

# REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8007290620 DOC. DATE: 80/07/22 NOTARIZED: NO DOCKET #  
 FACIL: 50-361 San Onofre Nuclear Station, Unit 2, Southern California 05000361  
 50-362 San Onofre Nuclear Station, Unit 3, Southern California 05000362  
 AUTH. NAME AUTHOR AFFILIATION  
 BASKIN, K.P. Southern California Edison Co.  
 RECIP. NAME RECIPIENT AFFILIATION  
 SCHWENCER, A. Licensing Branch 3

SUBJECT: Forwards response to NRC 800621 request for info re  
 potential for underclad cracking in reactor vessel nozzles.  
 Nozzle base metal matl is SA-508, Class II. Applicable matl  
 certification data sheets encl.

DISTRIBUTION CODE: 8001S COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 37  
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NOTES: Send all FSAR & ER amends to L Chandler. 05000361  
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ACTION:	A/D LICENSNG	1	0	SCHWENCER, A.	1	0
	LEE, J.	1	0	ROOD, H.	05	1
INTERNAL:	ACCID EVAL BR	1	1	AUX SYS BR	18	1
	CHEM ENG BR	1	1	CONT SYS BR		1
	CORE PERF BR	17	1	DIR, HUM FAC SFY		1
	DIR, SFTY TECH		1	EFF TR SYS BR		1
	EMERG PREP	22	0	EQUIP QUAL BR		1
	GEOSCIENCES		1	HYD/GEO BR	11	1
	IRC SYS BR	20	1	I&E	06	3
	MATL ENG BR		1	MECH ENG BR		1
	MPA		0	NRC PDR	02	1
	OELD		0	POWER SYS BR		1
	PROC/TST REV BR		1	QA BR	10	1
	RAD ASSESS BR	12	1	REAC SYS BR		1
	REL FILE	01	1	SIT ANAL BR	27	1
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EXTERNAL:	ACRS	16	16	LPDR	03	1
	NSIC	04	1			

JUL 30 1980

TOTAL NUMBER OF COPIES REQUIRED: LTR 51 ENCL 45

*Southern California Edison Company*

P. O. BOX 800  
2244 WALNUT GROVE AVENUE  
ROSEMEAD, CALIFORNIA 91770

K. P. BASKIN  
MANAGER, NUCLEAR ENGINEERING  
AND LICENSING

TELEPHONE  
(213) 572-1401

July 22, 1980

Director of Nuclear Reactor Regulation  
Attention: Mr. Albert A. Schwencer, Acting Branch Chief  
Licensing Projects Branch 3, DPM  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362  
San Onofre Nuclear Generating Station  
Units 2 and 3

In your letter to SCE dated June 24, 1980, information was requested to better define the potential for underclad cracking in the San Onofre Units 2 and 3 reactor vessel nozzles. Per your request enclosed is the requested information.

If you have any questions, please let me know.

Very truly yours,

*KPBaskin/jh*

Enclosure

B001  
S  
1/1

8007290620

A

RESPONSE TO NRC INFORMATION REQUEST

UNDERCLAD CRACKING IN REACTOR VESSEL NOZZLES  
SAN ONOFRE, UNITS 2 AND 3

Item 1

Nozzle base metal material specification type and grade, including material certification data of material used in construction.

Response

The nozzle base metal material is SA-508 Class II and copies of the applicable material certification data sheets are provided by attachments 1 through 4. For the sake of simplicity the following tabulation provides a correlation between C-E piece number and shop code number.

San Onofre Unit 2

<u>Location</u>	<u>Piece Number</u>	<u>Shop Code Number</u>
Outlet Nozzle	205-06 A	C-6411-1
Outlet Nozzle	205-06 B	C-6411-2
Inlet Nozzle	205-02 A	C-6410-1
Inlet Nozzle	205-02 B	C-6410-3
Inlet Nozzle	205-02 C	C-6410-2
Inlet Nozzle	205-02 D	C-6410-4

San Onofre Unit 3

<u>Location</u>	<u>Piece Number</u>	<u>Shop Code Number</u>
Outlet Nozzle	205-06 A	C-6830-1
Outlet Nozzle	205-06 B	C-6830-2
Inlet Nozzle	205-02 A	C-6829-4
Inlet Nozzle	205-02 B	C-6829-2
Inlet Nozzle	205-02 C	C-6829-1
Inlet Nozzle	205-02 D	C-6829-3

Item 2

Clad process type electrode size and number of clad layers, including material certification data of material used in construction.

Response

- A) The clad process used on the San Onofre Unit 2 nozzles was the Gas Metal Arc Automatic type. The process used on San Onofre Unit 3 nozzles was the Submerged Metal Arc Automatic Type.
- B) The electrode size and number of passes is as identified below:

San Onofre Unit 2

<u>Location</u>	<u>Pass No.</u>	<u>Wire Diameter/Type</u>	<u>Heat No.</u>
Inlet Nozzle	1	1/16" / 309	77820
Inlet Nozzle	2	1/16" / 308	570615
Outlet Nozzle	1	1/16" / 309	77820
Outlet Nozzle	2	1/16" / 308	570615

San Onofre Unit 3

Inlet Nozzle	1	3/32" / 309	4703
Inlet Nozzle	2	3/32" / 308	L-2482
Outlet Nozzle	1	3/32" / 309	774292 & 4703
Outlet Nozzle	2	3/32" / 308	L-2482

The actual material certification data sheets for each of the above listed numbers is provided in Attachment 5.

Item 3

Heat input (amps, volts, speed) for each clad layer.

Response

San Onofre Unit 2

Heat Input:

- Voltage
  - 1st pass, 29-30 V
  - 2nd pass, 29-30 V
- Amps
  - 1st pass, 250 DC - Reverse Polarity
  - 2nd pass, 275 DC - Reverse Polarity
- Wire Speed
  - 1st pass, 179 I.P.M.
  - 2nd pass, 185 I.P.M.

San Onofre Unit 3

Heat Input:

- Voltage
  - 1st pass 42-43 V
  - 2nd pass 42-43 V
- Amps
  - 1st pass 310/340 DC - Single Phase
  - 2nd pass 340/360 DC - Single Phase
- Wire Speed
  - 1st pass 150 I.P.M.
  - 2nd pass 170 I.P.M.

Item 4

Clad pre- and post-heat temperature and interpass temperature for each clad layer.

Response

During the cladding process, the pre-heat and interpass temperature of the individual nozzles is maintained between 250-350 F. Subsequent to cladding, but prior to final stress relief of the vessel assembly, the individual nozzles, are subjected to an intermediate post weld heat treatment (PWHT) of  $1100\text{ F} \pm 50\text{ F}$  for 15 minutes. This operation enables the interpass hold temperature to be stopped in order to facilitate the handling and installation of the nozzles into the reactor vessel shell course.

Item 5

Vessel stress relief treatment.

Response

The reactor vessel assembly is subject to a final Stress Treatment of  $1150\text{ F} \pm 25$  for 11 hours.

Item 6

Manufacturer or subcontractor who fabricated vessel and applied nozzle cladding.

Response

C-E Chattanooga Nuclear Operations is the manufacturer of the vessel assembly, and is also responsible for all cladding operations.

- Attachments:
- 1) National Forge Co., Test Certification, dated 2/18/71  
(SCE II Outlet Nozzles)
  - 2) National Forge Co., Test Certification, revised 8/21/74  
(SCE III outlet Nozzles)
  - 3) Standard Steel, Test Reports, dated 1/27/71-3/15/71  
(SCE II Inlet Nozzles)
  - 4) Standard Steel, Test Report, dated 12/74  
(SCE Inlet Nozzles)
  - 5) Chemical Analysis of Cladding Electrodes.



NATIONAL FORGE COMPANY  
TEST CERTIFICATION

So-2  
ATTACHMENT 1

CUSTOMER: Combustion Engineering

NATIONAL FORGE CO. ORDER: 60-A-1023

CUSTOMER ORDER NO. 40-83219

SPECIFICATION: P2C10(B) in accordance  
with ASME-508-C1. 2

DATE: 2/18/71

ITEM - SERIAL

HEAT NUMBER

DESCRIPTION

01-001

see below

Outlet Nozzle, Dwg. C-245-303-1, Rev. 1

HEAT NO.	C.	MN.	P.	S.	SI.	NI.	CR.	MO.	VA.
9-8926-1	.22	.80	.008	.006	.34	.81	.36	.64	.04
Check	.22	.72	.007	.007	.32	.80	.35	.64	.04
180 Check	.22	.72	.007	.005	.32	.80	.35	.64	.03

TEST	TENSILE STRENGTH	LBS. PER SQ. IN. Yield .2%	REDUCTION OF AREA %	ELONGATION %	FRACTURE	Charpy @ +10°F			
	LBS. PER SQ. IN.					#	%Shear Lat.Ev.		
#1A	102,500	83,500	68.8	23.0	1/2 cup	A	98.0	98%	.079
						A	103.0	100%	.081
						A	85.0	81%	.067
01#1B	105,000	86,000	69.3	22.5	2/3 cup	B	94.0	93%	.069
						B	99.0	98%	.073
						B	104.0	100%	.074
Normalized @1700°F for 14 hrs. Quenched @1580°F for 15 hrs. into water Tempered @1250°F for 18 hrs. Test Samples Stress Relieved @1150°F for 40 hrs.						Drop Weight Tests per ASTM-E-208-66T 1-no break @ 0°F 1-no break @ -20°F 1-no break @ -40°F 1-no break @ -60°F 2-no break @ -100°F NDT Temp. below -100°F			

State of Pennsylvania }  
Warren County } ss:

Before me, a Notary Public in and for above County, personally appeared E.K. Oviatt 7/170  
Engineer of Tests of the National Forge Company, who being duly Sworn according to Law, deposes and says that  
the above Report is a true and correct copy of tests shown on our Laboratory Records.

Subscribed and Sworn to

this 18th day of February 19 71

My Commission expires

Embossed Hereon is My  
Irvine, Warren County, Pennsylvania, Notary Public Seal  
My Commission Expires May 20, 1974  
COOPER & KUPINGER





NATIONAL FORGE COMPANY  
TEST CERTIFICATION

CUSTOMER: Combustion Engineering, Inc.,

NATIONAL FORGE CO. ORDER: 60-A-1023

CUSTOMER ORDER NO.: 40-83219

SPECIFICATION: ASME-508-C1. 2

DATE: 1/27/71

DESCRIPTION: Outlet Nozzle

DRAWING NO.: C-245-303-1, Rev. 1

ITEM-SERIAL	HEAT NO.	C.	Mn.	P.	S.	Si.	Ni.	Cr.	Mo.	V.
01-001 Charpy	Temp.	%Duct.	Lat. Exp.							
105.0	75°F	98%	.083							
105.0	75	94%	.072							
107.0	75	92%	.084							
52.5	-10	47%	.041							
57.5	-10	55%	.049							
63.5	-10	56%	.053							
25.5	-40	34%	.029							
37.5	-40	29%	.021							
30.0	-40	32%	.025							
10.0	-100	9%	.007							
6.5	-100	13%	.003							
10.0	-100	15%	.004							
3.0	-150	5%	.000							
2.5	-150	5%	.001							
4.0	-150	14%	.003							
01-002 Charpy	Temp.	%Duct.	Lat. Exp.							
117.0	75°F	86%	.087							
140.0	75	100%	.090							
121.0	75	92%	.084							
74.5	-10	47%	.057							
71.0	-10	45%	.055							
55.5	-10	46%	.043							
46.0	-40	34%	.039							
49.5	-40	32%	.041							
58.0	-40	41%	.040							
13.0	-100	15%	.005							
11.5	-100	12%	.002							
10.5	-100	12%	.005							
4.0	-150	5%	.000							
6.0	-150	3%	.000							
5.0	-150	9%	.002							

State of Pennsylvania

Warren County } ss:

Before me, a Notary Public in and for above County, personally appeared B.K. Oviatt

....., of the National Forge Company, who being duly Sworn according to Law, deposes and says that the above Report is a true and correct copy of tests as contained in the records of the Company.

Subscribed and Sworn to

this 27th day of January 1971

My Commission expires

Embossed Hereon is My

Irvine, Warren County, Pennsylvania, Notary Public Seal

My Commission Expires May 20, 1974

CORYNNE M. KETTLINGER

NATIONAL FORCE CO  
60-1023-01 #1

COMBUSTION ENGINEERING INC  
40-83219

160  
140  
120  
100  
80  
60  
40  
20  
0

TEMP. °FAHR

Test Temp. °F.	Foot Pounds		
	A	B	C
+10	98.0	103.0	85.0
+10	94.0	99.0	104.0
75°F	105.0	105.0	107.0
-10	52.5	57.5	63.5
-40	25.5	37.5	30.0
-100	10.0	6.5	10.0
-150	3.0	2.5	4.0



NATIONAL FORGE COMPANY  
TEST CERTIFICATION

CUSTOMER: Combustion Engineering

NATIONAL FORGE CO. ORDER: 60-A-1023

CUSTOMER ORDER NO. 40-83219

SPECIFICATION: P3C10(B) in accordance  
with ASME-508-C1. 2

DATE: 2/18/71

ITEM - SERIAL

HEAT NUMBER

DESCRIPTION

01-002

see below

Outlet Nozzle, Dwg. C-245-303-1, Rev. 1

HEAT NO.	C.	MN.	P.	S.	SI.	NI.	CR.	MO.	VA.
9-8936-1	.22	.73	.009	.005	.32	.87	.34	.65	.013
Check	.22	.75	.007	.006	.33	.86	.35	.63	.03
Check	.22	.76	.007	.005	.34	.86	.36	.62	.03

TEST	TENSILE STRENGTH	LBS. PER SQ. IN. Yield .2%	REDUCTION OF AREA %	ELONGATION %	FRACTURE	Charpy @ +10°F			
	LBS. PER SQ. IN.					#	%Shear Lat.E.		
01#2A	100,000	82,000	69.9	26.0	1/2 cup	A	114.0	90%	.077
						A	92.5	71%	.073
						A	115.5	92%	.083
01#2B	99,000	80,000	71.2	26.0	2/3 cup	B	112.0	79%	.082
						B	91.5	67%	.063
						B	124.0	84%	.087

Normalized @1700°F for 14 hrs.  
Quenched @1580°F for 15 hrs. into water  
Tempered @1250°F for 18 hrs.  
Test Samples Stress Relieved @1150°F for 40 hrs.

Drop Weight Tests per  
ASTM-E-208-66T  
1-no break @ +20°F  
2-no break @ 0°F  
1-no break @ -10°F  
1-break @ -70°F  
1-break @ -40°F  
NDT Temp. below 0°F

State of Pennsylvania }  
Warren County } ss:

C-6477-2  
71170

Before me, a Notary Public in and for above County, personally appeared E.K. Oviatt  
Engineer of Tests of the National Forge Company, who being duly Sworn according to Law, deposes and says that  
the above Report is a true and correct copy of tests shown on our Laboratory Records.

Subscribed and Sworn to  
this 18th day of February, 1971.  
*Cornelius M. Stellingma*  
My Commission expires

Embossed Hereon is My  
Irving, Warren County, Pennsylvania, Notary Public Seal  
My Commission Expires May 20, 1974  
CORNELIUS M. STELLINGMA



# NATIONAL FORGE COMPANY TEST CELL SPECIFICATION

CUSTOMER: Combustion Engineering, Inc.,

NATIONAL FORGE CO. ORDER: 60-A-1023

CUSTOMER ORDER NO.: 40-83219

SPECIFICATION: ASME-508-C1. 2

DATE: 1/27/71

DESCRIPTION: Outlet Nozzle

DRAWING NO.: C-245-303-1, Rev. 1

ITEM-SERIAL	HEAT NO.	C.	Mn.	P.	S.	Si.	Ni.	Cr.	Mo.	V.
01-001										
Charpy	Temp.	%Duct.	Lat.							
			Exp.							
105.0	75°F	98%	.083							
105.0	75	94%	.072							
107.0	75	92%	.084							
52.5	-10	47%	.041							
57.5	-10	55%	.049							
63.5	-10	56%	.053							
25.5	-40	34%	.029							
37.5	-40	29%	.021							
30.0	-40	32%	.025							
10.0	-100	9%	.007							
6.5	-100	13%	.003							
10.0	-100	15%	.004							
3.0	-150	5%	.000							
2.5	-150	5%	.001							
4.0	-150	14%	.003							
01-002										
Charpy	Temp.	%Duct.	Lat.							
			Exp.							
117.0	75°F	86%	.037							
140.0	75	100%	.090							
121.0	75	92%	.084							
74.5	-10	47%	.057							
71.0	-10	45%	.055							
55.5	-10	46%	.043							
46.0	-40	34%	.039							
49.5	-40	30%	.041							
58.0	-40	41%	.040							
13.0	-100	15%	.005							
11.5	-100	12%	.002							
10.5	-100	12%	.005							
4.0	-150	5%	.000							
6.0	-150	3%	.000							
5.0	-150	9%	.002							

C-644-2

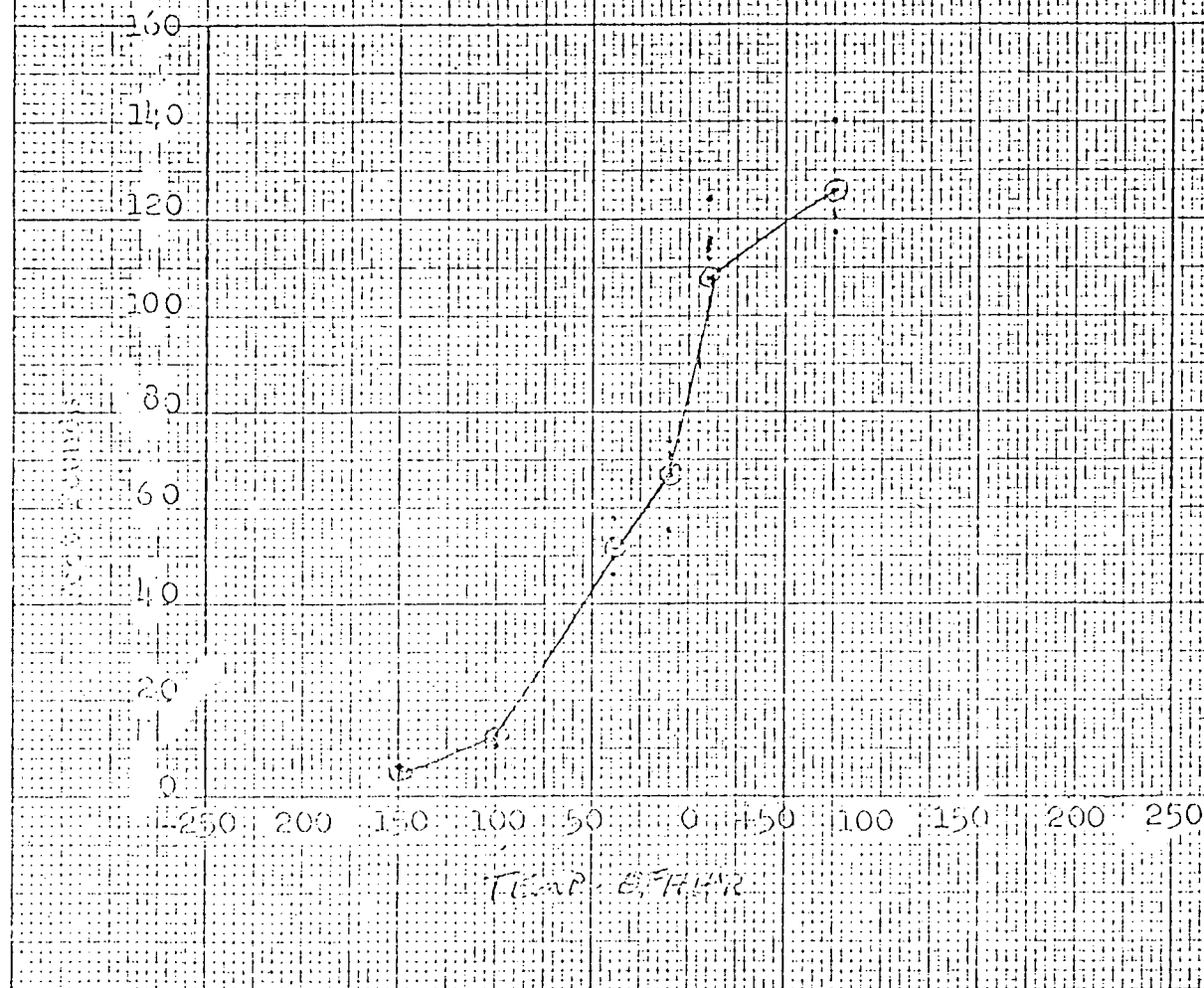
State of Pennsylvania }  
Warren County } ss:

Before me, a Notary Public in and for above County, personally appeared E.K. O'Brien, of the National Forge Company, who being duly sworn according to Law, deposed and says that the above Report is a true and correct copy of tests as contained in the records of the Company.

Subscribed and Sworn to  
this 27th day of January, 1971  
Carroll M. Kitching  
My Commission expires \_\_\_\_\_

Notary Public for  
State of Pennsylvania  
My Comm. Exp. 12/31/74  
C-644-2

NATIONAL FORGE CO.  
 60-1023-01 #2  
 COMBUSTION ENGINEERING, INC.  
 140-83219  
 4-1-1953



Test Temp. °F	Foot Pounds		
	A	B	C
+100	114.0	82.5	115.5
+80	112.0	91.5	124.0
+75	117.0	116.0	121.0
+10	74.5	71.0	
-40	46.0	49.5	68.0
-100	13.0	11.5	10.5
-150	4.0	4.0	6.0



# NATIONAL FORGE COMPANY

50-3

ATTACHMENT 2

TEST CERTIFICATION

REVISED 8/21/74

Page 1 of 2

CUSTOMER: Combustion Engineering, Inc.

NATIONAL FORGE CO. ORDER: 60-7034

CUSTOMER ORDER NO.: 43-83305

SPECIFICATION: ASME SA-506, Class 2, & C.E. Spec. N-P3C10 (c) Modified

ITEM-SERIAL NO.

DESCRIPTION:

L-001 Outlet Nozzle, Drawing C-246-325, Rev. 1

C-6830-1

Contract No. 72170, Job or Acct. No. A-98014, and Code #C-6830

72170

ITEM-SERIAL	HEAT NO.	C.	Mn.	P.	S.	Si.	Ni.	Cr.	Mo.	V.	Cu.
L-001	11-5108	.21	.75	.007	.017	.25	.83	.41	.62	.04	.07
	CHECK X6	.19	.75	.008	.019	.24	.86	.41	.64	.03	.06
	X12.20	.76	.009	.020	.25	.84	.42	.64	.03	.06	

TANGENTIAL

TEST	ULTIMATE TENSILE STRENGTH (P.S.I.)	YIELD .2% (P.S.I.)	% ELONGATION	% REDUCTION OF AREA	% SHEAR	CHARPY IMPACT (FT. LBS.) @ 100°F	LAT. EXP.
2:00	88,500	69,500	25.0	72.3	42%	55.0	.039
5:00	86,500	66,000	25.0	72.5	51%	73.0	.055 12:00
					52%	82.0	.058
					57%	88.0	.064
					54%	82.0	.060 6:00
					47%	75.0	.058
NORMALIZED @ 1700°F for 16 hrs							
RENTITIZED @ 1580°F For 16 hrs							
TEMPERED @ 1290°F for 8 hrs							
GRAIN SIZE 6-8							
TEST SPECIMENS STRESS RELIEVED @ 1150° ± 25°F, for 40 hrs, Furnace cooled 75°F/hr.							
below 600°F							
FREE OF MERCURY CONTAMINATION							
ROUND FLUTED INGOT MOLD							
ELECTRIC MELT VACUUM DEGASSED STEEL							

State of Pennsylvania  
Berren County

ss:

Before me, a Notary Public in and for above County, personally appeared N. C. Baxter, Jr., of the National Forge Company, who being duly Sworn according to Law, deposes and says that the above Report is a true and correct copy of tests as contained in the records of the Company.

*N. C. Baxter, Jr.*

Subscribed and Sworn to

13th day of August 1974

*Harry E. Weaver*

My Commission expires January 2, 1978  
SALLY L. WIEBE

SC-14

# TEST CERTIFICATION

Page 2 of 2

CUSTOMER: Combustion Engineering, Inc.

NATIONAL FORGE CO. ORDER: 60-7034

CUSTOMER ORDER NO.: 43-83305

ITEM SERIAL NO.:

1-001

## REPORT OF CHARPY IMPACTS (Y 12)

TEMPERATURE	FT. LBS.	% SHEAR	LAT. EXP.	TEMPERATURE	FT. LBS.	% SHEAR	LAT. EXP.
180°F	135.0	100%	.101	@ -50°F	13.5	9%	.012
	132.0	100%	.101		19.0	11%	.016
	132.0	100%	.013 (a)		38.0	22%	.034
135°F	134.0	100%	.090	@ -100°F	8.5	9%	.009
	127.0	100%	.085		8.5	11%	.009
	125.0	100%	.089		7.0	9%	.006
60°F	83.0	61%	.062	@ -140°F	2.5	3%	.003
	112.0	73%	.073		4.0	3%	.004
	110.0	77%	.075		5.5	3%	.005

### DROP WEIGHT RESULTS

Y 12      2 No Break      1 Break  
              -10°F                -20°F  
              Y 6                -10°F                -20°F

TNDT

(a) Investigation of lateral expansion figure of .013 mm indicates this is a typographical error. Corrected data sheet has been requested from supplier.

*Lesley Seyler* 4/18/1980  
 Lesley Seyler, SCE/Project QA Subv

State of Pennsylvania

Warren County } ss:

Before me, a Notary Public in and for above County, personally appeared..... N. C. Baxter, Jr.

of the National Forge Company, who being duly Sworn according to Law, deposes and says that the above Report is a true and correct copy of tests as contained in the records of the Company.

Subscribed and Sworn to

this 13th day of August 1974

*Sally J. Vevras*

My Commission expires.....

Irvine, Warren County, Pennsylvania Notary Public Seal

My Commission Expires January 2, 1978

SALLY J. VEVRAS

SCIII-14 A

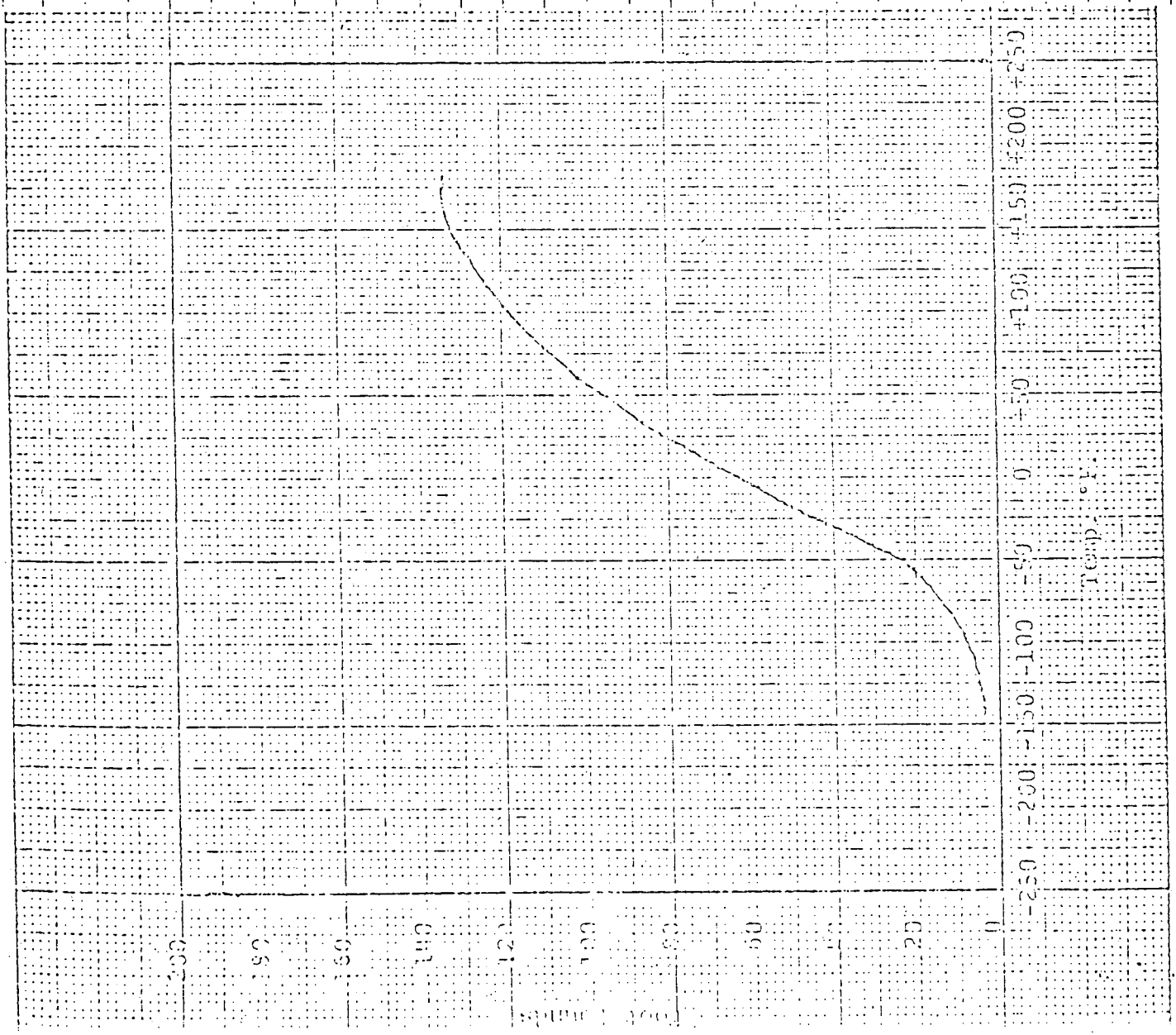
National Forge Co. 60-703401-71  
 Customer Converted Inc.  
 Customer Order No. \_\_\_\_\_

Drawing \_\_\_\_\_

Spec. \_\_\_\_\_

Y-17-2 Blue of 3

Test Temp.	#	Spec	Lot	Emp
+10	70.0	40		070
+60	102.0	70		070
+135	129.0	100		085
+190	134.0	100		107
-50	23.5	14		07
-100	3.0	10		05
-140	4.0	5		37







# NATIONAL FORGE COMPANY

## TEST CERTIFICATION

\*REVISED 9/4/74

Page 1 of 2

CUSTOMER: Combustion Engineering, Inc.

NATIONAL FORGE CO. ORDER: 60-7034

CUSTOMER ORDER NO.: 43-83305

SPECIFICATION: ASME SA-508, Class 2,  
& C.E. Spec. N-P3C10 (c) Modified

ITEM-SERIAL NO.

DESCRIPTION:

1-002 Outlet Nozzle, Drawing C-246-325, Rev. 1

Contract No. 72170, Job or Acct. No. A-98014, and Code #C-6830

C 6830-2

72170

ITEM-SERIAL	HEAT NO.	C.	Mn.	P.	S.	Si.	Ni.	Cr.	Mo.	V.	Cu.
1-002	11-5108	.21	.75	.007	.017	.25	.83	.41	.62	.04	.07
	CHECK X6	.20	.76	.009	.021	.25	.85	.42	.65	.03	.06
	X12	.20	.76	.009	.023	.25	.86	.42	.65	.03	.06

\* Y=Tangential

TEST	ULTIMATE TENSILE STRENGTH (P.S.I.)	YIELD .2% (P.S.I.)	% ELONGATION	% REDUCTION OF AREA	% SHEAR	CHARPY IMPACT (FT. LBS.)	LAT. EXP.
1-002						@ 100°F	
12:00	88,000	67,000	25.0	71.4	45%	62.0	.047
6:00	88,500	68,500	25.0	70.6	53%	79.0	.058 Y 12:00
					48%	74.0	.056
NORMALIZED @ 1700°F for 16 hrs					60%	99.0	.069
RENTITIZED @ 1530°F for 16 hrs					73%	106.0	.070 Y 6:00
TEMPERED @ 1290°F for 8 hrs					57%	94.0	.066
GRAIN SIZE 6-8							
TEST SPECIMENS STRESS RELIEVED @ 1150°±25°F for 40 hrs, Furnace cooled 75°F/hr to below 600°F							
FREE OF MERCURY CONTAMINATION							
ROUND FLUTED INGOT MOLD							
ELECTRIC MELT VACUUM DEGASSED STEEL							

State of Pennsylvania

Warren County } ss:

Before me, a Notary Public in and for above County, personally appeared N. C. Baxter, Jr.

of the National Forge Company, who being duly Sworn according to Law, deposes and says that the above Report is a true and correct copy of tests as contained in the records of the Company.

Subscribed and Sworn to

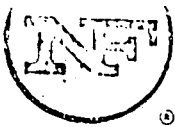
this 15th day of August 1974

My Commission expires

Irving, Warren County, Pennsylvania, Notary Public Seal

My Commission Expires January 2, 1978

SC-113



# NATIONAL FORGE COMPANY

## TEST CERTIFICATION

2 of 2

CUSTOMER: Combustion Engineering, Inc.

NATIONAL FORGE CO. ORDER: 60-7034

CUSTOMER ORDER NO.: 43-83305

ITEM-SERIAL NO.:

01-002

### REPORT OF CHARPY IMPACTS (Y12)

TEMPERATURE	FT. LBS.	% SHEAR	LAT. EXP.	TEMPERATURE	FT. LBS.	% SHEAR	LAT. EXP.
180°F	127.0	100%	.095	@ -50°F	25.0	20%	.022
	127.0	100%	.096		8.5	14%	.007
	135.0	100%	.095		20.0	16%	.016
135°F	132.0	100%	.090	@ -100°F	10.0	9%	.010
	133.0	100%	.093		13.0	9%	.011
	131.0	100%	.090		9.0	9%	.009
60°F	110.0	77%	.081	@ -140°F	3.0	3%	.004
	110.0	80%	.078		3.5	3%	.005
	111.0	76%	.082		4.0	3%	.004

### DROP WEIGHT RESULTS

Y 12      2 No Break      1 Break  
            -10°F              -20°F  
Y 6              -10°F              -20°F

TNDT

State of Pennsylvania

Warren County

ss:

Before me, a Notary Public in and for above County, personally appeared N. C. Baxter, Jr.  
of the National Forge Company, who being duly sworn according to Law, deposes and says that the above Report is a true and  
correct copy of tests as contained in the records of the Company.

Subscribed and Sworn to

this 15th day of August 1974

Sally L. Weaver

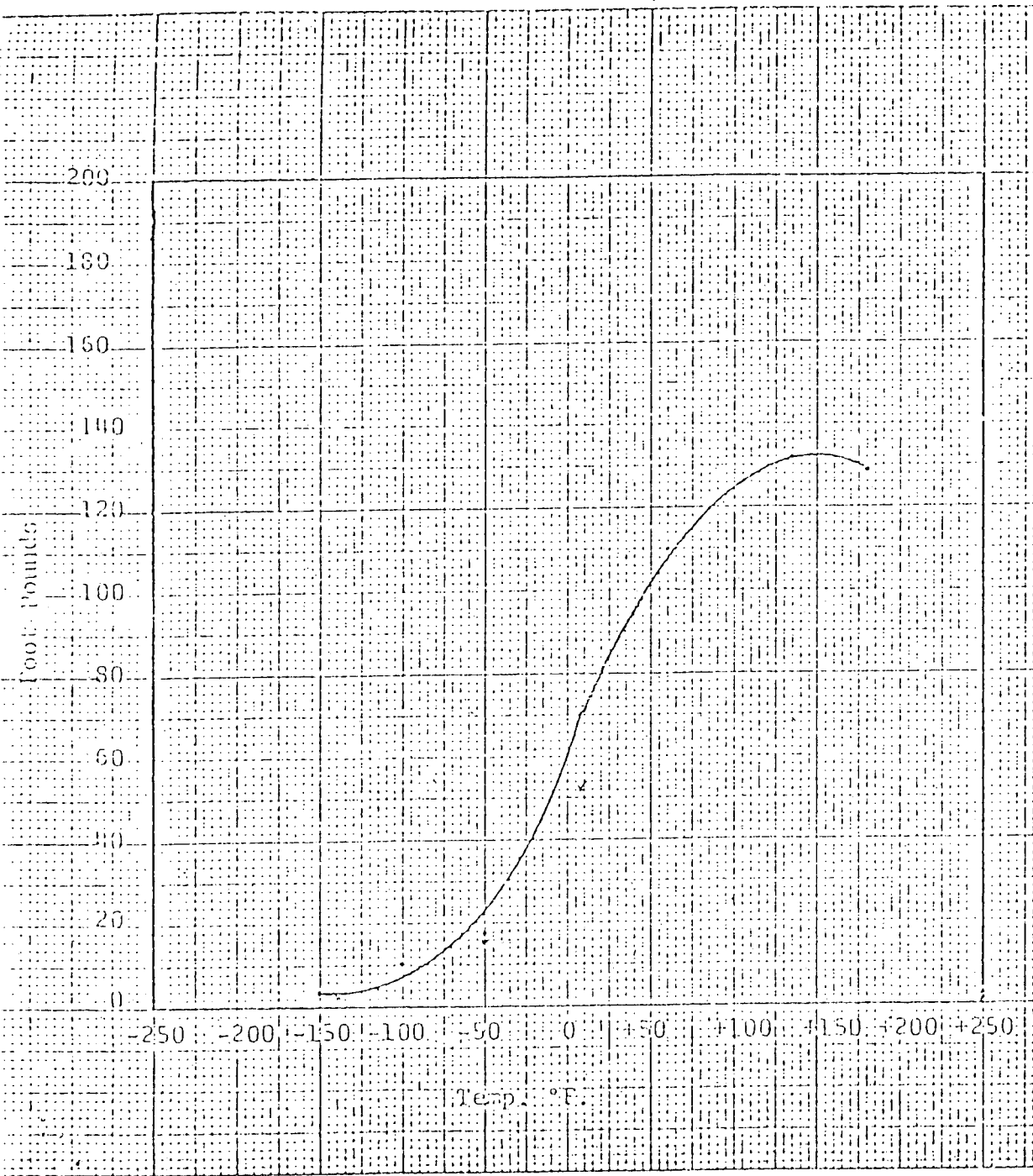
My Commission expires

Exhibited Herein to Me  
Irene, Warren County, Pennsylvania, Notary Public Seal

My Commission expires January 2, 1979

SALLY L. WEAVER

SC III - 13A



National Forge Co. 60-7024-51 22.  
 Customer CORRUPTION ENG.  
 Customer Order No. \_\_\_\_\_  
 Drawing \_\_\_\_\_  
 Spec. \_\_\_\_\_

*Y12 = Average of 3*

Test Temp.	#	% Shear	Lat. Exp.
+ 10°F	72.0	48	053
+ 40	110.0	78	080
+ 135	132.0	100	091
+ 180	129.0	100	095
- 50	28.2	17	015
- 100	10.5	9	010
- 140	4.0	3	007

**CORRECTED COPY**

A DIVISION OF BALEN STEELWORKS CORPORATION  
 BURNING, PA. 17003  
 A subsidiary of Brown and Company  
**METALLURGICAL DEPARTMENT**

**ATTACHMENT 3**

Date 1-27-71

Test Report of 2 Inlet Nozzles For Combustion Engineering, Inc.

Our Order 612-1123

Customer's Order 40-83218

Specification ASME SA-508-68, Class 2 as mod. by N-P3010(1)

Car No. Truck

HEAT	MATERIAL	Tensile Strength	Yield Strength	Elong. Per Cent in 2 inches	Reduction of Area Per Cent	CHEMICAL ANALYSIS								
						Carb.	Si.	Mn.	P.	S.	Cr.	Ni.	Mo.	V.
	Item #1, Dwg. Code C-6410	C-245-34-1, Rev. 1,												
AV5602	00W-1195#10	88000	68500	26.5	71.5	.20	.21	.009	.70	.008	.67	.35	.63	.033
	180	86500	66500	27.0	71.5	.20	.21	.010	.70	.010	.70	.38	.66	.034
AV5619	00W-1196#20	85000	65000	27.0	70.5	.21	.17	.010	.67	.010	.70	.38	.66	.034
	180	85500	66000	27.0	70.5	.19	.17	.011	.68	.012	.66	.37	.62	.025
	V-Notch Charpy C +10F = Ft.Lbs.					% Shear		Lab. Exp.						
	00W-1195	0	110			59		.075						
	-1		104			54		.070						
			109			59		.072						
	180		106			58		.074						
			112			61		.079						
			103			55		.075						
	00W-1196	0	54			37		.019						
	-2		34			25		.010						
			43			36		.012						
	180		86			54		.019						
			109			62		.076						
			65			38		.036						
	F.A.T.T. =	Temp.	Ft.Lbs.			% Flg.		Lab. Exp.						
	00W-1195	+130F	161			100		.103						
			150			100		.096						
			147			100		.092						
		+70F	135			77		.086						
			118			77		.085						
			124			82		.087						
		+10F	106			58		.074						
			112			61		.079						
			103			55		.075						
		-50F	26			14		.024						
			50			27		.078						
			41			22		.067						
		-100F	9			3		.074						
			4			0		.072						
			4			0		.062						
	00W-1196	+130F	149			100		.097						
			155			100		.102						
			150			100		.098						
		+70F	121			73		.086						
			113			51		.075						
			129			74		.090						

C. 6410-112

71170

*L. A. Nimrod*

Manager, Quality Control



A DIVISION OF BALDWIN LAMAR HAMILTON CORPORATION

BURNHAM, PA. 17009

A subsidiary of Brown and Company

METALLURGICAL DEPARTMENT



Page #2

Date 1-27-71

Test Report of 2 Inlet Nozzles

For

Combustion Engineering, Inc.

Our Order 612-1123

Customer's Order 140-53218

Specification (See page #1 Cont.)

Car No. Truck

HEAT	MATERIAL	Tensile Strength	Yield Strength	Elong. Per Cent in 2 inches	Reduction of Area Per Cent	CHEMICAL ANALYSIS							
						Carb.	SiL	Phos.	Mang.	Sul.	Ni.	Ctr.	Mo.
	F.A.T.T. =	Temp.	Ft. Lbs.			% Fib.			Lat. ex.				
	00N-1196	+10F	86			54			.049				
			109			62			.076				
			65			38			.046				
		-20F	18			30			.040				
			32			38			.038				
			50			39			.042				
		-50F	19			9			.041				
			7			6			.042				
			12			9			.045				
		-100F	4			0			.003				
			4			0			.003				
			4			0			.002				
	Nil Ductility Transition Temperature:												
	00N-1195	+20F											
	00N-1196	0°F											
	Heat Treatment:												
	1625F - 6 hrs. up - 9 hrs. hold - water												
	1280F - 4 hrs. up - 17 hrs. hold - air												
	Additional Heat Treatment: of SSD Test Specimens:												
	1150F +/-25F - 40 hrs. hold - fce cool to 600F @ 100F/hr. max.												
	Ultrasonic inspected per N-P3C10)b) and found to be satisfactory.												
	Magnetic Particle inspected per N-P3C10)b) and found to be satisfactory.												
	Sworn to and subscribed before me this 29th day of January, 1971.												
	<i>Richard G. Hoffman</i>												
	RICHARD G. HOFFMAN, Notary Public												
	Burnham, Millin Co., Pa.												
	My Commission Expires October 31, 1974												

Burnham, Millin Co., Pa.

My Commission Expires October 31, 1974

*L. A. McLeod*  
 L. A. McLeod, Manager, Quality Control



DIVISION OF BALDWIN-LAMSON CORPORATION

BURNHAM, PA. 17003

A subsidiary of Baldwin and Company

## METALLURGICAL DEPARTMENT



Date 3-12-71

Test Report of 1 Inlet Nozzle

For Combustion Engineering, Inc.

Our Order 612-1123

Customer's Order 40-83214

Specification ASME SA-508-63, Class 2 as mod. by N-  
P301051

Car No. Truck

HEAT	MATERIAL	Tensile Strength	Yield Strength	Elong. Per Cent in 2 inches	Reduction of Area Per Cent	CHEMICAL ANALYSIS								
						Carb.	Si	Phos.	Mang.	Sul	Ni	Cu	Mo	Va.
	Item #1, Dwg. Code C-6410	C-245-304-1, rev. 1												
	Contract No. 71170NP Job No. A-97985													
V6050	COY-1579 0 180	85000 84000	65000 63500	26.0 27.0	69.0 70.5	.19 .20	.26 .27	.008 .008	.66 .65	.007 .007	.64 .65	.33 .35	.60 .61	.035 .037
	V-Notch Charpy C +10F = Ft.Lbs.					3 Shear					Lat. Exp.			
	0	91 87 86				40 53 57					.053 .065 .040			
	180	60 79 104				45 54 56					.045 .061 .050			
	F.A.T.T. = Temp. Ft.Lbs.					3 Shear					Lat. Exp.			
	+130F	154 150 140				100 100 90					.072 .074 .094			
	+70F	95 130 129				62 75 74					.062 .067 .066			
	+10F	104 86 66				40 52 45					.040 .065 .053			
	-50F	13 6 40				24 16 13					.009 .012 .035			
	-100F	17 18 20				20 8 18					.010 .016 .011			
	Nil Ductility Transition Temperature: 0°F													
	Heat Treatment:													
	1625F - 6 hrs. up - 9 hrs. hold - water					1150F +/- 25F								
	1280F - 4 hrs. up - 17 hrs. hold - air					100F/hr. max.								
	Ultrasonic inspected per N-P3010(b) and found to be satisfactory.													
	Magnetic Particle inspected per N-P3010(b) and found to be satisfactory.													
	Sworn to and subscribed before me this 12th day of March, 1971.													
	<i>[Signature]</i>													

C-6410-3  
71170

RICHARD G. HOFFMAN, Notary Public  
Burnham, Millin Co., Pa.  
My Commission Expires October 31, 1971

L. A. Nicomond  
Manager, Quality Control



DIVISION OF BALDWIN L & A-HAMILTON CORPORATION  
BURNHAM, PA. 17003  
A subsidiary of American Locomotive Company  
**METALLURGICAL DEPARTMENT**



Date 3-15-71

Test Report of 1 Inlet Nozzle For Combustion Engineering, Inc.

Our Order 612-1123

Customer's Order 40-82212

Specification ASME SA-508-68, Class 2 mod. by N-P3C10(h)

Car No. Truck

HEAT	MATERIAL	Tensile Strength	Yield Strength	Elong. Per Cent in 2 inches	Reduction of Area Per Cent	CHEMICAL ANALYSIS									
						Carb.	Sil.	Phos.	Mang.	Sul.	Ni.	Chr.	Mo.	Va.	
AV5841	Item #1, Dwg. C-2115-3011-1, Rev. 1 Code C-6410 Contract No. 71170NH Job No. A-97985														
	00Y-1580 0 180 86500 68500 28.5 71.5 .21 .26 .010 .69 .010 .67 .35 .65 .035 180 86000 67500 27.0 72.5 .20 .29 .009 .70 .007 .67 .34 .63 .035														
	V-Notch Charpy @ +10F= Ft. Lbs.					% Shear						Lat. Exp.			
	0		110			59%						.080			
			107			61						.080			
			87			56						.064			
	180		115			60						.087			
			126			59						.087			
			88			53						.066			
	F.A.T.T. = Temp. Ft. Lbs.					% Shear						Lat. Exp.			
	+200F		153			100						.098			
			153			100						.098			
			179			100						.090			
	+70F		111			69						.070			
			131			74						.087			
			130			90						.081			
	-40F		73			29						.060			
			61			27						.047			
			61			27						.046			
	-100F		6			5						.010			
			4			0						.009			
			4			5						.005			
	+10F		111			56						.066			
			84			45						.062			
			93			54						.081			
	Heat Treatment:					Additional Heat Treatment of SSD Test Specimens.									
	1625F - 6 hrs. up - 9 hrs. hold -water					1150F +/-25F - 40 hrs. hold - Free cool to 600F									
	1280F - 4 hrs. up -17 hrs. hold -air					@ 100F/hr. max.									
	Nil Ductility Transition Temperature: 0°F														
	Ultrasonic inspected per N-P3C10(h) and found to be satisfactory.														
	Magnetic Particle inspected per N-P3C10(h) and found to be satisfactory.														
	Sworn to and subscribed before me this 15th day of March, 1971.														

C-6410-4  
71170

*L. A. [Signature]*  
Manager, Quality Control

**STANDARD STEEL**

Test Report of 3 Inlet Nozzles

For Combustion Engr. - Chattanooga

Division of Titanium Metals Corporation of America

Our Order No. 612-1441 Item 1

Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No.                      Specification SEE COVER PAGE

**METALLURGICAL DEPARTMENT**

**CHEMICAL ANALYSIS**

HEAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti						
1-1879	.22 .20	.27 .27	.006 .004	.62 .62	.010 .008	.68 .69	.35 .30	.67 .63	.021 .028	Ladle Check							

**MECHANICAL PROPERTIES**

MECHANICAL PROPERTIES															
HEAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GRAIN SIZE		
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Shear				
1-1879	4C-923 #1 Tangential Specimens	0° 91,500	73,000		23.5	65.0	Tang.	0°	+10	79	53	.062			
		180° 93,000	73,000		25.0	67.0				77	48	.061			
										75	48	.059			
									180°	+10	81	50		.064	
											55	42		.045	
											78	47		.060	
		C-6829-1													
		72170													
Principal direction of greatest work during forging - tangential.															
DROPT TEST															
LocationTemp.															
0°0° = Break															
180°+20° = No Break															
0°+10° = Break															
180°+20° = No Break															
0°+20° = No Break															
NOTT = +10°F															

**DROP WEIGHT TEST**

Location	Temp.	
0°	0°	= Break
180°	+20°	= No Break
0°	+10°	= Break
180°	+20°	= No Break
0°	+20°	= No Break

NDTT = +10°F

**HEAT TREATMENT**

TO OF	HRS UP	HRS. HOLD	NOTES
620	6	10	Water Quench
280	4	13	Air Cool
Simulated			Post Weld Heat
Treatment:			
1150	+25F	40	Fce. cool to 600F @ 100F/Hr.

**OTHER TESTS  
(SEE ATTACHMENTS)**

- DROP WT. NDT ☐  
 HEAT INDICATION ☐  
 JOMINY ☐  
 OTHER ☐

**ULTRASONIC INSPECTED PER.**

**MAGNETIC PARTICLE INSPECTED PER.**

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS

*L. A. Nicomodo*



Ship. Date \_\_\_\_\_  
Report Date 12-18-64

## STANDARD STEEL

Test Report of 3 Inlet Nozzles For Combustion Engr.-Chattanooga

Our Order No. 612-1441 Item 1 Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No. \_\_\_\_\_ Specification SEE COVER PAGE

METALLURGICAL DEPARTMENT

## CHEMICAL ANALYSIS

EAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti							
-1879																		

## MECHANICAL PROPERTIES

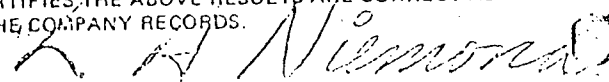
EAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA			Lateral Expansion	GRAIN SIZE
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Shear	
-1879	4C-923						TANGENTIAL		F. A. T.	T.		
									+100	109	100	.084
										121	100	.089
										115	100	.086
									+ 60	103	86	.076
										94	72	.063
										85	66	.064
									0	62	41	.049
										64	45	.050
										53	33	.042
									- 30	40	20	.031
										37	24	.029
										32	20	.027
									- 70	25	14	.017
										20	12	.015
										22	12	.016
									-110	6	0	.004
										11	4	.009
										9	0	.008

## HEAT TREATMENT

OTHER TESTS  
(SEE ATTACHMENTS)

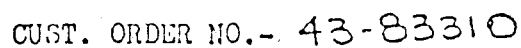
ULTRASONIC INSPECTED PER. \_\_\_\_\_

MAGNETIC PARTICLE INSPECTED PER. \_\_\_\_\_

 DROP WT. NDT ☐  
 HEAT INDICATION ☐  
 JOMINY ☐  
 OTHER ☐
THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS.


DIVISION OF TITANIUM METALS CORPORATION OF AMERICA

AREA CODE 717 248-4911



**STANDARD STEEL**Test Report of 3 Inlet Nozzles For Combustion Engr.-ChattanoogaOur Order No. 612-1441 Item 1 Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No. \_\_\_\_\_ Specification SEE COVER PAGE**METALLURGICAL DEPARTMENT****CHEMICAL ANALYSIS**

TEST NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti							
-1882	.16	.24	.010	.65	.010	.70	.29	.61	.026	Ladle								
	.16	.26	.005	.65	.008	.66	.29	.61	.026	Check								

**MECHANICAL PROPERTIES**

TEST NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GRAIN SIZE
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Snag		
-1882	4C-924 0°	87,000	70,000		26.0	71.5	Tang.	0°	+10	106	56	.079	
	#2 180°	87,500	70,500		26.0	72.5				105	59	.079	
		Tangential Specimens								109	65	.081	
								180°	+10	100	59	.078	
										109	60	.081	
										118	65	.084	
<b>DROP WEIGHT TEST</b> Location      Temp. 0°      0° = Break 180°      +20° = No Break 0°      +10° = No Break 180°      +10° = No Break NDTT = 0°F													
C-6829-2 72170 Principal direction of greatest work during forging - tangential.													

**HEAT TREATMENT****OTHER TESTS  
(SEE ATTACHMENTS)**

ULTRASONIC INSPECTED PER. \_\_\_\_\_

MAGNETIC PARTICLE INSPECTED PER. \_\_\_\_\_

	HRS. UP	HRS. HOLD	NOTES	
20	6	10	Water Quench	DROP WT. NCT <input type="checkbox"/>
50	4	13	Air Cool	HEAT INDICATION <input type="checkbox"/>
Isolated			Post Weld Heat	JOMINY <input type="checkbox"/>
Attachment				OTHER <input type="checkbox"/>
10	+25F	40	Fce. cool to 600F @ 100F/Hr.	

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS.*L. H. Diamond*

## STANDARD STEEL

Ship. Date \_\_\_\_\_  
Report Date 12-18-84

Test Report of 3 Inlet Nozzles For Combustion Engr. - Chattanooga

Our Order No. 612-1441 Item 1 Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No. \_\_\_\_\_ Specification SEE COVER PAGE

METALLURGICAL DEPARTMENT

## CHEMICAL ANALYSIS

EAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti							
-1882																		

## MECHANICAL PROPERTIES

EAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GRAIN SIZE
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Shear		
-1882	4C-924						TANGENTIAL		F. A.	T.	T.		
									+100	156	100	.090	
										158	100	.091	
										162	100	.093	
									+ 60	130	71	.083	
										139	81	.086	
										134	80	.085	
									- 30	70	41	.056	
										60	30	.047	
										80	42	.059	
									- 50	75	45	.057	
										65	33	.049	
									- 70	44	21	.031	
										14	13	.011	
										14	13	.012	
										23	20	.018	
									-110	6	0	.004	
										5	0	.003	
										7	0	.003	

HEAT TREATMENT				OTHER TESTS (SEE ATTACHMENTS)		ULTRASONIC INSPECTED PER.	
TO F	HRS. UP	HRS. HOLD	NOTES				
				DROP WT. NDT <input type="checkbox"/>	MAGNETIC PARTICLE INSPECTED PER.		
				HEAT INDICATION <input type="checkbox"/>			
				JOMINY <input type="checkbox"/>			
				OTHER <input type="checkbox"/>			

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS.

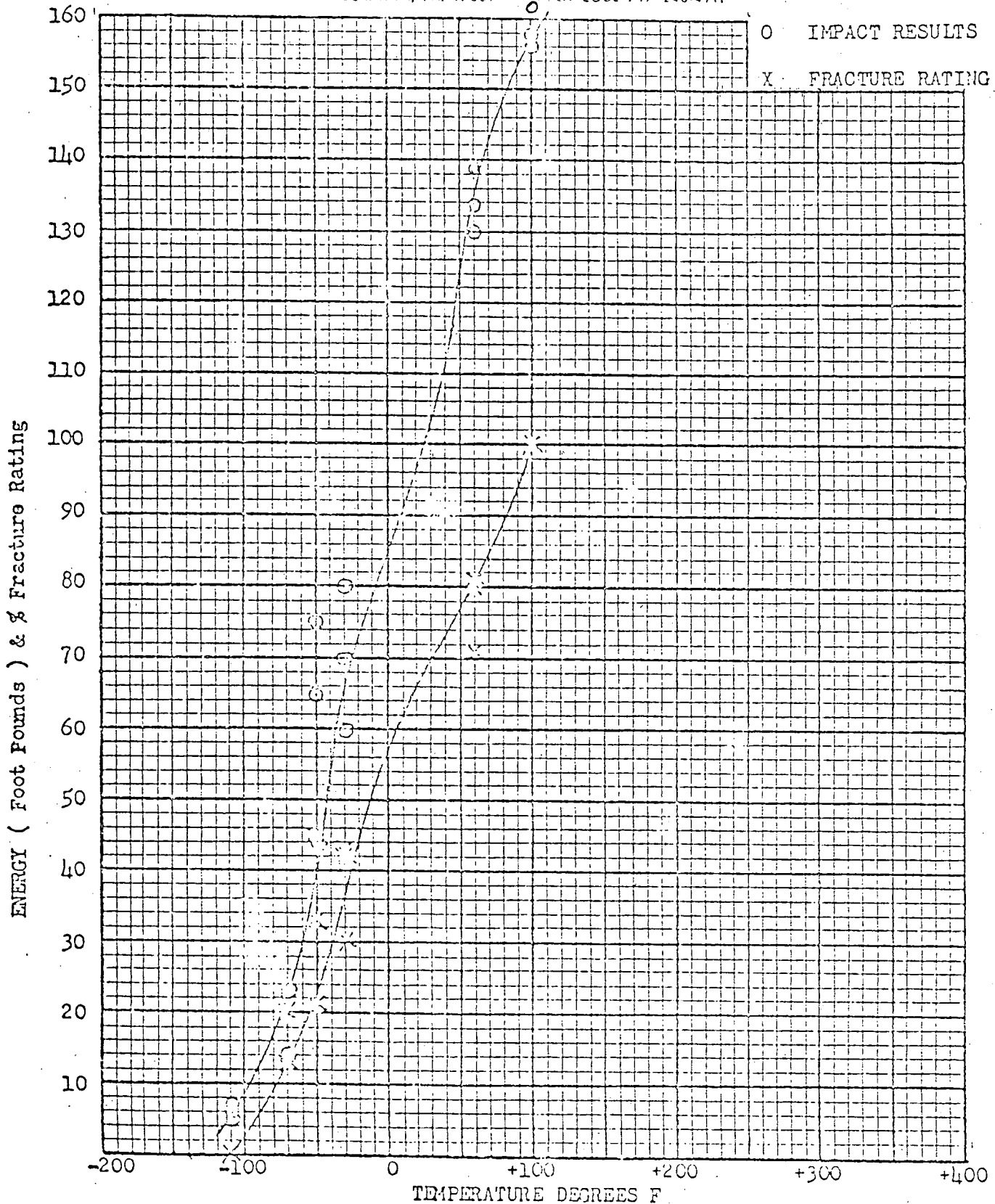
*[Signature]*

# STANDARD STEEL

DIVISION OF TITANIUM METALS CORPORATION OF AMERICA

BURNHAM, PA. 17009

APEA CODE 717 248-4911



SSD ORDER NO.- 612-1441

CUST. ORDER NO.- 43-83310

SERIAL NO.- 4C-924

HEAT NO.- EV-1882

# STANDARD STEEL

Test Report of 3 Inlet Nozzles For Combustion Engr. - Chattanooga

Division of Titanium Metals Corporation of America

Our Order No. 612-1441 Item 1 Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No.                      Specification SEE COVER PAGE

## METALLURGICAL DEPARTMENT

### CHEMICAL ANALYSIS

EAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti							
-1925	.22 .23	.29 .30	.010 .010	.64 .68	.010 .011	.69 .70	.33 .35	.66 .64	.027 .028	Ladle Check								

### MECHANICAL PROPERTIES

EAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GRAIN SIZE
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Shear		
-1925	4C-925 00	91,500	72,000		24.5	66.0	Tang.	00	+10	52	46	.045	
	1800	93,000	72,500		24.5	67.0				58	38	.046	
	#3	Tangential Specimens								60	42	.047	
								1800	+10	52	41	.042	
										78	53	.059	
										34	31	.028	
		DROP WEIGHT TEST											
		Location	Temp.										
		00	00	= Break									
		1800	+200	= No Break									
		00	+100	= Break									
		1800	+200	= No Break									
		00	+200	= No Break									
		NDTT = +100F											

C-6829-3

72170

Principal direction of greatest work during forging - tangential.

### HEAT TREATMENT

### OTHER TESTS (SEE ATTACHMENTS)

### ULTRASONIC INSPECTED PER.

### MAGNETIC PARTICLE INSPECTED PER.

	HRS. UP	HRS. HOLD	NOTES
20	6	10	Water Quench
30	4	13	Air Cool
Insulated			Post Weld Heat
treatment			
50	+25F	40	Fce. cool to 600F @ 100F/Hr.

DROP WT. NDT ☐  
HEAT INDICATION ☐  
JOMINY ☐  
OTHER ☐

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND CONTAINED IN THE COMPANY RECORDS.

*Handwritten signature and date*

## STANDARD STEEL

Division of Titanium Metals Corporation of America

BURNHAM, PA. 17009

METALLURGICAL DEPARTMENT

Test Report of

3 Inlet Nozzles

For

Combustion Engr.-Cattanooga

Our Order No.

612-1441 Item 1

Customer's Order No. 43-83310

Car No.

Specification

SEE COVER PAGE

## CHEMICAL ANALYSIS

EAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti							
-1925																		

## MECHANICAL PROPERTIES

EAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	% RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GRAIN SIZE
			0.2% OFFSET	0.02% OFFSET				Location	OF	Ft. Lbs.	% Shear		
-1925	4C-925						TANGENTIAL		F. A. T. T.				
									+90	113	100	.075	
										120	100	.078	
										112	100	.075	
									+60	93	73	.070	
										110	100	.072	
										86	69	.062	
									+30	50	40	.041	
										43	42	.036	
										52	47	.042	
									-30	26	31	.019	
										32	23	.022	
										30	22	.021	
									-60	18	15	.012	
										22	14	.014	
										17	14	.011	
									-90	9	5	.004	
										7	3	.003	
										9	0	.003	

## HEAT TREATMENT

TO OF	HRS. UP	HRS. HOLD	NOTES

OTHER TESTS  
(SEE ATTACHMENTS)

DROP WT. NDT ☐

HEAT INDICATION ☐

JOMINY ☐

OTHER ☐

ULTRASONIC INSPECTED PER.

MAGNETIC PARTICLE INSPECTED PER.

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS.

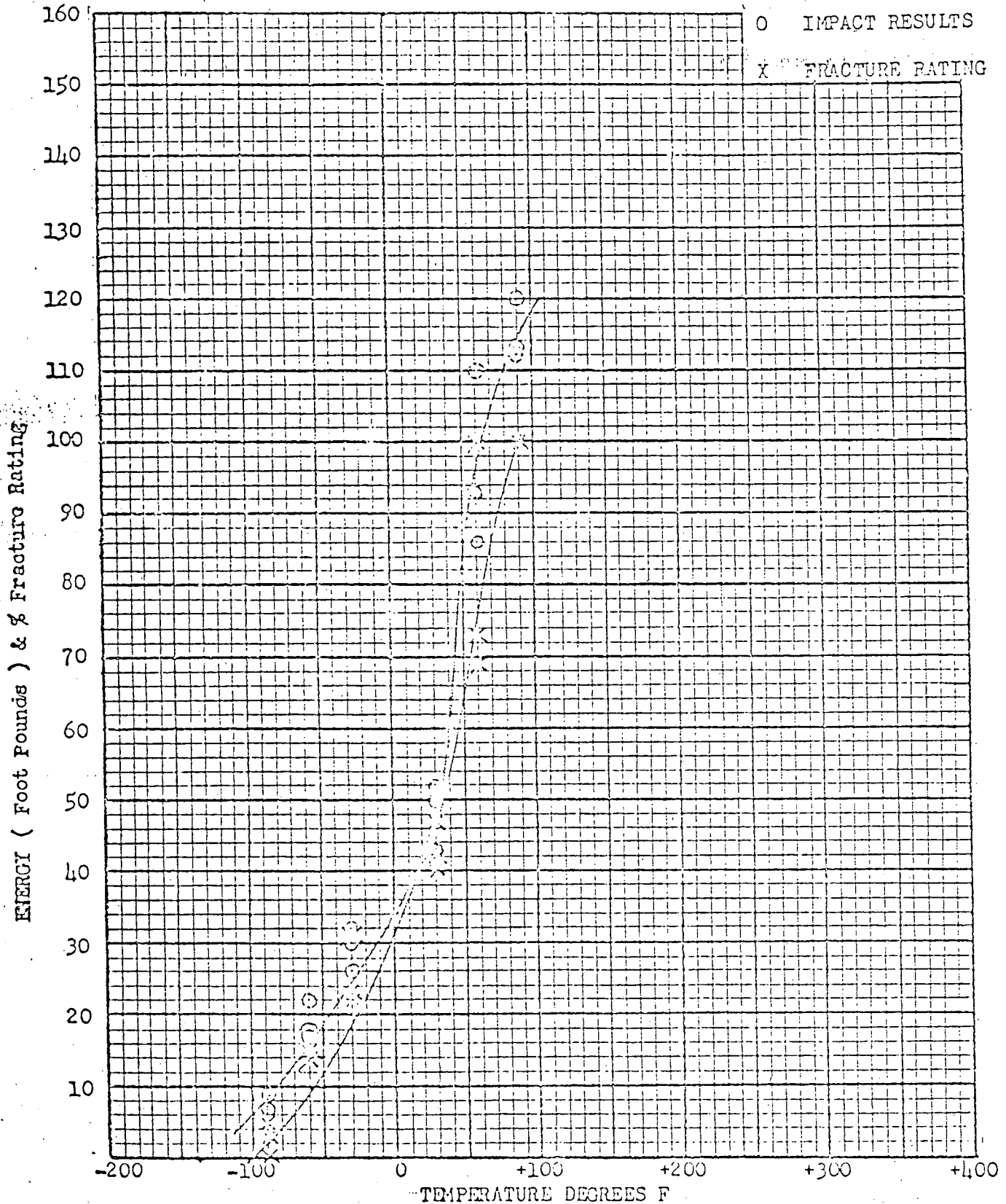
*R. A. N. [Signature]*

# STANDARD STEEL

DIVISION OF TITANIUM METALS CORPORATION OF AMERICA

BURNHAM, PA. 17009

AREA CODE 717 243-4911



SSD ORDER NO.- 612-1441

CUST. ORDER NO.- 43-83310



STANDARD STEEL

Test Report of 1 Inlet Nozzle

For Combustion Engr., Chatter

of Titanium Metals Corporation of America

Our Order No. 612-1414 Item 1

Customer's Order No. 43-83310

BURNHAM, PA. 17009

Car No. Specification SEE COVER PAGE

## METALLURGICAL DEPARTMENT

Report No. 184

Ref.

## CHEMICAL ANALYSIS

HEAT NO.	C	Si	P	Mn	S	Ni	Cr	Mo	V	Al	Ti						
EV-1926	.22	.26	.009	.59	.009	.70	.31	.66	.028	Ladle							
	.22	.28	.010	.65	.010	.68	.35	.64	.022	Check							

## MECHANICAL PROPERTIES

HEAT NO.	SER. NO.	TENSILE (psi)	YIELD STRENGTH (psi)		% ELONG in 2 IN.	RED. of AREA	BRINELL	IMPACT DATA				Lateral Expansion	GR.
			0.2% OFFSET	0.02% OFFSET				Location	OF	FT. LBS.	% Shear		
EV-1926	4C-926 0°	92,500	72,500		23.5	65.0	Tang.	0°	+ 10	55	37	.040	
	#4 180°	92,000	73,000		23.5	66.0				43	27	.033	
		Tangential Specimens								41	30	.032	
		DROP WEIGHT TEST								54	50	.045	
	Location	Temp.								82	69	.058	
	0°	-20° = Break								57	33	.045	
	180°	0° = Break											
	0°	+20° = No Break											
	180°	+10° = Break											
	0°	+20° = No Break											
	180°	+20° = No Break											
		NDTT= +10°F											

C-6829-4  
72170Principal direction of grain  
work during forging - tangential

## HEAT TREATMENT

OTHER TESTS  
(SEE ATTACHMENTS)

ULTRASONIC INSPECTED PER.

MAGNETIC PARTICLE INSPECTED PER.

UP TO OF	HRS. UP	HRS. HOLD	NOTES	
1620	6	10	Water Quench	DROP WT. NDT <input type="checkbox"/>
1280	4	13	Air Cool	HEAT INDICATION <input type="checkbox"/>
Simulated Post Weld Heat				JOMINY <input type="checkbox"/>
Treatment:				OTHER <input type="checkbox"/>
1150	+25°F	40	Free cool to 600°F @ 100°F/Hr.	

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS.

Division of Titanium Metals Corporation of America

BURNHAM, PA. 17009

Car No. \_\_\_\_\_ Specification SEE COVER PAGE

METALLURGICAL DEPARTMENT

Report No. 185

Ref.

## CHEMICAL ANALYSIS

[illegible]

## MECHANICAL PROPERTIES

THIS REPORT CERTIFIES THE ABOVE RESULTS ARE CORRECT AS REPORTED AND  
CONTAINED IN THE COMPANY RECORDS. 170

E.E. Magette  
Ext 3935

ATTACHMENT 5

# TECHALLOY ILLINOIS, INC.

URBANA, ILL. (215) 923-7131 TWX-910-642-3000

RAHNS, PENNA. 215-489-7211, TWX 510-660-6918 ATLANTA, GA. 404-MErose 4-2186  
CITY OF INDUSTRY, CALIF. 213-EDgewood 0-2211, TWX 910-584-1301

HOUSTON, TEXAS, 713-WAlnut 3-2581, TWX 910-831-1716  
HAMDEN, CONN., 203-ATwater 8-1017 • 1440 WHITNEY AVE.

CUSTOMER'S ORDER NO.	TECHALLOY ORDER NO.	DATE SHIPPED	SPECIFICATION
4034612	U97158	8/19/70	NONE

SHIPPED  
TO

COMBUSTION ENGINEERING  
911 WEST MAIN STREET-  
CHATTANOOGA, TENNESSEE 37408

NUCLEAR MARKED: T-309L  
QUALITY ITEM CONSISTING OF:

5033 LBS. .0625" C  
WIRE WELDING TEMPER BARE  
FINISH ON REELS

GENTLEMEN: WE HEREBY CERTIFY THAT MATERIAL REFERRED TO ABOVE CONFORMS TO THE PHYSICAL  
AND CHEMICAL TESTS AS FOLLOWS AND IS IN ACCORDANCE WITH SPECIFICATIONS.

HEAT	C.	Mn.	Si.	S.	P.	Cr.	Ni	Cu.	N	Fe.	AL	TL	CL + TL	VA	Co.
77820	.019	1.60	.31	.005	.017	24.73	12.78		.039					.034	.05

TEM	TENSILE STRENGTH	YIELD STRENGTH	ELON.	GRAIN SIZE	ROCKWELL	SHEAR
	128-139,000 PSI					

THIS IS IMPORTANT DATA  
PLEASE GIVE TO YOUR  
PURCHASING AGENT

Very truly yours,  
TECHALLOY ILLINOIS, INC.

B. BIGALKE  
AUTHORIZED OFFICIAL

**SANDVIK STEEL, INC. NUCLEAR  
QUALITY ENGR.**

COMBUSTION ENGINEERING  
911 West Main Street  
Chattanooga, Tennessee

JUN 23 1970

P. C. K.

Your Order Number No. 40-81073

Your Specification No.

Our Order Number No. P5832

Our Invoice Number No. 147142

**CERTIFICATE OF ANALYSIS**

**Material:** SANDVIK TYPE 308L STAINLESS STEEL WELDING WIRE

1/16" DIA. X 250# REELS Net Wt. 2000#

Cast No.	C %	Si %	Mn %	P %	S %	Cr %	Ni
5-70615	.014	.37	1.75	.005	.007	20.6	9.8

214

**SANDVIK STEEL, Inc.**

6/8/70

*Kenneth B. Nelson*  
Kenneth B. Nelson

METALLURGICAL RESEARCH AND  
DEVELOPMENT

TO: Don Binegar, Wayne Turner

JOB NUMBER H31255

CHEMICAL ANALYSIS OF WIRE-FLUX TEST WELD SAMPLE

SAMPLE NO.	1371	1372				
LAB NO.	D19667	D19668				
TYPE WIRE	309	308L				
SIZE WIRE	3/32"	3/32"				
HEAT NO.	4703	L2482				
FLUX	HS300	HS300				
LOT NO.	1684D	1684D				
SI	.57	.47				
S	.014	.014				
P	.028	.023				
MN	1.73	1.56				
C	.026	.022				
CR	23.16	20.47				
NI	12.08	9.78				
MO	.08	.16				
CB/TA	<.01/<.01	<.01/<.01				
TI	.01	<.01				
CO	.06	.11				
CU	.08	.03				
V	.04	.04				
N <sub>2</sub>	.042	.058				
FE						

*Don Martin*

TO: WAYNE TURNER, DON STEENE, PAUL KIEFER

JOB NUMBER E32255

CHEMICAL ANALYSIS OF WIRE-FLUX TEST WELD SAMPLE

SAMPLE NO.	1173	1175	1176	1178
LAB NO.	D11573	D11574	D11575	D11576
TYPE WIRE	309L	308L	308L	309L
SIZE WIRE	3/32"	3/32"	3/32"	3/32"
HEAT NO.	774292	L2343	L2260	4703
FLUX	HS300	HS300	HS300	HS300
LOT NO.	1193Y	1193Y	1193Y	1193Y
SI	.63	.52	.41	.52
S	.012	.012	.011	.012
P	.017	.017	.018	.020
MN	1.53	1.55	1.52	1.61
C	.031	.029	.025	.034
CR	22.38	20.40	20.75	22.51
NI	12.07	9.77	10.11	12.04
MO	.12	.09	.09	.10
CB/TA	<.01/<.01	<.01/<.01	<.01/<.01	<.01/<.01
TI	<.01	<.01	<.01	.01
CO	.10	.12	.14	.11
CU	.06	.06	.05	.06
V	.03	.03	.04	.03
N <sub>2</sub>	.047	.035	.038	.046
FE				

C. D. Norton