Lot GDKD
ASME Class 2
Commodity FLG
Diameter 2
Schedual N/A
Rating 150
Type RF,TH
Spec. 105
Grade NA
Source WJM
Vendor (WJM orPSI) WJM
CMTR Date 01/18/82
NCA-3800 (Y/N) Y
Supplier 1 Guyon Alloys, Inc.
Supplier 2 -
Quanity 72
Quanity In Stock 25
Installed-Acess ?
Installed-Not Acess ?
Add Test Results (Y/N) Y
Add Remarks (Y/N) Y

CNS-027-A was examined metallographically and was found to have an equiaxial grain structure (could not determine if it was forged). All flanges in stock were marked = 2"-WJ-150-SA-105-GDKD =.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-027 **--Specimen ID** CNS-027-A

	Test Data	CMTR Data
Tensile Strength (psi)	82,600	73,345
Yield Strength (psi)	42,900	40,280
% Elongation	24	30.5
% Reduction in Area	54	54.6
Hardness (BHN)	172	
% Carbon	0.30	0.27
% Manganese	0.87	0.86
% Silicon	0.21	0.23
% Phosphorous	0.009	0.010
% Sulfur	0.017	0.016
% Chromium	0.04	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (87 for CNS-027-A) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. The tensile specimens was approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-027 **--Specimen ID** CNS-027-B

	Test Data	CMTR Data
Tensile Strength (psi)	79,500	73,345
Yield Strength (psi)	43,000	40,280
% Elongation	30	30.5
% Reduction In Area	58	54.6
Hardness (BHN)	153	
% Carbon	0.27	0.27
% Manganese	0.92	0.86
% Silicon	0.23	0.23
% Phosphorous	0.006	0.010
% Sulfur	0.016	0.016
% Chromium	0.05	-
% Nickel	0.07	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (81 for CNS-027-B) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (414 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. The tensile specimens was approximatly 1/4 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-027 **--Specimen ID** CNS-027-C

	Test Data	CMTR Data
Tensile Strength (psi)	86,800	73,345
Yield Strength (psi)	44,900	40,280
% Elongation	22	30.5
% Reduction In Area	49	54.6
Hardness (BHN)	169	
% Carbon	0.31	0.27
% Manganese	0.88	0.86
% Silicon	0.20	0.23
% Phosphorous	0.010	0.010
% Sulfur	0.019	0.016
% Chromium	0.04	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? Y **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (86 for CNS-027-C) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (430 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. The tensile specimens was approximatly 1/2 inch in diameter and the test was performed inhouse.

NRC 88-05

TEST DATA WORKSHEET

Test Results for Line Item CNS-027 **--Specimen ID** CNS-027-D

	Test Data	CMTR Data
Tensile Strength (psi)	86,200	73,345
Yield Strength (psi)	45,700	40,280
% Elongation	22	30.5
% Reduction In Area	49	54.6
Hardness (BHN)	165	
% Carbon	0.31	0.27
% Manganese	0.88	0.86
% Silicon	0.21	0.23
% Phosphorous	0.009	0.010
% Sulfur	0.018	0.016
% Chromium	0.04	-
% Nickel	0.03	-
% Molybdenum	0.01	-

Heat Treatment Not given on CMTR

Another Test For This Line Item? N **Add Remarks?** Y

Hardness was performed at our inhouse Materials Laboratory on material from stock using Rockwell B hardness tester. The Rockwell B Hardness (85 for CNS-027-D) was converted to Brinell using Table 2 from ASTM E140 and entered into Test Data Worksheet. An EQUOTIP Hardness Value (432 L_D) was obtained from a flat surface where the tensile sample or the sample for chemical analysis was removed. Chemistry was performed by an outside laboratory on Duke's Approved Vendors List. The tensile specimens was approximatly 1/2 inch in diameter and the test was performed inhouse.

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 387 L_D which converts to 131 Brinell. The temperature of the flange was 97^0 F. Using the temperature correction factor developed by EPRI (+7), the corrected value is 394 L_D which converts to136 Brinell. The flange is located in the Unit 2 Main Steam Auxiliary Equipment System (ASME Class 2) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-2SA-029, Weld #1). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-A
LOCATION ISO# CN-2SA-029 WELD #1, ASME Class 2.
Line is connected to Aux. FDWP Turbine Stop Valve
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 387 L_D (131 Brinell)
TEMPERATURE 97^0 F (EPRI Correction Factor +7)
CORRECTED HARDNESS 394 L_D (136 Brinell)
DATE FOUND 07/20/88 **TIME** 10:00
DATE REPORTED 07/22/88 **TIME** 9:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 2 inch, 1500 pound, raised face, socket weld flange, Heat # COP made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 362 L_D which converts to 115 Brinell. The temperature of the flange was 323^0 F. Using the temperature correction factor developed by EPRI (+52), the corrected value is 414 L_D which converts to 150 Brinell. The flange is located in the Unit 1 Auxiliary Feedwater System and is classified as Duke Class F, seismic, (ISO# CN-1CF-046, Weld #8). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-004-E
LOCATION ISO# CN-1CF-046 WELD #8, Duke Class F (seismic).
SIZE 2 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. COP
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 362 L_D (115 Brinell)
TEMPERATURE 323^0 F (EPRI Correction Factor +52)
CORRECTED HARDNESS 414 L_D (150 Brinell)
DATE FOUND Non-Safety **TIME** -
DATE REPORTED 07/22/88 **TIME** 9:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 2 inch, 1500 pound, raised face, socket weld flange, Heat # COP made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 355 L_D which converts to 111 Brinell. The temperature of the flange was 323^0 F. Using the temperature correction factor developed by EPRI (+52), the corrected value is 407 L_D which converts to 145 Brinell. The flange is located in the Unit 1 Auxiliary Feedwater System and is classified as Duke Class F, seismic, (ISO# CN-1CA-104, Weld #1). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-004-F
LOCATION ISO# CN-1CA-104 WELD #1, Duke Class F (seismic).
SIZE 2 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. COP
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 355 L_D (111 Brinell)
TEMPERATURE 323^0 F (EPRI Correction Factor +52)
CORRECTED HARDNESS 407 L_D (145 Brinell)
DATE FOUND Non-Safety **TIME** -
DATE REPORTED 07/22/88 **TIME** 9:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 1 inch, 300 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 391 L_D which converts to 134 Brinell. The temperature of the flange was 111^0 F. Using the temperature correction factor developed by EPRI (+12), the corrected value is 403 L_D which converts to 142 Brinell. The flange is located in the Unit 2 Diesel Generator Engine Starting Air System (ASME Class 3) on a drain line coming from the 2A2 Starting Air Tank (ISO# CN-2VG-005, Weld #4). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-013-A
LOCATION ISO# CN-2VG-005 WELD #4, ASME Class 3, Drain line to the 2A2 Diesel Gen. Starting Air Tank
SIZE 1 Inch, 300 Pound, Sch. 40
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 391 L_D (134 Brinell)
TEMPERATURE 111^0 F (EPRI Correction Factor +12)
CORRECTED HARDNESS 403 L_D (142 Brinell)
DATE FOUND 07/21/88 **TIME** 16:00
DATE REPORTED 07/22/88 **TIME** 9:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 1 inch, 300 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 391 L_D which converts to 134 Brinell. The temperature of the flange was 102^0 F. Using the temperature correction factor developed by EPRI (+9), the corrected value is 400 L_D which converts to 140 Brinell. The flange is located in the Unit 2 Diesel Generator Engine Starting Air System (ASME Class 3) on a drain line coming from the 2B2 Starting Air Tank (ISO# CN-2VG-006, Weld #4). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-013-B
LOCATION ISO# CN-2VG-006 WELD #4, ASME Class 3.
Drain line to the 2B2 Diesel Gen. Starting Air Tank
SIZE 1 Inch, 300 Pound, Sch. 40
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 391 L_D (134 Brinell)
TEMPERATURE 102^0 F (EPRI Correction Factor +9)
CORRECTED HARDNESS 400 L_D (140 Brinell)
DATE FOUND 07/21/88 **TIME** 16:00
DATE REPORTED 07/22/88 **TIME** 9:45

July 26, 1988

MEMORANDUM FOR FILE

Subject: NRC Bulletin 88-05, Supplement 1
Nonconforming Materials Supplied By
Piping Supplies, Inc. at Folsom, New
Jersey and West Jersey Manufacturing
Company at Williamstown, New Jersey
Report of Deviation from Specification
Based on In-Situ Hardness Testing (EQUOTIP)
Report Number 1

This memorandum documents a report made to the NRC Operations Center in accordance with NRC Bulletin 88-05, Supplement 1.

Date Found:	July 20, 1988
Time Found:	10:00
Date of Call:	July 22, 1988
Time of Call:	09:45
Duke Personnel Participating:	D.W. Whitaker, P.G. LeRoy, J.S. Warren, and R.L. Williams
NRC Duty Person:	Gould
Unit(s) Affected:	Catawba 1 and 2
Power Level - Unit 1:	100%
Power Level - Unit 2:	5% (Mode 2)

The following information (except sample number and ISO number) on five flanges installed at Catawba was given to the NRC:

Sample (ISO #):	CNS - 014A (ISO CN-2SA-029-1)
Size:	3/4 inch
Rating:	1500 psi
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Actual Hardness Reading:	131 Brinell (136 Brinell with temperature correlation)

Location:	System SA, Main Steam Supply to Auxiliary Equipment (Includes Auxiliary Feedwater Pump Turbine) Unit 2 only
Class:	ASME 2
Temperature:	97 degrees-F
Samples (ISO #'s):	CNS - 004E, F (ISO CN-1CF-46-8; CN-1CA-104-1)
Size:	2 inches
Rating:	1500 #
Type:	Raised Face, Socket Weld
Heat Code #:	COP
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Location:	System CA, Auxiliary Feedwater Warming Line to S/G Nozzles Unit 1 Only
Actual Hardness Reading:	115, 111 Brinell (150, 145 Brinell with temperature correlation)
Class:	Duke Class F (Seismic)
Temperature:	323 degrees-F, 323 degrees-F

The above samples were stated to be in a seismically designed system, not safety-related.

Samples (ISO #'s):	CNS - 013A, B (ISO CN-2VG-5-4; CN-2VG-6-4)
Size:	1 inch
Rating:	300 #
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Location:	Diesel Generator Starting Air System (VG) Unit 2 Only
Actual Hardness Reading:	134, 134 Brinell (142, 140 Brinell with temperature correlation)
Class:	ASME 3
Temperature:	111 degrees-F, 102 degrees-F

The NRC duty person was advised that all reported hardness readings did not use NUMARC/EPRI temperature correlations.

The acceptability of applying these temperature correlations prior to determining 48-hour reportability and the need for a justification for continued operation was confirmed in a July 26, 1988 call to Ed Baker, ONRR, the NRC technical contact for Bulletin 88-05 and Supplement 1. Based upon this later interpretation received from the NRC, the above flanges - except for Sample CNS-014-A (ISO CNS-2SA-029-1) - would have passed the EQUOTIP Hardness Testing.

J.S. Warren
Licensing

JSW/217/bhp

xc: J.W. Glenn
R.D. Ivey
R.L. Williams
R.M. Glover
D.E. Whitaker
N.A. Rutherford
P.G. LeRoy
CN-801.01
CN-815.02
(9)

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 382 L_D which converts to 128 Brinell. The temperature of the flange was 126^0 F. Using the temperature correction factor developed by EPRI (+16), the corrected value is 398 L_D which converts to138 Brinell. The flange is located in the Unit 1 Feedwater Pump Turbine Exhaust System (ASME Class 3) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-1TE-027, Weld #26). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-D
LOCATION ISO# CN-1TE-027 WELD #26, ASME Class 3.
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 382 L_D (128 Brinell)
TEMPERATURE 126^0 F (EPRI Correction Factor +16)
CORRECTED HARDNESS 398 L_D (138 Brinell)
DATE FOUND 07/22/88 **TIME** 14:15
DATE REPORTED 07/22/88 **TIME** 14:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 378 L_D which converts to 125 Brinell. The temperature of the flange was 139^0 F. Using the temperature correction factor developed by EPRI (+19), the corrected value is 397 L_D which converts to138 Brinell. The flange is located in the Unit 1 Feedwater Pump Turbine Exhaust System (ASME Class 3) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-1TE-027, Weld #27). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-E
LOCATION ISO# CN-1TE-027 WELD #27, ASME Class 3.
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 378 L_D (125 Brinell)
TEMPERATURE 139^0 F (EPRI Correction Factor +19)
CORRECTED HARDNESS 397 L_D (138 Brinell)
DATE FOUND 07/22/88 **TIME** 14:15
DATE REPORTED 07/22/88 **TIME** 14:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 384 L_D which converts to 129 Brinell. The temperature of the flange was 118^0 F. Using the temperature correction factor developed by EPRI (+14), the corrected value is 398 L_D which converts to 138 Brinell. The flange is located in the Unit 1 Main Steam Auxiliary Equipment System (ASME Class 2) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-1SA-024, Weld #13). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-F
LOCATION ISO# CN-1SA-024 WELD #13, ASME Class 2.
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 384 L_D (129 Brinell)
TEMPERATURE 118^0 F (EPRI Correction Factor +14)
CORRECTED HARDNESS 398 L_D (138 Brinell)
DATE FOUND 07/22/88 **TIME** 14:15
DATE REPORTED 07/22/88 **TIME** 14:45

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 394 L_D which converts to 136 Brinell. The temperature of the flange was 123^0 F. Using the temperature correction factor developed by EPRI (+15), the corrected value is 409 L_D which converts to 146 Brinell. The flange is located in the Unit 1 Main Steam Auxiliary Equipment System (ASME Class 2) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-1SA-025, Weld #13). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-G
LOCATION ISO# CN-1SA-025 WELD #13, ASME Class 2.
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 394 L_D (136 Brinell)
TEMPERATURE 123^0 F (EPRI Correction Factor +15)
CORRECTED HARDNESS 409 L_D (146 Brinell)
DATE FOUND 07/22/88 **TIME** 14:15
DATE REPORTED 07/22/88 **TIME** 14:45

July 26, 1988

MEMORANDUM FOR FILE

Subject: NRC Bulletin 88-05, Supplement 1
Nonconforming Materials Supplied By
Piping Supplies, Inc. at Folsom, New
Jersey and West Jersey Manufacturing
Company at Williamstown, New Jersey
Report of Deviation from Specification
Based on In-Situ Hardness Testing (EQUOTIP)
Report Number 2

This memorandum documents a report made to the NRC Operations Center in accordance with NRC Bulletin 88-05, Supplement 1.

Date Found:	July 22, 1988
Time Found:	14:15
Date of Call:	July 22, 1988
Time of Call:	14:45
Duke Personnel Participating:	D.W. Whitaker and J.S. Warren
NRC Duty Person:	Jolliffe
Unit(s) Affected:	Catawba 1
Power Level - Unit 1:	100%
Power Level - Unit 2:	5% - 10%

The following information (except sample number and ISO number)on four flanges installed at Catawba was given to the NRC:

Sample (ISO #):	CNS - 014D (ISO CN-1TE-027-26)
Size:	3/4 inch
Rating:	1500 #
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Actual Hardness Reading:	128 Brinell (138 Brinell with temperature correlation)
Location:	FDWP Turbine Exhaust System (System TE)
Class:	ASME 3
Temperature:	126 degrees-F

Sample (ISO #):	CNS - 014E, (ISO CN-1TE-027-27)
Size:	3/4 inch
Rating:	1500 #
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Location:	FDWP Turbine Exhaust System (System TE)
Actual Hardness Reading:	125 Brinell (138 Brinell with temperature correlation)
Class:	ASME 3
Temperature:	139 degrees-F

Sample (ISO #):	CNS - 014F (ISO CN-1SA-024-13)
Size:	3/4 inch
Rating:	1500 #
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Location:	Main Steam to Auxiliary Equipment (System SA)
Actual Hardness Reading:	129 Brinell (138 Brinell with temperature correlation)
Class:	ASME Class 2
Temperature:	118 degrees-F

Sample (ISO #):	CNS - 014G (ISO CN-1SA-025-13)
Size:	3/4 inch
Rating:	1500 #
Type:	Raised Face, Socket Weld
Heat Code #:	A23
Minimum Allowable Hardness Reading:	137 Brinell
Material:	SA 105
Location:	Main Steam to Auxiliary Equipment (System SA)
Actual Hardness Reading:	136 Brinell (146 Brinell with temperature correlation)
Class:	ASME Class 2
Temperature:	123 degrees-F

The NRC duty person was advised that all reported hardness readings did not use NUMARC/EPRI temperature correlations.

The acceptability of applying these temperature correlations prior to determining 48-hour reportability and the need for a justification for continued operation was confirmed in a July 26, 1988 call to Ed Baker, ONRR, the NRC technical contact for Bulletin 88-05 and Supplement 1. Based upon this later interpretation received from the NRC, the above flanges would have passed the EQUOTIP Hardness Testing.

J.S. Warren
Licensing

JSW/218/bhp

xc: J.W. Glenn
R.D. Ivey
R.L. Williams
R.M. Glover
D.E. Whitaker
N.A. Rutherford
P.G. LeRoy
CN-801.01
CN-815.02
(9)

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 1 inch, 150 pound, raised face, blind flange, Heat # UE made from SA105 material that was above maximum hardness (187 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 477 L_D which converts to 200 Brinell. The temperature of the flange was 117^0 F. Using the temperature correction factor developed by EPRI (+13), the corrected value is 490 L_D which converts to 211 Brinell. The flange is located in the Unit 1 Lube Oil System on the 1B Emergancy Diesel Generator and is classified as ASME Class 3. Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-025-A
LOCATION DRAWING CNI-LD 1503 Rev. 2, ASME Class 3.
SIZE 1 Inch, 150 Pound
TYPE Raised Face, Blind
HEAT NO. UE
MATERIAL ASME SA105 (Allowable Max. Hardness 187 Brinell)
IN-SITU HARDNESS TEST 477 L_D (200 Brinell)
TEMPERATURE 117^0 F (EPRI Correction Factor +13)
CORRECTED HARDNESS 490 L_D (211 Brinell)
DATE FOUND 08/03/88 **TIME** 15:30
DATE REPORTED 08/05/88 **TIME** 9:00

August 5, 1988

MEMORANDUM FOR FILE

Subject: NRC Bulletin 88-05, Supplement 1
Nonconforming Materials Supplied By
Piping Supplies, Inc. at Folsom, New
Jersey and West Jersey Manufacturing
Company at Williamstown, New Jersey
Report of Deviation from Specification
Based on In-Situ Hardness Testing (EQUOTIP)
Report Number 4 (Catawba Unit 1)

This memorandum documents a report made to the NRC Operations Center in accordance with NRC Bulletin 88-05, Supplement 1.

Date Found:	August 3, 1988
Time Found:	15:30
Date of Call:	August 5, 1988
Time of Call:	09:00
Duke Personnel Participating:	J.W. Glenn, J.S. Warren, and D.E. Whitaker
NRC Duty Person:	Gould
Unit(s) Affected:	Catawba Unit 1
Power Level - Unit 1:	100%
Power Level - Unit 2:	100%

The following information (except sample number and ISO number) on one flange installed at Catawba was given to the NRC:

Sample (ISO #):	CNS - 025A (CNI-LD 1503.Rev.2)
Size:	1 inch
Rating:	150 #
Type:	Raised Face, Blind
Heat Code #:	UE
Maximum Allowable Hardness Reading:	187 Brinell
Material:	SA 105
Actual Hardness Reading:	200 Brinell (211 Brinell with temperature correlation)

Location:	1B Emergency Deisel Generator Lube Oil System, Unit 1 Only
Class:	ASME Class 3
Temperature:	117 Degrees-F

Preparation of a JCO is in progress.

J.S. Warren
Licensing

JSW/218/bhp

xc: J.W. Glenn
R.D. Ivey
R.L. Williams
R.M. Glover
D.E. Whitaker
N.A. Rutherford
P.G. LeRoy
CN-801.01
CN-815.02
(9)

Form 01077 (R3-88)

FORM 101.1	REVISION 11

CERTIFICATION OF ENGINEERING CALCULATION

STATION AND UNIT NUMBER Catawba 1 & 2

TITLE OF CALCULATION Operability Evaluation on PIR No. Ø-C88-Ø222

CALCULATION NUMBER CNC-1232.00-00-0096

ORIGINALLY CONSISTING OF:

PAGES 1 THROUGH 8

TOTAL ATTACHMENTS — TOTAL MICROFICHE ATTACHMENTS —

TOTAL VOLUMES 1

THESE ENGINEERING CALCULATIONS COVER QA CONDITION 1 ITEMS. IN ACCORDANCE WITH ESTABLISHED PROCEDURES. THE QUALITY HAS BEEN ASSURED AND I CERTIFY THAT THE ABOVE CALCULATION HAS BEEN ORIGINATED. CHECKED OR APPROVED AS NOTED BELOW:

ORIGINATED BY R. L. Villiam DATE 8/30/88

CHECKED BY T. D. Lefler DATE 8/31/88

APPROVED BY D W Collins DATE 8/31/88

ISSUED TO GENERAL SERVICES DIVISION _____ DATE _____

RECEIVED BY GENERAL SERVICES DIVISION _____ DATE _____

MICROFICHE ATTACHMENT LIST: ☐ Yes ☒ No SEE BACK OF FORM

REV. NO.	CALCULATION PAGES (VOL)			ATTACHMENTS (VOL)			VOLUMES		ORIG	CHKD	APPR	ISSUE DATE
	REVISED	DELETED	ADDED	REVISED	DELETED	ADDED	DELETED	ADDED	DATE	DATE	DATE	REC'D DATE

CNC-1232.00-00-0096 By: R.L. Williams 8/30/88
Pg. 1 of 8 DOCUMENTATION SUMMARY Chk. By: [illegible] 8/31/88

1.1 Design Procedure utilized in the preparation of these calculations based on internal ☐ ; external ☐ pressure criteria

a. Calculation for required pipe wall thickness: ☐

b. Calculation for overpressure capability for prespecified pipe wall thicknesses: ☐

c. Method utilized for calculations: Manual ☐ Computer ☐

Mark "X" in all applicable blocks.

1.2 Brief Statement of Problems: See body of Calculation

1.3 Statement of the Relation to Nuclear Safety: Duke Class B and C, Q.A. Condition 1

1.4 Applicable Codes and Standards Utilized:

(Sponsor Soc.)	(Unique Identity No. & Date)	(Subsection or Paragraph No.)
ASME	Section III	

1.5 List All Other Design Criteria Utilized: None

1.6 List Design Criteria in the PSAR/FSAR bearing on these calculations, including page, paragraph, and revision date as applicable:

None

1.7 List all Other Design Assumptions Utilized: No -

1.8 Statement of General or Specific Conclustions, As Applicable: These flanges do not impact plant operability.

1.9 The complete calculation(s) and necessary supporting documents shall be bound together with an appropriate cover sheet properly labeled. The completed presentation of these calculations shall be such that an appropriately qualified person can review the documentation.

Dev./Station Catawba Unit — File No.
Subject Operability Evaluation for PIR # Ø-C88-Ø222
By R. L. Wilson Date 8/30/88
Sheet No. 2 of 8 Problem No. Checked By [illegible] Date 8/31/88

Purpose: This calculation documents Design Engineering's operability evaluation for PIR No. Ø-C88-Ø222.

Problem: NRC Bulletin 88-05 required identification, testing, and evaluation of flanges made by WJM/PSI and used in Safety Related Systems. The subject PIR was written to track our work. Some of the flanges did not pass hardness test requirements. These were reported to Design Engineering by the Report forms on pages 4 and 7 of this calculation

We have two cases:

1. Sample CNS-014-A which is a 3/4" - 1500# socket weld flange to SA-105. This flange tested out at 136 Brinnell as opposed to the minimum allowable of 137.
2. Sample CNS-025-A which is a 1" - 150# blind flange to SA-105. This flange tested out at 211 Brinell as opposed to the maximum allowable of 187.

Evaluations: In our evaluation, we considered such things as, but not limited to, the following:

1. Service environment
2. Bolting preload
3. Welding or absence of
4. Piping stress levels (by Stress Analysis Group)
5. Design margin (design pressure versus code allowable pressure).

The results of our review and evaluations are shown as follows:

Dev./Station Catawba Unit — File No.

Subject Operability Evaluation for PIR# 0-C88-0222

By R.L.Wilkins Date 8/30/88

Sheet No. 3 of 8 Problem No. Checked By [illegible] Date 8/31/88

1. Sample CNS-014-A Documentation of the Stress Analysis review of this item is shown on pg. 5 of this calculation. Our Flange Evaluation Summary is on pg. 6 of this calculation.
2. Sample CNS-025-A. No piping was involved so we did not have this one reviewed by Stress Analysis. Our Flange Evaluation Summary is on pg. 8 of this calculation.

Conclusion: Based on our evaluations, it is our judgement that these flanges have no impact on plant operability.

CNC-1232.00-00-0096
Pg. 4 of 8

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 3/4 inch, 1500 pound, raised face, socket weld flange, Heat # A23 made from SA105 material that was below minimum hardness (137 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 387 L_D which converts to 131 Brinell. The temperature of the flange was 97^0 F. Using the temperature correction factor developed by EPRI (+7), the corrected value is 394 L_D which converts to 136 Brinell. The flange is located in the Unit 2 Main Steam Auxiliary Equipment System (ASME Class 2) next to the Auxiliary Feedwater Pump Turbine (ISO# CN-2SA-029, Weld #1). Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-014-A
LOCATION ISO# CN-2SA-029 WELD #1, ASME Class 2. Line is connected to Aux. FDWP Turbine Stop Valve
SIZE 3/4 Inch, 1500 Pound, Sch. 80
TYPE Raised Face, Socket Weld
HEAT NO. A23
MATERIAL ASME SA105 (Allowable Min. Hardness 137 Brinell)
IN-SITU HARDNESS TEST 387 L_D (131 Brinell)
TEMPERATURE 97^0 F (EPRI Correction Factor +7)
CORRECTED HARDNESS 394 L_D (136 Brinell)
DATE FOUND 07/20/88 **TIME** 10:00
DATE REPORTED 07/22/88 **TIME** 9:45

CNC-1232.00-00-0096
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CSPT-88-CN-082

August 24, 1988

T. F. Wyke, Chief Engineer
Mechanical/Nuclear Division

Attention: R. L. Williams

Re: Catawba Nuclear Station, Unit 2
PIR 0-C88-0222
Flange Operability Review
for NRC Bulletin 88-05
File No.: CN-1206.02-86

CSPE has reviewed the flange data transmitted by memo from R. L. Williams on July 21, 1988 for Flange ID #CNS-014, a 3/4 inch, 1500 pound, raised face, socket weld flange. The system is found to be operable for piping analysis considerations with the subject flange in place.

If there are any questions, please contact F. T. Rickenbaker at extension 3-7451.

S. B. Hager, Chief Engineer
Civil/Environmental Division

D Caldwell

By: D. L. Caldwell
Supervising Design Engineer

FTR/cnm

cc: M. S. Sills
Central Records

FLANGE EVALUATION

SUMMARY

- Sample No. CNS-014-A Heat No. A23
- Flange Description 3/4" 1500# Forged Steel Socket Weld to SA-105
- Construction Isometric CN-2SA-029
- Design Iso. and Flow Diagram CN-2492-SA008, CN-2593-1.1
- Design Conditions 1185 psig at 600°F Code & Class Sec. III Cl. 2
- Corrected Brinell Hardness 136
- Equivalent Strength 64,000 psi Tensile
- Piping Analysis Calculation No. CNC-2206.02-86-2001
- Conclusions: Stress Analysis has reviewed this and finds no problems from a stress standpoint. The equivilent strength of 64,000 psi is only about 9% less than the required 70,000 psi. The normal pressure rating for this flange is over 2600 psi compared to a design pressure of 1185 psi. Based on our review and the design margin, we consider this flange acceptable for continued operation.

Prepared by: R. L. Williams Date: 7/26/88

Checked by: S S Lefler Jr Date: 7/27/88

CNC-1232.00-00-0096
Pg. 7 of 8

DATA REPORT FOR NONCONFORMING OR INACESSABLE FLANGES

In response to NRC Bulletin 88-05, Supplement 1, Catawba Nuclear Station has found a 1 inch, 150 pound, raised face, blind flange, Heat * UE made from SA105 material that was above maximum hardness (187 Brinell). The readings were taken with an EQUOTIP Hardness Tester and the average was 477 L_D which converts to 200 Brinell. The temperature of the flange was 117° F. Using the temperature correction factor developed by EPRI (+13), the corrected value is 490 L_D which converts to 211 Brinell. The flange is located in the Unit 1 Lube Oil System on the 1B Emergancy Diesel Generator and is classified as ASME Class 3. Duke's Design Engineering Department is performing the JCO.

SAMPLE NO. CNS-025-A
LOCATION DRAWING CNI-LD 1503 Rev. 2. ASME Class 3.
SIZE 1 Inch, 150 Pound
TYPE Raised Face, Blind
HEAT NO. UE
MATERIAL ASME SA105 (Allowable Max. Hardness 187 Brinell)
IN-SITU HARDNESS TEST 477 L_D (200 Brinell)
TEMPERATURE 117° F (EPRI Correction Factor +13)
CORRECTED HARDNESS 490 L_D (211 Brinell)
DATE FOUND 08/03/88 **TIME** 15:30
DATE REPORTED 08/05/88 **TIME** 9:00

CNC-1232.00-00-0096

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FLANGE EVALUATION

SUMMARY

- Sample No. CNS-025-A Heat No. UE
- Flange Description 1"-150# Forged Steel Blind Flange, SA-105 (Drilled & Tapped for 3/8" NPT connection)
- Construction Isometric Instrument Detail CNI-LD2503
- Design Iso. and Flow Diagram CNM-1301.00-0192-001 & CN-2609-2.2
- Design Conditions 20 psig @ 200°F Code & Class ASME III Cl.3
- Corrected Brinell Hardness 211 (Max. allow. 187)
- Equivalent Strength N.A.
- Piping Analysis Calculation No. NA.
- Conclusions: The flange is mounted on top of a tank which is vented to atmosphere so there are no pressure loads. A ¼" O.D. tube is tied into the flange so there should be no appreciable external loads applied. The flange withstood the bolting preload so it has some degree of ductility. Any welding that might have been done would be a seal weld or small fillet weld. The loads on the flange are low enough that should any cracks occur, they should not propogate. Based on our review, we consider this flange acceptable for continued operation

Prepared by: R. L. Williams Date: 8/23/88

Checked by: D. O. Lefler Date: 8/31/88

PROPRIETARY

UNCONTROLLED DOCUMENT
INFORMATION ONLY

LEEB HARDNESS TESTING (EQUOTIP) OF INSTALLED PIPING FLANGES

PROCEDURE 1404.1

ORIGINAL DATE 7/18/88

PREPARED BY

REVIEWED BY

SUBUNIT APPROVAL

UNIT APPROVAL

REVISION DATE 9/07/88

1.0 Scope

1.1 This procedure provides instructions for determining the hardness of installed flanges using the EQUOTIP Hardness Tester in response to NRC Compliance Bulletin 88-05.

1.2 The Leeb hardness test is a dynamic method based on the principle of energy measurement. A ball tipped by tungsten carbide impacts under a spring force against the test surface and then rebounds. The impact and rebound velocities are measured and processed into a hardness value which is displayed on the device's digital readout as an L-value. This number is related to the ratio of the rebound velocity to the impact velocity of a 3 mm diameter impact body and multiplied by 1000.

$$L = \frac{\text{Rebound Velocity}}{\text{Impact Velocity}} \times 1000$$

The Leeb hardness number, LHV, is the corrected L-value based on probe position as calculated in Step 5.3.6. The EQUOTIP Hardness Tester is a patented trade name of the Leeb hardness test device based on the acronym for Energy - QUOtient (EQUO).

1.3 The operator may rule a test invalid due to inadequate surface finish or if operator error is involved. If a reading is discarded, another hardness test is performed and recorded.

If hardness readings are taken in any orientation other than vertical downward, a correction value must be applied to the L-value. This correction factor for routine measurements can be made by subtracting the appropriate amount as shown in Figure 1.

Confirmation of the correctness of the hardness values is required by repetitive grinding on the edge of the flange and two sets of sequential hardness tests being made with the mean values not varying by greater than ±10 LHV. The first or second set of 5 consecutive hardness readings for a given group of 10 should be within a range of ±10 L numbers.

If a situation does arise which prevents normal operation of the test equipment, refer to the operating instruction manual for possible cause and correction.

2.0 References

2.1 Operating instructions for the EQUOTIP Hardness Tester

2.2 "Guidelines For Hardness Testing In Response To NRC Bulletin 88-05," a two page EPRI handout

2.3 "Degradation And Failure Of Bolting In Nuclear Power Plants Volume 2," EPRI NP 5769

3.0 Apparatus

3.1 Equotip Hardness Tester with type "D" impact device

3.2 Digital thermometer with type J thermocouple probe

3.3 Gauss meter capable of measuring 4 gauss

4.0 Limits and Precautions

4.1 The piping connecting to the flange must be intact.

4.2 The insulation must be removed from the flange.

4.3 The following precautions shall be observed.

4.3.1 Do not use the device unless the instrument temperature is between 40° F (5° C) and 122° F (50° C).

4.3.2 Do not take hardness measurements on critical sealing surfaces.

4.3.3 Do not place the cocked impact device against head, hands, arms, etc. and discharge as serious injury may result.

4.3.4 Do not take hardness measurements if the flange is subjected to excess vibration.

4.3.5 The test is invalid when conducted in magnetic fields greater than 4 gauss in strength.

4.4 The instrument's batteries are replaced when the indicating meter is out of the green portion of its field.

5.0 Method

5.1 The EQUOTIP Hardness Tester contains no adjustments and therefore only a verification of calibration is necessary.

5.1.1 The verification of calibration shall be performed prior to and at the close of each day's use. It shall also be performed each time the batteries are replaced.

5.1.2 Re-verify the instrument after 100 hardness tests are performed.

5.1.3 Calibration verification is determined by the use of a standard test block. Make at least five hardness tests on the standardized test block being valid for the impact device under investigation. Record the readings on the "Calibration Verification Data Sheet".

Make tests no closer than 1/8 inch (3mm) together, and no closer than 1/4 inch (6mm) from the edge of the block. The EQUOTIP Hardness instrument shall be considered verified if 80% of the L readings taken on the test block deviate no more than ±6 L numbers from the mean in L hardness numbers marked on the block.

5.2 The surface of the specimen to be tested must have a clean, smooth metallic surface containing no corrosion products, scale, or other irregularities that would affect the hardness test. Excessive surface roughness results in lower L-values and broad variations of the individual measurements. Cold worked surfaces produce excessively large L-values. The surface of the flange should be prepared as follows.

5.2.1 An area of not less than 1-3 square inches should be prepared on the edge of the flange on which to take the hardness measurements.

5.2.2 Remove 0.04" - 0.06" material from the edge of the flange using a coarse grinder to remove any detrimental edge effects resulting from cold working or decarburization.

5.2.3 Use a handheld die grinder to further prepare the surface until the roughness equivalent of a 240 grit surface finish is obtained.

5.2.4 Care must be exercised not to overheat the surface during preparation.

5.3 Make the hardness test as follows.

5.3.1 Connect the impact device prior to turning on the instrument switch. When it is turned on, the instrument display will show three zeros and the battery indicator will move to the green portion of its scale (If the instrument is not equipped with a battery indicator, the presence of three zeros in the display indicates that battery power is adequate). If either of these conditions is not met, the batteries are discharged and must be replaced.

5.3.2 Allow approximately five minutes for the instrument to warm-up before taking the first measurements. For all subsequent measurements, no warm-up or waiting time is required.

5.3.3 To prepare the device to take a hardness reading, hold the impact device near its base with one hand and with the other depress the charging tube towards the base until contact is felt. The probe "clicks" when properly cocked. Then allow the tube to slowly return to the starting position.

5.3.4 To take a harness reading, place the base of the impact device on the test surface in a clean area making sure it is flush with the surface and does not rock. Trigger the impact device by lightly depressing the release button on top of the probe. The hardness value will appear on the digital display. Record the reading on the "Leeb Hardness Test Data Sheet".

5.3.5 The next reading can now be taken by repeating Steps 5.3.3 and 5.3.4. A minimum of 10 readings shall be taken per flange. Record the readings on the data sheet.

5.3.6 If the test position of the impact device is other than vertical, a correction factor (fcorr) must be used from Figure 1. LHV is calculated by the following formula and recorded on the data sheet.

$$L - fcorr = LHV$$

6.0 Enclosures

6.1 Figure 1 - Correction Values for Other Impact Directions

6.2 Figure 2 - Hardness Conversion Table

6.3 An Example of a Leeb Hardness Test Calibration Verification Data Sheet

6.4 An Example of a Leeb Hardness Test Data Sheet

6.5 An Example of a Physical Data Sheet

CORRECTION VALUES FOR OTHER IMPACT DIRECTIONS

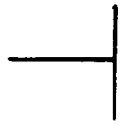
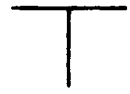
Measured L-Value				
200	7	14	23	33
250	6	13	22	31
300	6	12	20	29
350	6	12	19	27
400	5	11	18	25
450	5	10	17	24
500	5	10	16	22
550	4	9	15	20
600	4	8	14	19
650	4	8	13	18
700	3	7	12	17
750	3	6	11	16
800	3	6	10	15
850	2	5	9	14
900				

Figure 1 - Correction Values for Other Impact Directions

HARDNESS CONVERSION TABLE

Equotip Leeb Hardness Impact Device D	Brinell Hardness 300 Kg Load 10MM Ball	Rockwell C Scale 150 Kg Load Diamond Indenter	Rockwell B Scale 100 Kg Load 1/16" Ball	Vickers Hardness Number	Shore Hardness Number	Tensile Strength 1,000 lbs. Per Sq. In.
HL_D	HB	HRC	HRB	HV	HS	Tens. Str.
456	182		89	189		
454	180		89	187		87
452	179		88	185		85
450	177		88	183		
448	175		88	182		84
446	174		87	180		
444	172		87	178		83
442	171		86	176		82
440	169		86	175		
438	168		86	173		81
436	166		85	171		
434	165		85	170		80
432	163		84	168		
430	162		84	166		78
428	160		83	164		
426	158		83	163		
424	157		82	161		76
422	156		82	159		
420	154		82	158		74
418	153		81	156		
416	151		81	155		
414	150		80	153		72
412	148		80	151		
410	147		79	150		70
408	145		79	148		
406	144		78	147		
404	143		77	145		68
402	141		77	143		
400	140		76	142		
398	138		76	140		66
396	137		75	139		
394	136		75	137		
392	134		74	136		64
390	133		74	134		
388	132		73	133		
386	130		72	131		62
384	129		72	130		
382	128		71	128		
380	126		71	127		60
378	125		70	126		
376	124		69	124		
374	122		69	123		58
372	121		68	121		
370	120		67	120		56
368	119		67	119		

Figure 2- Hardness Conversion Table

LEEB H/ [illegible] S TEST
CALIBRATION VER[illegible]ATION DATA SHEET

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Time Performed ____________
L-Values

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Operator ________________ Date ______________ Test Block Value ____________

LEEB HARDNESS TEST DATA SHEET

Operator _____ Specimen ID/N _____

Date _____ EQUOTIP S/N _____

Hardness Readings (L-Value)

Metal Removed	1	2	3	4	5	6	7	8	9	10	Average Hardness	Position	Correction Factor	LHV

Comments:

PROPRIETARY

UNCONTROLLED DOCUMENT
INFORMATION ONLY

PHYSICAL DATA SHEET

Operator _____

Date _____

Flange ID/N _____

Digital Therm S/N _____

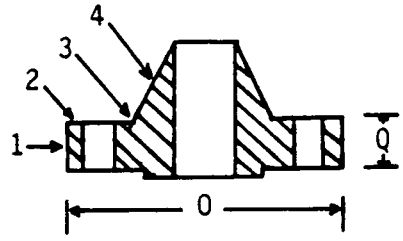
Cal Due Date _____

Gauss Meter S/N _____

Cal Due Date _____

Caliper S/N _____

Cal Due Date _____



Width of Rim (Q) _____

Diameter (O) _____ or Circumference _____

Temperature _____

Magnetic Field _____

Vibration _____

Marking: _____

Surface Finish (Forged or rolled, Machined, Flame Cut)

1. _____

2. _____

3. _____

4. _____

Comments:

1404-10

TI 1572 I VINE (NSAC/EPRI) 12-JUL-88 17:04 EDT
SUBJECT: NRC Bulletin 88-05 -- Temperature Correction Factors for In-Situ

EPRI has developed the following correction factors for in-situ Equotip hardness testing which must be performed at elevated temperatures. This correlation has been provided to NRC for information, but it has not been formally reviewed by NRC. These factors are for A-105 material. Our previous NETWORK entry TI-1557, dated July 7, 1988, noted the need for these correction factors. These factors should be added to the measured hardness (Equotip "L" value) to obtain the corrected (75 degrees F) hardness prior to conversion to Brinell. The table should be linearly interpolated for values between those listed. It is recommended that the temperature be measured with a surface contact pyrometer capable of calibration within plus or minus 10 degrees F. (Omega and Fluke are two manufacturers of such devices.) It is also recommended that, if possible, the temperature be measured in the same local area where the hardness measurement is made. Please note the temperature and the correction factor in the "remarks" data field of the previously provided diskette when reporting results for the industry database.

Measured Temperature (F)	Temperature Correction (L)
75	0
100	8
125	16
150	22
175	28
200	33
225	38
250	42
275	46
300	49
325	52
350	54
375	56
400	58
425	60
450	62
475	64
500	66
525	68
550	70
575	72
600	74

INFORMATION CONTACT: Biff Bradley (202) 872-1280
