REVIEWED By Jake Mowat at 12:42 pm, Jul 24, 2019



Eaton Metal Products Company LLC

ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4800 FAX: (303) 296-5736

MANUFACTURER DATA REPORT

132" OD x 82'-10" S/S INLET SLUG CATCHER

for

ANADARKO E&P ONSHORE LLC

EMP JOB # 5361-1

TAG # V-1000

May 8, 2019



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FIBRICATORS PETROLEUM EQUIPMENT (303) 294-4000 TAX: (303) 294-5736

Table of Contents

- 1. Document Index Log
- 2. Fabrication Drawings
- 3. ASME Data Reports
- 4. ASME Design Calculations
- 5. Material Test Reports
- 6. Non-Destructive Examination (NDE) Reports
- 7. Weld Procedure Specifications
- 8. Inspection Records



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FIBRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

Document Index Log

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

EATON METAL PRODUCTS COMPANY LLC Document Index Log

	Boodino	nt maox Eog		
JOB NUMBER 5361-1	DA	ATA SHEET REG	SISTERED YES X	NO
DOCUMENT	STORAGE LOCATION	RETENTION DATE	QAM	AI
Manufacturer's Data Report	PWA - electronic	5/15/2024	Data Reports	H
☑ Nameplate Picture	PWA - electronic	5/15/2024	Data Reports	Z
Manufacturer's Drawings	PWA - electronic	5/15/2024	Anitys	and the second sec
 Design Calculations 	PWA - electronic	5/15/2024	Algulations	Contraction of the contraction o
J MTRs	PWA - electronic	5/15/2024	Manghian Becords	-H
WPS / PQR	PWA - electronic	5/15/2024	AN PQ	
✓ WPQ / Continuity Records	PWA - electronic	5/15/2024	WFS WPQ	2
✓ NDE Reports	PWA - electronic	5/15/2024	Not Bedords	E
Repair Procedure / Records	PWA - electronic	N/A	N/A	N/A
Process Control Sheets (ITP)	PWA - electronic	5/15/2024	Inspection Records	Z
✓ Weld Map Description	PWA - electronic	5/15/2024	Inspedien Records	Ý
Paint Inspection Records	PWA - electronic	5/15/2024	Inspection Records	N/A
Hydrostatic Test Records	PWA - electronic	5/15/2024	Inspection Records	
PWHT Records	PWA - electronic	N/A	/ N/A	N/A
	PWA - electronic	N/A	N/A	N/A



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FIBRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

ASME Data Reports

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

	53	61-1 b #			FO	RM U-1A	MAN	UFACTU	RER'S DA	TA R	EPOR	T FO	R PRE	SSU	RE VESSE	LS	Co	rected			
	Se	282 erial #		As	(/ Requir	Alternative I ed by the F	orm fo rovisio	r Single Ch	amber, Comp SME Boiler ar	pletely nd Pres	Shop or ssure Ve	Field Ssel (Fabricate Code Rule	ed Ve es, Se	ssels Only) ection VIII, Di [,]	vision	(¹ Page	;opy e 1 of 2			
1. N	lanufacture	d and c	ertifie	ed by Ea	ton N	letal Pro	ducts	s Compa	iny LLC P	lant #	#3, 669	9 We	est Qui	nn F	Road Build	ding	#16, P	ocatello	, Idaho	, 83201	
2. N	lanufacture	d for 🦯	ANAI	DARKO E	E&P C	NSHOR	E LL(C, UNKC	WN, Colo	orado Jame a	and add	ress o	of Purcha	aser)							
3. L	ocation of I	nstallati	ion 🛓	Johnstov	vn Co	mpresso	or Sta	tion, Co	lorado		() (
4 T.		orizont	al		2	on			NI/A		(Name	and	address)	21 1				274		201	0
4. I <u>y</u>	/pe Horizon	tal or vertic	cal, tanl	k) (Mar	∠ nufacture	62 er's serial nur	nber)		(CRN)				D-530 (Drawing r	numbe	r)		(Natio	214 Inal Board nu	umber)	(Year b	9 uilt)
5. /	ASME Code	e, Sectio	on VI	II, Divisior	1	[Edition and	2017/ Addenda	/ N/A a, if applicabl	e (date)]		(Cod	N/ e Case	'A e numbers])			[Spe	N/A cial service p	A Der UG-120	D(d)]	
6. S	hell:	S	SA-51	6-70			375 in			0 in				11'	(OD)				82' 10"		
		(Material	spec. r	number, grade	e)	(Nomi	nal thickr	ness)	(Coi	rr. allow	r.)		(Inner c	liameter)			[Le	ngth (over	all)]	
					Flange				Body Flang	ges or	n Shells	5					E	Bolting			
No.	Туре		ID	OD	Thk	Min Hu	b Thk	Ma	terial	Atta	iched	Lo	cation	N	um & Size	Bo Ma	olting aterial	Washer th	(OD, ID, k)	Washer Materia	
N/A	N/A	N/#	A	N/A	N/A	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
7. S	eams:[Lor	Typ ng. (welded	e 1, d, dbl., :	Butt sngl., lap, butt	t)] [F	Full R.T.(spot or f	ull)]	100 (Eff.,%)	N/A (H.T. temp)	(1	N/A Time, hr)	[Ty Girth. (wel	ype ded, d	1, Butt ol., sngl., lap, b	outt)]	S [R.T. (s	pot pot or full)]	85 (Eff.,	6 (No. of c	; ourses)
8. ⊢	leads: (a)	Materia				SA- (Spec.	516-7 no., gra	'O de)			(b) N	/later	ial				SA-5 (Spec. n	16-70 o., grade)			
[Location (Top Ends	, Bottom,)	, 1	Minimum Fhickness	Co	orrosion owance	Crow	n Radius	Knuckle Ra	idius E	Elliptical	Ratio	Conical Ang	Apex le	Hemispher Radius	ical D	Flat iameter	Side to	Pressur Conca	e (Convex or ave)	
(a)	End			.85		0		N/A	N/A		2:1		N//	4	N/A		N/A		Conc	ave	
(b)	End			.85		N/A		N/A	N/A		2:1		N/#	4	N/A		N/A		Conc	ave	
									Body Flang	jes on	Heads			-				- <i>w</i>			
	Location	Тур	е	ID	OD	Flang	e Thk	Min Hub Thk	Mate	erial	H	ow At	tached		lum & Size	Bolt	ing Mate	erial Wash	er (OD,	Washer Mate	erial
a)	N/A	N/A		N/A	N/A	N/A		N/A	N/A		N/A					N/A		N/A	uik)	N/A	-
9. N	IAWP	2	250 p (Intern	osi al)			(Ex	N/A (ternal)		at m	nax. ter	mp.			125 °F			N/A (Externa	al)		
М	in. design n	netal tei	mp.	-20 °F	-	at		250 psi			Hydro	o, pne	eu., or c	omb	. test press	sure		HYDR	O at 32	25 psi	
Pi	oof test		_								N/A										
0. N	ozzles, insp	ection a	and s	afety valv	e oper	nings:															
Purp	ose (Inlet, Ou Drain, etc.)	itlet,	No.	Diameter	or	Туре	N	Ma	terial		Nozzl	e Thio	ckness	Rei	nforcement	/	Attachm	ent Details	L	ocation (Insp	<i>.</i>
	Manwav		3	20	R	F150WN	SA	-106B	SA-10)5	.5		0	S	A-516-70	UW	·16.1 (d)	Butt we	eld Ir	n Shell/ Hea	d
	Inlet/Outlet		2	24	R	F150WN	SA	A-106B	SA-10)5	.5		0	S	A-516-70	UW	·16.1 (d)	Butt we	ld		
	Various		3	2	R	F150LWN	S	A-105			.53		0	I	nherent	UW	·16.1 (d)				
	Various		3	3	R	F150LWN	S	A-105			1.02	2	0	<u> </u>	nherent	UW	·16.1 (d)				
	various evel Gauge		3	2		F150LWN	5	A-105 A-105			1.24	5	0	<u> </u>	nherent		·16.1 (d) .16 1 (d)				_
•	LAHH		1	4	R	F150LWN	S	A-105			1.30	5	0	I	nherent	UW	·16.1 (d)				
	Boot		1	36	R	F150WN	SA	A-106B	SA-10)5	.5		0	S	A-516-70	UW	·16.1 (d)	Butt we	ld		
Addit	ional Nozzles	s - See A	Attache	ed U-4																	
11. S	upports: S	kirt	No (Yes or	no) Lug	JS (Nu	0 L mber)	egs	0 (Number)	Other			(C	addles Describe)			Attach	ed	Wel (ded to W Where and	/ear Pad d how)	
12. Re	emarks: Manu	facturer's	Partia	al Data Repo	orts prop	perly identif	ied and	signed by	Commissione	ed Insp	ectors, ł	nave b	been furni	ished	for the follow	ing ite	ms of the	e report:			
Ν	/A																				-
	<u>-</u>						(Name	of part, item	number, Manut	facturer'	's name a	and ide	ntifying sta	amp)	F AAAAAAAAAAAAA						
	Material Safety R (3) 20" 3 - 1/8" H	is e elief RF1501 eavy 1	Dev Dev BLIN Hex	ot from vice By ID attac Studs (impa Othe ched SA-1	ct tes rs to ves 94-2H)	sel v	per UC with (2 h	G-20(f) 20) 1 -	<u>at t</u> 1/8"	he De	esic l Tř	gn MDM nread	IT o Stu	<u>f -20°F</u> ds (SA-	193-	B7) a	and (40) 1		
-	-, 5 II			20400		(Juci	-													

	FORM U-1A	Pa	ige 2 of 2
Manufactured by Eaton Metal Produ		iinn Road Building #16, Pocatello, Idaho, 83201	
Manufacturer's Serial No. 282	CRN <u>N/A</u>	National Board No. 274	
	CERTIFICATE OF SHOP/FIELD COMPL		
We certify that the statements made in conform to the ASME BOILER AND P expires December 13, 2019	n this report are correct and that all details of RESSURE VESSEL CODE, Section VIII, Di	of design, material, construction, and workmanship of this ve vivision 1. "U" Certificate of Authorization Number 3296	essel 2
Date 07/25/2019 Co. name	Eaton Metal Products Company LLC F (Manufacturer)	Plant #3 Signed (Representative)	<u>#</u>
	CERTIFICATE OF SHOP/FIELD	DINSPECTION	
Vessel constructed by Eaton M	letal Products Company LLC Plant #3 at	669 West Quinn Road Building #16, Pocatello, Idaho, 83201	
I, the undersigned, holding a valid con	mission issued by The National Board of B	oiler and Pressure Vessel Inspectors and employed by	
The Hartford Steam Boiler Inspection and Insu	rance Company, of Hartford, CT		
have inspected the component descril and state that, to the best of my know AND PRESSURE VESSEL CODE, Se warranty, expressed or implied, conce nor his/her employer shall be liable in this inspection.	bed in this Manufacturer's Data Report on edge and belief, the Manufacturer has cons action VIII, Division 1. By signing this certific rning the pressure vessel described in this I any manner for any personal injury or prope	July 25, 2019 structed this pressure vessel in accordance with ASME BOI cate neither the Inspector nor his/her employer makes any Manufacturer's Data Report. Furthermore, neither the Insp erty damage or a loss of any kind arising from or connected	ILER pector d with
Date 07/25/2019 Signed	Comm (Autrionzed Hispector)	missions 14735, UTS0635 (National Board Authorized Inspector Commission number))
3377420 exe: v6.3.46		Form and version:	: U1A-19

3377420 exe: v6.3.46

5361-1 Job # 	FORM U-4 MANUFACTURER'S DATA REPOR As Required by the Provisions of the ASME Boiler and Pressu	T SUPPLEMENTARY SHEET re Vessel Code Rules, Section VIII, Division 1	Corrected Copy
1. Manufactured and certified	by Eaton Metal Products Company LLC Plant #3, 669 W (Name and ad	Yest Quinn Road Building #16, Pocatello, Idal Idress of Manufacturer)	ho, 83201
2. Manufactured for ANADA	ARKO E&P ONSHORE LLC, UNKOWN, Colorado		
	(Name and address of	of Purchaser)	
3. Location of installation <u>J</u>	ohnstown Compressor Station, Colorado (Name ar	id address)	
4 Type Horizo	ntal N/A	282	
(Horizontal, vertica	I, or sphere) (Tank, separator, heat exch., etc.)	(Manufacturer's serial number)	
N/A (CRN)	D-5361-1 (Drawing number)	274 (National Board number)	2019 (Year built)
Data Report Item Number	Remarks		、

Additional nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet,	No	Diameter or	Turne	Material		Nozzle Thickness		Reinforcement	Attachment Details		Location (Insp.
Drain, etc.)	INO.	Size	Type	Nozzle	Flange	Nom.	Corr.	Material	Nozzle	Flange	Open.)
Boot Interface	1	3	RF150LWN	SA-105		.6	0	Inherent	UW-16.1 (d)		

Certificate of Authoriza	tion: Type	"U" No.	32962	Expires December 13, 2019	
Date 07/25/2019	Name	Eaton Metal Products Company (Manufacturer)	LLC Plant #3	Signed _ Ache Houst	
Date 07/25/2019	Name	(Authorized Inspector)	Commissions	(Representative) 14735, UTS0635 (National Board Authorized Inspector Commission number)	



EATON METAL PRODUCTS COMPANY LLC, PLANT #3

psig at

050

-





Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

Fabrication Drawings

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1



0° (N9A) (N8) N2 315° 45° N9A 6'-6 NOZ N2 6'-2 N8 & $\langle N12 \rangle$ ZON 2'-9 -270° · 90° ----(n11) N13 ထု 3′-0 6'-2 N9B & N10 2. 6'-6 BP & NOZ 1 5'-5 NOZ N15A ́мз` (N15A) <u>6'-3</u> NOZ M3 ZON SADDLE GROUND ING-LUG 13 '-1 <u>1/8</u> GSKT 5/8 (N15B)-~ (N17A) ·.... t-1/4 6'-6 7/8 B00T <u>3</u>,-6 ТҮР N16 FS Ľ-' 4 (N15C)-- (N17B) Ģ 1'-7 ŧ. TYP TYP 4'-4 4'-4 (N9B) (N10) (N13) (N18) 180° LEFT END VIEW А D-5361-1





	Thk Inches	Width Inches	Length Inches	Material Spec	See Note	MTR	Weights
S	1.500	22	129	A-36			1194
rs	1.500	22	129	A-36			1187
	0.750	53,813	124.75	A-36			1168
	0.750	18	53.813	A-36			824
	0.750	8.625	25.375	A-36			368
	0.750	8.625	13.688	A-36			199
	0.750	8.625	10.125	A-36			74
	0.375	30	175.688	SA-516-70		Х	1121
	0.250	2	3	A-36			-



MAT	ERIAI						
a	Thk Inches	Width Inches	Length Inches	Material Spec	See Note	MTR	Weights
				SA-105		X	199
				SA-105		Х	271
LINGERSIL	C-4401			KL INGERS 1L			1
	1.250	3	5.5	A-36		Х	8
	1.250	4.188	4.813	A-36		Х	5
	1.250	4.188	4.813	A-36		X	5
			15.5	A-36			3
		1	12	A-36		X	1
	-		6.25	SA-193-87			35
		<u></u>		SA-194-2H			23
				STEEL			-
	1		1.5	STEEL			-
	0.500		8	SA-106-B		Х	69
″DD	0.750	Shop 1	O FORM	SA-516-70		X	119
						.A	l





						_	
)F MA	TERL	AL					
	Thk Inches	Width Inches	Length Inches	Material Spec	See Note	MTR	Weights
WN XH B	DRE (35″ I	.0.)		SA-105		Х	270
		· · · · · · · · · · · · · · · · · · ·	The collect I conjugate in a second sec	SA-105		Х	542
			9	SA-105		Х	239
	LALING CONTRACTOR		12.25	SA-105		Х	80
			9	SA-105		X	114
				SA-105		Х	13
			9	SA-105		X	44
			3.375	SA 105		X	8
	0.500		9.5	SA-106-B		X	199
	0.600		10	SA-106-B		X	16
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0.300		2	SA-106-B		X	2
TANS	0.500	10.938	119.5	SA-516-70		X	173
Roll	1.000			SA-516-70		X	616
ROLL	0.750			SA-516-70		X	474
	0.500			A-36			12
	0.500	6	8	SA-516-70		X	7
3RK)	0.500	3.75	6	SA-516-70		X	6
				SA-105		X	25
				SA-105		X	11
YPE. C-44	401	1		KLINGERSTL		1	1
YPE, C-44	401			KL INGERS I L			_
			4.25	SA-193-B7			4
				SA-194-2H			3
			3.75	SA-193-B7			1
				SA-194-2H			-
			······································	CONTRACTOR		A REAL PROPERTY AND A REAL PROPERTY.	





2 P1-P1-FCAW-AL P1-P1-GMAWP-AL

				BILL OI
5hip Pcs	Mark No.	Assy Pcs	Name	Description
	5361-1E-1	1	HOUSING	VANE PAK HOUSING (BY AMA
	5361-1E-2	1	VANE PAK	VANE PAK W / DISTRIBUTOR
	5361-1E-3	1	PLATE	1/2" WEIR PLATE, SKETCH



BILL O WELDING PROCEDURE KEY Ship Pcs Assy Pcs 5 P1-P8-FC AW - AL P1-P8-GMAW P-A Mark No. Name Description 1/2" PLATE, SKETCH W/H 5361-1F-1 4 PLATE P1-P8-GTAW - AL 5361-1F-2 2 BEAM W6 x 20 W/HOLES & SLO 6 P8-P8-GMAWP-A 5361-1F-3 4 1/2" PLATE, SKETCH W/H PLATE P8-P8-GTAW-AL 5361-1F-4 4 PLATE 1/2" PLATE, SKETCH P8-P8-SMAW-A 3/8" HEAVY HEX 5361-1F-5 156 NUT 5361-1F-6 2 BAFFLE DISTRIBUTION BAFFLE (BY 90'-4 11/16 +/- 0.A.L. 82'-10 S/S 16 '-11 15 '-3 52.53 see detail B (C) 44 aifi) (<u>him</u> ELEVATION Ø, -SYMM ABOUT THIS ¢ NOTE: ALL DIMENSIONS ARE TAKEN FROM DATUM WHICH IS LOCATED 12" TO THE LEFT OF RIGHT H/S SEAM ®Æ 4 3 MK-5 6 TO MK-1/2 TYP 2 6 TACK MK-1 TO SHELL 5 TYP 5 ΤYΡ (6)6 1/4 <u>3'-0 7/8</u> MK-6 (REF) 2 2 6 TYP 1 1/4 5 TYP 5'-2 1/8 MK-6 (REF) 1 3 3 6.2″ 5 1/4 1/2″ PL SHOP NOTES: ΤYΡ ΤYΡ MK-1 (TYP) 1/2' 1. BOLT MK-2 BEAMS TO MK-3 PLATE N. INF PL USING 3/8" BOLTS, (2) WASHERS & NUTS (PROVIDED BY AMACS) 1' - 84 3 2. ALIGN MK-5 NUTS TO 7/16" HOLES 1'-3 1'-3 IN MK-1 & -2 (SEE D-5361-1FA). DETAIL ″B″ BOLT MK-6 BAFFLE TO MK-1 RING SEC А AND MK-2 BEAM USING 3/8" BOLTS & WASHERS (PROVIDED BY AMACS) TYP (2) PLACES WORK THIS DWG WITH D-5361-1. -1A & -1FA

F MA	TERI	AL					
	Thk Inches	Width Inches	Length Inches	Material Spec	See Note	MTR	Weights
OLES	0.500	50,125	100.25	SA-240-304		X	175
TS			123,5	304 SS			412
OLES	0.500	6	7	SA-240-304		Х	23
	0.500	5.25	7	SA-240-304		Х	17
				304 SS			5
AMACS)				304L SS			900



SHOP NOTE: ALL INTERNAL WELDS MUST BE SUITABLY PREPPED FOR INTERNAL LINING. ALL SHARP EDGES & ROUGH WELD CONTOURS ARE TO BE ROUNDED/SMOOTHED OUT. POROSITY & WELD SPATTER SHALL BE REMOVED.



Date	By	Chk 'd	Revision Description
			EATON METAL PRODUCTS CO LLC
HITA	PRODUCTS	N)	DENVER SALT LAKE CITY
			BAFFLE DETAILS
n By:		RT	<u>132″ UU x 82′-10″ S/S INLET SLUG CATCHER</u> P.O. # 4500100246 - TAG # V-1000
9	/18/	2018	Loc: JOHNSTOWN COMPRESSOR STATION, COLORADO
í By:		DB	Cust: ANADARKO E&P ONSHORE LLC
	10/	5/18	Job No. 5361-S01 No. D-5361-1F
	Date	Date By 9/18/ 3 By: 10 / 10 /	Date By Chk'd Image: Chk'd Image: Chk'd Image: Chk'd









ILES	Inches	Inches	Inches	Spec	See Note	MTR	Weights
	0.500	30	36	SA-240-304			87
	0.500		18.688	SA-312-TP304			144
	0.500		23.75	SA-312-TP304			14 9
	0.500		10,563	SA-312-TP304		X	59
	0.500	4	12	SA-240-304			1
	0.500	2.25	3.5	SA-240-304			Ĺ
	0.500	2.5	70	SA-240-304		X	49
	0.500	5.5	7.813	SA-240-304	1	X	12
	0.500	4	9.688	SA-240-304		X	20
LES	0.500	6	12	SA-240-304		X	1(
		-		22 1406			94.3
			74		YP 6		
5	► 6 1/2 1/2	2	8/L 0-,C		9		
DDEN	► 6 1/2 1/2 1/4	2		P 6 APP FOR COI	P) P) RO NSTR	VEI	
	A 6 1/2	2	TY	P 6 APP FOR COI DATE /// 57	9 9 RO NSTR	VEI	D QN ZZ
DDEN RITY	6 1/2 1/2 1/4 By Cnk'd			P 6 Revision Description	RO	VEI UCTI BY	
DDEN TY Date	6 1/2 1/2 1/4 By Cnk'd	EAT		P 6 Revision Description TAL PROI			
	6 1/2 1/2 1/4 By Chk'd	EAT		P 6 Revision Description TAL PROI VER SALT I			
DDEN NITY Date	6 1/2 1/2 1/4 By Chk'd			P 6 Revision Description ETAL PROI VER SALT I R DETAILS			
	6 1/2 1/2 1/4 By Chk'd			P 6 Revision Description TAL PROI VER SALT I R DETAILS -10" S/S INLET			

10/5/18 Job No. 5361-S01 No. D-5361-1G





		Width	enoth	Material	See		
	Inches	Inches	Inches	Spec	Note	MTR	Weights
	-						1551#
WN XH BO	RE (35"	.0.)	440 5	SA-105		X	270
	0.500	55.25	119.5	SA-516-70		X	874
. 2:1 SF=	<u>Z</u>			SA-516-70		X	228
			0	SA-105		X	10
	0 337		9 0.25	SA- 105		A V	12 /
	0.337		21.	SA-312-TP304		X	26
"B" RING	TYPF (-	4401	24	KLINGERS11			20
			6.75	SA-193-B7			51
				SA-194-2H			26
				W EL D I NG		FDUR	PE KEY
		P 5		P1-P1 5 P1-P8 P1-P8 6 P8-P8 P8-P8 P8-P8	I-EM14 3-FC A 3-GMA 3-GTA 3-GMA 3-GTA 3-SMA	¥K1-A W - AL W P-7 W - AI	A L L
	SHOP SUITA ALL SH ARE T & WEI	NOTE: A BLY PR HARP E O BE R LD SPA	ALL INT EPPED DGES & OUNDEE TTER S	ERNAL WELT FOR INTERN ROUGH WE SMOOTHED HALL BE RE FOR COL DATE	DS MU AL LI LD CC OUT. MOVED RO' NSTR	JST E NING DNTOU POR D. VEI	BE JRS OSITY D
. Dale	By Chk'd	FAT		TAL PROF		18.0	0110
	AN						
		BUUT					
	DT	$-132^{\prime\prime}$ (<u>DCTAILS</u> DD x_82'	-10" S/S INLE1	SLUG	<u>C A T C</u>	HER
эwn 8y:	KI 18/2019	P.0.	4500100	0246 - TAG #	V-1000)	
e: 7/	0/2010 01	Cust: AN	ADARKO	E&P ONSHORE L			
e:	10/5/18	- EMP Job No.	5361	-S01 No. E)-53	61-1	H



	Thk Inches	Width Inches	Length Inches	Material Spec	See Note	MTR	Weights
				SA-105		X	399
	1			SA-105		Х	541
LINGERSIL	C-4401			KLINGERSIL			2
	1.250	3	5.5	A-36		Х	16
	1.250	4.188	4.813	A-36		Х	9
	1.250	4.188	4.813	A-36		Х	9
			15.5	A-36			7
			12	A-36		Х	3
			6.25	SA-193-B7			70
				SA-194-2H			46
				STEEL			-
			1.5	STEEL			-
	0.500		20.563	SA-106-B		Х	357
	1.000	*		SA-516-70		X	586



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

ASME Design Calculations

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

Eaton Metal Products

4800 York Street

Denver, Colorado 80216

(303) 296-4800 General

COMPRESS Pressure Vessel Design Calculations

Customer: Anadarko Description: 132" OD x 82'-10" S/S Inlet Slug Catcher V-1000 **P.O.** # 4500100246 Job No.: 5361 By: RT **Date:** 10/5/18

Check By: 25 Date: 10/5/18

e da da com ca desta da contrema a c	ASME	Section VIII Di	vision 1, 2017 Editio	n		
Component		Ellipsoidal Head				
Material		SA-516 70 (II-D p. 18, In. 33)				
Attac	hed To		Shell			
Impact Tested	Normalized	Fine Grain Practice	Optimize MDMT/ Find MAWP			
No	No	Yes	No	No		
		Design Pressure (psi)	Design Temperature (°F)	Design MDMT (°F)		
Int	ernal	250	125	-20		
		Static Liq	uid Head			
Con	dition	P _s (psi)	H _s (in)	SG		
Ope	rating	4.7	130.275	1		
Test ho	Test horizontal		143.15	1		
		Dimen	sions			
Outer 1	Diameter	132"				
Head	Ratio	2				
Minimum	Thickness	0.85"				
Corrosion	Inner	0"				
	Outer	0"				
Leng	gth L _{sf}	2"				
Nominal T	`hickness t _{sf}	1"				
	******	Weight and	l Capacity			
		Wei	Capacity (US gal) ¹			
N	ew	5,1	1,368.52			
Cor	roded	5,004.26 1,368.52				
	un san selan sena sena sena sena sena sena sena se	Radiog	raphy			
Categor	y A joints	Full UW-11(a) Type 1				
Head to shell seam		Spot UW-11(a)(5)(b) Type 1				

¹ includes straight flange

Results Summary				
Governing condition	internal pressure			
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"			
Design thickness due to internal pressure (t)	<u>0.831</u> "			
Rated MDMT	-20°F			

ł

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	0.85"
MDMT ==	-20°F

۰÷,

Material is exempt from impact testing per UG-20(f) at the Design MDMT of -20°F.

Factor K						
$K = (1/6)^* [2 + (D / (2^*h))^2]$						
Corroded	$\mathbf{K} = (1/6)^* [2 + (130.3 / (2^*32.575))^2]$	1				
New	$\mathbf{K} = (1/6)^* [2 + (130.3 / (2^*32.575))^2]$	1				

Design thickness for internal pressure, (Corroded at 125 °F) Appendix 1-4(c)

- t = $P*D_0*K / (2*S*E + 2*P*(K 0.1)) + Corrosion$
 - = 254.7*132*1 / (2*20,000*1 + 2*254.7*(1 0.1)) + 0
 - = <u>0.831</u>"

% Extreme fiber elongation - UCS-79(d)

EFE =	$(75*t/R_{f})*(1 - R_{f}/R_{o})$
-------	----------------------------------

- $= (75*1/22.651)*(1-22.651/\infty)$
 - = 3.3111%

The extreme fiber elongation does not exceed 5%.

Shell

anne maga palan ne rida di awara wana dini ar 1 - n - n	ASME S	ection VIII Divis	sion 1, 2017 Edition	terret a Kator a la az portunya Sondern Katorana producti a datu a Marida		
Com	Component		Cylinder			
Material		SA-516 70 (II-D p. 18, ln. 33)				
Impact Tested	Normalized	Fine Grain Practice	PWHT	Optimize MDMT/ Find MAWP		
No	No	Yes	No	No		
		Design Pressure (psi)	Design Temperature (°F)	Design MDMT (°F)		
Int	ernal	250	125	-20		
		Static Liquid	l Head			
Con	dition	P _s (psi)	H _s (in)	SG		
Ope	rating	4.7	130.25	1		
Test ho	Test horizontal		143.125	1		
		Dimensio	ons			
Outer 1	Diameter	132"				
Le	ngth	994"				
Nominal	Thickness	0.875"				
Correction	Inner	0"				
Corrosion	Outer	0"				
		Weight and C	Capacity			
an de Mandolmen and an		Weight (lb)		Capacity (US gal)		
N	ew	100	100,929.05			
Cor	Corroded		100,929.05 57,334.99			
		Radiogra	phy			
Longitue	linal seam	Full UW-11(a) Type 1				
Left Circum	ferential seam	Spot UW-11(a)(5)(b) Type 1				
Right Circun	ıferential seam	Spot UW-11(a)(5)(b) Type 1				

Results Summary					
Governing condition	Internal pressure				
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"				
Design thickness due to internal pressure (t)	0.8363"				
Rated MDMT	-20 °F				

 UCS-66 Material Toughness Requirement	S
Governing thickness, t _g ==	0.875"
MDMT =	-20°F

Design thickness, (at 125 °F) Appendix 1-1

- $= P^*R_0 / (S^*E + 0.40^*P) + Corrosion$
 - = 254.7*66 / (20,000*1.00 + 0.40*254.7) + 0
 - = 0.8363''

t

% Extreme fiber elongation - UCS-79(d)

EFE =	(50*t / R _f)*(1 - R _f / R _o)
-------	---

- $= (50*0.875 / 65.5625)*(1 65.5625 / \infty)$
- = 0.6673%

The extreme fiber elongation does not exceed 5%.

Allowable Compressive Stress, Hot and Corroded- ScHC, (table CS-2)

А	=	0.125 / (R ₀ / t)
	==	0.125 / (66 / 0.875)
	=	0.001657
В	=	14,214 psi
S	=	20,000 / 1.00 = 20,000 psi
S_{cHC}	=	min(B, S) = 14,214 psi
Allowable Com	pressi	ve Stress, Hot and New- S _{cHN}
\mathbf{S}_{cHN}	=	S _{cHC}
		14,214 psi
Allowable Com	pressi	ve Stress, Cold and New- S _{cCN} , (table CS-2)
А	-	0.125 / (R ₀ / t)
	11	0.125 / (66 / 0.875)
	=	0.001657
В	=	14,214 psi
S	=	20,000 / 1.00 = 20,000 psi
S _{cCN}	=	min(B, S) = 14,214 psi
Allowable Com	pressiv	ve Stress, Cold and Corroded- S _{cCC}
S_{cCC}	=	S _{cCN}
	=	14,214 psi

Allowable Compressive Stress, Vacuum and Corroded- ScVC, (table CS-2)

А	=	0.125 / (R _o / t)
	=	0.125 / (66 / 0.875)
		0.001657
В -	=	14,214 psi
S	=	20,000 / 1.00 = 20,000 psi
S _{cVC}	=	min(B, S) = 14,214 psi

ASME Section VIII Division 1, 2017 Edition							
Component		Ellipsoidal Head					
Material		SA-516 70 (II-D p. 18, ln. 33)					
Attac	hed To	Shell					
Impact Tested Normalized		Fine Grain Practice PWHT		Optimize MDMT/ Find MAWP			
No	No	Yes	No	No			
		Design Design Pressure (psi) Temperature (Design MDMT (°F)			
Int	ernal	250	125	-20			
		Static Liq	uid Head				
Con	dition	P _S (psi)	H _s (in)	SG			
Ope	rating	4.7	130.275	1			
Test horizontal		5.17	1				
		Dimen	sions				
Outer Diameter		132"					
Head Ratio		2					
Minimum	Thickness	0.85"					
Corrosion	Inner	0"					
Corresion	Outer	0"					
Leng	gth L _{sf}	2"					
Nominal T	'hickness t _{sf}	1"					
		Weight and	Capacity				
		Wei	Capacity (US gal) ¹				
New		4,9	1,368.52				
Cori	roded	4,939.01 1,368.52					
	Radiography						
Categor	y A joints		Full UW-11(a) Typ	le 1			
Head to :	shell seam	Spot UW-11(a)(5)(b) Type 1					

¹ includes straight flange

Results Summary						
Governing condition	internal pressure					
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"					
Design thickness due to internal pressure (t)	<u>0.831</u> "					
Rated MDMT	-20°F					

5

UCS-66 Material Toughness Requirements				
Governing thickness, $t_g =$	0.85"			
MDMT =	-20°F			

Material is exempt from impact testing per UG-20(f) at the Design MDMT of -20°F.

Factor K						
K = (1/6)*	$[2 + (D / (2*h))^2]$					
Corroded	$\mathbf{K} = (1/6)^* [2 + (130.3 / (2^*32.575))^2]$	1				
New	$K = (1/6)^* [2 + (130.3 / (2^*32.575))^2]$	1				

Design thickness for internal pressure, (Corroded at 125 °F) Appendix 1-4(c)

 $t = P^*D_0^*K / (2^*S^*E + 2^*P^*(K - 0.1)) + Corrosion$

- = 254.7*132*1 / (2*20,000*1 + 2*254.7*(1 0.1)) + 0
- = <u>0.831</u>"

% Extreme fiber elongation - UCS-79(d)

EFE = $(75*t / R_f)*(1 - R_f / R_o)$

- $= (75*1/22.651)*(1-22.651/\infty)$
 - = 3.3111%

The extreme fiber elongation does not exceed 5%.

Liquid Level

ASME Section VIII Division 1, 20	17 Edition
Location from Center Line (in)	65.125
Operating Liquid Specific Gravity	1

Building Code: ASCE 7-10						
Elevation of base above grade	1.00 ft					
Increase effective outer diameter by	1.00 ft					
Wind Force Coefficient, Cf	0.6000					
Risk Category (Table 1.5-1)	III					
Basic Wind Speed, V	120.0000 mph					
Exposure Category	С					
Wind Directionality Factor, Kd	0.9500					
Topographic Factor, Kzt	1.0000					
Enforce minimum design load of 16 psf per ASCE 29.8:	Yes					
Hazardous, toxic, or explosive contents	No					

Wind Pressure (WP) Calculations

```
Kz = 2.01 * (Z/z_g)^{2/\alpha}
= 2.01 * (15.00 / 900.00)^{0.2105}
= 0.8489
qz = 0.00256 * Kz * Kzt * Kd * V<sup>2</sup>
```

```
= 0.00256 * 0.8489 * 1.0000 * 0.9500 * 120.0000<sup>2</sup>
= 29.7286 psf
```

```
qz = 0.6 * max[ 29.7286, 16.0000 ]
= 17.8372 psf
```

Note: The 0.6 factor is the wind load combination factor from Section 2.4.1.

	Table Lookup Values
where and and	$\alpha = 9.5000, z_g = 900.00 \text{ ft}$ [Table 26.9-1, page 256]

Shear calculations are reported in the saddle report.

ASME Section VIII Division 1, 2017 Edition						
Saddle Material	SA-36					
Saddle Construction	Centered web					
Welded to Vessel	Yes					
Saddle Allowable Stress, S _s	21,6	00 psi				
Saddle Yield Stress, S _y	36,0	00 psi				
Foundation Allowable Stress	1,35	50 psi				
Design Pressure	Left Saddle	Right Saddle				
Operating	254	.7 psi				
Test	330.	17 psi				
Dimensio	ns	la de mante a constante a constante a constante en constante en constante en constante en constante en constant				
Right saddle distance to datum	1	86"				
Tangent To Tangent Length, L	9	98"				
Saddle separation, L _s	5!	98"				
Vessel Radius, R	66"					
Tangent Distance Left, A _l	200"					
Tangent Distance Right, A _r	200"					
Saddle Height, H _s	78"					
Saddle Contact Angle, θ	140°					
Web Plate Thickness, t _s	0.75"					
Base Plate Length, E	129"					
Base Plate Width, F	22"					
Base Plate Thickness, t _b	1	.5"				
Number of Stiffening Ribs, n		7				
Largest Stiffening Rib Spacing, d _i	20.9	583"				
Stiffening Rib Thickness, t _w	0.	75"				
Saddle Width, b	1	8"				
Reinforcing	Plate					
Thickness, t _p	0.375"					
Width, W _p	30"					
Contact Angle, θ _w	152°					
Bolting	*****	****				
Material	A-	307				
Polt Allowable Sheer	10,000 psi					

Description	2.75" series 8 threaded			
Corrosion on root	0"			
Anchor Bolts per Saddle	4 0.45			
Base coefficient of friction, µ				
Weigh	t	********		
	Operating, Corroded	Hydrotest		
Weight on Left Saddle	308,872 lb	308,926 lb		
Weight on Right Saddle	310,287 lb	310,325 lb		
Weight of Saddle Pair	/eight of Saddle Pair 6,290 lb			

Notes

(1) Saddle calculations are based on the method presented in "Stresses in Large Cylindrical Pressure Vessels on Two Saddle Supports" by L.P. Zick.

Stress Summary										
Load	Condition	Saddle	Bending + pressure between saddles (psi)				Bending + pressure at the saddle (psi)			
			S ₁ (+)	allow (+)	S ₁ (-)	allow (-)	S ₂ (+)	allow (+)	S ₂ (-)	allow (-)
Seismic	Operating	Right Saddle	<u>10,905</u>	24,000	<u>1.426</u>	17,057	18,763	24,000	<u>9,285</u>	17,057
		Left Saddle					<u>18,763</u>	24,000	<u>9,285</u>	17,057
	Operating	Right Saddle	<u>10,560</u> 24,000	1.082	17.057	17,899	24,000	<u>8.420</u>	17,057	
Wind		Left Saddle		24,000	1.002	17,007	17.899	24,000	<u>8,420</u>	17,057
w nu	Test	Right Saddle	12 255	<u>13,355</u> 34,200	<u>1.068</u>	17,057	20,708	34,200	<u>8,421</u>	17,057
		Left Saddle	10,000				20,708	34,200	<u>8,421</u>	17,057
Weight	Operating	Right Saddle	10.530	20,000	<u>1.061</u>	14,214	<u>17,899</u>	20,000	<u>8,420</u>	14,214
		Left Saddle	10,339				17,899	20,000	<u>8,420</u>	14,214

				Stre	ess Summ	ary					
	Condition	Saddle	Tangential shear (psi)		Circumferential stress (psi)			Stress over saddle (psi)		Splitting (psi)	
Load			S ₃	allow	S ₄ (horns)	S ₄ (Wear plate)	allow (+/-)	S ₅	allow	S ₆	allow
Seismic	Operating	Right Saddle	4,264	16,000	<u>-28,971</u>	-28,927	30,000	<u>15,597</u>	18,000	5,323	14,400
		Left Saddle	4,234	16,000	<u>-28,839</u>	-28,795	30,000	<u>15,526</u>	18,000	5,299	14,400
	Operating	Right Saddle	2,893	16,000	-21,966	<u>-21,933</u>	30,000	11,826	18,000	4,036	14,400
Wind		Left Saddle	<u>2.871</u>	16,000	-21,868	-21.835	30,000	11,773	18,000	4.018	14,400
	Test	Right Saddle	2.830	27,360	-21,685	-21,653	34,200	11,675	32,400	3.985	32,400
		Left Saddle	2,808	27,360	-21,588	-21,556	34,200	<u>11,623</u>	32,400	<u>3,967</u>	32,400
Weight	Operating	Right Saddle	<u>2,798</u>	16,000	<u>-21,543</u>	<u>-21,511</u>	30,000	<u>11,598</u>	18,000	<u>3,959</u>	14,400
		Left Saddle	2,776	16,000	<u>-21,445</u>	<u>-21,413</u>	30,000	11.545	18,000	<u>3,940</u>	14,400

. 1.

Seismic base shear on vessel				
Vessel is assumed to be a rigid structure.	анания на политические и окология на окология на			
Method of seismic analysis	ASCE 7-10 ground supported			
Vertical seismic accelerations considered	Yes			
Importance factor, I _e	1.25			
Site Class	D			
Short period spectral response acceleration as percent of g, S_s	100			
1 second spectral response acceleration as percent of g, S_1	40			
From Table 11.4-1, F _a	1.1			
From Table 11.4-2, F _v	1.6			
Risk Category (Table 1.5-1)				
Hazardous, toxic, or explosive contents	nonanananananananananananananananananan			
Equations	kaan ahdaanna ay ahaan ahaa			
$S_{MS} = F_a * S_s$	" A DE TRATER DA MARIA (A DE			
$s_{M1} = F_v * s_1$	99999999999999999999999999999999999999			
$S_{DS} = (2 / 3) * S_{MS}$				
$S_{D1} = (2 / 3) * S_{M1}$	na van den den neuerieren den een den een de			
$F_p = 0.3 * S_{DS} * W * I_e * 0.7$	สารีที่สาราสสาราสสาราสาราชสาราชสาราชสาราชสาราช			
Results	49991/199499/199799/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/19979/			
S _{MS} = 1.1*1	1.1			
$S_{M1} = 1.6*0.4$	0.64			
$S_{DS} = (2 / 3) * 1.1$	0.7333			
$S_{D1} = (2 / 3) * 0.64$	0.4267			
Seismic Design Category (Section 11.6)	innonnenienten innenieten innenieten innenieten innenieten innenieten interneten			
$F_p = 0.3*0.7333*619,159*1.25*0.7$	119,188.11 lb _f			
Saddle reactions due to waie	ht + seismic			
$V_{\rm v}$ = vertical seismic force acting on the saddle	III I JUIJIIII.			
Y				

V = horizontal seismic shear acting on the saddle (worst case if not slotted)

Seismic longitudinal reaction, Q_I

Seismic transverse reaction, Qt

Equations

 $\mathbf{Q}_{l} = \mathbf{V} * \mathbf{H}_{s} / \mathbf{L}_{s} + \mathbf{V}_{v}$

 $Q_t = V^*H_s / (R_0^*Sin(\theta / 2)) + V_v$

 $Q = W + \max[Q_t, Q_l]$

Results
	Right Saddle	Q ₁ = 119,188.11*78 / 598 + 0.14*0.7333*310,287	47,402.41 lb _f
		$Q_t = 59,730.25*78 / (66*Sin(140 / 2)) + 0.14*0.7333*310,287$	106,976.75 lb _f
Opowating		Q = 310,287 + max[106,976.75 , 47,402.41]	417,263.75 lb _f
Operating	Left Saddle	Q ₁ = 119,188.11*78 / 598 + 0.14*0.7333*308,872	47,257.13 lb _f
		$Q_t = 59,457.86*78 / (66*Sin(140 / 2)) + 0.14*0.7333*308,872$	106,488.91 lb _f
		Q = 308,872 + max[106,488.91 , 47,257.13]	415,360.91 lbf

		Saddle reactions due to weight + wind	
Wind long	itudinal reaction	n, Qj	
Wind trans	verse reaction,	Qt	
Wind press	sure, P _w		17.8372 psf
		Equations	
$V_{wt} = P_w^*$	G*(C _{f(shell)} *(P	rojected shell area) + $C_{f(saddle)}$ *(Projected saddle are	a))
$V_{we} = P_w^*$	G*(C _{f(shell)} *π'	$R_0^2 / 144 + C_{f(saddle)}^*$ (Projected saddle area))	
$Q_t = V_{wt}^*$	H _s / (R _o *Sin(θ	/ 2))	
$Q_l = V_{we}^*$	H _s / L _s		
Q = W + n	nax[Qt,Ql]		
	540au14499945556000008600019939999999999999999999	Results	
		$V_{wt} = 17.84*0.85*(0.6*527.2743 + 2*1.5)$	4,842.07 lb _f
	Right Saddle	$V_{\rm WC} = 17.84*0.85*(0.5*\pi*72^2 / 144 + 2*22.8069)$	1,548.95 lb _f
		$Q_t = 4,842.07*78 / (66*Sin(140 / 2))$	6,089.71 lb _f
		$Q_l = 1,548.95*78 / 598$	202.04 lb _f
, A st		Q = 310,287 + max[6,089.71 , 202.04]	316,376.71 lb _f
Operating		$V_{wt} = 17.84*0.85*(0.6*527.2743 + 2*1.5)$	4,842.07 lb _f
	Left Saddle	$V_{we} = 17.84*0.85*(0.5*\pi*72^2 / 144 + 2*22.8069)$	1,548.95 lb _f
		$Q_t = 4,842.07*78 / (66*Sin(140 / 2))$	6,089.71 lb _f
		Q ₁ = 1,548.95*78 / 598	202.04 lb _f
		Q = 308,872 + max[6,089.71 , 202.04]	314,961.71 lb _f
		$V_{wt} = 5.89*0.85*(0.6*527.2743 + 2*1.5)$	1,597.88 lb _f
		$V_{we} = 5.89*0.85*(0.5*\pi*72^2 / 144 + 2*22.8069)$	511.15 lb _f
	Right Saddle	$Q_t = 1,597.88*78 / (66*Sin(140 / 2))$	2,009.6 lb _f
Test		Q _I = 511.15*78 / 598	66.67 lb _f
		Q = 310,325 + max[2,009.6 , 66.67]	312,334.6 lb _f
		$V_{wt} = 5.89*0.85*(0.6*527.2743 + 2*1.5)$	1,597.88 lb _f

•

	Left Saddle	$V_{we} = 5.89*0.85*(0.5*\pi*72^2 / 144 + 2*22.8069)$	511.15 lbf
		$Q_t = 1,597.88*78 / (66*Sin(140 / 2))$	2,009.6 lb _f
		$Q_{I} = 511.15*78 / 598$	66.67 lb _f
		Q = 308,926 + max[2,009.6 , 66.67]	310,935.6 lb _f

Load Case 1: Seismic, Operating

Longitudinal stress between saddles (Seismic, Operating, right saddle loading and geometry govern)

 $S_1 = \pm 3*K_1*Q*(L / 12) / (\pi*R^2*t)$ = 3*0.1619*417,263.75*(998 / 12) / (π*65.5625²*0.875) = 1,426 psi

$$\begin{split} &S_p = P^*R / (2^*t) \\ &= 254.7^*65.125 / (2^*0.875) \\ &= 9,479 \text{ psi} \end{split}$$

Maximum tensile stress $S_{1t} = S_1 + S_p = 10.905$ psi Maximum compressive stress (shut down) $S_{1c} = S_1 = 1.426$ psi

Tensile stress is acceptable (≤ 1.2 *S*E = 24,000 psi) Compressive stress is acceptable (≤ 1.2 *S_c = 17,057 psi)

Longitudinal stress at the right saddle (Seismic, Operating)

 $L_e = 2*(Left head depth) / 3 + L + 2*(Right head depth) / 3$ = 2*33.425 / 3 + 998 + 2*33.425 / 3 = 1,042.5667 in

Seismic vertical acceleration coefficient m = 0.5333*0.1925 = 0.1027

 $w = W_t * (1 + m) / L_e = 619,159 * (1 + 0.1027) / 1,042.5667 = 654.85 lb_f/in$

Bending moment at the right saddle:

$$\begin{split} M_q &= w^*(2^*H^*A_r / 3 + A_r^2 / 2 - (R^2 - H^2) / 4) \\ &= 654.85^*(2^*33.425^*200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 15,485,248.6 \ \text{lb}_{f} \text{-in} \end{split}$$

$$\begin{split} & S_2 = \pm M_q * K_1' / (\pi * R^{2*}t) \\ &= 15,485,248.6*7.0845 / (\pi * 65.5625^{2*}0.875) \\ &= 9,285 \text{ psi} \end{split}$$

 $S_p = P*R / (2*t)$ = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{2t} = S_2 + S_p = 18.763$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = 9.285$ psi

Tensile stress is acceptable (≤ 1.2 *S = 24,000 psi) Compressive stress is acceptable (≤ 1.2 *S_c = 17,057 psi)

Tangential shear stress in the shell (right saddle, Seismic, Operating)

```
\begin{array}{l} Q_{shear} = Q - w^*(a + 2^*H \,/\, 3) \\ = 417,263.75 - 654.85^*(200 + 2^*33.425 \,/\, 3) \\ = 271,701.25 \,\, lb_f \end{array}
```

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$ = 0.9003*271,701.25 / (65.5625*0.875) = <u>4.264</u> psi Tangential shear stress is acceptable (≤ 0.8 *S = 16,000 psi)

Circumferential stress at the right saddle horns (Seismic, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -417,263.75 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*417,263.75 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -28,971 \text{ psi} \end{split}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 \text{*} \text{S}_a = 30,000 \text{ psi}$)

Circumferential stress at the right saddle wear plate horns (Seismic, Operating)

$$\begin{split} &S_4 = -Q / (4*t*(b+1.56*Sqr(R_0*t))) - 3*K_3*Q / (2*t^2) \\ &= -417,263.75 / (4*0.875*(18+1.56*Sqr(66*0.875))) - 3*0.0305*417,263.75 / (2*0.875^2) \\ &= -28,927 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 \text{*S}_a = 30,000 \text{ psi}$)

Ring compression in shell over right saddle (Seismic, Operating)

$$\begin{split} &S_5 = K_5 * Q / ((t + t_p) * (t_s + 1.56 * Sqr(R_0 * t_c))) \\ &= 0.6971 * 417,263.75 / ((0.875 + 0.375) * (0.75 + 1.56 * Sqr(66 * 1.25))) \\ &= \underline{15,597} \text{ psi} \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 * S_v = 18,000 \text{ psi}$)

Saddle splitting load (right, Seismic, Operating)

Area resisting splitting force = Web area + wear plate area

 $\begin{array}{l} A_e = H_{eff} * t_s + t_p * W_p \\ = 10.125 * 0.75 + 0.375 * 30 \\ = 18.8438 \ in^2 \end{array}$

 $S_6 = K_8 * Q / A_e$ = 0.2404*417,263.75 / 18.8438 = <u>5.323</u> psi

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Longitudinal stress at the left saddle (Seismic, Operating)

 $L_e = 2*(\text{Left head depth}) / 3 + L + 2*(\text{Right head depth}) / 3$ = 2*33.425 / 3 + 998 + 2*33.425 / 3 = 1,042.5667 in

Seismic vertical acceleration coefficient m = 0.5333*0.1925 = 0.1027

 $w = W_t^*(1 + m) / L_e = 619,159^*(1 + 0.1027) / 1,042.5667 = 654.85 \ lb_f/in$

Bending moment at the left saddle:

$$\begin{split} M_q &= w^* (2^* H^* A_1 / 3 + A_1^2 / 2 - (R^2 - H^2) / 4) \\ &= 654.85^* (2^* 33.425^* 200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 15,485,248.6 \ lb_{f^*} in \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*}t)$ = 15,485,248.6*7.0845 / (\pi * 65.5625^{2*}0.875) = 9,285 psi

S_p = P*R / (2*t) = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{2t} = S_2 + S_p = \underline{18.763}$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = \underline{9.285}$ psi Tensile stress is acceptable (≤ 1.2 *S = 24,000 psi) Compressive stress is acceptable (≤ 1.2 *S_c = 17,057 psi)

Tangential shear stress in the shell (left saddle, Seismic, Operating)

$$\begin{split} & Q_{shear} = Q - w^*(a + 2^*H / 3) \\ &= 415,360.91 - 654.85^*(200 + 2^*33.425 / 3) \\ &= 269,798.41 \ lb_f \end{split}$$

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$ = 0.9003*269,798.41 / (65.5625*0.875) = <u>4.234</u> psi

Tangential shear stress is acceptable (≤ 0.8 *S = 16,000 psi)

Circumferential stress at the left saddle horns (Seismic, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -415,360.91 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*415,360.91 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -28.839 \ \text{psi} \end{split}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 \text{*}S_a = 30,000 \text{ psi}$)

Circumferential stress at the left saddle wear plate horns (Seismic, Operating)

$$\begin{split} &S_4 = -Q / (4*t*(b+1.56*Sqr(R_0*t))) - 3*K_3*Q / (2*t^2) \\ &= -415,360.91 / (4*0.875*(18+1.56*Sqr(66*0.875))) - 3*0.0305*415,360.91 / (2*0.875^2) \\ &= -28.795 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 \text{*S}_a = 30,000 \text{ psi}$)

Ring compression in shell over left saddle (Seismic, Operating)

$$\begin{split} &S_5 = K_5 * Q / ((t + t_p) * (t_s + 1.56 * Sqr(R_0 * t_c))) \\ &= 0.6971 * 415,360.91 / ((0.875 + 0.375) * (0.75 + 1.56 * Sqr(66 * 1.25))) \\ &= \underline{15,526} \text{ psi} \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 * S_v = 18,000 \text{ psi}$)

Saddle splitting load (left, Seismic, Operating)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff}^* t_s + t_p^* W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

S₆ = K₈*Q / A_e = 0.2404*415,360.91 / 18.8438 = <u>5,299</u> psi

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Load Case 2: Wind, Operating

Longitudinal stress between saddles (Wind, Operating, right saddle loading and geometry govern)

$$\begin{split} &S_1 = \pm 3*K_1*Q*(L / 12) / (\pi*R^{2*}t) \\ &= 3*0.1619*316,376.71*(998 / 12) / (\pi*65.5625^{2*}0.875) \\ &= 1,082 \text{ psi} \end{split}$$

 $S_p = P*R / (2*t)$ = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{1t} = S_1 + S_p = 10,560$ psi

15

Maximum compressive stress (shut down) $S_{1c} = S_1 = 1.082$ psi

Tensile stress is acceptable (≤ 1.2 *S*E = 24,000 psi) Compressive stress is acceptable (≤ 1.2 *S_c = 17,057 psi)

Longitudinal stress at the right saddle (Wind, Operating)

$$\label{eq:Le} \begin{split} L_e &= 2*(\text{Left head depth}) / 3 + L + 2*(\text{Right head depth}) / 3 \\ &= 2*33.425 / 3 + 998 + 2*33.425 / 3 \\ &= 1,042.5667 \text{ in} \end{split}$$

 $w = W_t / L_e = 619,159 / 1,042.5667 = 593.88 lb_f/in$

Bending moment at the right saddle:

$$\begin{split} M_q &= w^*(2^*H^*A_r / 3 + A_r^2 / 2 - (R^2 - H^2) / 4) \\ &= 593.88^*(2^*33.425^*200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 14,043,454 \ lb_{\Gamma} in \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*t})$ = 14,043,454*7.0845 / (\pi * 65.5625^{2*0.875}) = 8,420 psi

$$\begin{split} S_p &= P^*R / (2^*t) \\ &= 254.7^*65.125 / (2^*0.875) \\ &= 9,479 \text{ psi} \end{split}$$

Maximum tensile stress $S_{2t} = S_2 + S_p = 17,899$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = 8,420$ psi

Tensile stress is acceptable (≤ 1.2 *S = 24,000 psi) Compressive stress is acceptable (≤ 1.2 *S_c = 17,057 psi)

Tangential shear stress in the shell (right saddle, Wind, Operating)

$$\begin{split} & Q_{shear} = Q - w^*(a + 2^*H \ / \ 3) \\ &= 316,376.71 - 593.88^*(200 + 2^*33.425 \ / \ 3) \\ &= 184,367.18 \ lb_f \end{split}$$

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$ = 0.9003*184,367.18 / (65.5625*0.875) = <u>2.893</u> psi

Tangential shear stress is acceptable (≤ 0.8 *S = 16,000 psi)

Circumferential stress at the right saddle horns (Wind, Operating)

$$\begin{split} &S_4 = -Q \,/\, (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \,/\, (2^*(t^2+t_p^2)) \\ &= -316,376.71 \,/\, (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*316,376.71 \,/\, (2^*(0.875^2+0.375^2)) \\ &= -21,966 \text{ psi} \end{split}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 * S_a = 30,000 \text{ psi}$)

Circumferential stress at the right saddle wear plate horns (Wind, Operating)

$$\begin{split} &S_4 = -Q / (4^*t^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q / (2^*t^2) \\ &= -316,376.71 / (4^*0.875^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0305^*316,376.71 / (2^*0.875^2) \\ &= -21.933 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 * S_a = 30,000 \text{ psi}$)

Ring compression in shell over right saddle (Wind, Operating)

$$\begin{split} &S_5 = K_5 * Q / ((t + t_p) * (t_s + 1.56 * Sqr(R_0 * t_c))) \\ &= 0.6971 * 316,376.71 / ((0.875 + 0.375) * (0.75 + 1.56 * Sqr(66 * 1.25))) \\ &= \underline{11.826} \text{ psi} \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 * S_v = 18,000 \text{ psi}$)

Saddle splitting load (right, Wind, Operating)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff}^* t_s + t_p^* W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

 $S_6 = K_8 * Q / A_e$ = 0.2404*316,376.71 / 18.8438 = <u>4,036</u> psi

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Longitudinal stress at the left saddle (Wind, Operating)

 $L_e = 2*(Left head depth) / 3 + L + 2*(Right head depth) / 3 = 2*33.425 / 3 + 998 + 2*33.425 / 3 = 1,042.5667 in$

 $w = W_t / L_e = 619,159 / 1,042.5667 = 593.88 \text{ Ib}_f/\text{in}$

Bending moment at the left saddle:

$$\begin{split} M_q &= w^*(2^*H^*A_1 / 3 + A_1^2 / 2 - (R^2 - H^2) / 4) \\ &= 593.88^*(2^*33.425^*200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 14,043,454 \ lb_{\Gamma} in \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*}t)$ = 14,043,454*7.0845 / (\pi * 65.5625^{2*}0.875) = 8,420 psi

 $S_p = P*R / (2*t)$ = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{2t} = S_2 + S_p = \frac{17,899}{1200}$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = \frac{8,420}{1000}$ psi

Tensile stress is acceptable ($\leq 1.2^{*}\mathrm{S}$ = 24,000 psi) Compressive stress is acceptable ($\leq 1.2^{*}\mathrm{S}_{c}$ = 17,057 psi)

Tangential shear stress in the shell (left saddle, Wind, Operating)

 $\begin{aligned} & Q_{shear} = Q - w^*(a + 2^*H / 3) \\ &= 314,961.71 - 593.88^*(200 + 2^*33.425 / 3) \\ &= 182,952.18 \ \text{Ib}_f \end{aligned}$

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$ = 0.9003*182,952.18 / (65.5625*0.875) = <u>2,871</u> psi

Tangential shear stress is acceptable (≤ 0.8 *S = 16,000 psi)

Circumferential stress at the left saddle horns (Wind, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -314,961.71 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*314,961.71 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -21.868 \ \text{psi} \end{split}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 * S_a = 30,000 \text{ psi}$)

Circumferential stress at the left saddle wear plate horns (Wind, Operating)

 $S_4 = -Q / (4*t*(b+1.56*Sqr(R_0*t))) - 3*K_3*Q / (2*t^2)$

 $= -314,961.71 / (4*0.875*(18+1.56*Sqr(66*0.875))) - 3*0.0305*314,961.71 / (2*0.875^2) = -21.835 \text{ psi}$

Circumferential stress at wear plate horns is acceptable (≤ 1.5 *S_a = 30,000 psi)

Ring compression in shell over left saddle (Wind, Operating)

$$\begin{split} &S_5 = K_5 * Q \ / \ ((t+t_p) * (t_s+1.56* Sqr(R_0 * t_c))) \\ &= 0.6971 * 314,961.71 \ / \ ((0.875+0.375) * (0.75+1.56* Sqr(66*1.25))) \\ &= \underline{11.773} \ psi \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 * S_y = 18,000 \text{ psi}$)

Saddle splitting load (left, Wind, Operating)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff} * t_s + t_p * W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

$$\begin{split} & S_6 = K_8 * Q \ / \ A_e \\ &= 0.2404 * 314,961.71 \ / \ 18.8438 \\ &= \underline{4,018} \ psi \end{split}$$

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Load Case 3: Wind, Test

Longitudinal stress between saddles (Wind, Test, right saddle loading and geometry govern)

$$\begin{split} S_1 &= \pm 3*K_1 * Q^*(L / 12) / (\pi^* R^{2*}t) \\ &= 3*0.1619*312,334.6*(998 / 12) / (\pi^* 65.5625^{2*}0.875) \\ &= 1,068 \text{ psi} \end{split}$$

$$\begin{split} S_p &= P^* R \ / \ (2^* t) \\ &= 330.17^* 65.125 \ / \ (2^* 0.875) \\ &= 12,287 \ psi \end{split}$$

Maximum tensile stress $S_{11} = S_1 + S_p = \underline{13.355}$ psi Maximum compressive stress (shut down) $S_{1c} = S_1 = \underline{1,068}$ psi

Tensile stress is acceptable ($\leq 0.9 \text{*}S_y \text{*}E = 34,200 \text{ psi}$) Compressive stress is acceptable ($\leq 1.2 \text{*}S_c = 17,057 \text{ psi}$)

Longitudinal stress at the right saddle (Wind, Test)

$$\label{eq:Leff} \begin{split} L_e &= 2*(\text{Leff head depth}) / \ 3 + L + 2*(\text{Right head depth}) / \ 3 \\ &= 2*33.425 / \ 3 + 998 + 2*33.425 / \ 3 \\ &= 1,042.5667 \text{ in} \end{split}$$

 $w = W_t / L_e = 619,251 / 1,042.5667 = 593.97 lb_f/in$

Bending moment at the right saddle:

$$\begin{split} \mathbf{M}_{q} &= \mathbf{w}^{*}(2^{*}\mathbf{H}^{*}\mathbf{A}_{r} / 3 + \mathbf{A}_{r}^{2} / 2 - (\mathbf{R}^{2} - \mathbf{H}^{2}) / 4) \\ &= 593.97^{*}(2^{*}33.425^{*}200 / 3 + 200^{2} / 2 - (66^{2} - 33.425^{2}) / 4) \\ &= 14,045,540.6 \ \mathsf{lb}_{f} \text{-in} \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*}t)$ = 14,045,540.6*7.0845 / (\pi * 65.5625^{2*}0.875) = 8,421 psi

$$\begin{split} S_p &= P^*R \; / \; (2^*t) \\ &= 330.17^*65.125 \; / \; (2^*0.875) \\ &= 12,287 \; psi \end{split}$$

. .

Maximum tensile stress $S_{21} = S_2 + S_p = 20,708$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = 8,421$ psi

Tensile stress is acceptable ($\leq 0.9^{*}S_{y} = 34,200 \text{ psi}$) Compressive stress is acceptable ($\leq 1.2^{*}S_{c} = 17,057 \text{ psi}$)

Tangential shear stress in the shell (right saddle, Wind, Test)

 $\begin{array}{l} Q_{shear} = Q - w^*(a + 2^*H / 3) \\ = 312,334.6 - 593.97^*(200 + 2^*33.425 / 3) \\ = 180,305.47 \ lb_f \end{array}$

$$\begin{split} &S_3 = K_{2,2} * Q_{shear} / (R*t) \\ &= 0.9003 * 180,305.47 / (65.5625 * 0.875) \\ &= \underline{2,830} \text{ psi} \end{split}$$

Tangential shear stress is acceptable ($\leq 0.8*(0.9*S_v) = 27,360 \text{ psi}$)

Circumferential stress at the right saddle horns (Wind, Test)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -312,334.6 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*312,334.6 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -21.685 \ \text{psi} \end{split}$$

Circumferential stress at saddle horns is acceptable (≤ 0.9 *S_y = 34,200 psi)

Circumferential stress at the right saddle wear plate horns (Wind, Test)

$$\begin{split} &S_4 = -Q / (4*t*(b+1.56*Sqr(R_0*t))) - 3*K_3*Q / (2*t^2) \\ &= -312,334.6 / (4*0.875*(18+1.56*Sqr(66*0.875))) - 3*0.0305*312,334.6 / (2*0.875^2) \\ &= -21.653 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable (≤ 0.9 *S_v = 34,200 psi)

Ring compression in shell over right saddle (Wind, Test)

$$\begin{split} &S_5 = K_5 * Q / ((t + t_p) * (t_s + 1.56 * Sqr(R_0 * t_c))) \\ &= 0.6971 * 312,334.6 / ((0.875 + 0.375) * (0.75 + 1.56 * Sqr(66 * 1.25))) \\ &= \underline{11,675} \text{ psi} \end{split}$$

Ring compression in shell is acceptable (≤ 0.9 *S_y = 32,400 psi)

Saddle splitting load (right, Wind, Test)

Area resisting splitting force = Web area + wear plate area

 $\begin{array}{l} A_e = H_{eff} * t_s + t_p * W_p \\ = 10.125 * 0.75 + 0.375 * 30 \\ = 18.8438 \ in^2 \end{array}$

 $S_6 = K_8 * Q / A_e$ = 0.2404*312,334.6 / 18.8438 = <u>3.985</u> psi

Stress in saddle is acceptable ($\leq 0.9 \text{*}S_y = 32,400 \text{ psi}$)

Longitudinal stress at the left saddle (Wind, Test)

$$\label{eq:Leff} \begin{split} L_e &= 2*(\text{Left head depth}) / 3 + L + 2*(\text{Right head depth}) / 3 \\ &= 2*33.425 / 3 + 998 + 2*33.425 / 3 \\ &= 1,042.5667 \text{ in} \end{split}$$

 $w = W_t / L_e = 619,251 / 1,042.5667 = 593.97 lb_f/in$

Bending moment at the left saddle:

$$\begin{split} M_q &= w^*(2^*H^*A_1 / 3 + A_1^2 / 2 - (R^2 - H^2) / 4) \\ &= 593.97^*(2^*33.425^*200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 14,045,540.6 \ lb_{f} \text{ in} \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^2 * t)$ = 14,045,540.6*7.0845 / (\pi * 65.5625^2 * 0.875) = 8,421 psi

$$\begin{split} & \mathrm{S}_{\mathrm{p}} = \mathrm{P*R} \; / \; (2^{*}t) \\ & = 330.17^{*}65.125 \; / \; (2^{*}0.875) \\ & = 12,287 \; \mathrm{psi} \end{split}$$

Maximum tensile stress $S_{2t} = S_2 + S_p = 20.708$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = 8.421$ psi

Tensile stress is acceptable (≤ 0.9 s $_y = 34,200$ psi) Compressive stress is acceptable (≤ 1.2 s $_c = 17,057$ psi)

Tangential shear stress in the shell (left saddle, Wind, Test)

 $\begin{array}{l} Q_{shear} = Q - w^*(a + 2^*H \,/\, 3) \\ = 310,935.6 - 593.97^*(200 + 2^*33.425 \,/\, 3) \\ = 178,906.47 \,\, lb_f \end{array}$

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$ = 0.9003*178,906.47 / (65.5625*0.875) = <u>2.808</u> psi

Tangential shear stress is acceptable ($\leq 0.8*(0.9*S_v) = 27,360$ psi)

Circumferential stress at the left saddle horns (Wind, Test)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -310,935.6 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*310,935.6 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -21.588 \ \text{psi} \end{split}$$

Circumferential stress at saddle horns is acceptable (≤ 0.9 *S_y = 34,200 psi)

Circumferential stress at the left saddle wear plate horns (Wind, Test)

$$\begin{split} &S_4 = -Q / (4^*t^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q / (2^*t^2) \\ &= -310,935.6 / (4^*0.875^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0305^*310,935.6 / (2^*0.875^2) \\ &= -21,556 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable (≤ 0.9 *S_v = 34,200 psi)

Ring compression in shell over left saddle (Wind, Test)

 $S_5 = K_5 * Q / ((t + t_p)*(t_s + 1.56*Sqr(R_o*t_c))) = 0.6971*310,935.6 / ((0.875 + 0.375)*(0.75 + 1.56*Sqr(66*1.25))) = 11.623 \text{ psi}$

Ring compression in shell is acceptable (≤ 0.9 *S_y = 32,400 psi)

Saddle splitting load (left, Wind, Test)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff}^* t_s + t_p^* W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

 $S_6 = K_8 * Q / A_e$ = 0.2404*310,935.6 / 18.8438 = <u>3.967</u> psi

 $t_{1} \geq t_{2}$

Load Case 4: Weight, Operating

Longitudinal stress between saddles (Weight, Operating, right saddle loading and geometry govern)

$$\begin{split} S_1 &= \pm \ 3^*K_1^*Q^*(L \ / \ 12) \ / \ (\pi^*R^{2*}t) \\ &= \ 3^*0.1619^*310,287^*(998 \ / \ 12) \ / \ (\pi^*65.5625^{2*}0.875) \\ &= \ 1,061 \ psi \end{split}$$

 $S_p = P*R / (2*t)$ = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{1t} = S_1 + S_p = \underline{10.539}$ psi Maximum compressive stress (shut down) $S_{1c} = S_1 = \underline{1.061}$ psi

Tensile stress is acceptable (\leq S*E = 20,000 psi) Compressive stress is acceptable (\leq S_c = 14,214 psi)

Longitudinal stress at the right saddle (Weight, Operating)

$$\label{eq:Leff} \begin{split} L_e &= 2*(\text{Left head depth}) / 3 + L + 2*(\text{Right head depth}) / 3 \\ &= 2*33.425 / 3 + 998 + 2*33.425 / 3 \\ &= 1,042.5667 \text{ in} \end{split}$$

 $w = W_t / L_e = 619,159 / 1,042.5667 = 593.88 lb_{f}/in$

Bending moment at the right saddle:

$$\begin{split} M_q &\coloneqq w^*(2^*H^*A_r / 3 + A_r^2 / 2 \cdot (R^2 - H^2) / 4) \\ &= 593.88^*(2^*33.425^*200 / 3 + 200^2 / 2 \cdot (66^2 - 33.425^2) / 4) \\ &= 14,043,454 \ lb_f \ in \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*}t)$ = 14,043,454*7.0845 / (\pi * 65.5625^{2*}0.875) = 8,420 psi

 $S_p = P^*R / (2^*t)$ = 254.7*65.125 / (2*0.875) = 9,479 psi

Maximum tensile stress $S_{2t} = S_2 + S_p = 17.899$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = 8.420$ psi

Tensile stress is acceptable ($\leq S = 20,000 \text{ psi}$) Compressive stress is acceptable ($\leq S_c = 14,214 \text{ psi}$)

Tangential shear stress in the shell (right saddle, Weight, Operating)

 $\begin{aligned} Q_{shear} &= Q - w^*(a + 2^*H / 3) \\ &= 310,287 - 593.88^*(200 + 2^*33.425 / 3) \\ &= 178,277.48 \ lb_f \end{aligned}$

 $S_3 = K_{2,2} * Q_{\text{shear}} / (R*t)$ = 0.9003*178,277.48 / (65.5625*0.875) = <u>2.798</u> psi

Tangential shear stress is acceptable (≤ 0.8 *S = 16,000 psi)

Circumferential stress at the right saddle horns (Weight, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(R_0^*t))) \ - \ 3^*K_3^*Q \ / \ (2^*(t^2+t_p^2)) \\ &= -310,287 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) \ - \ 3^*0.0379^*310,287 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -21,543 \ \text{psi} \end{split}$$

21

Circumferential stress at saddle horns is acceptable ($\leq 1.5 \text{*} \text{S}_a = 30,000 \text{ psi}$)

Circumferential stress at the right saddle wear plate horns (Weight, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*t^*(b+1.56^*\text{Sqr}(R_0^*t))) \ - \ 3^*K_3^*Q \ / \ (2^*t^2) \\ &= -310,287 \ / \ (4^*0.875^*(18+1.56^*\text{Sqr}(66^*0.875))) \ - \ 3^*0.0305^*310,287 \ / \ (2^*0.875^2) \\ &= -21,511 \ \text{psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 * S_a = 30,000 \text{ psi}$)

Ring compression in shell over right saddle (Weight, Operating)

$$\begin{split} &S_5 = K_5 * Q \ / \ ((t+t_p) * (t_s + 1.56 * \text{Sqr}(R_0 * t_c))) \\ &= 0.6971 * 310,287 \ / \ ((0.875 + 0.375) * (0.75 + 1.56 * \text{Sqr}(66 * 1.25))) \\ &= \underline{11,598} \text{ psi} \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 \text{*S}_{v} = 18,000 \text{ psi}$)

Saddle splitting load (right, Weight, Operating)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff}^* t_s + t_p^* W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

 $S_6 = K_8 * Q / A_e$ = 0.2404*310,287 / 18.8438 = <u>3.959</u> psi

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Longitudinal stress at the left saddle (Weight, Operating)

 $w = W_t / L_e = 619,159 / 1,042.5667 = 593.88 lb_f/in$

Bending moment at the left saddle:

$$\begin{split} M_q &= w^*(2^*H^*A_1 / 3 + A_1^2 / 2 - (R^2 - H^2) / 4) \\ &= 593.88^*(2^*33.425^*200 / 3 + 200^2 / 2 - (66^2 - 33.425^2) / 4) \\ &= 14,043,454 \ lb_{1} in \end{split}$$

 $S_2 = \pm M_q * K_1' / (\pi * R^{2*}t)$ = 14,043,454*7.0845 / (\pi * 65.5625^{2*}0.875) = 8,420 psi

$$\begin{split} S_p &= \mathbb{P}^* \mathbb{R} \ / \ (2^* t) \\ &= 254.7^* 65.125 \ / \ (2^* 0.875) \\ &= 9,479 \ \mathrm{psi} \end{split}$$

Maximum tensile stress $S_{2t} = S_2 + S_p = \underline{17.899}$ psi Maximum compressive stress (shut down) $S_{2c} = S_2 = \underline{8.420}$ psi

Tensile stress is acceptable ($\leq S = 20,000 \text{ psi}$) Compressive stress is acceptable ($\leq S_c = 14,214 \text{ psi}$)

Tangential shear stress in the shell (left saddle, Weight, Operating)

 $Q_{shear} = Q - w^*(a + 2^*H / 3)$ = 308,872 - 593.88*(200 + 2*33.425 / 3) = 176,862.48 lb_f

 $S_3 = K_{2,2} * Q_{shear} / (R*t)$

= 0.9003*176,862.48 / (65.5625*0.875)

= <u>2,776</u> psi

Tangential shear stress is acceptable ($\leq 0.8 \text{*S} = 16,000 \text{ psi}$)

Circumferential stress at the left saddle horns (Weight, Operating)

$$\begin{split} &S_4 = -Q \ / \ (4^*(t+t_p)^*(b+1.56^*\text{Sqr}(\text{R}_0^*t))) - 3^*\text{K}_3^*\text{Q} \ / \ (2^*(t^2+t_p^2)) \\ &= -308,872 \ / \ (4^*(0.875+0.375)^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0379^*308,872 \ / \ (2^*(0.875^2+0.375^2)) \\ &= -21,445 \ \text{psi} \end{split}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 \text{*} \text{S}_a = 30,000 \text{ psi}$)

Circumferential stress at the left saddle wear plate horns (Weight, Operating)

$$\begin{split} &S_4 = -Q / (4^*t^*(b+1.56^*\text{Sqr}(R_0^*t))) - 3^*K_3^*Q / (2^*t^2) \\ &= -308,872 / (4^*0.875^*(18+1.56^*\text{Sqr}(66^*0.875))) - 3^*0.0305^*308,872 / (2^*0.875^2) \\ &= -21,413 \text{ psi} \end{split}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 * S_a = 30,000 \text{ psi}$)

Ring compression in shell over left saddle (Weight, Operating)

$$\begin{split} &S_5 = K_5 * Q / ((t + t_p) * (t_s + 1.56 * Sqr(R_0 * t_c))) \\ &= 0.6971 * 308,872 / ((0.875 + 0.375) * (0.75 + 1.56 * Sqr(66 * 1.25))) \\ &= \underbrace{11,545}_{2} \text{ psi} \end{split}$$

Ring compression in shell is acceptable ($\leq 0.5 \text{*S}_{y} = 18,000 \text{ psi}$)

Saddle splitting load (left, Weight, Operating)

Area resisting splitting force = Web area + wear plate area

 $A_e = H_{eff} * t_s + t_p * W_p$ = 10.125*0.75 + 0.375*30 = 18.8438 in²

 $S_6 = K_8 * Q / A_e$ = 0.2404*308,872 / 18.8438 = <u>3.940</u> psi

Stress in saddle is acceptable ($\leq (2/3)$ *S_s = 14,400 psi)

Shear stress in anchor bolting, one end slotted

Maximum seismic or wind base shear = 119,188.11 lb_f

Thermal expansion base shear = $W^*\mu = 313,432^*0.45 = 141,044.4 \text{ lb}_f$ Corroded root area for a 2.75" series 8 threaded bolt = 5.259 in² (4 per saddle)

Bolt shear stress = 141,044.4 / (5.259*1*4) = 6,705 psi

Anchor bolt stress is acceptable ($\leq 10,000$ psi)

Shear stress in anchor bolting, transverse

Maximum seismic or wind base shear = 119,188.11 lb_f Corroded root area for a 2.75" series 8 threaded bolt = 5.259 in^2 (4 per saddle)

Bolt shear stress = 119,188.11 / (5.259*2*4) = 2,833 psi

Anchor bolt stress is acceptable ($\leq 10,000$ psi)

Web plate buckling check (Escoe pg 251)

Allowable compressive stress S_c is the lesser of 21,600 or 42,963 psi: (21,600)

 $S_c = K_i * \pi^2 * E / (12*(1 - 0.3^2)*(d_i / t_s)^2)$

= $1.28 \pi^2 \times 29E + 06 / (12 \times (1 - 0.3^2) \times (20.9583 / 0.75)^2)$ = 42,963 psi

Allowable compressive load on the saddle

$$\begin{split} b_c &= d_i^* t_s / (d_i^* t_s + 2^* t_w^* (b - 1)) \\ &= 20.9583^* 0.75 / (20.9583^* 0.75 + 2^* 0.75^* (18 - 1)) \\ &= 0.3814 \end{split}$$

$$\begin{split} F_b &= n^* (A_s + 2^* b_e^* t_s)^* S_c \\ &= 7^* (12.9375 + 2^* 0.3814^* 0.75)^* 21,600 \\ &= 2,042,640.07 \ lb_f \end{split}$$

Saddle loading of 420,408.75 $lb_f is \le F_b$; satisfactory.

Primary bending + axial stress in the saddle due to end loads (assumes one saddle slotted)

$$\begin{split} \sigma_b &= V^*(H_s - x_o)^* y \ / \ I + Q \ / \ A \\ &= 119,188.11^*(78 - 50.7638)^* 9 \ / \ 2,553.35 + 417,263.75 \ / \ 183.5921 \\ &= 13,715 \ psi \end{split}$$

The primary bending + axial stress in the saddle $\leq S_s = 21,600$ psi; satisfactory.

Secondary bending + axial stress in the saddle due to end loads (includes thermal expansion, assumes one saddle slotted)

$$\begin{split} \sigma_b &= V^*(H_s - x_0)^* y \ / \ I + Q \ / \ A \\ &= 260,232.51^*(78 - 50.7638)^* 9 \ / \ 2,553.35 + 417,263.75 \ / \ 183.5921 \\ &= 27,256 \ psi \end{split}$$

The secondary bending + axial stress in the saddle $\leq 2*S_y = 72,000$ psi; satisfactory.

Saddle base plate thickness check (Roark sixth edition, Table 26, case 7a)

where a = 20.9583, b = 10.625 in

$$\begin{split} t_b &= (\beta_1 * q^* b^2 / (1.5^* S_a))^{0.5} \\ &= (1.7753 * 148 * 10.625^2 / (1.5 * 21,600))^{0.5} \\ &= 0.9572 \text{ in} \end{split}$$

The base plate thickness of 1.5 in is adequate.

Foundation bearing check

 $S_f = Q_{max} / (F^*E)$ = 420,408.75 / (22*129) = 148 psi

Concrete bearing stress $\leq 1,350$ psi ; satisfactory.

۰.,

ASME Section VIII Division 1, 2017 Edition					
Note: round inside edges per UG-76(c)	การกัดสารางสารกัดสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสารกระสาร				
Location and Orientation	ากรัฐสาขานสายแรงสารสารกรรมสารสารสารสารสารสารสารสารสารสารสารสารสารส				
Located on	Right Head				
Orientation	0°				
End of nozzle to datum line	-57.5"				
Calculated as hillside	No				
Distance to head center, R	0"				
Passes through a Category A joint					
Nozzle					
Description	NPS 20 Sch 30 (XS)				
Access opening	Yes				
Material specification	SA-106 B Smls pipe (II-D p. 14, ln. 10)				
Inside diameter, new	19 ¹¹ 19 ¹¹				
Pipe nominal wall thickness	0.5"				
Pipe minimum wall thickness ¹	0.4375"				
Corrosion allowance	0"				
Projection available outside vessel, Lpr	4.7709"				
Internal projection, h _{new}	1.25"				
Projection available outside vessel to flange face, Lf	10.4609"				
Local vessel minimum thickness	0.85"				
Liquid static head included	2.35 psi				
Longitudinal joint efficiency	0.85				
Reinforcing Pad					
Material specification	Material specification SA-516 70 (II-D p. 18, ln. 33)				

Ì

Diameter, D _p	33.5"
Thickness, t _e	0.75"
ls split	No
Welds	
Inner fillet, Leg ₄₁	0.5"
Outer fillet, Leg ₄₂	0.5625"
Lower fillet, Leg ₄₃	0.3125"
Nozzle to vessel groove weld	0.85"
Pad groove weld	0"

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange					
Description NPS 20 Class 150 WN A105					
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, In. 32)				
Blind included	Yes				
Rated MDMT	-31.5°F				
Liquid static head	2.35 psi				
MAWP rating	278.75 psi @ 125°F				
MAP rating	285 psi @ 40°F				
Hydrotest rating	450 psi @ 40°F				
PWHT performed	No				
Impact Tested	No				
Circumferential joint radiography	None UW-11(c) Type 1				
Bore diameter, B (specified by purchaser)	19"				
Gasket					
Description	Klingersil C-4401 Synthetic Fiber				
Notes					
Flange rated MDMT per UCS-66(b)(1)(b) = -31.5° F (Coincident ratio = 0.8854)					

Bolts rated MDMT per Fig UCS-66 note (c) = -55° F

UCS-66 Material Toughness Requirements Nozzle						
$t_r = 252.35*9.5 / (17,100*0.85 - 0.6*252.35) =$	0.1667"					
Stress ratio = $t_r * E^* / (t_n - c) = 0.1667 * 0.85 / (0.4375 - 0) = 0.3238$						
Stress ratio ≤ 0.35 , MDMT per UCS-66(b)(3) = -155°F						
Material is exempt from impact testing at the Design MDMT of -20°F.						

 UCS-66 Material Toughness Requirements Pa	d
 Governing thickness, $t_g =$	0.75"

MDMT =			-20°F
Material is exempt from impa	act testing per UG-2	20(f) at the Design	MDMT of -20°F.

ŝ,

Reinforcement Calculations for Internal Pressure

	UG-37 A	UG-45 Sur	nmary (in)					
For P = 252.35 psi @ 125 °F The opening is adequately reinforced							The nozzle p	asses UG-45
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
14.2768	<u>15.0001</u>	<u>1.9662</u>	<u>1.2264</u>	1.0688	<u>10.125</u>	<u>0.6137</u>	<u>0.1667</u>	0.4375

UG-41 Weld Failure Path Analysis Summary (lb _f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W ₁₋₁	Path 1-1 strength	Weld load W ₂₋₂	Path 2-2 strength	Weld load W ₃₋₃	Path 3-3 strength
<u>247,995.38</u>	237.632	473,400.7	<u>66,384</u>	609,090.02	<u>275,212</u>	<u>767,549.99</u>

UW-16 Weld Sizing Summary						
Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status						
Nozzle to pad fillet (Leg ₄₁)	<u>0.35</u>	0.35	weld size is adequate			
Pad to shell fillet (Leg ₄₂)	<u>0.375</u>	0.3938	weld size is adequate			

Calculations for internal pressure 252.35 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

$$L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$$

$$= MAX(19, 9.5 + (0.5 - 0) + (0.85 - 0))$$

= 19 in

Outer Normal Limit of reinforcement per UG-40

 $\begin{array}{rcl} L_{\rm H} &=& {\rm MIN}(2.5^*(t-{\rm C}),\,2.5^*(t_{\rm n}-{\rm C}_{\rm n})+t_{\rm e}) \\ &=& {\rm MIN}(2.5^*(0.85-0),\,2.5^*(0.5-0)+0.75) \\ &=& 2 \ {\rm in} \end{array}$

Inner Normal Limit of reinforcement per UG-40

$$L_{I} = MIN(h, 2.5*(t - C), 2.5*(t_{i} - C_{n} - C))$$

- = MIN(1.25, 2.5*(0.85 0), 2.5*(0.5 0 0))
 - = 1.25 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 252.3508*9.5 / (17,100*1 0.6*252.3508)
 - = 0.1414 in

Required thickness t_r from UG-37(a)(c)

 $t_r = P^*K_1^*D_0 / (2^*S^*E + 0.8^*P)$

- = 252.3508*0.9*132 / (2*20,000*1 + 0.8*252.3508)
 - = 0.7457 in

Required thickness tr per Interpretation VIII-1-07-50

$$t_{r} = P^{*}D_{o}^{*}K / (2^{*}S^{*}E + 2^{*}P^{*}(K - 0.1))$$

$$= 252.35*132*1 / (2*20,000*1 + 2*252.35*(1 - 0.1))$$

29

Area required per UG-37(c)

Allowable stresses: $S_n = 17,100$, $S_v = 20,000$, $S_p = 20,000$ psi

 $f_{r\,l} = {\rm lesser} ~{\rm of}~ l~{\rm or}~ S_n$ / $S_v = 0.855$

 f_{r2} = lesser of 1 or $S_n / S_v = 0.855$

 $f_{r3} = lesser of f_{r2} or S_p / S_v = 0.855$

 f_{r4} = lesser of 1 or S_p / S_v = 1

 $d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$ === А

- 0.855)

$$= 19*0.7457*1 + 2*0.5*0.7457*1*(1 - 1)$$

$$= 19*0.7457*1 + 2*0.5*0.745$$

$$= 19*0.7457*1 + 2*0.5*0.74$$

$$= 19^{+}0.7437^{+}1 + 2^{+}0.3^{+}0.7437^{+}$$
$$= 14.2768 \text{ in}^{2}$$

$$=$$
 14.2768 in²

$$A_1 =$$
larger of the following $= 1.9662$ in²

$$= d^{*}(E_{1}^{*}t - F^{*}t_{r}) - 2^{*}t_{n}^{*}(E_{1}^{*}t - F^{*}t_{r})^{*}(1 - f_{r1})$$

$$= 19*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.7457)*(1 - 0.85)$$

$$=$$
 1.9662 in²

= =

=

=

==

=

=

= =

==

=

=

=

≔

= =

==

==

=:

A₄₁

$$= 19*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.7457)*(1 - 0.855)$$

$$= 19^{*}(1^{*}0.85 - 1^{*}0.7457) - 2^{*}0.5^{*}(1^{*}0.85 - 1^{*})$$

$$= 1.0662 \cdot n^{2}$$

$$= 19*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.745)$$

$$= 19^{*}(1^{*}0.85 - 1^{*}0.7457)$$

$$= 19*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.745)$$

$$= 1.9662 \text{ in}^2$$

$$= 19*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.7457)*(1 - 0.855)$$

2*(0.85 + 0.5)*(1*0.85 - 1*0.7457) - 2*0.5*(1*0.85 - 1*0.7457)*(1 - 0.855)

. Marine

$$= 19^{*}(1^{*}0.85 - 1^{*}0.7457) - 2^{*}0.5^{*}(1^{*}0.85)$$
$$= 1.9662 \text{ in}^{2}$$

$$= 19662 \text{ in}^2$$

$$=$$
 1.9662 in²

$$=$$
 1.9662 in²

$$=$$
 1.9662 in²

$$2^{*}(t + t_{n})^{*}(E_{1}^{*}t - F^{*}t_{r}) - 2^{*}t_{n}^{*}(E_{1}^{*}t - F^{*}t_{r})^{*}(1 - f_{r1})$$

$$2^{*}(t + t_{n})^{*}(E_{1}^{*}t - F^{*}t_{r}) - 2^{*}t_{n}^{*}(E_{1}^{*}t - F^{*}t_{r})^{*}(1 - f_{r1})$$

$$1.9662 \text{ in}^2$$

0.2664 in²

 $A_2 = \text{smaller of the following} = 1.2264 \text{ in}^2$

1.3031 in²

1.2264 in²

 $A_3 = \text{smaller of the following} = 1.0688 \text{ in}^2$

 $5*t*t_i*f_{r2}$

<u>1.8169</u> in²

 $5 t_i t_i t_i f_{r2}$

1.0688 in²

2*h*t_i*f_{r2}

<u>1.0688</u> in²

Leg²*f_{r3}

 $0.5^{2*}0.855$

<u>0.2138</u> in²

COMPRESS 2018 Build 7800; 5361

5*0.85*0.5*0.855

5*0.5*0.5*0.855

2*1.25*0.5*0.855

 $5^{*}(t_{n} - t_{rn})^{*}f_{r2}^{*}t$

5*(0.5 - 0.1414)*0.855*0.85

 $2*(t_n - t_{rn})*(2.5*t_n + t_e)*f_{r2}$

2*(0.5 - 0.1414)*(2.5*0.5 + 0.75)*0.855

$$= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t - F^{*}t_{r}) - 2^{*}t_{n}^{*}(E_{1}^{*}t - F^{*}t_{r})^{*}(1 - f_{r})$$

A ₄₂ :	=	Leg $^{2*}f_{r4}$ 0.5625 ^{2*} 1 <u>0.3164</u> in ²
A ₄₃	=	Leg ² *f _{r2} 0.3125 ² *0.855 <u>0.0835</u> in ²
A ₅	=	$(D_p - d - 2*t_n)*t_e*f_{r4}$ (33.5 - 19 - 2*0.5)*0.75*1 <u>10.125</u> in ²

Area = $A_1 + A_2 + A_3 + A_{41} + A_{42} + A_{43} + A_5$ = 1.9662 + 1.2264 + 1.0688 + 0.2138 + 0.3164 + 0.0835 + 10.125= 15.0001 in²

As Area \geq A the reinforcement is adequate.

UW-16(c)(2) Weld Check

Inner fillet:	t _{min}	= lesser of 0.75 or t_n or $t_e = 0.5$ in
	t _{w(min)}	$= 0.7 * t_{min} = 0.35$ in
	t _{w(actual)}	= 0.7*Leg $= 0.7*0.5 = 0.35$ in
Outer fillet:	t _{min}	= lesser of 0.75 or t_e or $t = 0.75$ in
	t _{w(min)}	$= 0.5 * t_{min} = 0.375$ in
	tw(actual)	= 0.7*Leg $= 0.7*0.5625 = 0.3938$ in

UG-45 Nozzle Neck Thickness Check (Access Opening)

Interpretation VIII-1-83-66 has been applied.

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	252.3508*9.5 / (17,100*0.85 - 0.6*252.3508) + 0
	п	0.1667 in
ta	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.1667 , 0]
	=	0.1667 in

Available nozzle wall thickness new, $t_n = 0.875*0.5 = 0.4375$ in

The nozzle neck thickness is adequate.

Allowable stresses in joints UG-45 and UW-15(c)

Groove weld in tension:	0.74*20,000 =	14,800 psi
Nozzle wall in shear:	0.7*17,100 =	11,970 psi
Inner fillet weld in shear:	0.49*17,100 =	8,379 psi
Outer fillet weld in shear:	0.49*20,000 =	9,800 psi
Lower fillet weld in shear:	0.49*17,100 =	8,379 psi

Strength of welded joints:

(1) Inner fillet weld in shear $(\pi / 2)$ *Nozzle OD*Leg*S_i = $(\pi / 2)$ *20*0.5*8,379 = 131,617.02 lb_f

(2) Outer fillet weld in shear

 $(\pi / 2)$ *Pad OD*Leg*S_o = $(\pi / 2)$ *33.5*0.5625*9,800 = 290,076.99 lb_f

(3) Nozzle wall in shear

 $(\pi / 2)$ *Mean nozzle dia*t_n*S_n = $(\pi / 2)$ *19.5*0.5*11,970 = 183,323.71 Ib_f

(4) Groove weld in tension

 $(\pi / 2)$ *Nozzle OD*t_w*S_g = $(\pi / 2)$ *20*0.85*14,800 = 395,212.35 lb_f

(5) Lower fillet weld in shear

 $(\pi / 2)$ *Nozzle OD*Leg*S₁ = $(\pi / 2)$ *20*0.3125*8,379 = 82,260.64 Ib_f

Loading on welds per UG-41(b)(1)

W	=	$(A - A_1 + 2*t_n*f_{r1}*(E_1*t - F*t_r))*S_v$
	=	(14.2768 - 1.9662 + 2*0.5*0.855*(1*0.85 - 1*0.7457))*20,000
	==	<u>247,995.38</u> lb _f

 $W_{1-1} = (A_2 + A_5 + A_{41} + A_{42}) * S_v$

- = (1.2264 + 10.125 + 0.2138 + 0.3164) * 20,000
 - = <u>237,632</u> lb_f

W ₂₋₂	11 11	$\begin{array}{l}(A_2+A_3+A_{41}+A_{43}+2^*t_n^*t^*f_{r1})^*S_v\\(1.2264+1.0688+0.2138+0.0835+2^{*}0.85^{*}0.85^{*}0.855)^{*}20,000\end{array}$
	=	<u>66.384</u> lbf
W2 2	=	$(A_2 + A_2 + A_5 + A_{41} + A_{42} + A_{42} + 2*t_**t_{-1})*S_{}$

- $w_{3-3} = (A_2 + A_3 + A_5 + A_{41} + A_{42} + A_{43} + 2^* \iota_n^* \iota^* \iota_{r_1})^* S_v$
 - = (1.2264 + 1.0688 + 10.125 + 0.2138 + 0.3164 + 0.0835 + 2*0.5*0.85*0.855)*20,000
 - $= 275,212 \, lb_f$

Load for path 1-1 lesser of W or $W_{1-1} = 237,632 \text{ lb}_f$ Path 1-1 through (2) & (3) = 290,076.99 + 183,323.71 = 473,400.7 lb_f Path 1-1 is stronger than W_{1-1} so it is acceptable per UG-41(b)(1).

Load for path 2-2 lesser of W or $W_{2-2} = 66,384 \text{ lb}_{f}$ Path 2-2 through (1), (4), (5) = 131,617.02 + 395,212.35 + 82,260.64 = <u>609,090.02</u> lb_f Path 2-2 is stronger than W_{2-2} so it is acceptable per UG-41(b)(1).

Load for path 3-3 lesser of W or $W_{3-3} = 247,995.38 \text{ lb}_{f}$ Path 3-3 through (2), (4), (5) = 290,076.99 + 395,212.35 + 82,260.64 = <u>767,549.99</u> lb_f Path 3-3 is stronger than W so it is acceptable per UG-41(b)(2).



Diameter, D _p	38.9783"				
Thickness, t _e	1"				
Is split	No.				
Welds					
Inner fillet, Leg ₄₁	0.5"				
Outer fillet, Leg ₄₂	0.5625"				
Nozzle to vessel groove weld	0.875"				
Pad groove weld	0"				

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange					
Description	NPS 20 Class 150 WN A105				
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)				
Blind included	Yes				
Rated MDMT	-31.1°F				
Liquid static head	3.51 psi				
MAWP rating	278.75 psi @ 125°F				
MAP rating	285 psi @ 40°F				
Hydrotest rating	450 psi @ 40°F				
PWHT performed	No				
Impact Tested	No				
Circumferential joint radiography	None UW-11(c) Type 1				
Bore diameter, B (specified by purchaser)	19"				
Ga	sket				
Description	Klingersil C-4401 Synthetic Fiber				
Notes					
Flange rated MDMT per UCS-66(b)(1)(b) = -31.1° F (Coincident ratio = 0.8895) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F					

UCS-66 Material Toughness Requirements Nozzle					
$t_{\Gamma} = 253.51*9.5 / (17,100*0.85 - 0.6*253.51) =$	0.1674"				
Stress ratio = $t_r * E^* / (t_n - c) = 0.1674 * 0.85 / (0.4375 - 0) =$	0.3253				
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155°F				
Material is exempt from impact testing at the Design MDMT of -20°F.					

UCS-66 Material Toughness Requirements Pad						
Governing thickness, t _g =	0.875"					
MDMT =	-20°F					

Material is exempt from impact testing per UG-20(f) at the Design MDMT of -20°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in ²) UG-45 Summary (in)								
For P = 253.51 psi @ 125 °F The opening is adequately reinforced The nozzle passe							asses UG-45	
A required	A available	A ₁	A ₂	A ₃	A 5	A welds	t _{req}	t _{min}
18.3238	<u>18.7955</u>	<u>0.9265</u>	<u>1.3388</u>		<u>16</u>	<u>0.5302</u>	<u>0,1674</u>	0.4375

UG-41 Weld Failure Path Analysis Summary (lb _f)										
All failure paths are stronger than the applicable weld loads										
Weld load WWeld load W1-1Path 1-1 strengthWeld load W2-2Path 2-2 strengthWeld load W3-3Path 3- strength										
<u>348.674.7</u> <u>357.380</u> <u>520.837.38</u> <u>46.014.5</u> <u>538.453.27</u> <u>372,342.5</u> <u>744,349.92</u>										

· U	W-16 Weld Sizi	ng Summary	
Weld description	Required weld throat size (in)	Actual weld throat size (iu)	Status
Nozzle to pad fillet (Leg ₄₁)	<u>0.35</u>	0.35	weld size is adequate
Pad to shell fillet (Leg ₄₂)	<u>0.375</u>	0.3938	weld size is adequate

Calculations for internal pressure 253.51 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(21.8695, 10.9348 + (0.5 0) + (0.875 0))
 - = 21.8695 in

Outer Normal Limit of reinforcement per UG-40

 $L_{H} = MIN(2.5*(t - C), 2.5*(t_n - C_n) + t_e)$

- = MIN(2.5*(0.875 0), 2.5*(0.5 0) + 1)
 - = 2.1875 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P*R_n / (S_n*E - 0.6*P)$

- = 253.5059*9.5 / (17,100*1 0.6*253.5059)
- = 0.1421 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 253.5059*66 / (20,000*1 + 0.4*253.5059)
- = 0.8323 in

Area required per UG-37(c)

Allowable stresses: $S_n = 17,100$, $S_v = 20,000$, $S_p = 20,000$ psi

 $f_{r1} = lesser of 1 \text{ or } S_n / S_v = 0.855$

 $f_{r2} = lesser of I or S_n / S_v = 0.855$

 $f_{r3} = \text{lesser of } f_{r2} \text{ or } S_p / S_v = 0.855$

 $f_{r4} = lesser of l or S_p / S_v = 1$

- $d*t_r*F + 2*t_n*t_r*F*(1 f_{r1})$ A =
- - = 21.8695*0.8324*1 + 2*0.5*0.8324*1*(1 - 0.855) = 18.3238 in²
- Area available from FIG. UG-37.1
- $A_1 = \text{larger of the following} = 0.9265 \text{ in}^2$
 - $d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$ =
 - 21.8695*(1*0.875 1*0.8324) 2*0.5*(1*0.875 1*0.8324)*(1 0.855) =
 - 0.9265 in² ----

 - $2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$ =
 - = 2*(0.875 + 0.5)*(1*0.875 - 1*0.8324) - 2*0.5*(1*0.875 - 1*0.8324)*(1 - 0.855)
 - = 0.1111 in²

 $A_2 = \text{smaller of the following} = 1.3388 \text{ in}^2$

- $5^{*}(t_{n} t_{rn})^{*}f_{r2}^{*}t$ =
- = 5*(0.5 - 0.1421)*0.855*0.875
- 1.3388 in² =
- $2*(t_n t_{rn})*(2.5*t_n + t_e)*f_{r2}$
- 2*(0.5 0.1421)*(2.5*0.5 + 1)*0.855 =
- 1.377 in² =

Leg²*f_{r3} A_{41} =

- 0.52*0.855 =
- 0.2138 in2
- Leg²*f_{r4} A42 =
 - 0.56252*1 =
 - 0.3164 in2 =

 A_5 $(D_p - d - 2*t_n)*t_e*f_{r4}$ = (38.9783 - 22.9783)*1*1 = = 16 in²

- $A_1 + A_2 + A_{41} + A_{42} + A_5$ Area =
- 0.9265 + 1.3388 + 0.2138 + 0.3164 + 16= =
 - 18.7955 in²

As Area >= A the reinforcement is adequate.

UW-16(c)(2) Weld Check

```
Inner fillet: t<sub>min</sub>
                         = lesser of 0.75 or t_n or t_e = 0.5 in
              t_{w(min)} = 0.7 t_{min} = 0.35 in
              t_{w(actual)} = 0.7*Leg = 0.7*0.5 = 0.35 in
                         = lesser of 0.75 or t_e or t = 0.75 in
Outer fillet: tmin
              t_{w(min)} = 0.5 * t_{min} = 0.375 in
              t_{w(actual)} = 0.7*Leg = 0.7*0.5625 = 0.3938 in
```

.

· ···· .,

UG-45 Nozzle Neck Thickness Check (Access Opening)

t _a UG-27	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
		253.5059*9.5 / (17,100*0.85 - 0.6*253.5059) + 0
	=	0.1674 in

 $\begin{array}{rcl}t_{a} & = & \max[t_{a \, UG-27}, t_{a \, UG-22}]\\ & = & \max[0.1674, 0]\\ & = & 0.1674 \, \mathrm{in}\end{array}$

Available nozzle wall thickness new, $t_n = 0.875*0.5 = 0.4375$ in

The nozzle neck thickness is adequate.

Allowable stresses in joints UG-45 and UW-15(c)

Groove weld in tension: 0.74*20,000 = 14,800 psi Nozzle wall in shear: 0.7*17,100 = 11,970 psi Inner fillet weld in shear: 0.49*17,100 = 8,379 psi Outer fillet weld in shear: 0.49*20,000 = 9,800 psi

Strength of welded joints:

(1) Inner fillet weld in shear $(\pi / 2)$ *Nozzle OD*Leg*S_i = $(\pi / 2)$ *20*0.5*8,379 = 131,617.02 lb_f

(2) Outer fillet weld in shear $(\pi / 2)$ *Pad OD*Leg*S₀ = $(\pi / 2)$ *38.9783*0.5625*9,800 = 337,513.67 lb_f

(3) Nozzle wall in shear (π / 2)*Mean nozzle dia* t_n *S_n = (π / 2)*19.5*0.5*11,970 = 183,323.71 lb_f

(4) Groove weld in tension

 $(\pi / 2)$ *Nozzle OD*t_w*S_g = $(\pi / 2)$ *20*0.875*14,800 = 406,836.25 lb_f

Loading on welds per UG-41(b)(1)

 $(A - A_1 + 2*t_n*f_{r1}*(E_1*t - F*t_r))*S_v$ W = (18.3238 - 0.9265 + 2*0.5*0.855*(1*0.875 - 1*0.8324))*20,000 = 348,674.7 lbf = $(A_2 + A_5 + A_{41} + A_{42}) * S_v$ $W_{1-1} =$ === (1.3388 + 16 + 0.2138 + 0.3164)*20,000357,380 lbf = $(A_2 + A_3 + A_{41} + A_{43} + 2*t_n*t*f_{r1})*S_v$ $W_{2-2} =$ (1.3388 + 0 + 0.2138 + 0 + 2*0.5*0.875*0.855)*20,00046,014.5 lbf = $(A_2 + A_3 + A_5 + A_{41} + A_{42} + A_{43} + 2*t_n*t*f_{r1})*S_v$ $W_{3-3} =$ (1.3388 + 0 + 16 + 0.2138 + 0.3164 + 0 + 2*0.5*0.875*0.855)*20,000 = 372,342.5 lbf =

Load for path 1-1 lesser of W or $W_{1-1} = 348,674.7 \text{ lb}_{f}$ Path 1-1 through (2) & (3) = 337,513.67 + 183,323.71 = <u>520,837.38</u> lb_{f} Path 1-1 is stronger than W so it is acceptable per UG-41(b)(2).

Load for path 2-2 lesser of W or $W_{2-2} = 46,014.5 \text{ lb}_{f}$

Path 2-2 through (1), (4) = $131,617.02 + 406,836.25 = \frac{538,453.27}{538,453.27}$ lb_f Path 2-2 is stronger than W₂₋₂ so it is acceptable per UG-41(b)(1).

Load for path 3-3 lesser of W or $W_{3-3} = 348,674.7 \text{ lb}_{f}$ Path 3-3 through (2), (4) = 337,513.67 + 406,836.25 = <u>744,349.92</u> lb_f Path 3-3 is stronger than W so it is acceptable per UG-41(b)(2).

,



Thickness, t _e	0.75"
Is split	No
	Welds
Inner fillet, Leg ₄₁	0.5"
Outer fillet, Leg ₄₂	0.5625"
Lower fillet, Leg ₄₃	0.3125"
Nozzle to vessel groove weld	0.875"
Pad groove weld	0"

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange		
Description	NPS 24 Class 150 WN A105	
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)	
Blind included	No	
Rated MDMT	-32.3°F	
Liquid static head	0 psi	
MAWP rating	278.75 psi @ 125°F	
MAP rating	285 psi @ 40°F	
Hydrotest rating	450 psi @ 40°F	
PWHT performed	No	
Impact Tested	No	
Circumferential joint radiography	None UW-11(c) Type 1	
Bore diameter, B (specified by purchaser)	23"	
Gasket		
Description	Klingersil C-4401 Synthetic Fiber	
N	Dtes	
Elange rated MDMT per UCS-66(b)(1)(b) = -	32 3°E (Coincident ratio = 0.8772)	

Flange rated MDMT per UCS-66(b)(1)(b) = -32.3° F (Coincident ratio = 0.8772) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F

UCS-66 Material Toughness Requirements Nozzle	
Governing thickness, t _g =	0.4375"
Exemption temperature from Fig UCS-66 Curve B =	-13° F
$t_r = 250*11.5 / (17,100*0.85 - 0.6*250) =$	0.1999"
Stress ratio = $t_r * E^* / (t_n - c) = 0.1999 * 0.85 / (0.4375 - 0) =$	0.3883
Reduction in MDMT, T_R from Fig UCS-66.1 =	101.6°F
$MDMT = max[MDMT - T_R, -55] = max[-13 - 101.6, -55] =$	-55°F
Material is exempt from impact testing at the Design MDMT of	of - 20°F.

UCS-66 Material Toughness Requirements Pa	d .
Governing thickness, $t_g =$	0.75"
MDMT =	-20°F
Material is exempt from impact testing per UG-20(f) at the Design	MDMT of -20°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in ²)					UG-45 Sun	nmary (in)		
For P = 250 psi @ 125 °F The opening is adequately reinforced			The nozzle passes UG-45					
A required	A available	A _l	A ₂	A ₃	A 5	A welds	t _{req}	t _{min}
<u>18.9997</u>	<u>19,424</u>	<u>1.2365</u>	<u>1.13</u>	<u>1.0688</u>	15.375	<u>0.6137</u>	<u>0.3281</u>	0.4375

	UG-41 Weld Failure Path Analysis Summary (lbf)					
	All failu	re paths are str	onger than th	ie applieable w	eld loads	
Weld load W	Weld load W ₁₋₁	Path 1-1 strength	Weld load W ₂₋₂	Path 2-2 strength	Weld load W ₃₋₃	Path 3-3 strength
356,189.72	<u>340,704</u>	606,254.73	<u>64.883.5</u>	744,856.69	378,711.5	972,242.42

עי	W-16 Weld Sizin	ng Summary	
Weld description	Required weld throat size (in)	Aetual weld throat size (in)	Status
Nozzle to pad fillet (Leg ₄₁)	<u>0.35</u>	0.35	weld size is adequate
Pad to shell fillet (Leg ₄₂)	<u>0.375</u>	0.3938	weld size is adequate

Calculations for internal pressure 250 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

$$\begin{array}{rcl} L_R & \rightleftharpoons & MAX(d,\,R_n + (t_n \text{ - } C_n) + (t \text{ - } C)) \\ & = & MAX(23,\,11.5 + (0.5 \text{ - } 0) + (0.875 \text{ - } 0)) \end{array}$$

= 23 in

Outer Normal Limit of reinforcement per UG-40

Inner Normal Limit of reinforcement per UG-40

$$L_{I} = MIN(h, 2.5^{*}(t - C), 2.5^{*}(t_{i} - C_{n} - C))$$

- = MIN(1.25, 2.5*(0.875 0), 2.5*(0.5 0 0))
 - = 1.25 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 250*11.5 / (17,100*1 0.6*250)
- = 0.1696 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_0 / (S^*E + 0.4^*P)$

- = 250*66 / (20,000*1 + 0.4*250)
- = 0.8209 in

Area required per UG-37(c)

42

Allowable stresses: $S_n = 17,100$, $S_v = 20,000$, $S_p = 20,000$ psi

 $f_{r1} = \text{lesser of 1 or } S_n / S_v = 0.855$

 f_{r2} = lesser of 1 or $S_n / S_v = 0.855$

 $f_{r3} = lesser of f_{r2} or S_p / S_v = 0.855$

 $f_{r4} = lesser of 1 \text{ or } S_p / S_v = 1$

 $A = d^{*}t_{r}^{*}F + 2^{*}t_{n}^{*}t_{r}^{*}F^{*}(1 - f_{r})$

= 23*0.8209*1 + 2*0.5*0.8209*1*(1 - 0.855)

= <u>18.9997</u> in²

Area available from FIG. UG-37.1

 $A_1 = \text{larger of the following} = 1.2365 \text{ in}^2$

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 23*(1*0.875 1*0.8209) 2*0.5*(1*0.875 1*0.8209)*(1 0.855)
- = 1.2365 in²
- $= 2^{*}(t+t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- $= 2^{*}(0.875 + 0.5)^{*}(1^{*}0.875 1^{*}0.8209) 2^{*}0.5^{*}(1^{*}0.875 1^{*}0.8209)^{*}(1 0.855)$
- = 0.1409 in²

 $A_2 = \text{smaller of the following} = 1.13 \text{ in}^2$

- = 5*(t_n t_{rn})*f_{r2}*t
- = 5*(0.5 0.1696)*0.855*0.875
- = 1.2359 in²
- $= 2^{*}(t_{n} t_{rn})^{*}(2.5^{*}t_{n} + t_{e})^{*}f_{r2}$
- = 2*(0.5 0.1696)*(2.5*0.5 + 0.75)*0.855
- = 1.13 in²

 $A_3 = \text{smaller of the following} = 1.0688 \text{ in}^2$

- $= 5*t*t_i*f_{r2}$
- = 5*0.875*0.5*0.855
- = <u>1.8703</u> in²
- $= 5*t_i*t_i*f_{r2}$
- = 5*0.5*0.5*0.855
- = <u>1.0688</u> in²
- $= 2*h*t_i*f_{r_2}$
- = 2*1.25*0.5*0.855
- = <u>1.0688</u> in²

 $A_{41} = Leg^{2*}f_{r3}$

- = $0.5^{2}*0.855$
- = <u>0.2138</u> in²
- $A_{42} = Leg^{2*}f_{r4}$
 - = 0.5625²*1
 - $= 0.3164 \text{ in}^2$
- $A_{43} = Leg^{2*}f_{r2}$
 - = 0.3125²*0.855

= <u>0.0835</u> in²

 $A_5 = (D_p - d - 2*t_n)*t_e*f_{f4}$

= (44.5 - 23 - 2*0.5)*0.75*1

$$=$$
 15.375 in²

Area = $A_1 + A_2 + A_3 + A_{41} + A_{42} + A_{43} + A_5$ = 1.2365 + 1.13 + 1.0688 + 0.2138 + 0.3164 + 0.0835 + 15.375= 19.424 in²

As Area \geq A the reinforcement is adequate.

UW-16(c)(2) Weld Check

Inner fillet: t_{min} = lesser of 0.75 or t_n or $t_e = 0.5$ in $t_{w(min)}$ = 0.7* $t_{min} = 0.35$ in $t_{w(actual)} = 0.7*Leg = 0.7*0.5 = 0.35$ in

Outer fillet: t_{min} = lesser of 0.75 or t_e or t = 0.75 in $t_{w(min)}$ = 0.5* $t_{min} = 0.375$ in $t_{w(actual)} = 0.7*Leg = 0.7*0.5625 = 0.3938$ in

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	250*11.5 / (17,100*0.85 - 0.6*250) + 0
	=	0.1999 in
t	_	max[t]
۲a	_	$\operatorname{max}[\operatorname{a} \cup G-27]$, $\operatorname{a} \cup G-22$]
	=	max[0.1999 , 0]
	=	0.1999 in
thi	=	$P*R_o / (S*E + 0.4*P) + Corrosion$
01	_	250*66/(20.000*1+0.4*250)+0
	_	$230^{\circ}607(20,000^{\circ}1+0.4^{\circ}230)+0$
	=	0.8209 in
t _{b1}	=	max[t _{b1} , t _{b UG16}]
	=	max[0.8209.0.0625]
	=	0.8209 in
		0.0209 m
tb	=	min[t _{b3} , t _{b1}]
	=	min[0.3281, 0.8209]
	m	0.3281 in
t _{UG-45}	=	max[t _a , t _b]
	=	max[0.1999 , 0.3281]
	=	0.3281 in
		siminimum -

Available nozzle wall thickness new, $t_n = 0.875*0.5 = 0.4375$ in

The nozzle neck thickness is adequate.

Allowable stresses in joints UG-45 and UW-15(c)

Groove weld in tension:	0.74*20,000 =	14,800 psi
Nozzle wall in shear:	0.7*17,100 ==	11,970 psi
Inner fillet weld in shear:	0.49*17,100 =	8,379 psi
Outer fillet weld in shear:	0.49*20,000 =	9,800 psi

Strength of welded joints:

(1) Inner fillet weld in shear $(\pi / 2)$ *Nozzle OD*Leg*S_i = $(\pi / 2)$ *24*0.5*8,379 = 157,940.43 lb_f

(2) Outer fillet weld in shear $(\pi / 2)$ *Pad OD*Leg*S₀ = $(\pi / 2)$ *44.5*0.5625*9,800 = 385,326.15 lb_f

(3) Nozzle wall in shear $(\pi / 2)^*$ Mean nozzle dia* $t_n^*S_n = (\pi / 2)^*23.5^*0.5^*11,970 = 220,928.58 \text{ lb}_f$

(4) Groove weld in tension (π / 2)*Nozzle OD*t_w*S_g = (π / 2)*24*0.875*14,800 = 488,203.5 lb_f

(5) Lower fillet weld in shear $(\pi / 2)$ *Nozzle OD*Leg*S₁ = $(\pi / 2)$ *24*0.3125*8,379 = 98,712.77 lb_f

Loading on welds per UG-41(b)(1)

W		$(A - A_1 + 2*t_n*f_{r1}*(E_1*t - F*t_r))*S_v$
	=	(18.9997 - 1.2365 + 2*0.5*0.855*(1*0.875 - 1*0.8209))*20,000
	=	<u>356,189.72</u> lb _f
W ₁₋₁	=	$(A_2 + A_5 + A_{41} + A_{42})*S_v$
	=	(1.13 + 15.375 + 0.2138 + 0.3164)*20,000
	=	<u>340,704</u> lbf
W ₂₋₂	=	$(A_2 + A_3 + A_{41} + A_{43} + 2*t_n*t*f_{r1})*S_v$
	=	(1.13 + 1.0688 + 0.2138 + 0.0835 + 2*0.5*0.875*0.855)*20,000
		<u>64,883.5</u> lb _f
W3-3		$(A_2 + A_3 + A_5 + A_{41} + A_{42} + A_{43} + 2^*t_n^*t^*f_{r1})^*S_v$
	=	(1.13 + 1.0688 + 15.375 + 0.2138 + 0.3164 + 0.0835 + 2*0.5*0.875*0.855)*20,000
	=	<u>378,711.5</u> lbf

Load for path 1-1 lesser of W or $W_{1-1} = 340,704 \text{ lb}_{f}$ Path 1-1 through (2) & (3) = 385,326.15 + 220,928.58 = <u>606,254.73 lb_{f}</u> Path 1-1 is stronger than W_{1-1} so it is acceptable per UG-41(b)(1).

Load for path 2-2 lesser of W or $W_{2-2} = 64,883.5 \text{ lb}_{f}$ Path 2-2 through (1), (4), (5) = 157,940.43 + 488,203.5 + 98,712.77 = <u>744,856.69</u> lb_f Path 2-2 is stronger than W_{2-2} so it is acceptable per UG-41(b)(1).

Load for path 3-3 lesser of W or $W_{3-3} = 356,189.72 \text{ lb}_{f}$ Path 3-3 through (2), (4), (5) = 385,326.15 + 488,203.5 + 98,712.77 = <u>972,242.42</u> lb_f Path 3-3 is stronger than W so it is acceptable per UG-41(b)(2).

ASME Section VIII Division 1, 2017 Edition				
Note: round inside edges per UG-76(c)				
Location and Orientation	en son in den en e			
Located on	Shell			
Orientation	n ^{derendentisken bilden det er derenden er er er er der derenden er derenden er derenden er derenden er derend 0°}			
Nozzle center line offset to datum line	24"			
End of nozzle to shell center	74"			
Passes through a Category A joint	No			
Nozzle				
Access opening	No			
Material specification	SA-105 (II-D p. 18, ln. 19)			
Inside diameter, new	2"			
Nominal wall thickness	0.53"			
Corrosion allowance	0" 0"			
Projection available outside vessel, Lpr	7.25"			
Projection available outside vessel to flange face, Lf	8"			
Local vessel minimum thickness	0.875"			
Liquid static head included	0 psi			
Longitudinal joint efficiency	1			
Welds				
Inner fillet, Leg ₄₁	0.375"			
Nozzle to vessel groove weld	0.875"			

ASME B16.5-2013 Flange		
Description	NPS 2 Class 150 LWN A105	
 Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, In. 32)	

,

Blind included	No		
Rated MDMT	-32.3°F		
Liquid static head	0 psi		
MAWP rating	278.75 psi @ 125°F		
MAP rating	285 psi @ 40°F		
Hydrotest rating	450 psi @ 40°F		
PWHT performed	No		
Impact Tested	No		
Gasket			
Description	Klingersil C-4401 Synthetic Fiber		
Notes			
Flange rated MDMT per UCS-66(b)(1)(b) = -32.3°F (Coincident ratio = 0.8772) Bolts rated MDMT per Fig UCS-66 note (c) = $-55^{\circ}F$			

Bolts rated MDMT per Fig UCS-66 note (c) = -55° F

	UCS-66 Material Toughness Requirements							
the state of the s	LWN rated MDMT per UCS-66(c)(4) =	-32.3°F						
	Material is exempt from impact testing at the Design MDMT of -20°							
UG-37 Area Calculation Summary (in ²)					UG-45 Sum	mary (in)		
---	--	----------------	----------------	----------------	------------	------------	------------------	------------------
	For P = 250 psi @ 125 °F						The nozzle pa	sses UG-45
A required	A available	A ₁	A ₂	A ₃	A 5	A welds	t _{req}	t _{min}
This nozzle is	This nozzle is exempt from area calculations per UG-36(c)(3)(a						<u>0.189</u>	0.53

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld descriptionRequired weld throat sizc (in)Actual weld throat sizc (in)Status			Status
Nozzle to shell fillet (Leg ₄₁)	0.25	0.2625	weld size is adequate

Calculations for internal pressure 250 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(2, 1 + (0.53 0) + (0.875 0))
 - = 2.405 in

Outer Normal Limit of reinforcement per UG-40

- $L_{H} = MIN(2.5*(t C), 2.5*(t_n C_n) + t_e)$
 - = MIN(2.5*(0.875 0), 2.5*(0.53 0) + 0)
 - = 1.325 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 250*1 / (20,000*1 0.6*250)
 - = 0.0126 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 250*66 / (20,000*1 + 0.4*250)
- = 0.8209 in

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.53 in $t_{c(min)}$ = lesser of 0.25 or 0.7* t_{min} = <u>0.25</u> in $t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

^t a UG-27	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	250*1/(20,000*1 - 0.6*250) + 0
	=	0.0126 in
ta	=	max[t _{a UG-27} , t _{a UG-22]}
	=	max[0.0126 , 0]
	=	0.0126 in
t.		D*D = /(C*E + 0.4*D) + Conversion
ъ	=	$F^{+}K_{0} / (S^{+}E + 0.4^{+}F) + Corrosion$
	=	250*66 / (20,000*1 + 0.4*250) + 0
	=	0.8209 in
th 1	_	max[the thread]
'DI		
	_	$\max[0.8209, 0.0625]$
	-	0.8209 In
tb	=	min[t _{b3} , t _{b1}]
	=	min[0.189, 0.8209]
	=	0.189 in
	j.,	
^t UG-45	=	max[t _a ,t _b]
	=	max[0.0126 , 0.189]
	=	<u>0.189</u> in

Available nozzle wall thickness new, $t_{n}\,{=}\,0.53$ in

The nozzle neck thickness is adequate.

ASME Section VIII Division 1, 2017 Edition		
4,9400 4,9400 1,0200 1,0200 6,5600 0,8750 1 0,8750 1 0,8750 1 0,8750		
Location and Orientation	25 mg = 0,125 m harmaninaisenaaraan kaintakaan kaintakaan kaintakaan kaintakaan kaintakaan kaintakaan kaintakaan kaintakaan kai	
	nadewanitisitasi teri politine toa terniterasiteria initeriaria damana damana karana karana karana karana karan Shell	
Orientation	180°	
Nozzle center line offset to datum line 24"		
End of nozzle to shell center 74"		
Passes through a Category A joint	No	
Nozzle	***************************************	
Access opening	No	
Material specification SA-105 (II-D		
Inside diameter, new 2.9"		
Wall thickness, t _n 1.02"		
Minimum wall thickness	0.8325"	
Corrosion allowance	0"	
Projection available outside vessel, Lpr	7.06"	
Heavy barrel length, L _{lib}	6.56"	
Projection available outside vessel to flange face, Lf 8"		
Local vessel minimum thickness 0.875"		
Liquid static head included 4.73 psi		
Longitudinal joint efficiency	1	
Welds	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
Inner fillet, Leg ₄₁ . 0.375"		
Nozzle to vessel groove weld 0.875"		

COMPRESS 2018 Build 7800; 5361

ASME B16.5-2013 Flange			
Description	NPS 3 Class 150 FVC HB A105 (Nut Stop)		
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, In. 32)		
Blind included	No		
Rated MDMT	-30.5°F		
Liquid static head	5.02 psi		
MAWP rating	278.75 psi @ 125°F		
MAP rating	285 psi @ 40°F		
Hydrotest rating	450 psi @ 40°F		
PWHT performed	No		
Impact Tested	No		
	Gasket		
Description	Klingersil C-4401 Synthetic Fiber		
Notes			

Flange rated MDMT per UCS-66(b)(1)(b) = $-30.5^{\circ}F$ (Coincident ratio = 0.8948) Bolts rated MDMT per Fig UCS-66 note (c) = $-55^{\circ}F$

UCS-66 Material Toughness Requirements Nozzle At Intersection		
$t_r = 254.73*1.45 / (20,000*1 - 0.6*254.73) =$	0.0186"	
Stress ratio = $t_r * E^* / (t_n - c) = 0.0186*1 / (1.02 - 0) =$	0.0183	
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) = -155°F		
Material is exempt from impact testing at the Design MDMT of -20°F.		

UCS-66 Material Toughness Requirements Nozzle		
$t_r = 254.73*1.45 / (20,000*1 - 0.6*254.73) =$	0.0186"	
Stress ratio = $t_r * E^* / (t_n - c) = 0.0186*1 / (0.8325 - 0) =$	0.0224	
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155°F	
Material is exempt from impact testing at the Design MDMT of -20°F.		

•

UG-37 Area Calculation Summary (in ²)					UG-45 Sur	nmary (in)		
For P = 254.73 psi @ 125 °F The opening is adequately reinforced				The nozzle p	asses UG-45			
A required	A available	A ₁	A ₂	A ₃	A5	A welds	t _{req}	t _{min}
2.4254	<u>4.6681</u>	<u>0.1464</u>	<u>4.3811</u>			<u>0.1406</u>	<u>0.2258</u>	0.8325

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(1)

 UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
 Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate

Calculations for internal pressure 254.73 psi @ 125 °F

Parallel Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$ = MAX(2.9, 1.45 + (1.02 - 0) + (0.875 - 0)) = 3.345 in

Outer Normal Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

- $L_{\rm H} = {\rm MIN}(2.5^*(t C), 2.5^*(t_n C_n) + t_e)$
 - = MIN(2.5*(0.875 0), 2.5*(1.02 0) + 0)
 - = 2.1875 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 254.7332*1.45 / (20,000*1 0.6*254.7332)
- = 0.0186 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 254.7332*66 / (20,000*1 + 0.4*254.7332)
 - = 0.8364 in

Area required per UG-37(c)

Allowable stresses: $S_n = 20,000$, $S_v = 20,000$ psi

 $f_{r1} = lesser of 1 \text{ or } S_n / S_v = 1$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 1$

- $A = d^{*}t_{r}^{*}F + 2^{*}t_{n}^{*}t_{r}^{*}F^{*}(1 f_{r1})$
 - = 2.9*0.8364*1 + 2*1.02*0.8364*1*(1 1)

 $= 2.4254 \text{ in}^2$

Area available from FIG. UG-37.1

1

$A_1 =$ larger of the following = 0.1464 in²

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 2.9*(1*0.875 1*0.8364) 2*1.02*(1*0.875 1*0.8364)*(1 1)
- = 0.1121 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 2*(0.875 + 1.02)*(1*0.875 1*0.8364) 2*1.02*(1*0.875 1*0.8364)*(1 1)
- = 0.1464 in²

 $A_2 = \text{smaller of the following} = \frac{4.3811}{1} \text{ in}^2$

- = 5*(t_n t_{rn})*f_{r2}*t
- = 5*(1.02 0.0186)*1*0.875
- = 4.3811 in²
- = 5*(t_n t_{rn})*f_{r2}*t_n
- = 5*(1.02 0.0186)*1*1.02
- = 5.1071 in²

 $A_{41} = Leg^{2*}f_{t2}$

- = 0.375²*1
- = <u>0.1406</u> in²

Area = $A_1 + A_2 + A_{41}$ = 0.1464 + 4.3811 + 0.1406

- = <u>4.6681</u> in²

As Area \geq A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.75 in $t_{c(min)}$ = lesser of 0.25 or 0.7* t_{min} = <u>0.25</u> in $t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	255.022*1.45 / (20,000*1 - 0.6*255.022) + 0
	=	0.0186 in
ta		$\max[t_{a UG-27}, t_{a UG-22}]$
	=	max[0.0186 , 0]
	=	0.0186 in
t _{b1}	=	$P*R_0 / (S*E + 0.4*P) + Corrosion$
	=	254.7332*66 / (20,000*1 + 0.4*254.7332) + 0
	=	0.8364 in
thi	==	max[th1,th11G16]
01	123	max[0.8364, 0.0625]
	_	0.8364 in
	_	0.8504 m
tb	***	min[t _{b3} , t _{b1}]
		min[0.2258 , 0.8364]
	=	0,2258 in

t_{UG-45}

- = $\max[t_a, t_b]$ = $\max[0.0186, 0.225]$
 - $= \max[\ 0.0186 \ , \ 0.2258 \] \\ = \underbrace{0.2258}_{0.2258} \text{ in}$
- Available nozzle wall thickness new, $t_n = 0.8325$ in

The nozzle neck thickness is adequate.

· .

ASME Section VIII Division 1, 2017 Edition			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$			
Note: Per UW-16(b) minimum inside corner radius $r_1 = min [1 / 4*t, 0.125 i]$	n] = 0.125 in		
Location and Orientation	นส่วนให้ส่วนให้ๆ จูนั้นส่วนให้เกิดไหวการกฎการสุดการการการสารแปลเมลาการที่ ก็สารแกรการการสารแกะไปประการการการกา		
Located on	Shell		
Orientation	180°		
Nozzle center line offset to datum line	72"		
End of nozzle to shell center	74"		
Passes through a Category A joint	No		
Nozzle			
Access opening No			
Material specification	SA-105 (II-D p. 18, ln. 19)		
Inside diameter, new	5.76"		
Wall thickness, t _n	1.245"		
Minimum wall thickness	1.0575"		
Corrosion allowance	0""		
Projection available outside vessel, Lpr	7"		
Heavy barrel length, L _{hb}	6.5"		
Projection available outside vessel to flange face, Lf 8"			
Local vessel minimum thickness 0.875"			
Liquid static head included 4.73 psi			
Longitudinal joint efficiency 1			
Welds			
Inner fillet, Leg ₄₁ 0.375"			
Nozzle to vessel groove weld 0.875"			

ASME B16.5-2013 Flange		
Description	NPS 6 Class 150 FVC HB A105 (Nut Stop)	
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)	
Blind included	No	
Rated MDMT	-30.5°F	
Liquid static head	5.02 psi	
MAWP rating	278.75 psi @ 125°F	
MAP rating	285 psi @ 40°F	
Hydrotest rating	450 psi @ 40°F	
PWHT performed	No	
Impact Tested	No	
Gasket		
Description Klingersil C-4401 Synthetic Fiber		
Notes		
Element we have $I \subseteq C \subseteq $		

Flange rated MDMT per UCS-66(b)(1)(b) = -30.5°F (Coincident ratio = 0.8948) Bolts rated MDMT per Fig UCS-66 note (c) = -55°F

UCS-66 Material Toughness Requirements Nozzle At Intersection			
$t_r = 254.73 \times 2.88 / (20,000 \times 1 - 0.6 \times 254.73) =$	0.037"		
Stress ratio = $t_r * E^* / (t_n - c) = 0.037*1 / (1.245 - 0) =$	0.0297		
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155°F		
Material is exempt from impact testing at the Design MDMT	of -20°F.		

UCS-66 Material Toughness Requirements Nozzle				
$t_r = 254.73 \times 2.88 / (20,000 \times 1 - 0.6 \times 254.73) =$	0.037"			
Stress ratio = $t_r * E^* / (t_n - c) = 0.037*1 / (1.0575 - 0) =$	0.035			
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	- 155°F			
Material is exempt from impact testing at the Design MDMT of -20°F.				

UG-37 Area Calculation Summary (in ²)					UG-45 Sur	nmary (in)		
For P = 254.73 psi @ 125 °F The opening is adequately reinforced					The nozzle p	asses UG-45		
A required	A availablc	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
<u>4.8174</u>	<u>5.6482</u>	<u>0.2226</u>	<u>5.285</u>			<u>0.1406</u>	<u>0.2818</u>	1.0575

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary					
Weld description	Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status				
Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate		

Calculations for internal pressure 254.73 psi @ 125 °F

Parallel Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(5.76, 2.88 + (1.245 0) + (0.875 0))
 - = 5.76 in

Outer Normal Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

- $L_{H} = MIN(2.5*(t C), 2.5*(t_{n} C_{n}) + t_{e})$
 - = MIN(2.5*(0.875 0), 2.5*(1.245 0) + 0)
 - = 2.1875 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 254.7332*2.88 / (20,000*1 0.6*254.7332)
- = 0.037 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 254.7332*66 / (20,000*1 + 0.4*254.7332)
 - = 0.8364 in

Area required per UG-37(c)

Allowable stresses: $S_n = 20,000$, $S_v = 20,000$ psi

 $f_{r1} = lesser of 1 \text{ or } S_n / S_v = 1$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 1$

 $A = d^{*}t_{r}^{*}F + 2^{*}t_{n}^{*}t_{r}^{*}F^{*}(1 - f_{r})$

= 5.76*0.8364*1 + 2*1.245*0.8364*1*(1 - 1)

= <u>4.8174</u> in²

Area available from FIG. UG-37.1

$A_1 = \text{larger of the following} = 0.2226 \text{ in}^2$

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 5.76*(1*0.875 1*0.8364) 2*1.245*(1*0.875 1*0.8364)*(1 1)
- = 0.2226 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r}_{1})$
- = 2*(0.875 + 1.245)*(1*0.875 1*0.8364) 2*1.245*(1*0.875 1*0.8364)*(1 1)
- = 0.1638 in²

 $A_2 = \text{smaller of the following} = 5.285 \text{ in}^2$

- $= 5^{*}(t_{n} t_{rn})^{*}f_{r2}^{*}t$
- = 5*(1.245 0.037)*1*0.875
- = 5.285 in²
- = 5*(t_n t_{rn})*f_{r2}*t_n
- = 5*(1.245 0.037)*1*1.245
- = 7.5198 in²

 $A_{41} = Leg^{2*}f_{r2}$

- = 0.375²*1
- = <u>0.1406</u> in²

Area = $A_1 + A_2 + A_{41}$

- = 0.2226 + 5.285 + 0.1406
- $= 5.6482 \text{ in}^2$

As Area \geq A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: $t_{min} = \text{lesser of } 0.75 \text{ or } t_n \text{ or } t = 0.75 \text{ in}$ $t_{c(min)} = \text{lesser of } 0.25 \text{ or } 0.7*t_{min} = \underline{0.25} \text{ in}$ $t_{c(actual)} = 0.7*\text{Leg} = 0.7*0.375 = 0.2625 \text{ in}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	255.022*2.88 / (20,000*1 - 0.6*255.022) + 0
	=	0.037 in
t _a	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.037 , 0]
	=	0.037 in
t _{b1}	=	$P*R_0 / (S*E + 0.4*P) + Corrosion$
	=	254.7332*66 / (20,000*1 + 0.4*254.7332) + 0
		0.8364 in
t _{b1}	=	max[t _{b1} , t _{b UG16}]
		max[0.8364 , 0.0625]
	=	0.8364 in
tb	=	min[t _{b3} , t _{b1}]
	=	min[0.2818 , 0.8364]
	=	0.2818 in

max[t_a , t_b] t_{UG-45} = max[0.037 , 0.2818] = =

<u>0.2818</u> in

Available nozzle wall thickness new, $t_n = 1.0575$ in

The nozzle neck thickness is adequate.

.

ASME Section VIII Division 1, 2017 Edition				
ASME Section VIII Division 1, 2017 Edition				
Note: round inside edges per UG-76(c)	οτικό στη διατική που ποι ποι ποι ποι ποι ποι που ποι που το πολογού το			
Location and Orientation	1			
Located on	Left Head			
Orientation	0°			
End of nozzle to datum line	1,020.0374"			
Calculated as hillside				
Distance to head center, R	0"			
Passes through a Category A joint	No			
Nozzle	หมดที่ได้ที่มีกินส์ที่มีปกติบัติมาปกก / อันเอาเมติสอง เสียงเปลาสินสีของ เสาะแนกสมาสินสีของสินสีของสินสีของสินส			
Description	NPS 2 Class 6000 - threaded			
Access opening	No			
Material specification	SA-105 (II-D p. 18, ln. 19)			
Inside diameter, new	nentriseitanan operatuuriteesinen turineesinen kurneren kurneren kurneren kurneren kurneren kurneren kurneren k 2.375"			
Nominal wall thickness	0.625"			
Corrosion allowance	0""			
Projection available outside vessel, Lpr	2.625"			
Local vessel minimum thickness	0.85"			
Liquid static head included	2.35 psi			
Longitudinal joint efficiency	сние «ниже по ракоски полонични полонични полонични полонични полонични полонични полонични полонични полонични 1			
Welds	งและสำหรับสามาร์ที่สามาร์ สามาร์ แล้วและสามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร์สามาร			
Inner fillet, Leg ₄₁	0.375"			
Nozzle to vessel groove weld				

UCS-66 Material Toughness Requirements Nozzle

$t_r = 252.35*1.1875 / (20,000*1 - 0.6*252.35) =$	0.0151"
Stress ratio = $t_r * E^* / (t_n - c) = 0.0151*1 / (0.625 - 0) =$	0.0242
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155°F
Material is exempt from impact testing at the Design MDMT	' of - 20°F.

UG-37 Area Calculation Summary (in ²)							UG-44 Sum	mary (in)
For P = 252.35 psi @ 125 °F					The nozzle pa	sses UG-44		
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is	This nozzle is exempt from area calculations per UG-36(c)(3)(a)						0.0625	0.625

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary					
Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status					
Nozzle to shell fillet (Leg ₄₁) 0.25 0.2625 weld size is adequate					

Calculations for internal pressure 252.35 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(2.375, 1.1875 + (0.625 0) + (0.85 0))
 - = 2.6625 in

Outer Normal Limit of reinforcement per UG-40

 $L_{\rm H}$ = MIN(2.5*(t - C), 2.5*(t_n - C_n) + t_e)

- = MIN(2.5*(0.85 0), 2.5*(0.625 0) + 0)
 - = 1.5625 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 252.3508*1.1875 / (20,000*1 0.6*252.3508)
 - = 0.0151 in

Required thickness t_r from UG-37(a)(c)

 $t_r = P^*K_1^*D_0 / (2^*S^*E + 0.8^*P)$

- = 252.3508*0.9*132 / (2*20,000*1+0.8*252.3508)
- = 0.7457 in

Required thickness t_r per Interpretation VIII-1-07-50

$t_r =$	P*D_*K / (2	*S*E + 2*P*	(K - 0.1))
---------	-------------	-------------	------------

- = 252.35*132*1 / (2*20,000*1 + 2*252.35*(1 0.1))
 - = 0.8234"

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

 $Fillet weld: t_{min} = lesser of 0.75 \text{ or } t_n \text{ or } t = 0.625 \text{ in} \\ t_{c(min)} = lesser of 0.25 \text{ or } 0.7*t_{min} = \underline{0.25} \text{ in} \\ t_{c(actual)} = 0.7*Leg = 0.7*0.375 = 0.2625 \text{ in} \\$

1,0000

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

Interpretation VIII-1-83-66 has been applied.

^t a App 1-1	=	P*R _o / (S _n *E + 0.4*P) + Corrosion
	=	252.3508*1.8125 / (20,000*1 + 0.4*252.3508) + 0
	=	0.0228 in
t _{a UG-44}	:=	max[t _{a App} 1-1 , t _b UG16]
	=	max[0.0228 , 0.0625]
	=	<u>0.0625</u> in

Available nozzle wall thickness new, $t_n = 0.625$ in

The nozzle neck thickness is adequate.

.

Nozzle N12 - 4" 150# LAHH (N12)

ASME Section VIII Division 1, 2017 Edition				
0,8500 ,750 ,8500 ,750 ,8500 ,750 ,750 ,750 ,8500 ,750 ,750 ,750 ,750 ,750 ,750 ,750 ,750 ,750 ,7500 ,7500 ,750 ,7500 ,7				
Note: Per UW-16(b) minimum inside corner radius $r_1 = min [1 / 4*t, 0.125]$	[in] = 0.125 in			
Location and Orientation	กกะร่างประการกระการการการการการการการการการการการการการก			
Located on	Left Head			
Orientation	0°			
End of nozzle to datum line	1,022"			
Calculated as hillside	Yes			
Distance to head center, R	33"			
Passes through a Category A joint	No			
Nozzle				
Access opening	No			
Material specification	SA-105 (II-D p. 18, ln. 19)			
Inside diameter, new	3.83"			
Wall thickness, t _n	1.305"			
Minimum wall thickness	1.1175"			
Corrosion allowance	0"			
Opening chord length	3.9924"			
Projection available outside vessel, Lpr	7.231"			
Heavy barrel length, L _{hb} 6.731"				
Projection available outside vessel to flange face, Lf 8.171"				
Local vessel minimum thickness	0.85"			
Liquid static head included	1.16 psi			
Longitudinal joint efficiency	1			
Welds				
Inner fillet, Leg ₄₁	0.375"			
สมมณฑิสลายแบบปีของแบบแล้วการรับส่วนของการรับส่วนที่ได้สำนักของการสารระบบแบบและอาจสองสารระบบการวันสมบริณาและและการสารระบบคนและและจาก				

ASME B16.5-2013 Flange			
Description	NPS 4 Class 150 FVC HB A105 (Nut Stop)		
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)		
Blind included	No		
Rated MDMT -31.9°F			
Liquid static head	1.16 psi		
MAWP rating 278.75 psi @ 125°F			
MAP rating 285 psi @ 40°F			
Hydrotest rating 450 psi @ 40°F			
PWHT performed No			
Impact Tested	No		
na na internationa and a kip nggana gin kina na na ana dha dha na na na an	Gasket		
Description Klingersil C-4401 Synthetic Fiber			
Notes			
Flange rated MDMT per UCS-66(b)(1)(b) = -31.9° F (Coincident ratio = 0.8813) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F			

UCS-66 Material Toughness Requirements Nozzle At Intersection		
$t_r = 251.16*1.915 / (20,000*1 - 0.6*251.16) =$	0.0242"	
Stress ratio = $t_r * E^* / (t_n - c) = 0.0242*1 / (1.305 - 0) =$	0.0186	
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155° F	
Material is exempt from impact testing at the Design MDMT of -20°F.		

UCS-66 Material Toughness Requirements Nozzle			
$t_r = 251.16*1.915 / (20,000*1 - 0.6*251.16) =$	0.0242"		
Stress ratio = $t_r * E^* / (t_n - c) = 0.0242*1 / (1.1175 - 0) =$	0.0217		
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155° F		
Material is exempt from impact testing at the Design MDMT of -20°F.			

t

UG-37 Area Calculation Summary (in ²)					UG-45 Su	mmary (in)		
For P = 251.16 psi @ 125 °F The opening is adequately reinforced				The nozzle	passes UG-45			
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
2.9632	<u>6.0485</u>	<u>0.4645</u>	<u>5.4434</u>			<u>0,1406</u>	<u>0.245</u>	1.1175

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(1)

	UW-16 Weld Sizing Summary			
	Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozz	le to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate

Calculations for internal pressure 251.16 psi @ 125 °F

Parallel Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(3.9924, 1.9962 + (1.305 0) + (0.85 0))
 - = 4.1512 in

Outer Normal Limit of reinforcement per UG-40 and Fig. UG-40 sketch (e-2)

L _H =	MIN(2.5*(t -	C), 2.5*(t _n -	C_n) + t _e)
------------------	--------------	---------------------------	----------------------------

- = MIN(2.5*(0.85 0), 2.5*(1.305 0) + 0)
 - = 2.125 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 251.1596*1.915 / (20,000*1 0.6*251.1596)
- = 0.0242 in

Required thickness t_r from UG-37(a)(c)

 $t_r = P^*K_1^*D_0 / (2^*S^*E + 0.8^*P)$ = 251.1596*0.9*132 / (2*20,000*1 + 0.8*251.1596)

= 0.7422 in

Required thickness t_r per Interpretation VIII-1-07-50

 $t_r = P*D_0*K / (2*S*E + 2*P*(K - 0.1))$ = 251.16*132*1 / (2*20,000*1 + 2*251.16*(1 - 0.1)) = 0.8196"

Area required per UG-37(c)

Allowable stresses: $S_n = 20,000$, $S_v = 20,000$ psi

 $f_{r1} = 1 \text{ esser of } 1 \text{ or } S_n / S_v = 1$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 1$

 $A = d^{*}t_{r}^{*}F + 2^{*}t_{n}^{*}t_{r}^{*}F^{*}(1 - f_{r})$

- = 3.9924*0.7422*1 + 2*1.305*0.7422*1*(1 1)
- = <u>2.9632</u> in²

Area available from FIG. UG-37.1

 $A_1 = \text{larger of the following} = 0.4645 \text{ in}^2$

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 3.9924*(1*0.85 1*0.7422) 2*1.305*(1*0.85 1*0.7422)*(1 1)
- = 0.4303 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 2*(0.85 + 1.305)*(1*0.85 1*0.7422) 2*1.305*(1*0.85 1*0.7422)*(1 1)
- = 0.4645 in²

 $A_2 = \text{smaller of the following} = 5.4434 \text{ in}^2$

- $= 5^{*}(t_{n} t_{rn})^{*}f_{r2}^{*}t$
- = 5*(1.305 0.0242)*1*0.85
- = 5.4434 in²
- $= 5^{*}(t_{n} t_{m})^{*}f_{r2}^{*}t_{n}$
- = 5*(1.305 0.0242)*1*1.305
- = 8.3572 in²

 $A_{41} = Leg^{2*}f_{r2}$

- = 0.375²*1
- = 0.1406 in²

 $Area = A_1 + A_2 + A_{41}$

- = 0.4645 + 5.4434 + 0.1406
- $= 6.0485 \text{ in}^2$

As Area \geq A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.75 in $t_{c(min)}$ = lesser of 0.25 or 0.7* t_{min} = <u>0.25</u> in $t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

t _{a UG-27}	Н	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	251.1596*1.915 / (20,000*1 - 0.6*251.1596) + 0
	=	0.0242 in
ta	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.0242 , 0]
	=	0.0242 in
t _{b1}	=	0.8196 in

67

t _{b1}	11	max[t _{b1} , t _{b UG16}]
		max[0.8196 , 0.0625]
	=	0.8196 in
tb	=	min[t _{b3} , t _{b1}]
		min[0.245 , 0.8196]
	=	0.245 in
^t UG-45	=	max[t _a , t _b]
	=	max[0.0242 , 0.245]
	=	<u>0.245</u> in

Available nozzle wall thickness new, $t_n = 1.1175$ in

.

The nozzle neck thickness is adequate.

ASME Section VIII Division 1, 2017 Edition				
0,5625				
Note: round inside edges per UG-76(c)				
Location an	d Orientation .			
Located on	Shell			
Orientation	180°			
Nozzle center line offset to datum line	720"			
End of nozzle to shell center	138"			
Passes through a Category A joint	No			
No	ozzle			
Access opening	No			
Material specification	SA-516 70 (II-D p. 18, ln. 33)			
Inside diameter, new	35"			
Nominal wall thickness	0.5"			
Corrosion allowance	0"			
Projection available outside vessel, Lpr	72"			
Local vessel minimum thickness	0.875"			
Liquid static head included	4.73 psi			
Longitudinal joint efficiency	0.7			
Reinfor	rcing Pad			
Material specification	SA-516 70 (II-D p. 18, ln. 33)			
Diameter, D _p	63"			
Thickness, t _e	1"			
Is split	No			
W	elds			
Inner fillet, Leg ₄₁	0.5"			

Outer fillet, Leg ₄₂	0.5625"
Nozzle to vessel groove weld	0.875"
Pad groove weld	0"

UCS-66 Material Toughness Requirements Nozzle			
Governing thickness, t _g =	0.5"		
Exemption temperature from Fig UCS-66 Curve B =	-7°F		
$t_r = 254.73*17.5 / (20,000*0.7 - 0.6*254.73) =$	0.3219"		
Stress ratio = $t_r * E^* / (t_n - c) = 0.3219 * 0.8 / (0.5 - 0) =$	0.5151		
Reduction in MDMT, T_R from Fig UCS-66.1 =	55°F		
$MDMT = max[MDMT - T_R, -55] = max[-7 - 55, -55] =$	-55°F		
Material is exempt from impact testing at the Design MDMT of -20°F.			

 UCS-66 Material Toughness Requirements Pad				
 Governing thickness, $t_g =$	0.875"			
 MDMT =	-20°F			
 Material is exempt from impact testing per UG-20(f) at the Design MDMT of -20°F.				

UG-37 Area Calculation Summary (in ²))	UG-45 Summary (in)		
For P = 254.73 psi @ 125 °F The opening is adequately reinforced The nozzle passes UG-4					ses UG-45			
A required	A available	A	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
29.2726	30.1237	<u>1.3524</u>	<u>1.2049</u>		27	0.5664	<u>0.3281</u>	0.5

UG-41 Weid Failure Path Analysis Summary (lb _f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W ₁₋₁	Path 1-1 strength	Weld load W ₂₋₂	Path 2-2 strength	Weld load W ₃₋₃	Path 3-3 strength
<u>559,176.8</u>	<u>575,426</u>	935,860.81	<u>46,598</u>	1,009,393.72	<u>592,926</u>	1,277,823.17

UW-16 Weld Sizing Summary				
Weld o	lescription	Required weld throat size (in)	Aetual weld throat size (in)	Status
Nozzle to p	ad fillet (Leg ₄₁)	<u>0.35</u>	0.35	weld size is adequate
Pad to she	ll fillet (Leg ₄₂)	<u>0.375</u>	0.3938	weld size is adequate

Calculations for internal pressure 254.73 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

$$L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$$

$$= MAX(35, 17.5 + (0.5 - 0) + (0.875 - 0))$$

= 35 in

Outer Normal Limit of reinforcement per UG-40

 $L_{H} = MIN(2.5^{*}(t - C), 2.5^{*}(t_{n} - C_{n}) + t_{e})$

- = MIN(2.5*(0.875 0), 2.5*(0.5 0) + 1)
 - = 2.1875 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 254.7332*17.5 / (20,000*1 0.6*254.7332)
- = 0.2246 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_0 / (S^*E + 0.4^*P)$

- = 254.7332*66 / (20,000*1 + 0.4*254.7332)
- = 0.8364 in

Area required per UG-37(c)

Allowable stresses: $S_n = 20,000$, $S_v = 20,000$, $S_p = 20,000$ psi

 $f_{r1} = lesser of 1 \text{ or } S_n / S_v = 1$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 1$

 f_{r3} = lesser of f_{r2} or $S_p / S_v = 1$

 $f_{r4} = lesser of 1 \text{ or } S_p / S_v = 1$

- $A = d*t_r*F + 2*t_n*t_r*F*(1 f_{r1})$
 - = 35*0.8364*1 + 2*0.5*0.8364*1*(1 1)
 - = <u>29.2726</u> in²

Area available from FIG. UG-37.1

 $A_1 = \text{larger of the following} = 1.3524 \text{ in}^2$

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- $= 35^{*}(1^{*}0.875 1^{*}0.8364) 2^{*}0.5^{*}(1^{*}0.875 1^{*}0.8364)^{*}(1 1)$
- = 1.3524 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 2*(0.875 + 0.5)*(1*0.875 1*0.8364) 2*0.5*(1*0.875 1*0.8364)*(1 1)
- = 0.1063 in²

 $A_2 = \text{smaller of the following} = 1.2049 \text{ in}^2$

- = 5*(t_n t_{rn})*f_{r2}*t
- = 5*(0.5 0.2246)*1*0.875
- = 1.2049 in²
- $= 2^{*}(t_{n} t_{rn})^{*}(2.5^{*}t_{n} + t_{e})^{*}f_{r2}$
- = 2*(0.5 0.2246)*(2.5*0.5 + 1)*1
- = 1.2393 in²

 $A_{41} = Leg^{2*}f_{r3}$

- = 0.5²*1
- $= 0.25 \text{ in}^2$

 $A_{42} = Leg^{2*}f_{r4}$

- = 0.5625²*1
- = <u>0.3164</u> in²

 $\begin{array}{rcl} A_5 & = & (D_p - d - 2^* t_n)^* t_e^* f_{r4} \\ & = & (63 - 35 - 2^* 0.5)^* 1^* 1 \\ \end{array}$

 $= 27 \text{ in}^2$

Area = $A_1 + A_2 + A_{41} + A_{42} + A_5$ = 1.3524 + 1.2049 + 0.25 + 0.3164 + 27

= <u>30.1237</u> in²

As Area \geq A the reinforcement is adequate.

UW-16(c)(2) Weld Check

 $t_{w(actual)} = 0.7*Leg = 0.7*0.5625 = 0.3938$ in

۰,

UG-45 Nozzle Neck Thickness Check

^t a UG-27	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	257.3322*17.5 / (20,000*0.7 - 0.6*257.3322) + 0
	=	0.3253 in
ta	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.3253 , 0]
	=	0.3253 in
t _{b1}	=	$P*R_o / (S*E + 0.4*P) + Corrosion$
	=	254.7332*66 / (20,000*1 + 0.4*254.7332) + 0
	=	0.8364 in
t _{b1}	=	max[t _{b1} , t _b UG16]
	=	max[0.8364 , 0.0625]
	=	0.8364 in
th	=	$\min[t_{b3}, t_{b1}]$
0	=	min[0.3281, 0.8364]
	=	0.3281 in
tuG-45	=	$\max[t_a, t_b]$
00-45	=	$\max[0.3253, 0.3281]$
	==	0.3281 in

Available nozzle wall thickness new, $t_n = 0.5$ in

The nozzle neck thickness is adequate.

Allowable stresses in joints UG-45 and UW-15(c)

Groove weld in tension:	0.74 * 20,000 =	14,800 psi
Nozzle wall in shear:	0.7*20,000 =	14,000 psi
Inner fillet weld in shear:	0.49*20,000 =	9,800 psi
Outer fillet weld in shear:	0.49*20,000 =	9,800 psi

Strength of welded joints:

(1) Inner fillet weld in shear $(\pi / 2)$ *Nozzle OD*Leg*S_i = $(\pi / 2)$ *36*0.5*9,800 = 277,088.47 lb_f

(2) Outer fillet weld in shear $(\pi / 2)$ *Pad OD*Leg*S₀ = $(\pi / 2)$ *63*0.5625*9,800 = 545,517.93 lb_f

(3) Nozzle wall in shear $(\pi / 2)^*$ Mean nozzle dia* $t_n^*S_n = (\pi / 2)^*35.5^*0.5^*14,000 = 390,342.89 \text{ lb}_f$

(4) Groove weld in tension $(\pi / 2)$ *Nozzle OD*t_w*S_g = $(\pi / 2)$ *36*0.875*14,800 = 732,305.24 lb_f

Loading on welds per UG-41(b)(1)

W	==	$(A - A_1 + 2*t_n*f_{r1}*(E_1*t - F*t_r))*S_v$
	=	(29.2726 - 1.3524 + 2*0.5*1*(1*0.875 - 1*0.8364))*20,000
	=	<u>559,176.8</u> lb _f

 $W_{1-1} = (A_2 + A_5 + A_{41} + A_{42}) S_v$

= (1.2049 + 27 + 0.25 + 0.3164) * 20,000

= 575,426 lb_f

 $W_{2-2} = (A_2 + A_3 + A_{41} + A_{43} + 2^*t_n^*t^*f_{r1})^*S_v$ = (1.2049 + 0 + 0.25 + 0 + 2*0.5*0.875*1)*20,000 = <u>46.598</u> lb_f

$$\begin{split} W_{3-3} &= & (A_2 + A_3 + A_5 + A_{41} + A_{42} + A_{43} + 2^* t_n^* t^* f_{r1})^* S_v \\ &= & (1.2049 + 0 + 27 + 0.25 + 0.3164 + 0 + 2^* 0.5^* 0.875^* 1)^* 20,000 \\ &= & \underline{592,926} \ lb_f \end{split}$$

Load for path 1-1 lesser of W or $W_{1-1} = 559,176.8 \text{ lb}_{f}$ Path 1-1 through (2) & (3) = 545,517.93 + 390,342.89 = <u>935,860.81</u> lb_{f} Path 1-1 is stronger than W so it is acceptable per UG-41(b)(2).

Load for path 2-2 lesser of W or $W_{2-2} = 46,598 \text{ lb}_{f}$ Path 2-2 through (1), (4) = 277,088.47 + 732,305.24 = <u>1,009,393.72</u> lb_f Path 2-2 is stronger than W_{2-2} so it is acceptable per UG-41(b)(1).

Load for path 3-3 lesser of W or $W_{3-3} = 559,176.8 \text{ lb}_{f}$ Path 3-3 through (2), (4) = 545,517.93 + 732,305.24 = <u>1,277,823.17</u> lb_{f} Path 3-3 is stronger than W so it is acceptable per UG-41(b)(2).

% Extreme fiber elongation - UCS-79(d)

EFE = $(50*t/R_f)*(1 - R_f/R_0)$

- $= (50*0.5 / 17.75)*(1 17.75 / \infty)$
 - = 1.4085%

The extreme fiber elongation does not exceed 5%.

Boot Head

ASME Section VIII Division 1, 2017 Edition						
Component		Ellipsoidal Head				
Material		SA-516 70 (II-D p. 18, ln. 33)				
Attac	hed To	Noz	zle NI3 - 36" 150# B	oot (N13)		
Impact Tested	Normalized	Fine Grain Practice	Р₩НТ	Optimize MDMT/ Find MAWP		
No	No	Yes	No	No		
		Design Pressure (psi)	Design Temperature (°F)	Design MDMT (°F)		
Int	ernal	250	125	-20		
		Static Liq	uid Head			
Con	dition	P _s (psi)	H _s (in)	SG		
Ope	rating	7.72	213.9375	1		
Test ho	orizontal	8.19	226.8125	1		
		Dimen	sions			
Outer Diameter		36"				
Head Ratio		2				
Minimum	Thickness	0.375"				
Corrosion	Inner	0"				
	Outer	0"				
Leng	th L _{sf}	2"				
Nominal T	`hickness t _{sf}	0.5"				
		Weight and	Capacity			
	Weight (lb) ¹ Capacity (US gal			Capacity (US gal) ¹		
New		1	33.15			
Cori	oded	186.03 33.15				
Radiography						
Categor	y A joints		Seamless No RT	`		
Head to shell seam		None UW-11(c) Type 1				

¹ includes straight flange

Results Summary				
Governing condition	internal pressure			
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"			
Design thickness due to internal pressure (t) 0.2693"				
Straight Flange governs MDMT -55°F				

Factor K

$K = (1/6)^* [2 + (D / (2^*h))^2]$				
Corroded	$K = (1/6)^* [2 + (35.25 / (2^* 8.8125))^2]$	1		
New	$K = (1/6)^* [2 + (35.25 / (2^* 8.8125))^2]$	1		

Design thickness for internal pressure, (Corroded at 125 °F) Appendix 1-4(c)

- $t = P*D_0*K / (2*S*E + 2*P*(K 0.1)) + Corrosion$
 - = 257.72*36*1 / (2*20,000*0.85 + 2*257.72*(1 0.1)) + 0
 - = <u>0.2692</u>"

% Extreme fiber elongation - UCS-79(d)

EFE = $(75*t/R_f)*(1 - R_f/R_o)$

- $= (75*0.5 / 6.2425)*(1 6.2425 / \infty)$
- = 6.0072%

The extreme fiber elongation exceeds 5 percent. Heat treatment per UCS-56 may be required. See UCS-79(d)(4) or (5).

- 2

Nozzle N14 - 2" 150# HP Drain Recycle (N14)

ASME Section VIII Division 1, 2017 Edition			
Note: round inside edges per UG-76(c)			
Location and Orientation			
Located on	Shell		
Orientation	0°		
Nozzle center line offset to datum line	177"		
End of nozzle to shell center	74"		
Passes through a Category A joint	No		
Nozzle	และเกลม่อยเสียงี่งานแบบขนางแม่แรมแบบแม่ไม่ข้างงาน เออาจากสายไปการที่ใจเริ่มที่		
Access opening	No		
Material specification	SA-105 (II-D p. 18, ln. 19)		
Inside diameter, new	2"		
Nominal wall thickness	0.53"		
Corrosion allowance	0"		
Projection available outside vessel, Lpr	7.25"		
Projection available outside vessel to flange face, Lf	8"		
Local vessel minimum thickness	0.875"		
Liquid static head included 0 psi			
Longitudinal joint efficiency	1		
Welds			
Inner fillet, Leg ₄₁	0.375"		
Nozzle to vessel groove weld	0.875"		

ASME B16.5-2013 Flange		
Description	NPS 2 Class 150 LWN A105	
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, 1n. 32)	

Blind included	No	
Rated MDMT	-32.3°F	
Liquid static head	0 psi	
MAWP rating	278.75 psi @ 125°F	
MAP rating	285 psi @ 40°F	
Hydrotest rating	450 psi @ 40°F	
PWHT performed No		
Impact Tested No		
	Gasket	
Description Klingersil C-4401 Synthetic Fiber		
Notes		
Flange rated MDMT per UCS-66(b)(1)(b) = -32.3° F (Coincident ratio = 0.8772) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F		

 UCS-66 Material Toughness Requirements

 LWN rated MDMT per UCS-66(c)(4) =
 -32.3°F

Material is exempt from impact testing at the Design MDMT of -20°F.

UG-37 Area Calculation Summary (in ²)						UG-45 Sum	mary (in)	
For P = 250 psi @ 125 °F					The nozzle passes UG-45			
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)					<u>0.189</u>	0.53		

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary					
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status		
Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate		

Calculations for internal pressure 250 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(2, 1 + (0.53 0) + (0.875 0))
 - = 2.405 in

Outer Normal Limit of reinforcement per UG-40

- $L_{\rm H}$ = MIN(2.5*(t C), 2.5*(t_n C_n) + t_e)
 - = MIN(2.5*(0.875 0), 2.5*(0.53 0) + 0)
 - = 1.325 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

= 250*1 / (20,000*1 - 0.6*250)

= 0.0126 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 250*66 / (20,000*1 + 0.4*250)
- = 0.8209 in

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{min} = \text{lesser of } 0.75 \text{ or } t_n \text{ or } t = 0.53 \text{ in}$ $t_{c(min)} = \text{lesser of } 0.25 \text{ or } 0.7*t_{min} = 0.25 \text{ in}$ $t_{c(actual)} = 0.7*\text{Leg} = 0.7*0.375 = 0.2625 \text{ in}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	==	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
		250*1 / (20,000*1 - 0.6*250) + 0
	=	0.0126 in
ta	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.0126 , 0]
		0.0126 in
t _{b1}	17760	$P*R_o / (S*E + 0.4*P) + Corrosion$
		250*66 / (20,000*1+0.4*250) + 0
	=	0.8209 in
t _{b1}	=	max[t _{b1} , t _{b UG16}]
	=	max[0.8209 , 0.0625]
	==	0.8209 in
tb	H	min[t _{b3} , t _{b1}]
	=	min[0.189 , 0.8209]
	=	0.189 in
		F 1
t _{UG-45}	=	max[t _a ,t _b]
	=	max[0.0126 , 0.189]
		<u>0.189</u> in

Available nozzle wall thickness new, $t_n = 0.53$ in

The nozzle neck thickness is adequate.

Nozzle N15A - 3" 150# Level (Boot Interface) (N15A)



0.875"

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME I	316.5-2013 Flange		
Description	NPS 3 Class 150 WN A105		
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)		
Blind included	No		
Rated MDMT	-31°F		
Liquid static head	3.65 psi		
MAWP rating	278.75 psi @ 125°F		
MAP rating	285 psi @ 40°F		
Hydrotest rating	450 psi @ 40°F		
PWHT performed	No		
Impact Tested	No		
Circumferential joint radiography	Full UW-11(a) Type 1		
	Gasket		
Description	Klingersil C-4401 Synthetic Fiber		
ulainin mohadansaadiillikkkos äädättörkoraanaatiiliinkaastorispassaasassissassaanassassa on saara on see saaraa	Notes		
Flange rated MDMT per UCS-66(b)(1 Bolts rated MDMT per Fig UCS-66 n	$I(b) = -31^{\circ}F$ (Coincident ratio = 0.89) ote (c) = -55^{\circ}F		

UCS-66 Material Toughness Requirements Nozzle					
$t_r = 253.65*1.15 / (17,100*1 - 0.6*253.65) =$	0.0172"				
Stress ratio = $t_r * E^* / (t_n - c) = 0.0172*1 / (0.525 - 0) =$	0.0328				
Stress ratio \leq 0.35, MDMT per UCS-66(b)(3) =	-155°F				
Material is exempt from impact testing at the Design MDMT of -20°F.					

COMPRESS 2018 Build 7800; 5361

UG-37 Area Calculation Summary (in ²)						UG-45 Sur	nmary (in)	
For P = 253.65 psi @ 125 °F The opening is adequately reinforced					The nozzle p	asses UG-45		
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
1.2187	<u>2.8881</u>	<u>1.273</u>	<u>1.4949</u>			0.1202	<u>0.189</u>	0.525

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary					
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status		
Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate		

Calculations for internal pressure 253.65 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

$L_R = MAX(d, R_n + (t_n - C))$	$_{n}) + (t - C))$	
---------------------------------	--------------------	--

- = MAX(2.7526, 1.3763 + (0.6 0) + (0.875 0))
 - = 2.8513 in

Outer Normal Limit of reinforcement per UG-40

- $L_{\rm H} = {\rm MIN}(2.5^*(t C), 2.5^*(t_n C_n) + t_e)$
 - = MIN(2.5*(0.875 0), 2.5*(0.6 0) + 0)
 - = 1.5 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 253.6503*1.15 / (17,100*1 0.6*253.6503)
- = 0.0172 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_0 / (S^*E + 0.4^*P)$

- = 253.6503*66 / (20,000*1 + 0.4*253.6503)
 - = 0.8328 in

Area required per UG-37(c)

Allowable stresses: $S_n = 17,100$, $S_v = 20,000$ psi

 $f_{r1} = \text{lesser of 1 or } S_n / S_v = 0.855$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 0.855$

A = $d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$

= 2.7526*0.8328*0.5 + 2*0.6*0.8328*0.5*(1 - 0.855)

= <u>1.2187</u> in²

Area available from FIG. UG-37.1
$A_1 =$ larger of the following= <u>1.273</u> in²

$$= d^{*}(E_{1}^{*}t - F^{*}t_{r}) - 2^{*}t_{n}^{*}(E_{1}^{*}t - F^{*}t_{r})^{*}(1 - f_{r_{1}})$$

- $= 2.7526^{*}(1^{*}0.875 0.5^{*}0.8328) 2^{*}0.6^{*}(1^{*}0.875 0.5^{*}0.8328)^{*}(1 0.855)$
- = 1.1825 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- $= 2^{*}(0.875 + 0.6)^{*}(1^{*}0.875 0.5^{*}0.8328) 2^{*}0.6^{*}(1^{*}0.875 0.5^{*}0.8328)^{*}(1 0.855)$
- = 1.273 in²

 $A_2 = \text{smaller of the following} = 1.4949 \text{ in}^2$

- = 5*(t_n t_{rn})*f_{r2}*t
- = 5*(0.6 0.0172)*0.855*0.875
- = 2.18 in²
- = 5*(t_n t_m)*f_{r2}*t_n
- $= 5^{*}(0.6 0.0172)^{*}0.855^{*}0.6$

,

= 1.4949 in²

 $A_{41} = Leg^{2*}f_{r2}$

- = 0.375²*0.855
- = <u>0.1202</u> in²

Area = $A_1 + A_2 + A_{41}$

- = 1.273 + 1.4949 + 0.1202
- = <u>2.8881</u> in²

As Area \geq A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.6 in $t_{c(min)}$ = lesser of 0.25 or 0.7* t_{min} = <u>0.25</u> in $t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	253.6503*1.15 / (17,100*1 - 0.6*253.6503) + 0
	=	0.0172 in
ta	==	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.0172 , 0]
	=	0.0172 in
t _{b1}	=	P*R ₀ / (S*E + 0.4*P) + Corrosion
	ш	253.6503*66 / (20,000*1 + 0.4*253.6503) + 0
	=	0.8328 in
t _{b1}	=	$\max[t_{b1}, t_{bUG16}]$
	=	max[0.8328 , 0.0625]
		0.8328 in
		1 F
tb	=	$\min[t_{b3}, t_{b1}]$
	=	min[0.189 , 0.8328]
	=	0.189 in

t_{UG-45}

= $\max[t_a, t_b]$ = $\max[0.0172, 0.189]$

= 0.189 in

Available nozzle wall thickness new, $t_{\rm h} = 0.875*0.6 = 0.525$ in

The nozzle neck thickness is adequate.

Reinforcement check in the plane parallel to the longitudinal axis

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in ²)						UG-45 Sui	nmary (in)	
	For P = 253.65 psi @ 125 °F						The nozzle p	asses UG-45
A required	A available	A ₁	A ₂	A ₃	A 5	A welds	t _{req}	t _{min}
This nozzle is	This nozzle is exempt from area calculations per UG-36(c)(3)(a						<u>0.189</u>	0.525

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary					
Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status					
Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate		

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(2.3, 1.15 + (0.6 0) + (0.875 0))
- = 2.625 in

Outer Normal Limit of reinforcement per UG-40

- $L_{H} = MIN(2.5*(t C), 2.5*(t_{n} C_{n}) + t_{e})$
 - = MIN(2.5*(0.875 0), 2.5*(0.6 0) + 0)
 - = 1.5 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 253.6503*1.15 / (17,100*1 0.6*253.6503)
 - = 0.0172 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R_o / (S^*E + 0.4^*P)$

- = 253.6503*66 / (20,000*1 + 0.4*253.6503)
- = 0.8328 in

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

^t a UG-27		P*R _n / (S _n *E - 0.6*P) + Corrosion 253.6503*1.15 / (17,100*1 - 0.6*253.6503) + 0 0.0172 in
t _a		max[t _{a UG-27} , t _{a UG-22}] max[0.0172 , 0] 0.0172 in
t _{b1}	=	$P*R_0 / (S*E + 0.4*P) + Corrosion$

	=	253.6503*66 / (20,000*1+0.4*253.6503)+0
	=	0.8328 in
t _{b1}	=	$\max[t_{b1}, t_{b} \cup G_{16}]$
0.1	=	max[0.8328 , 0.0625]
	=	0.8328 in
f.	_	min[tea_tec]
ч <u>р</u>	_	
	=	min[0.189 , 0.8328]
	=	0.189 in
t _{UG-45}	11	max[t _a , t _b]
	=	max[0.0172, 0.189]
	=	<u>0.189</u> in

Available nozzle wall thickness new, $t_{\rm n}$ = 0.875*0.6 = 0.525 in

The nozzle neck thickness is adequate.



	ASME B16.5-2013 Flange			
	Description	NPS 3 Class 150 LWN A105		
A before the description of the second	Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, In. 32)		

Blind included	No			
Rated MDMT	-29.8°F			
Liquid static head	7.12 psi			
MAWP rating	278.75 psi @ 125°F			
MAP rating	285 psi @ 40°F			
Hydrotest rating	450 psi @ 40°F			
PWHT performed	No			
Impact Tested	No			
	Gasket			
Description	Klingersil C-4401 Synthetic Fiber			
Notes				
Flange rated MDMT per UCS-66(b)(1)(b) = -29.8° F (Coincident ratio = 0.9022) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F				

UCS-66 Material Taughness Requirements						
	, para ana ana ana ana ana ana ana ana ana					
 LWN rated MDMT per UCS-66(c)(4) =	-29.8° F					
 Material is exempt from impact testing at the Design MDM	MT of - 20°F.					

1

Reinforcement Calculations for Internal Pressure

U	UG-37 Area Calculation Summary (in ²)						UG-45 Sum	mary (in)
For P = 257.12 psi @ 125 °F						The nozzle passes UG-45		
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{rcq}	t _{nin}
This nozzle is	This nozzle is exempt from area calculations per UG-36(c)(3)(a)						0.2074	0.625

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary					
Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status					
Nozzle to shell fillet (Leg ₄₁)	<u>0.25</u>	0.2625	weld size is adequate		

Calculations for internal pressure 257.12 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(3, 1.5 + (0.625 0) + (0.5 0))
 - = 3 in

Outer Normal Limit of reinforcement per UG-40

 $L_{\rm H}$ = MIN(2.5*(t - C), 2.5*(t_n - C_n) + t_e)

- = MIN(2.5*(0.5-0), 2.5*(0.625-0)+0)
 - = 1.25 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 257.1156*1.5 / (20,000*1 0.6*257.1156)
 - = 0.0194 in

Required thickness t_r from UG-37(a)

 $t_r = P*R / (S*E - 0.6*P)$

- = 257.1156*17.5 / (20,000*1 0.6*257.1156)
- ⇒ 0.2267 in

Required thickness tr per Interpretation VIII-1-07-50

 $t_{\rm f} = P^{\rm *R} / (S^{\rm *E} - 0.6^{\rm *P})$ = 257.1156*17.5 / (20,000*0.7 - 0.6*257.1156) = 0.325 in

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.5 in $t_{c(min)}$ = lesser of 0.25 or 0.7* $t_{min} = 0.25$ in $t_{c(actual)} = 0.7*Leg = 0.7*0.375 = 0.2625$ in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-c).

UG-45 Nozzle Neck Thickness Check

^t a UG-27	=	P*R _n / (S _n *E - 0.6*P) + Corrosion
	=	257.1156*1.5 / (20,000*1 - 0.6*257.1156) + 0
	=	0.0194 in
ta	=	$\max[t_{a UG-27}, t_{a UG-22}]$
		max[0.0194 , 0]
	=	0.0194 in
thi	=	P*R / (S*E - 0.6*P) + Corrosion
-01	_	$257.1156*17.5 / (20.000*1 - 0.6*257.1156) \pm 0.000$
	_	$257.1150.17.57(20,000.1+0.0.257.1150) \pm 0$
	_	0.2287 111
t _{b1}		max[t _{b1} , t _b UG16]
	=	max[0.2267, 0.0625]
	=	0.2267 in
t.		min[t., t.]
чb	=	$\min[\iota_{b3},\iota_{b1}]$
	=	min[0.2074 , 0.2267]
	11	0.2074 in
tuG-45	=	max[t ₂ , t ₂]
00-45	=	max[0,0194,0.2074]
	_	0 2074 in
		<u>V.2V/+</u> 111

Available nozzle wall thickness new, $t_n = 0.625$ in

The nozzle neck thickness is adequate.



Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange				
Description	NPS 4 Class 150 WN A105			
Bolt Material	SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32)			
Blind included	No			
Rated MDMT	-29.8°F			
Liquid static head	7.12 psi			
MAWP rating	278.75 psi @ 125°F			
MAP rating	285 psi @ 40°F			
Hydrotest rating	450 psi @ 40°F			
PWHT performed	No			
Impact Tested	No			
Circumferential joint radiography	Full UW-11(a) Type 1			
	Gasket			
Description	Klingersil C-4401 Synthetic Fiber			
Notes				
Flange rated MDMT per UCS-66(b)(1)(b) = -29.8° F (Coincident ratio = 0.9022) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F				

UHA-51 Material Toughness Requirements Nozzl	e	
$t_r = 257.12*1.913 / (20,000*0.85 - 0.6*257.12) =$	0.0292"	
Stress ratio = $t_r * E^* / (t_n - c) = 0.0292 * 0.85 / (0.2949 - 0) =$	0.0842	
Impact test exempt per UHA-51(g) (coincident ratio = 0.0842)		
Rated MDMT =	- 320°F	
Material is exempt from impact testing at the Design MDMT of -20°F.		

UG-37 Area Calculation Summary (in ²)						UG-45 Sun	nmary (in)	
For P = 257.12 psi @ 125 °F The opening is adequately reinforeed					The nozzle p	asses UG-45		
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
<u>0.8674</u>	<u>2.3426</u>	<u>1.0456</u>	<u>0.5261</u>	<u>0.5678</u>		<u>0.2031</u>	<u>0.2074</u>	0.2949

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary				
Weld description Required weld throat size (in)		Actual weld throat size (in)	Status	
Nozzle to shell fillet (Leg ₄₁)	<u>0.2359</u>	0.2625	weld size is adequate	

Calculations for internal pressure 257.12 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(3.826, 1.913 + (0.337 0) + (0.5 0))
 - = 3.826 in

Outer Normal Limit of reinforcement per UG-40

- $L_{H} = MIN(2.5*(t C), 2.5*(t_{n} C_{n}) + t_{e})$
 - = MIN(2.5*(0.5-0), 2.5*(0.337-0)+0)
 - = 0.8425 in

Inner Normal Limit of reinforcement per UG-40

- $L_{I} = MIN(h, 2.5*(t C), 2.5*(t_{i} C_{n} C))$
 - = MIN(1.875, 2.5*(0.5 0), 2.5*(0.337 0 0))
 - = 0.8425 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 257.1156*1.913 / (20,000*1 0.6*257.1156)
- = 0.0248 in

Required thickness t_r from UG-37(a)

 $t_r = P^*R / (S^*E - 0.6^*P)$

- = 257.1156*17.5 / (20,000*1 0.6*257.1156)
 - = 0.2267 in

Required thickness t_r per Interpretation VIII-1-07-50

 $t_r = P^*R / (S^*E - 0.6^*P)$

- = 257.1156*17.5 / (20,000*0.7 0.6*257.1156)
- = 0.325 in

Area required per UG-37(c)

 $f_{r1} = lesser of 1 \text{ or } S_n / S_v = 1$

 $f_{r2} = lesser of 1 \text{ or } S_n / S_v = 1$

 $A = d^{*}t_{r}^{*}F + 2^{*}t_{n}^{*}t_{r}^{*}F^{*}(1 - f_{r1})$ = 3.826*0.2267*1 + 2*0.337*0.2267*1*(1 - 1) = 0.8674 in²

Area available from FIG. UG-37.1

 $A_1 = \text{larger of the following} = 1.0456 \text{ in}^2$

- $= d^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- $= 3.826^{*}(1^{*}0.5 1^{*}0.2267) 2^{*}0.337^{*}(1^{*}0.5 1^{*}0.2267)^{*}(1 1)$
- = 1.0456 in²
- $= 2^{*}(t + t_{n})^{*}(E_{1}^{*}t F^{*}t_{r}) 2^{*}t_{n}^{*}(E_{1}^{*}t F^{*}t_{r})^{*}(1 f_{r1})$
- = 2*(0.5 + 0.337)*(1*0.5 1*0.2267) 2*0.337*(1*0.5 1*0.2267)*(1 1)
- = 0.4575 in²

 $A_2 = \text{smaller of the following} = 0.5261 \text{ in}^2$

- = 5*(t_n t_{rn})*f_{r2}*t
- = 5*(0.337 0.0248)*1*0.5
- = 0.7805 in²
- $= 5^{*}(t_{n} t_{n})^{*}f_{r2}^{*}t_{n}$
- = 5*(0.337 0.0248)*1*0.337
- = 0.5261 in²

 $A_3 = \text{smaller of the following} = 0.5678 \text{ in}^2$

- $= 5*t*t_{i}*f_{r2}$
- = 5*0.5*0.337*1
- $= 0.8425 \text{ in}^2$
- $= 5*t_i*t_i*f_{r2}$
- = 5*0.337*0.337*1
- $= 0.5678 \text{ in}^2$
- $= 2*h*t_i*f_{r2}$
- = 2*1.875*0.337*1
- = 1.2638 in²
- $A_{41} = Leg^{2*}f_{r2}$
 - $= 0.375^{2*1}$
 - $= 0.1406 \text{ in}^2$
- $A_{43} = Leg^{2*}f_{r2}$
 - = 0.25²*1
 - = <u>0.0625</u> in²
- Area = $A_1 + A_2 + A_3 + A_{41} + A_{43}$
- = 1.0456 + 0.5261 + 0.5678 + 0.1406 + 0.0625
 - = <u>2.3426</u> in²

As Area >= A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: $t_{min} = \text{lesser of } 0.75 \text{ or } t_n \text{ or } t = 0.337 \text{ in}$ $t_{c(min)} = \text{lesser of } 0.25 \text{ or } 0.7*t_{min} = 0.2359 \text{ in}$ $t_{c(actual)} = 0.7*\text{Leg} = 0.7*0.375 = 0.2625 \text{ in}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

t _{a UG-27}	=	$P*R_n / (S_n*E - 0.6*P) + Corrosion$
	=	257.1156*1.913 / (20,000*0.85 - 0.6*257.1156) + 0
	=	0.0292 in
ta	=	max[t _{a UG-27} , t _{a UG-22}]
	=	max[0.0292 , 0]
	=	0.0292 in
t _{b1}	=	P*R / (S*E - 0.6*P) + Corrosion
	=	257.1156*17.5 / (20,000*1 - 0.6*257.1156) + 0
	=	0.2267 in
t _{b1}	=	$\max[t_{b1}, t_{b}]$
01	=	max[0.2267 , 0.0625]
	=	0.2267 in
th	=	$\min[t_{h3}, t_{h1}]$
U	==	$\min[0.2074, 0.2267]$
	=	0.2074 in
tuc 15	=	max[to.th]
-00-45	=	max[0,0292,0,2074]
	=	0.2074 in

Available nozzle wall thickness new, $t_n = 0.875*0.337 = 0.2949$ in

The nozzle neck thickness is adequate.

ASME Section VIII Division 1, 2017 Edition				
Note: round inside edges per UG-76(c)	มะกรรมเสราะ เขาสำนักของเหมือที่ได้เกิดของเสมีของเสมชื่อของเหมือง เราการ หมดไหน่ง, ร.พ. พ.ศ. รัฟ หารับมามา ๆ รัพ 			
Location and Orientation				
Located on	Boot Head			
Orientation	0°			
End of nozzle to datum line	0"			
Calculated as hillside	No			
Distance to head center, R	0" toisisisestelleenteenseenseelsestiinteenseelseliktiinteenseelseksiikteenseelseksiikteense			
Passes through a Category A joint	No			
Nozzle				
Access opening	No			
Material specification	SA-105 (II-D p. 18, ln. 19)			
Inside diameter, new	3" 			
Nominal wall thickness	0.625"			
Corrosion allowance	0"			
Projection available outside vessel, Lpr	6.9367"			
Projection available outside vessel to flange face, Lf	7.8767"			
Local vessel minimum thickness	0.375"			
Liquid static head included	7.74 psi			
Longitudinal joint efficiency	1			
Welds				
Inner fillet, Leg ₄₁	0.375"			
Nozzle to vessel groove weld	0.375"			

ASME B16.5-2013 Flange			
Description	NPS 3 Class 150 LWN A105		

Bolt Material SA-193 B7 Bolt <= 2 1/2 (II-D p. 388, ln. 32				
Blind included No				
Rated MDMT	-29.5°F			
Liquid static head	8.02 psi			
MAWP rating 278.75 psi @ 125°F				
MAP rating	285 psi @ 40°F			
Hydrotest rating	450 psi @ 40°F			
PWHT performed No				
Impact Tested	No			
	Gasket			
Description Klingersil C-4401 Synthetic Fiber				
Notes				
Elange rated MDMT per LICS-66(b)(1)(b) = -20 5°E (Coincident ratio = 0.0053)				

Flange rated MDMT per UCS-66(b)(1)(b) = -29.5° F (Coincident ratio = 0.9053) Bolts rated MDMT per Fig UCS-66 note (c) = -55° F

	UCS-66 Material Toughness Requirements	***************************************
	LWN rated MDMT per UCS-66(c)(4) =	-29.5° F
COLUMN THE PROPERTY OF THE PRO	Material is exempt from impact testing at the Design MDM	ИТ of -20°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in ²)					UG-45 Sum	mary (in)		
	For P = 257.74 psi @ 125 °F					The nozzle pa	isses UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is	This nozzle is exempt from area calculations per UG-36(c)(3)(a)						<u>0.2074</u>	0.625

UG-41 Weld Failure Path Analysis Summary

The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary				
Weld descriptionRequired weld throat size (in)Actual weld throat size (in)Status			Status	
Nozzle to shell fillet (Leg ₄₁) 0.25		0.2625	weld size is adequate	

Calculations for internal pressure 257.74 psi @ 125 °F

Parallel Limit of reinforcement per UG-40

 $L_R = MAX(d, R_n + (t_n - C_n) + (t - C))$

- = MAX(3, 1.5 + (0.625 0) + (0.375 0))
 - = 3 in

Outer Normal Limit of reinforcement per UG-40

 $L_{H} = MIN(2.5*(t - C), 2.5*(t_n - C_n) + t_e)$

- = MIN(2.5*(0.375 0), 2.5*(0.625 0) + 0)
 - = 0.9375 in

Nozzle required thickness per UG-27(c)(1)

 $t_{rn} = P^*R_n / (S_n^*E - 0.6^*P)$

- = 257.7361*1.5 / (20,000*1 0.6*257.7361)
 - = 0.0195 in

Required thickness t_r from UG-37(a)(c)

 $t_r = P^*K_1^*D_0 / (2^*S^*E + 0.8^*P)$

- = 257.7361*0.9*36 / (2*20,000*1 + 0.8*257.7361)
- = 0.2077 in

Required thickness t_r per Interpretation VIII-1-07-50

t _r	==	P*D ₀ *K / (2*S*E + 2*P*(K - 0.1))
	=	257.74*36*1 / (2*20,000*0.85 + 2*257.74*(1 - 0.1))
	=	0.2692"

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.375 in $t_{c(min)}$ = lesser of 0.25 or 0.7* t_{min} = <u>0.25</u> in $t_{c(actual)} = 0.7*Leg = 0.7*0.375 = 0.2625$ in The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.					
t _{a UG-27}	=	P*R _n / (S _n *E - 0.6*P) + Corrosion			
	=	258.0181*1.5 / (20,000*1 - 0.6*258.0181) + 0			
	=	0.0195 in			
ta	=	max[t _{a UG-27} , t _{a UG-22}]			
	=	max[0.0195, 0]			
	=	0.0195 in			
t _{b1}	=	0.2293 in			
t _{b1}	=	max[t _{b1} , t _b UG16]			
	=	max[0.2293 , 0.0625]			
		0.2293 in			
tb	=	min[t _{b3} , t _{b1}]			
-	=	min[0.2074 , 0.2293]			
	=	0.2074 in			
tug-45	=	$\max[t_a, t_b]$			
00-10	=	max[0.0195 . 0.2074]			
	=	0.2074 in			

Available nozzle wall thickness new, $t_n = 0.625$ in

The nozzle neck thickness is adequate.



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

Material Test Reports

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

_																					
	Final					nal Bill	of N	later	ial												
		ASME CODE VESS	EL		BY		BY	DATE		JOB NO.					REQU	IRED DAT	E:	12/21/18			
		MILL TEST REPORT	s		DATE		СНКЮ	10/23/2018 DATE		5361-S	501				STO	CK CHECK		11/29/18			
		REQUIRED AS INDICA	TED		REV		DB	11/26/2018		Anada	rko				TO PU	RCHASIN	G:	11/26/18	-		
	Ship		Assy	,					Thk	Width	Length	Material	See								
Re	v Pcs	Mark No.	Pcs	Name	Descr	ription			Inches	Inches	Inches	Specification	Note	MTR	Weight	Ship To:	PO No	. / Vendor	Manufacturer	Number	Plate ID
		5361-1-1	2	HEAD	0.85	" MIN x 1	32" OD ASME 2:1	SF=2"				SA-516-70		Х	11263	SLC	4498	B6 CMF	Hyundai	FA38079	
		5361-1-2	4	PLATE	0.87	5" SHELL	., ROLLED		0.875	124.25	411.938	SA-516-70		х	50805	SLC	4498	0 Evraz	Evraz	N19015, N19840, N19841	35U, 36U, 37U, 38U
		5361-1-3	4	PLATE	0.87	5" SHELL	, ROLLED		0.875	124.25	411.938	SA-516-70		х	50808	SLC	4498	0 Evraz	Evraz	N19008, N19833, N19841, N20370	31U, 32U, 33U, 34U
		5361-1-4	1	PLATE	1/4"	PLATE S	ĸ		0.250	3.188	9	A-36		х	2	SLC	s	tock	Arcelormittal	D0872	38R
		5361-1-5	1	PLATE	1/4"	PLATE			0.250	6	9	A-36			4	SLC	s	tock			
		5361-1-6	1	NAMEPL	ASN	IE NAME	PLATE (EMP ST))				STN STL			-	SLC	Purcha	ase by QC			
		5361-1B-1	1	PLATE	1-1/2	2" BASEP	PLATE W/ HOLES		1.500	22	129	A-36			1194	SLC	s	tock			
		5361-1B-2	1	PLATE	1-1/2	2" BASEP	PLATE W/ SLOTS		1.500	22	129	A-36			1187	SLC	s	tock			
		5361-1B-3	2	PLATE	3/4"	WEB PLA	ATE SKETCH		0.750	53.813	124.75	A-36			1168	SLC	45336	Reliance			
		5361-1B-4	4	PLATE	3/4"	END PLA	ATE		0.750	18	53.813	A-36			824	SLC	45336	Reliance			
		5361-1B-5	8	PLATE	3/4"	RIB PLA	TE		0.750	8.625	25.375	A-36			368	SLC	45336	Reliance			
		5361-1B-6	8	PLATE	3/4"	RIB PLA	TE		0.750	8.625	13.688	A-36			199	SLC	45336	Reliance			
		5361-1B-7	4	PLATE	3/4"	RIB PLA	TE		0.750	8.625	10.125	A-36			74	SLC	45336	Reliance			
		5361-1B-8	2	PLATE	3/8"	WEAR P	LATE, ROLL		0.375	30	175.688	SA-516-70		х	1121	SLC	45335	Ryerson	SSAB	A810J2	40U
		5361-1B-9	2	PLATE	1/4"	PLATE V	W/HOLE		0.250	2	3	A-36			-	SLC	s	tock			
		5361-1C-1	1	FLANGE	20" -	- 150# RF	WN XH BORE					SA-105		х	199	SLC	450	09 IPP	Norma	1231	
		5361-1C-2	1	FLANGE	20" -	- 150# RF	BLIND					SA-105		х	271	SLC	450	09 IPP	ST&H	805820E	
		5361-1C-3	1	GASKET	1/8"	- 20" - 15	0# RING TYPE K	LINGERSIL	C-4401			KLINGERSIL			1	SLC	45281	KLINGER			
		5361-1C-4	2	PLATE	1-1/4	4" SKETC	CH PL W/ HOLE		1.250	3	5.5	A-36		х	8	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1C-5	1	PLATE	1-1/4	4" SKETC	CH PL W/ SLOT		1.250	4.188	4.813	A-36		х	5	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1C-6	1	PLATE	1-1/4	4" SKETC	CH PL W/ SLOT		1.250	4.188	4.813	A-36		х	5	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1C-7	1	ROD	1" D	ia rod v	W/ HOLES				15.5	A-36			3	SLC	45335	Ryerson			
		5361-1C-8	1	ROD	3/4"	DIA ROD	, BEND				12	A-36		х	1	SLC	s	tock	Nucor	PL16105676	
		5361-1C-9	20	STUD	1-1/8	8" DIA FU	ILL THREAD				6.25	SA-193-B7			35	SLC	45302	UINTAH			
		5361-1C-10	40	NUT	1-1/8	8" HEAVY	(HEX					SA-194-2H			23	SLC	45302	UINTAH			
		5361-1C-11	2	WASHER	1" S	TANDAR	D ROUND					STEEL			-	SLC	45302	UINTAH			
		5361-1C-12	2	COTTER	1/4"	DIA COT	TER PIN				1.5	STEEL			-	SLC	45302	UINTAH			
		5361-1C-13	1	PIPE	20"	NOM XH			0.500		8	SA-106-B		х	69	SLC	450	09 IPP	USS	MA6721	
		5361-1C-14	1	PLATE	3/4"	CIRC PL	20.25" ID x 33.5"	OD	0.750	Shop	to Form	SA-516-70		х	119	SLC	45335	Ryerson	SSAB	A81210	39U
		5361-1D-1	1	FLANGE	36" -	- 150# SE	RIES "B" RFWN	XH BORE (3	5" I.D.)			SA-105		х	270	SLC	450	09 IPP	Coastal	ACDXJ	
		5361-1D-2	2	FLANGE	24" -	- 150# RF	WN XH BORE					SA-105		х	542	SLC	450	09 IPP	ST&H	N13378	
		5361-1D-3	3	FLANGE	6" - "	150# RF I	HB LWN NS				9	SA-105		х	239	SLC	45008	Ameriforge	FVC	DVB	
		5361-1D-4	1	FLANGE	4" - 1	150# RF I	HB LWN NS				12.25	SA-105		х	80	SLC	45008	Ameriforge	FVC	EKR	
		5361-1D-5	3	FLANGE	3" - "	150# RF I	HB LWN NS				9	SA-105		х	114	SLC	45008	Ameriforge	FVC	BWL, DXN	
		5361-1D-6	1	FLANGE	3" - "	150# RFV	WN XXH BORE					SA-105		х	13	SLC	450	09 IPP	ST&H	012898F	
		5361-1D-7	3	FLANGE	2" - '	150# RF I	LWN				9	SA-105		х	44	SLC	45008	Ameriforge	FVC	DGT	
		5361-1D-8	1	COUPLING	2" - (6000# FU	ILL SCRD				3.375	SA-105		х	8	SLC	450	09 IPP	Bonney Forge	1133	

																			1		
							Fir	nal Bill	Bill of Material												
		ASME CODE VESSE			PV		BY	DATE	01 10	JOB NO.					REQUI	IRED DAT	E:	12/21/18			
		Nome CODE VECCE	-		DATE		RT	10/23/2018		5361-5	601				STO	CK CHECK	:	11/29/18			
		MILL TEST REPORTS REQUIRED AS INDICAT	ED		DATE		CHKID	DATE		CUSTOMER	d				TO PU	RCHASIN	G:	11/26/18	-		
					REV		DR	11/26/2018	1	Anadai	ко		1								
	Ship		Assy						Thk	Width	Length	Material	See	2						Heat & Slab	
Rev	Pcs	Mark No.	Pcs	Name	Descri	iption			Inches	Inches	Inches	Specification	Note	ΨT	Weight	Ship To:	PO No.	/ Vendor	Manufacturer	Number	Plate ID
		5361-1D-9	2	PIPE	24" N	NOM XH			0.500		9.5	SA-106-B		Х	199	SLC	450	09 IPP	USS	MA2116	
		5361-1D-10	1	PIPE	3" NO	OM XXH			0.600		10	SA-106-B		х	16	SLC	450	09 IPP	ТМК	478063	
		5361-1D-11	1	PIPE	3" NC	OM XH, S	KETCH		0.300		2	SA-106-B		х	2	SLC	450	09 IPP	Arcelormittal	1609658	
		5361-1D-12	1	PLATE	1/2" I	PLATE, R	OLLED w/4" TAN	NS	0.500	10.938	119.5	SA-516-70		х	173	SLC	45335	Ryerson	Nucor	8505498	30U
		5361-1D-13	1	PLATE	CIRC	C 36.25 ID	x 63 OD ROLL		1.000			SA-516-70		х	616	SLC	45335	Ryerson	Nucor	8505555	28U
		5361-1D-14	2	PLATE	CIRC	C 24.25 ID	x 44.5 OD ROL	L	0.750			SA-516-70		х	474	SLC	45335	Ryerson	SSAB	A81210	39U
		5361-1D-15	1	PLATE	PLAT	TE CIRC 1	10.50" DIA		0.500			A-36			12	SLC	45335	Ryerson			
		5361-1D-16	1	PLATE	1/2"	PLATE (V	ORTEX BRK)		0.500	6	8	SA-516-70		х	7	SLC	45335	Ryerson	Nucor	8505498	30U
		5361-1D-17	2	PLATE	1/2" \$	SKETCH	PL (VORTEX BR	ικ)	0.500	3.75	6	SA-516-70		х	6	SLC	45335	Ryerson	Nucor	8505498	30U
		5361-1D-18	1	FLANGE	6" - 1	150# RF B	LIND					SA-105		х	25	SLC	45289	MWPS	RNG	5912	
		5361-1D-19	1	FLANGE	3" - 1	150# RF B	LIND					SA-105		х	11	SLC	4528	MWPS	Boltex	T217	
		5361-1D-20	1	GASKET	1/8" -	- 6" - 150#	ŧ, RING TYPE, C	-4401				KLINGERSIL			1	SLC	45281	KLINGER			
		5361-1D-21	1	GASKET	1/8" -	- 3" - 150#	ŧ, RING TYPE, C	-4401				KLINGERSIL			-	SLC	45281	KLINGER			
		5361-1D-22	8	STUD	3/4" [DIA. FULL	THREAD				4.25	SA-193-B7			4	SLC	45302	UINTAH			
		5361-1D-23	16	NUT	3/4" I	HEAVY H	EX					SA-194-2H			3	SLC	45302	UINTAH			
		5361-1D-24	4	STUD	5/8" [DIA. FULL	THREAD				3.75	SA-193-B7			1	SLC	45302	UINTAH			
		5361-1D-25	8	NUT	5/8" I	HEAVY H	EX					SA-194-2H			-	SLC	45302	UINTAH			
		5361-1E-1	1	HOUSING	VAN	E PAK HC	DUSING (BY AM	ACS)				SA-516-70		х	393	SLC	Furni Cu:	shed by stomer	Nucor	8507558	
		5361-1E-2	1	VANE PAK	VAN	E PAK W/	DISTRIBUTOR	(BY AMACS))			304L SS			500	SLC	Furni Cu:	shed by stomer			
		5361-1E-3	1	PLATE	1/2" \	WEIR PLA	ATE, SKETCH		0.500	32	112.125	SA-516-70		х	360	SLC	45335	Ryerson	Nucor	8505498	30U
		5361-1F-1	4	PLATE	1/2"	PLATE, S	KETCH W/HOLI	ES	0.500	50.125	100.25	SA-240-304		х	175	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1F-2	2	BEAM	W6 x	< 20 W/H	DLES & SLOTS				123.5	304 SS			412	SLC	45349	Ryerson			
		5361-1F-3	4	PLATE	1/2" I	PLATE, S	KETCH W/HOLI	ES	0.500	6	7	SA-240-304		х	23	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1F-4	4	PLATE	1/2" I	PLATE, S	KETCH		0.500	5.25	7	SA-240-304		х	17	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1F-5	156	NUT	3/8" I	HEAVY H	EX					304 SS			5	SLC	45302	UINTAH			
		5361-1F-6	2	BAFFLE	DIST	RIBUTIO	N BAFFLE (BY A	MACS)				304L SS			900	SLC	Furni Cus	shed by stomer			
		5361-1G-1	1	PLATE	1/2" I	PLATE, S	KETCH W/HOLI	ES	0.500	30	36	SA-240-304			87	SLC	45335	Ryerson			
		5361-1G-2	1	PIPE	24" N	NOM XH, S	SKETCH		0.500		18.688	SA-312-TP304			144	SLC	45289	MWPS			
		5361-1G-3	1	PIPE	24" N	NOM XH, S	SKETCH		0.500		23.75	SA-312-TP304			145	SLC	45289	MWPS			
		5361-1G-4	1	PIPE	24" N	NOM XH, S	SKETCH		0.500		10.563	SA-312-TP304		х	59	SLC	45289	MWPS	Outokumpu	441917	
		5361-1G-5	2	PLATE	1/2"	PLATE W	//HOLES		0.500	4	12	SA-240-304			13	SLC	45335	Ryerson			
		5361-1G-6	4	PLATE	1/2"	PLATE, S	KETCH		0.500	2.25	3.5	SA-240-304			4	SLC	45335	Ryerson			
		5361-1G-7	2	PLATE	1/2"	PLATE W	//HOLES		0.500	2.5	70	SA-240-304		х	49	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1G-8	2	PLATE	1/2"	PLATE W	//HOLE		0.500	5.5	7.813	SA-240-304		х	12	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1G-9	4	PLATE	1/2"	PLATE, S	KETCH		0.500	4	9.688	SA-240-304		х	20	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1G-10	1	PLATE	1/2" I	PLATE, S	KETCH W/HOLI	ES	0.500	6	12	SA-240-304		х	10	SLC	45335	Ryerson	NAS	A19W	29U
		5361-1G-11	1	DIFFUSER	INLE	T DIFFUS	SER ASSY (BY A	MACS)				304L SS			942	SLC	Furni	shed by			

									Fin	al Bill	of N	later	ial										
		ASME CODE VESSE	L		BY				BY	DATE		JOB NO.					REQU	IRED DATI		12/21/18			
		MILL TEST REPORTS	5		DATE				CHK/D	10/23/2018 DATE		5361-S	501				STO	CK CHECK:		11/29/18			
		REQUIRED AS INDICAT	ΓED		REV				DB	11/26/2018		Anadaı	ĸo				TO PU	RCHASING	6:	11/26/18			
Rev	Ship	Mark No	Assy Pcs	Name	Descr	ription					Thk	Width	Length	Material	See Note	ATR	Weight	Shin To:	PO No	/ Vendor	Manufacturer	Heat & Slab	Plate ID
	105	5361-1H-1	1	FLANGE	36" -	- 150#	SER	IES "E	B" RFWN X	H BORE (3	5" I.D.)	monos	manos	SA-105	note	X	270	SLC	450	09 IPP	Coastal	ACDXJ	Trate 10
		5361-1H-2	1	PLATE	1/2"	PLAT	E, RC		D w/4" TAN	S	0.500	55.25	119.5	SA-516-70		х	874	SLC	45335	Ryerson	Nucor	8505498	30U
		5361-1H-3	1	HEAD	0.37	5" MI	N x 36	6" OD	ASME 2:1	SF=2"				SA-516-70		х	228	SLC	449	97 CMF	Nucor	8505299	
		5361-1H-4	1	FLANGE	4" - '	150#	RFWM	N XH I	BORE					SA-105		х	16	SLC	450	09 IPP	RNG	H6336	
		5361-1H-5	5	FLANGE	3" - "	150#	RF LV	VN					9	SA-105		х	127	SLC	45008	Ameriforge	FVC	C1000AF	
		5361-1H-6	1	PIPE	4" N	ом х	H, SK	ETCH	1		0.337		9.25	SA-312-TP304		х	10	SLC	450	09 IPP	Seah	N08288	
		5361-1H-7	1	PIPE	4" N	ом х	H, SK	ETCH	1		0.337		24	SA-312-TP304		х	26	SLC	450	09 IPP	Seah	N08288	
	1	5361-1H-B		GASKET	1/8"	- 36"	- 150#	# SER	IES "B" RI	NG TYPE C	-4401			KLINGERSIL			1	SLC	45281	KLINGER			
	44	5361-1H-C		STUD	7/8"	DIA F	ULL -	THRE	AD				6.75	SA-193-B7			51	SLC	45302	UINTAH			
	88	5361-1H-D		NUT	7/8"	HEA\	/Y HE	X						SA-194-2H			26	SLC	45302	UINTAH			
		5361-1J-1	2	FLANGE	20" -	- 150#	ŧ RFW	/N XH	I BORE					SA-105		х	399	SLC	450	09 IPP	Norma	1231	
		5361-1J-2	2	FLANGE	20" -	- 150#	ŧ RF E	BLIND						SA-105		х	541	SLC	450	09 IPP	ST&H	805820E	
		5361-1J-3	2	GASKET	1/8"	- 20"	- 150#	# RIN	G TYPE KL	INGERSIL (C-4401			KLINGERSIL			2	SLC	45281	KLINGER			
		5361-1J-4	4	PLATE	1-1/4	4" SK	ЕТСН	PL W	// HOLE		1.250	3	5.5	A-36		х	16	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1J-5	2	PLATE	1-1/4	4" SK	ЕТСН	PL W	// SLOT		1.250	4.188	4.813	A-36		х	9	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1J-6	2	PLATE	1-1/4	4" SK	ЕТСН	PL W	// SLOT		1.250	4.188	4.813	A-36		х	9	SLC	45335	Ryerson	Nucor	8505747	27U
		5361-1J-7	2	ROD	1" D	IA RC	D W/	HOLE	ES				15.5	A-36			7	SLC	45335	Ryerson			
		5361-1J-8	2	ROD	3/4"	DIA F	ROD, I	BEND)				12	A-36		х	3	SLC	s	tock	Nucor	PL16105676	
		5361-1J-9	40	STUD	1-1/8	B" DIA	FUL		READ				6.25	SA-193-B7			70	SLC	45302	UINTAH			
		5361-1J-10	80	NUT	1-1/8	8" HE.	AVY H	ΗEX						SA-194-2H			46	SLC	45302	UINTAH			
		5361-1J-11	4	WASHER	1" S	TANC	ARD	ROUI	ND					STEEL			-	SLC	45302	UINTAH			
		5361-1J-12	4	COTTER	1/4"	DIAC	отт	ER PI	N				1.5	STEEL			-	SLC	45302	UINTAH			
		5361-1J-13	2	PIPE	20"	NOM	хн				0.500		20.563	SA-106-B		х	357	SLC	450	109 IPP	USS	MA6721	
		5361-1J-14	2	PLATE	CIRC	C 20.2	25 ID :	x 39" (OD ROLL		1.000			SA-516-70		х	586	SLC	45335	Ryerson	Nucor	8505555	28U



Commercial Metal Forming - O 341 West Collins Ave Orange, CA 92867 PHONE: 714.532.6321 FAX:

PACKING LIST

SHIPMENT NO.300227PAGE NO.2

SALES ORDER	CUSTOMER NO.	P.O. NUMBER	P.O. DATE	S.O. DATE	PLANT
999118	17913	0044986	09/21/18	09/21/18	OCW

- SOLD TO: EATON METAL PRODUCTS* 4800 YORK ST. DENVER, CO 80216
- SHIP TO: EATON METAL PRODUCTS 844 S. CHESTNUT STREET SALT LAKE CITY, UT 84104 USA
 - ITEM PART NO. DESCRIPTION

1 6392113201000 132"OD X 1"NOM SE 2:1 SA516-70 2"SF BEVEL PER PRINT SA516-70 MTRS 5420# (.85"MIN) #1-1 HEAT: JJP=FA38079 SLAB: P30709 SHIP DATE: 11/16/18

PREPAID&ALLOW-FOB DE

B/L NO. 259767

MTR'S WITH SHIPMENT

	REL RE	EQ DATE	DUE QTY	SHIP QTY
:1	1 11	L/16/18	2	2
Т				

5501 mk# 1-1

CARBON STEEL PARTS WHICH WERE COLD FORMED COMPLY WITH ASME SECTION VIII DIV. 1 UG-79/& UCS-79D. PARTS:_____ WERE NOT HEAT TREATED _____ WERE HEAT TREATED ALL PARTS COMPLY WITH UG-81 CERTIFIED BY:_____



SAGI	e-70 53	,6/ MK# 1-1	1"	P30700	1
÷.	Reviewed +	o ZOIZ ASME Sect.	onII		
	AJAP	MILL TEST C	<mark>등 명 서</mark> CERTIFICATE	HYUNDAI BINEA: STEEL BINEA: SV ENA SUE AFAULE 180 AI BUNEA: Sorgek-Eup, Dangin SI, Churgman, Kore	
주문번호 Order No.	: E170400143			·	
좀 몋 Commodity	: Hot Rolled Steel Plate	고객사 Customer : AMERICAN ALLOY		중명서 번호 Certificate No : 20170501-PS-022-013	
제출규격 Specification	ASME SA516-70(2013)/ASTM A516-70(20	15) 주문자 Contractor	CA, INC.	환형일자 :2017-08~01 Date of Issue	_
제품치수 Dimension	수당 전망 제강변호 제문변호 Quardy (Kg) HeatNo. HostalNo.	인정사영 Tensie Test G YP TS BL YP-EL RA YR YP	화작성분 Chemical Compos Q C 명 Win P 5 Q	Elifi Ura 5cn(%) 2:x100 3:x1,000 4:x10,000 5:x100,000 Ni B Cu Mo No Ti Y Sci Ni B Cu Mo No Ti Y Sci CEQ	
1*x170*x340* • 1*x170*x340*	1 7,436 P30709 FA83807601 1 7,436 P30709 FA83807902	(V)ac) (56) (56) (56) (56) T 345.2 524.5 49 2 2 T 345.2 524.5 49 2 2	- 4 3 3 4 4 2 L 1,713 357 1,136 135 36 14 L 1,713 357 1,136 135 36 14 L 1,713 357 1,136 135 36 14	2 4 3 2 3	
*** Sub Totallon of a	U) *** 2 14,872(Kg) supply: As Robot ==**	· · · · · · · · · · · · · · · · · · ·			-1
Test Coupon	HeatTreatment***				
** Metrod A *** *	* Applicable test Zerns Torsola Test				
** Method A ***	+ 1 Normalizing Times: 1) - Heating Temp: 900°C, Heat	ng Pate : 170°C/Hr Max at above 400°C, Holding Time: 30 Min, Do	colog Rate: Air Coding		
400 JOJ ***	the los 385,000 PO/Carliet National	NI CAMELICIAL AND			
+++ (astlem			· · · · · · · · · · · · · · · · · · ·		-
					-
			·	APPROVED	
		•			
* Position * Tensile test N * Division - (TYTop, M:Middle, B:Bottom t — Direction:Transverse, YP Mtd : 2 (0.2% off C:Check analysis, L'Ladie analysis	-set),5 (0.5% underload), U (Upper yield point), L (L	ower yield point)	CMF	
5 T W					
* The plate Is	s fully killed and fine grained steel. Basic oxyg	en process and Vacuum depassing process were app	olled. This Mill Test Certificate Is Issued	In accordance with EN 10204 Type 3.1	
	ا حلي WE HEREBY CERTIPY THAT THE MATERIAL HAS BE	NG근 감사의 결과 지정전 규격에 참격한 것을 중당합니다. NMADEAND TESTED N ACCORDANCE WITH THE ABOVE SPE	COPICATION AND THE FEOLIPEMENTS	Signature S. B. Part	

* 본 점사중당시는 원료인 전자문시(전자)위영 정보 포함) 공부위 중격된 사실입니다. 전자문시인 내용은 프입지정 고객포함에서 원인하는 수 있습니다.(http://smlbyundal-steel.com/cs/cm/login_sp) * This M월 Teat Cartificate is a oppy that bas been printed from original electronic document(with digital signing). You are able to check an original electronic document at hyponobical's customer ported(http://smlbyundel-steel.com/cs/cm/login_isp) * QRcode scanner App : 'QReal' # (사용상 포시장인 정 포시장 에 명기된 규칙 및 기본 귀 제공은 및 안전상 문제가 발생한 수 있습니다. * (Caution for Use) Damage on products and safety problems may arise if used other them to the spec stated in this MBI Teat Certification.

ODUC

1

ΠK PO64675 7/14

· m.st.	EV	'nR.	ΑZ		C. NA					RE	PORT O)F CI	HEM	ICAL/P	HYSICA	L TESTS		CERT	IFICATE NO.	DATE		PAGE
	Evraz Ori	egon S	teel 144	00 N. Rivergate	Blvd., Portlan	id, Oregon S	7203											1	643589	Dec	21, 2	018 1
										1								MILL	ORDER NO.		DATE	
				EATO	N METAL	PROD	UCTS	со			EATON	I ME	TAI	PRO	DUCTS	co.		3	29921	.		
		\ \\	õ	POB	OX 1640)5				· · .	844 C	HES	STNU	T ST	REET	-		CUST	OMER ORDER	NO.		
12	૦ કા	JU'I	Ľ	STOC	KYARD S	 STATIO	N				SALT	LAR	CE C		UT.	84104		0	044980			
Л	EGISTE	RED	D	DENV	ER. CO	8021	6					~~~~		,				JOB/F	REQ. NO.			
4	A.P.	- TOP-	т	US														5	361-501	0103	1	
	ATE PRO	<i>v</i> -	Ò				-											SHIP	PING NO.		DATE	
																		1	643589		12/2	21/2018
-		1 1/40	DECNA	TANUEACTU				NEETTH		ATIONS AL		CHAC				NTC		CARF	NER		,-	
		STEF	T. DRI	RSSTRR	VESSEL	OTTAT.T	ידיע יידי דיק יידי	ATE AS	STM A51	16-17	GRADE	2 7 (ME S	QUINEM A 51 6			T	rinity	Trans	mort.	
	RADE 7	0 20	17.	AS ROLL	ED KILI	UED FT	NE GE	ATN NO	WELD	REPAT	R. F		sm	E VE	SSEL			CAR	TRUCK NO.		2020	
			· • ·										0001					4	F002			
~		-							PH	SICAL	. PRO	DPF	BT	IES				~				
· 📃	<u>19 19 1</u>									VIELD	TEM	Nie		010			END					
ITEM NO				DESCRIPT	ION			HEAT N	D. SLAB	PSI-X 10	0 PSI X	100	76 EL 8"	2" 9	% RA (BHN T	EST		IMP	ACTS		
1	0.875	0 X	126.	000ME X	413.5	00																
	PT#	SA-5	516-7	0							2					ļ						
	ĸ	11	20	12929	LBS		^	N1901	5 A32	57	alva	785	29				35U					
1	1	2 1	PCS	25858	LBS		~	N1984	0 A22	\$ 56	0 0	780	23					-3611&	3711			
		11	PC	12929	1.85		^	N1984	1 A23	57	5 1	810	23					-500 &	370	RTI		
				10040																		
		4 1	PCS	51716	LBS. TO	TALS				1												
				01.10		1120												-				
																	1	ł.	0# 44980	ļ		
				RO	DUCTS													5	5361			
				120	00 8	1												50.77 T # 250				
				6 5	PU &	1									1			MK	#1-3			
				E 01	IALITY 2																	
				10	~7												1					
					- 37																	
	-					-																
	E AT NO				N 0	1 0	1 0.	1 60	C			NA	LYS		Ti		N	0.			05	McCuald Eho
NT1	EALNO.	19	1 3	A 013	008	28	01	<u>NI</u>	025		045		Or 02	MO 0.0	1.000		<u>N</u>	Ua			CE	Grain Size
NT1	9940	110	1 3	5 013	006	21	0.02	05	024	000	034		02		000	0000			· ·			
L FL	0941	20	1 2	3 012		20	01	0.05	024	1 000	011	-	02	.00	000	0000			1			
	JOHL	.20	r. 3	2 1.013		1	1.01	1.05	.027			1.	02	.00	1.000		[l		
	זיי תיוד דו		NDICA	TED MT	יו (ב) דמיי		יפירינדא		NITEACT	ד תקקו	ינוידי דא	יד א	52	HEAT	S TNT	 በተሮኔሞድካ	שייידיש	(^) 1071	RE POL		א דידי	
	прац			עמי.		113AG 1			NOLWOI				PU.	11041		LCUIPT		1, 1, MT		1 ²⁰ I,	- 11DE	UDA.
		1														1	l					
		ENT		יייניטקא																		
L			- pr		• • • • • •	• •			1		1				1							· · · · ·

Aaron Capps Quality Coordinator

I certify the above to be correct as contained in the records of EVRAZ INC. NA By

₩E\	/R/	٩Z	EVRAZ INC.	NA	0	1000			REP	ORT O	CHEN	IICAL/P	HYSICA	L TESTS		CE	RTIFICATE NO.	DATE	100	PAGE
ISO 9 REGIST	001	S O L D T O	EATON PO BOJ STOCKJ DENVEL US	METAL (1640 (ARD S' R, CO	PRODI 5 TATIO 8021	UCTS (N 6	co		E E E E E E E E E E E E E E E E E E E	EATON 344 CH SALT I	META IESTN LAKE	L PRO UT ST CITY,	DUCTS REET UT	CO. 84104		JO SH	LL ORDER NO. 329921 ISTOMER ORDER (0044980 B/REQ. NO. 5361-501 SUPPING NO.	NO. L 0103	DATE	
THIS MATER CARBON	AL HAS	BEEN MA	NUFACTURE	D, TESTEL	O AND FO	UNDTO TY PL	MEETTHE ATE AS	SPECIFIC	ATIONS AN L6~17 (REPATI		HASE OF 70 A	RDER RE SME S	QUIREME A516	INTS		CA	ARER Trinity	Trans	port	9/2018
QUALIT	Y.	A 7 4 AX										101 12					14			
		_						PH	/SICAL	. PRO	PERI	TIES								
TEMNO		D	ESCRIPTIO	N		1	LICAT NO		YIELD	TENSI	E %E		w DA	ARDNESS B	END		IMP	ACTS		
	F0 V	100 0	AGNER V	112 50	0		HEAI NO	J. SLAB			00 8.		76 HA	BHIN	£81					^
L U.8/	50 A 58-5	120.0 16-70	UOME A 4	±12.20	U				1	1										
	3 A -5		12929 T.I	25		~	N19008	1 4 4 4 4	57	5 7	90 23					J				
	1 P	e.	12929 TJ	BS		~	N19833	A23	57	5 2 8	10 23									
	1 0	c r	12929 T.I	BS		~	N19841	A27	1 57	5 8	10 25						3411			
	1 P	c .	12929 L	BS		~	N20370) A22	56	5 8	00122						2211			
	- 4 P	CS	51716 L	в'я тот	ALS										4	5361 P	O# 44980			
I.	2	26													m	水井	(-)	LE DON META	SPD UALITY	AS COMPANY
	2					<u> </u>	A.11	Cł	IEMIC		JALY	SIS	473		P 1	0				Machine
HEAT NO.	+C	Mn 1 31	,015	.006	28	01	.05	v .024	.000	AI . 037	Cr	M0	11	8	N.	Ca			CE	Grain Siz
N19833	.20	1.39	.012	.004	32	.02	.05	.024	.000	.039	.02	.00	.000	.0000						
N19841	20	1.33	.013	.006	.30	.01	.05	.024	.000	.041	.02	.00	.000	.0000						
N2.0370	. 19	1.33	.015	.005	.33	.01	.05	.024	.000	.040	.03	.00	.002	.0000						
HEA	TS IN	DICAI	ED WITH	(+) [°] W	ERE M	ELTED	& MAI	NUFACT	URED I	N THE	USA.	HEAT		ICATE	WITH	(^) 1	WERE ROL	TED IN	тне	USA.
										1				1						
* * * * * * *	. ENĻ	OFF	EPORT .	••••	•							1	l						.	
		10	ertify the abo	ve to be co	rrect as d	ontained	in the rec	ords of EV	RAZ INC. N	A Bw						Aaron C	Capps			
	•												i i		Qu	ality Coo	ordinator		-	

, [:]:

.

08/29/2017 From: AMERICAN ALLOY STEEL, INC. P.O.#: 0043258 S.O.# Item: 1 (1 FC) 1/4" X 96" X 240" TAG: MARK# 1B-1	To: EATON ME #: 580058	TAL PRODUCTS AA PL#: 51873	341
· · · ·			- the
ARCELORMITTAL PLATE LLC SHIP TO: AMERICAN ALLOY STEEL C/O SKOL TRACK 21 6350 N ERIE AVE OWASSO OK 00000	TEST CERTI MILLO	FICATE PAGE NO: 01 OF FILE NO: 0284-0 RDER NO: 80489- MELT NO: D0872 SLAB NO: 39A DATE: 07/18/	ArcelorMith 05 243 002 17
SOLD TO: AMERICAN ALLOY STEEL, INC P. O. BOX 40469 HOUSTON TX 77240-0469	SEND TO:		01-C
STEEL PLATE DIMENSIC	NS / DESCRI	PTION	
TOTAL QTY GAUGE WIDTH LE	NGTH DESCRIPTION	PIECE WEIGHT	
9 .25" 96" 2	40" RECTANGLE	1634#	
CUSTOMER INFORMATION CUSTOMER FO; 111583-OK PART NO. 2	Certified a true or original, retained in AMERICAN ALLOY S Reviewed Bu	iy of the cour file STERE, A Hill	
SPECIFICATION (S)	Warman Branch Contract of Street	anti f (jag ment	
THIS MATERIAL HAS BEEN MANUFACTURED ORDER REQUIREMENTS AND SPECIFICATION	AND TESTED IN ACCORDA N(S).	NCE WITH PURCHA	ASE
ASTM A516 YR 10 GR 70 ASTM A516 YR 10 GR 65 ASTM A516 YR 10 GR 60 ASME SA516 ED 15 GRADE 70 ASME SA516 ED 15 GRADE 65 ASME SA516 ED 15 GRADE 60 PRODUCT OF COIL THE MANAGEMENT SYSTEMS FOR MANUFACT TO ISO 9001:2008 (CERTIFICATE NO. 30 (CERTIFICATE NO. 49009).	TRE OF THIS PRODUCT ARI 130) AND ISO 14001;20	E CERTIFIED	,
CHEMICAL COMPOSITION (WT%) FOR ALL ELEME	NTS EXCEPT H (PPM)		
MELT:D0672 .20 .93 .01	.5 .004 .28 .19	NI CR MO ,16 ,19 ,0	4
MELT: D0872 .002 .003 .000	AL CB 2 .019 .001		
and the second second	i. TT		
EVIEWED TO ZOIT ASME SAC	5361- MK# ID#	-1 1-4 38R	AMERICAN ALLOYU
WE HEREBY CERTIFY THE ABOVE INFORMATION IS CORRECT:		*	
ARCELORMITTAL PLATE LLC QUALITY ASSURANCE LABORATORY 139 MODENA ROAD COATESVILLE, PA 19320	SUPERVISOR - TE	STREPORTING	

08/29/2017 From: AMERICAN ALLOY STREL,	INC.	To: EATON	METAL PRODUCT	5
P.O.#: 0043258	S.Q.#;	580058	AA PL#: 5	187341
Item: 1 (1 PC) 1/4" X 96" X 240"				
TAG: MARK# 1B-1				
		IEST CER	PAGE NO DA	ሰክ ባይ
		MILL	FILE NO: 024	34-01-43
		441 A41	MELT NO: DOF	189-002 172
			$\begin{array}{c} \text{SLAB NO: } 39A \\ \text{DATE: } 07 \end{array}$	18/17
				20/2/
HEAT TREAT CONDIT	ION		SET T	WO ·
MATL OP URAM TO	T+3.011			
TEST DESCRIP	TION TE	MP MINS	COOL MTRD	
TEST ONLY NORMAL	TZE 16	5017 30	ATP COOT	
			ALK COVE	•
TENSILE PROPERTIE	8		SET T	W Ó
			ELONGATION	
SLAB	TIELD PRENCTH	V TENSILE	AFTER FRACTUR	E
NO LOC DIR V PS	t X 1000	PST X 1000	LGTH &	
39A BOT. TRANS.	55	75	8.00 22 0.	
(39A MID. TRANS. 39A TOP TRANS.	56 57	77	8 00" 23.0	•
Y Y			0.00~ 23.0	

WE HEREBY CERTIFY THE ABOVE INFORMATION IS CORRECT:

ARCELORMITTAL PLATE LLC QUALITY ASSURANCE LABORATORY 139 MODENA ROAD COATESVILLE, PA 19320

00

SUPERVISOR - TEST REPORTING LOC TRAN

08/29/20	17 From: AMERICAN ALLOY STEEL,	INC.	To; EATON	METAL PRODUC	TTS ·	
P.O.#;	0043258	S.O.#:	580058	AA PL#:	5187341	
Item:	1 (1 PC) 1/4" X 96" X 240"					
	TAG: MARK# 1B-1					

TEST CERTIFICATE PAGE NO: 04 OF 05 FILE NO: 0284-01-43 MILL ORDER NO: 80489-002 MELT NO: D0872 SLAB NO: 39A DATE: 07/18/17

GENERAL INFORMATION

ALL STEEL HAS BEEN MELTED AND MANUFACTURED IN THE U.S.A. TEST CERTS. ARE PREPARED IN ACCORD. WITH PROCEDURES OUTLINED IN EN10204:2004 TYPE 3.1 MERCURY OR MERCURY COMPOUNDS ARE NOT USED IN THE MANUFACTURE OF ARCELORMITTAL PLATE LLC PRODUCTS, ALL STEEL HAS BEEN MANUFACTURED IN THE U.S.A. ACID SOLUBLE ALUMINUM FOR MORE INFORMATION AND PROCESSING GUIDELINES, REFER TO WWW.USA.ARCELORMITTAL.COM/FLATE

MERCURY OR MERCURY COMPOUNDS ARE NOT USED IN THE MANUFACTURE OF ARCELORMITTAL PLATE LLC PRODUCTS.

B/L #17519 TTPX 80714

SUPERVISOR - TEST REPORTING

WE HEREBY CERTIFY THE ABOVE INFORMATION IS CORRECT:

ARCELORMITTAL PLATE LLC QUALITY ASSURANCE LABORATORY 139 MODENA ROAD COATESVILLE, PA 19320

00/20/21	17 From: AMERICAN ALLOY STEEL,	INC,	TO: EATON METAL PRODUCTS
P.O.#:	0043258	S.O.#:	580058 AA PL#: 5187341
Item:	l (1 PC) 1/4" X 96" X 240"		
	TAG: MARK# 1B-1		

CERTIFICATE T E S T PAGE NO: 05 OF 05 FILE MILL ORDER 0284-80489 NO: -01 NO: 80485 NO: D0872 NO: 39A NO: 39A -43 002 MELT SLAB DATE

INCHES

AIR COOL

MILLIMETERS

MEXICAN GOVERMENT PRODUCT IDENTIFICATION REQUIREMENTS:

01. PRODUCT DESCRIPTION: HOT ROLLED CARBON STEEL PLATE CUT TO LENGTH

02. TYPE OF STEEL: NON-ALLOY

03. TYPE OF COATING USED: N/A

04. TYPE OF FINISHING OR COMPLEMENTARY MANUFACTURING: N/A

05.	PROPRIETARY	STANDARD:	ASTM	A516 A516	YR YR	10 (GR 70	
			ADIM	V 2T0	11	10"	ar ou .	
			ASME	5A515	ED ED	15	GRADE	- 73
			ASME	BA516	5 ED	15	GRADE	-65
			ASME	SA516	i ED	15	GRADE	-60

06. PRODUCT PRESENTATION: PLATE

07. ACCESSORIES INTEGRATED TO THE GOOD: N/A

WIDTH LENGTH 240 6096mm 08. PRODUCT DIMENSIONS: GAUGE .25 6.35MM 96 2438.4MM

09. TECHNICAL SPECIFICATION: N/A

10. FHYSICAL SPECIFICATIONS: NORMALIZE

11. COUNTRY OF ORIGIN: USA

12. CHEMICAL COMPOSITION: (WEIGHT %) DETAILED IN MILL TEST REPORT

13. PRODUCING MILL:

ARCELORMITTAL PLATE LLC SUPERVISOR TEST REPORTING, QUALITY, 930 139 MODENA ROAD COATESVILLE, PA 19320

LOC TRAN (610) 236-7579 MAILTO:LOC.TRAN@ARCELORMITTAL.COM PHONE : ΈM

14, CERIFICATE NUMBER: D0872

15. PLATE IDENTIFIER: 39A

CONTACT PERSON:

WE HEREBY CERTIFY THE ABOVE INFORMATION IS CORRECT:

ARCELORMITTAL PLATE LLC QUALITY ASSURANCE LABORATORY 139 MODENA ROAD COATESVILLE, PA 19320

SUPERVISOR - TEST REPORTING

LOC TRAN

SSAE **Test Certificate** Form TC1: Revision 3: Date 7 Peb 2018 1770 Bill Sharp Boulevard, Musentine, IA 52761-9412, US Customer P.O. No.: 4500900645 Mill Order No.1 41-550133-01 Shipping Manufest : ASC359274 -Custemer: JOSEPHI T. RYERSON & SON, INC. Product Description: ASTM A516-70(17)/ASME \$A516-70(17) Ship Daler 15 Oct 18 Cerl No: 061737010 ACCOUNTS PAYABLE DEPT. Cort Date: 15 Dct 18 (lage for 1). PO BOX 91601 LOBBOCK TX 79490-1681 Size: 0.375 X 96.00 X 240,0 (IN) Tested Pieces Tensiles Chachy Impact Tests Abs. Energy (FTLB) UTS %RA Flong % Tst % Shear Tat Tst Tst Tst VS) BDWTT Ileat Plece. Tested Thickness Locy (KSI) . (KSI) 2in Lia Dir Hordness 1 2 3 Avg 1 3 Avg Taip Dir Siz Trup %Shr ľð in J (mm 1,373 (DISCRT) 77 18(012 C51 . 1 Chemical Analysis Hent Tot AL Sol AL XI. ORGN £μ Ci_ 610 СР 14 .000 .024 .006 .0002 .93 .009 026 .023 .28 1.09 .11 .03 481012 .17 .002 17 .38 1151 KILLED STEEL MERCURY 15 NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY AUDED DURING THE MANUFACTURE OF THIS PRODUCT. KILLED STEEL, PRODUCED TO A FINR GRAIN PRACTICE CEV (IIW) = C + MN/G + (CR+MO+V)/S + .(NI1CU)/15NACE MR0175/19015156-2:2015 ANNBX A2.1,2 COMPLIANT WTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT 100% MELITED AND MANUFACTURED IN THE USA. NO NELD REPAIR HAS HEEN PERFORMED ON THIS MATERIAL. 7045335 TD 404 PRODUCTS SHIPPED: A81013 C51 PCR91 0, LBS; 19500 WE HEILERY CRATHY THAT THIS MATRIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE RIQUIREMENTS OF, THE APPROPRIATE SPECIFICATION in Cust Part # : 160004835 Brian Wales THANDE ARTAILLIR (1157 - PROUUCT

· · · ·

.

.*

5361-1 Reviewed to 2017 ASME Section I

		mk#	- 12-1	,13-1				ion II
48,Site IV Tel: 91-120	NORMA (I V industrial Area, Sah -2896091, 2895404 Fax: 5	NDIA) I ibabad, Ghazi 91-120-2895930	abad-201010 E-mail: normai	ED (U.P) INDIA. india@gmail.com		Wo	rks Test (Certificate
NORMA/LAB	NO-6539/14-15		INVO	DICE NO. E-400			DATE:-13-1	0-14
P. Order. No;	503/005034		Customer:-	<u>, </u>		Forg	ng specification	ASME SA105 -09
Component	20"-150# WNRF XH	FLG.		1]		ASTM A105 -12
Drawing No.						Ste	el Supplier	Adhunik Metaliks Ltd.
Machining	ANSI B16.5-2009		Quantity:-	091	Nos.	ļ		
510	TEOT DEDI	1.00	L			<u> </u>	fill Heat No.	14AI 145
	TEST RESUL						NORMA HEA	T NO-1231
	CHEMICAL COM	POSTION		MECHANIC	AL PROPE	RTIES.		
Elements %	Specified Composition	Act	MILL T.C.	PROPERTIES	SPECIFIED	OBTAINE	D Specified carb 0.25n	oon as per Purchase Order nax.
Carbon	0.35max.	0.20	0.20	Vield Strength	250.00	321.65	-	
Manganese	0.60-1.05	111	1 10	N (mpa)	min.	521.05	Serrated face	as per MSS-SP-6 with in limits
Silicon	0 10-0 35	0.18	0.20	-			01 125-25054	(KH
Sulphur	0.040max	0.012	0.20	Tanaila Chung ath	495.00	601 PC		
Phosphorous	0.075max	0.012	0.015	(mpa)	465.00 min	521.00	CARBON EQ	UIVALENT (CE)
Chase	0.0350082.	0.010	0.015	($CE = C + \underline{Mn}$	+ Cr+Mo+Y + Ni+Cu
	0.30max.	V 0.012	0.014	50mm / 4D	22.00 min	31.76	0	5 15
Nickel	0.40max.	0.009	0.007	Hardness	187.	149-163		
Copper	0.40max.	0.012	0.009	HB.	max.		MARKING A	S PER MSS-SP-25-2008
Molybdenum	0.12max	0.004	0.001	% Reduction of Area	30.00 min.	61.01		
Vanadium	0.080max.	0.004	0.002	Remarks:- We here	by certify th	at the mater	ial Checked by:	
Carbon	0.47max.	0.390	0.387	described here in h with the applicable	as been tested	in accordan	ce ve	Metallurgist
Equivalent (C	E)		01201	and meets the requir	cments as per l	EN10204/3.1	B Certified by:	
				& NACE Standard-	MR0175-2003.	N	-t	Ouality Control Manager
				ireduction of 0.01%	below the si	note:-ror ca necified carb	on	
				maximum(0.35%).a	n increase	of 0.00	1%	PRODUC
				manganese above	the specific to man	ied maximi	au	St CD-
				&NACE Standard N	ARO175/ISO1	156 Standan		SPD S
				Country of Origin-	India.			O QUALITY S

CERTIFICATE OF INSPECTION & TEST (EN 10204 3.1)



ST&H CORPORATION 74, Jwadongsunhwan-ro, Haeundae-gu, Busan, Korea Tel: +82.51.744-4680(5 line) Fax: +82.51.744-4670 E-mail :qm@stnhcorp.com

Certified to ISO9001/ ISO14001:2015, PED2014/68/EC by LRQA



195 0 #CD00 / 4

Certificate No. MJH0003A-19/25 Customer

Contract No. 202261-00-1ST

Spec. For Material ASTM A105N-14,ASME SA105N-17,NACE MR0175/ISO 15156-2:2015,NACE MR0103/ISO 17495 1:2016 Heat Treatment 930°C NORMALIZED & A.C Dimensional inspectionASME B16.5 - 2017

Date : AUG. 21. 2018

ITEM / SIZE			Size of Speci	Test imen		Ten	sion 1	Fest E.L	R.A	Hardness Test		Charpy Impact Test (10X10mm Specimen Si			rt Size)	
	ITEM / SIZE	Q'ty	Batch No./	D	GL	Max	MPa	MPa	_%	%	(H 11	B) 37	Indiv. 21J	Ave. 27J	Notch V	Temp. -29℃
				12.5	50.0	Min	250	485	22.0	30.0			Tes	t Result	(J)	Ave.(J)
BA150BR16	150LBS BL RF 16"	60	805820D	12.5	50.0		32 3	518	33	75	152	156	143	120	118	127
- BA150BR20	150LBS BL RF 20"	60	805820E	12.5	50.0		323	518	33	75	152	156	143	120	118	127
_	BLANK		BLANK					BLA	NK		8L/	NK				

5361-1 MK# 16-2, 13-2

				T		<u>, </u>			- and and		141						NDE	
		10	10	han	1	1	1 m	L.C.	nemical Ma	Compos	Sition (%	· · · · · · · · · · · · · · · · · · ·			CE			
Batch No./	Max Min	0.350	0.350 0.100	1.050	0.035	0.040	0.400	0.300	0.120	0.400	0.080					UΤ	МТ	PT
	Н	0.184	0.258	1.040	0.012	0.005	0.007	0.016	0.002	0.023	0.001				0.363			
805820D	Ρ	0.175	0.250	1.030	0.014	0.004	0.007	0.019	0.003	0.023	0.001				0.353			
	н	0,184	0.258	1.040	0.012	0.005	0.007	0.016	0.002	0.023	0.001		ODL	ICTS	0.363			
805820E	Р	0.175	0.250	1.030	0.014	0.004	0.007	0.019	0.003	0.023	0.001		1ª at	10°	0.353			
										BLAN	ĸ		13 51	しき				
REMARK	* H : Heat * Impact T	Analysis est perfo	P:Pro	oduct An	alysis to ASTN	A A370 a	& MESC	76 / 210/	/2017 Pa	ragraph	8.5 / Tab	ie 4 & 5.	NO AND	ALITY 2	18H	CORPO	ATIO	
	* C:Mn = * * Mn is Pe	rmitted	up to Ma	ax 1.65%	6 (ASTM	A105-14	1 TABLE	1, NOTE	: 1.)			ZZZ	76		C.C.C.	Y MANA	Tm)*	
We hereby ce	rtify that the	e material	herein ha	as been n	nade and	tested in	accorda	nce				Witnoscod by	, u . I	55	Manager of (+ / 14V	КІМ

with the above specification and also with the requirements called for by the above order.

Witnessed by / H. J. LEE

5T&H CORPORATION

ST-801-14-02

1605 River Rd P.O.Box 279 **Mill Test Report** Muccr Winton, NC 27986 Coffeld, NC 27922 × . (252) 356-3700 (252) 356-3700 PLATE MILL Page 1 laculing Dato : 09/12/2018 B/L No. : 612940 Load No. ; 623425 Cust. Order No. : 4500893649 Our Order No. : 159438/1 Vohicle No: NOICL 725090 RYERSON INC. DENVER RYERSON PROCUREMENT CORP. Sold To: Ship To: PO BOX 91601 LUDBOCK,TX 79490 6600 HIGHWAY 85 COMMERCE CITY,CO 80022 Specification: 1.2600" x 96.000" x 240.000" ASTM A36-14/ASTM A709 Grade 35-18/AASH fC M270Grade 35/ASME SA36 2015/2017 AASHTO M270-2017 36 Marking : 160005004 Vc V Mo VP Heal No s VI 51 Cu ٧ NU ĩ Сø а Sn Caq Pcm NI Cr Мo Al(tat) н 8605747 0.20 0.84 0.010 0,004 0,19 **0**.19 0.08 0.10 0.01 0 025 0.002 0,602 0 0042 0 0000 0.011 0.39 0.26 0.003 Tonslio Yost Piste Serial No Pieces lons (psi) Yleld (psi) elienaT Elony. % in 21 E∣ong. %ilo 9* Qir 40,900 69,790 41,000 70,100 8505747-04 3 12.25 .T 27.2 Manufactured to fully killed fare grain process by Electric Arc Formec, Wolding or weld repar was not performed on Bis invalinint. Wolf horosy carify thet the Martury has not been used in the direct manufacturing of this inplantial Produced as continuous cast discrete plote as rolled, unless electrice noted in Specification, For Moxico shipments.mic- Sales/MX@Necc.com Yied by 0.6EUL method unless otherwise specified. Ency = Cr (Mx09) + ((Cr1AlorV)/5) + ((Cr1 We hareby certify thei the contents of this report are accurate and correct. All test results and operations performed by the material monulactorer are in comptionce with the applicable specifications, buckdon outloave specifications. ons, lockiding clisionier specifications. 1 J.J. aprilo 9/13/2018 8:48:15 AM T.A Deprelis, Metallurgist 5361-1 PLID # 270 MK# 1(-4,5,6 13-4,5,6

× ,

NUCOR CORPORATION

NUCOR STEEL UTAH

Sold To: INTSEL STEEL WEST LLC PO BOX 21119 HOUSTON, TX 77226-1119

Mill Certification 10/11/2016

Ship To: INTSEL STEEL WEST 1887 SOUTH 700 WEST SALT LAKE CITY, UT 84104 (801) 433-2210 Fax: (801) 972-6145

Customer P.O.	SLC-12130	Sales Order	268246.4
Product Group	Merchant Bar Quality	Part Number	3000075024004W0
Grade	A36/A529GR50/CSA44W/50W	Lot #	PL1610567651
Size	3/4" (.7500) Round	Heat #	PL16105676
Product	3/4* (.7500) Round 20'A36/A529-50/44W/50W	B.L. Number	U1-548929
Description	A36/A529-50/44W/50W	Load Number	U1-357740
Customer Spec		Customer Part #	

I hereby carily that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

Roll Date: 8/13/2016 Melt Date: 8/10/2016 Qty Shipped LBS: 11,895 Qty Shipped Pcs: 396

ASTM A36/A36M-12, A709/709M-13 GR36, ASME SA36-10 Ed '11 Ad. ASME SA36-2010 EDITION-2011 ADDENDA &STM A709/&709M-13 GR 36 [250] ۷P ¥ ¥ Cu С Mn ۹ s Si Ni Cr Мо ۷ Cb 0.19% 0.72% 0.010% 0.045% 0.24% 0.23% 0.09% 0.13% 0.018% 0.0016% 0.000% Yield 1: 51,498psi Tensile 1: 73,816psi Elongation: 28% in 8"(% in 203.3mm) ١ Yield 2: 50,764psi Tensile 2: 73,645psi Elongation 26% in 8"(% in 203.3mm) Weight Variation 000.0%

Specification Comments: MEETS THE REQUIREMENTS OF: ASTM A36/A36M-12, A529/A529-05 GR50, CSA G40.21-04 GR44W(300W)&GR50W(350W) AASHTO M270/M270M-12 GR36(270), ASME SA36/SA36M-07

Comments: NUCOR - PLYMOUTH IS AN I.S.O. 9001 AND AN A.B.S. CERTIFIED MILL CMTR COMPLIES WITH DIN EN 10204 - 3.1

. 1. ALL MANUFACTURING PROCESSES OF THE STEEL MATERIALS IN THIS PRODUCT, INCLUDING MELTING, CASTING, AND HOT ROLLING HAVE OCCURRED WITHIN THE UNITED STATES. ALL PRODUCTS PRODUCED ARE WELD FREE. MERCURY, IN ANY FORM, HAS NOT BEEN USED IN THE PRODUCTION OR TESTING OF THIS MATERIAL. 2. PROPOSITION 65 WARNING; THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND/OR BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM. FOR MORE INFORMATION, PLEASE CALL 1-435-458-2300.

Reviewed to 2017 ASME Section II

5361-1 MK# 1C-8, 1J-8



hyan hangt

Ryan Pennington Division Metallurgist

USS UNITED S	A TATES ST)36 NKT	I- FIC	/ 13 RATIO) ON (IN ACC	CEI CORDANC	QWQ TUBULA TIFIE E WITH	A +	DUCT: T REJ 4/EN102	S PORT	> A	SM (E Sa	SERI	DAT TIM TAL N		11/30/2 04:05:4 L005410	14 47 07		
DR00652	80	si R0:	3446	NO.		P 10P15	0. NUMBER			GO	NX31	.0.910								
	SOLD TO AD	ORESS						MAIL TO	ADDRES	s			UN LO 21 LO	ITED RAIN 99 EI RAIN	STAT TUBU AST 2 , OH	VENCOR TES ST LAR 8TH 4405	TEEL CO OPERAT ST. 5	orp Ions		
					l		SPECIFI	CATION A	D GRADE	 E										
SALUG-*2013 OF NACE STAN	BDITION DARD MR-	GRADE 01-75	B/C ★:I;	BLK SO 1	REG 5156-	MILL 2 200	Coat P 9 Ed a	e bev No mr	30 -010	DEG M 3-201	EKT)	ING AI	I. THE	APP)	LICAE	LE R	EQUIRE	MENT	:5	
MATERIAL COND: AS RC	LLED						0.D.: 2	0.000	(508	.000)			in (anan)	WALL: D.	500	(12.7	00)		in (rom)	
	TEN	ISILE	1	1		YI	ELD	EXTY		TENSILE		Y/T	ELO	IG %	HAP	DNESS	MINH	YDRO	DWELL(SEC)	
PRODUCT	TEST T ORIENT	YPE/ ATION	TE Cr	est ond.	galige Width	MIN:	42100	1 .50	MIN:	700	000	MAX;	MIN		MIN:		19	00	5	
			-		IN	NAX	71800		MAX	950	000	0.93		29.0	MAX:					
X83582 E795A	A STRIP A STRIP	'/L/B '/L/B	AR	**	1.500 1.500 END C	F DAT	49700 A THIS	- 50 - 50 SHEP	**	785	000	0.65		39.7 45.5			19	00	5	
LEGEND: L-L U-I	INGITUDINAL		T-TRU	ANSVER!	SE :	-Tp 58	QUENCH & T	EMPERED		AR-A	S ROLL	ED	G ROLLED	BODY	<u> </u>		W-WELL	0		•
	T		C	MN	1 P	S	U CU	NI	CR	MO	AL	NVY	B	Π	CB	C0			C.E.*	
IDENTIFICATION	TYPE		V	1	V	1		V	V	V		1						1	MAX	
MA6721	HEAT		19	104	1 010	003	3 15	:08	:09	:02	025	0	0003	002	003				.41	RODU
MA6721 F1571	A PROD		20	104	007	002	4 15	07	08	03	026	0	1 0002	1001	001			{	.42	12 CD
MA6721 P1577	HEAT	{ }	20	104	1 008	003	3 102	07	08	01	027	0.0	3 0002	002	001				.40	5 OP
MA6721 F1571 X83582	a boon	1 1	19	IOI	5 004	005	5 02	01	08	01	041	0	0003	002	003		}	}	.40	E QUAL
MA6721 F1571 X83582 X83582 E7954	A PROD		22	101	5 003	009	25 01	01	08	01	042	0	3 0005	002	006			Į	.41	2100
WA6721 F1571 X83582 X83582 E7954 X83582 E7954	A PROD	1 1	1:44			, j.	1.									(
MA6721 F1571 X83582 X83582 E7951 X83582 E7951 X83582 E7952	A PROD				END	DF DAT	THI A	SHB	er *				1		1		ļ	ł		-
MA6721 F1571 X83582 X83582 E7952 X83582 E7952	A PROD A PROD				END	OF DAT	TA THI	SHE	er *											

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT. ELEMENTS REPORTED IN MASS FRACTION (%)
PAGE 1 OF 2

`

à,

			(IN ACCO	CERT	WITHIS	0 TEST	RBPOR	T IN50849 "	type 3.1")		SER	IAL	NO :	L00!	5410	7	
THE ORDERITENNO	1	Shippe	RS NO.		P.O.	NUMBER												
MATERIAL	1	R0344	6	10	P1570	1-CA		1			0	0190	12					
COND: AS ROLLED						20.0.2	0000	508 00	0)	Le la	(Trum)	WALL:	500	(12 7	001			lin (774-02)
	1			1				300.00		CHARPY V-N	OTCHIME	ACT TE	STING	(44.17	007			
PRODUCT	FLAT	REND	ORAIN	- MI	N	DIR	TEST	TEMP	SIZE	TEST		F	185			% SHE	AR	
ICENTIFICATION			SIZE	COLL	APSE		LOC.			COND,	1	2	_3	AVG	1	2	3	AVG
MA6721 F157AA	07			+				DEG	1 2/4	1	-				1 10	60	50	50
X83582 8795AA	OK	{		}		7	5	+ 34	3/4	AR	100	11	104	95	100	100	100	100
			**	ENT C	י גרו שו			+ 34	3/4	ALC:	200	94	104	55	100	1-04	200	200
	j	1			E DA.	A IA			{	1						1 1	1	
		{		1		}	{	1.			}							
	l			1			1			}							1	
LEGEND L.LONGITU			7.794	NSVERSE		B. 80							AT ACTE	TED TON		Ił		
			1-100			STINC (110	BECTION	CORMATION	W-WELL			inter • Fil	ALAFER	100				
TEST / IN	SPECTION			YES	1	- 1010 / 100	- LO HON R	I ORMANON		RESULTS / C	OMMENT	s						
FULL LENGTH VISUAL				v														
FULL LENGTH EMI						00								0 08	NTC)/T			
FULL LENGTH MPI					<u> </u>	00_		0040 _		L		<u>u</u>		0.0%	NOT	CH		
FULL LENGTH UT				x			Y							0 08	NOT	CH		
END AREA INSPECTION (PLAIN)	END)			x		- 01	X	UDAD				<u>UT</u>		0.08				
SPECIAL END AREA (SEA) INSP					<u> </u>													
FULL LENGTH DRIFT					1	MPt.												
						URUP	MARDRO	L SIZE:										
					+													
						ADDITIONA	MOTERIO	OMMENTS										
Melted and Manu To the steel an Manufactured in Product was hot	FACTUR D ALL AN IS ROLLE	ed in Mercur O 9003 D And	THE US Y BEAR CERTI HOT FI	A, NO ING E(FIED I NISHEI	REPA QUIPM FACIL	IRS B ENT I ITY -	y wel: S pro Cert	DING, N FECTED IFICATE	10 Mero By A 1 2 #3202	CURY CO DOUBLE 22.	BCUN	nds Dary	ARE COF	ADDE CONT.	D AINM	ient .		
																		_
THIS IS TO ACOMING AN A	ie product i Inspected in Ements in Su	DESCRIBIED ACCORDAL CH RESPEC	HEREIN WAS I ICE WITH THE TS.	ANUFACTI SPECIFICA	ired, Tion													
THIS IS TO CERTIFY THAT TH SAMPLED, TESTED AND/OR I AND FULFILLS THE REQUIRE		AD KOT	IRY - M	ANAGE	R, Q.	A.												1
THIS IS TO CERTIFY THAT TH SAMPLED, TESTED AND/OR I AND FULFILLS THE REQUIRE PREPARED BY THE OFFICE (OF: BR																	

.


UNITED STATES STEEL CORPORATION

 \mathbf{V}

TUBULAR PRODUCTS ADDITIONAL COMMENTS SHEET

DATE: 11/30/14 TIME: 04:05:51 PAGE: 1 OF 1

•

MILL ORDERATEM NO. DR00652 08	SHIPPERS NO.	P.O. NUMBER 10P15701-CA	. HEAT	SERIAL NUMBER: L0054107
SOLD TO) ADDRESS	HAIL TO AD	L	VENDOR UNITED STATES STEEL CORP LORAIN TUBULAR OPERATIONS 2199 EAST 28TH ST. LORAIN, OH 44055
HEAT MA6721 - 1 HEAT X83582 - 1 END OF DATA	MELTED AT:NUCOR STER MELTED AT:FAIRFIELD	L MEMPHIS, MEMPHIS Works, Fairfield,	2, TN 38109 AL 35064	· · · · · ·
				PRODUCTS COMPANY SPD WE QUALITY TO THE TO TH

SSAB Test Certificate Form TC1; Revision 3; Date 7 Feb 2018 1770 Bill Sharp Boulovard, Muscathe, LA 52761-9412, US MIU Order No.: 41:549855-01 Shipplug Manifest : MT359175 Customer P.O. No.: 4500399993 Clistaniers JOSEPH.T. RYERSON & SON, INC. l'ruduet Description: ASTM A516-70(17)/ASME SA516-70(17). Ceri No: 061736567 -Ship Date: 12 Oct 18 ACCOUNTS PAYAOLE DEPTY . Cert Date: -12 Oct 18 (Poge 1 of 1) 1'O BOX:91601 LUBROCK TX 79490-1601 Sho: 0. 150 X 95.00 X 240.0 (IN) Troslles Charpy Impact Tests Tested Pleces JUIS SKA Blong % Tst Tat Tst Tat Til YS Abs. Energy(F.PLB) H Shear BUWYET. Deal Piece Tested (KSI) Loc (KSI) 2m Bln Dhr Hurdness 1 .2 3 Avg 1 2 3 Avg Tinp Dir Siz Tom Star โป ld Thickness . (ព្នះភា C09 55 481210 0,748 (DISCRT) I Chemical Analysis Heat ORGN TolAl SolAl М Cr Mo 1114 Id Cu 100. .028 .026 .28 .11 .08 .02 .030 .002 .0003 .38 A81210 17. .99 .010 .002 USA KILLED STEEL REPOURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT. KILLED STREL, PRODUCED TO A FINI GRAIN PRACTICE CEV (IIN) = C + Mi/6 + (Ck+ikO+V)/5 + (NI+CU)/15NTR EN 10204 2004 INSPECTION CERTIFICATE 3.1 COMPLIANT 100% MELTRD AND MANOPACTURED IN THE USA. NO WELD REPAIR HAS DEEN PERFORMED ON THIS MATERIAL. 2045355 D 39U PRODUCTS SHIPPED; 9802 V81510 2. LDS: MKH 10-14 WE REREDY CERTIFY THAT THIS MATERIAL WAS TUSTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE STECIFICATION ŝ Cust Part # : 160004840 Brian Wales SENIOR HETALLURUNT - PRUDUCT



COASTAL FLANGE P.O. BOX 40443 HOUSTON, TX 77240-0443

MATERIAL CERTIFICATION

7451000 MTR #: 857

Page: 1 of 1

SOLD TO:			SHIP TO:		
DATE	SALES ORDER #	CUST P.O.#	TAG NUMBER	SPECIFICATION	
04/08/201	16 160414	S630278		SA105	
ITEM # Q	TY ITEM DESCRIPTION			HEAT CODE	
	7 36" 150# RF WN XH "	B" ASME B16.47		ACDXJ	



		PHY	SICAL PROPER	RTIES		HEAT TREATMENT
Tensile PSL	Yield PSI	Elongation	REDUCTION OF AREA %	BHN	BHN	
75565	47427	33	60	149	147	THE SPD COMPANY AND QUALITY AND OT A

SUPPLEMENTAL INFORMATION

I hereby certify that the reported figures are correct, as contained in the records of the corporation and that the material was manufactured in the United States of America under a ISO:9001:2008 certified Quality Management System. NACE MRO175 EN 10204 3.1

5361-1 MK# 10-1,1H-1 Reviewed to ASME 2017 Section II

Production Assister



CERTIFICATE OF INSPECTION & TEST (EN 10204 3.1)



ST&H CORPORATION

74, Jwadongsunhwan-ro, Haeundae-gu, Busan, Korea Tal : +82.51.744-4680(5 line) Fax : +82.51.744-4670 E-mail :qm@stnhcorp.com





Certified to ISO9001/ ISO14001:2015, PED2014/68/EC by LRQA

Customer Contract No. 203880-00-1ST

MJH0029A-05/08

Certificate No.

Spec. For Material ASTM A105N-14,ASME SA105N-17,NACE MR0175/ISO 15156-2:2015,NACE MR0103/ISO 17495-12016 Heat Treatment 930°C NORMALIZED & AC

Date: JUL 25. 2018

				~						Ginter	incontar /	mpedi		THE D	10.0 -	2017						
										Size o	of Test		Ter	sion 7	Test .		Harc Te	iness est	C (10X	harpy In 10mm S	ipact Tes pecimen	t Sîze)
i		175	64 / CI7	'E				04	Heat No./	- ope			Y.5	1.5	EL	RA	Л	IR)	1-14	Aug.	Black-b	Tame
		100	IVI / 514	E		•		UTY	Batch No.	D	GL	Max	MPa	MPa	%	%	1	87	1naiv. 21 (AVe.	Noten	
										12.5	50.0	Min	250	485	22.0	30.0	"	07	Tes	t Result	(J)	Ave.(J)
BA300WRSTD20	30	OLBS WI		20"					NOR178	125	50.0		224	505	20	70.5	1 / 2	1/6	48	80	73	67
BA600WRYH16	60	OLDS W		16"				20	N00170	12.5	50.0		224	500	20	70.5	145	140	40	80	73	67
DATCODE24	10			10	-			30	NU0170	12.5	50.0		324	200	30	70.5	143	146	48	80	/3	07
DA ISUBP24	15	OTR2 RL	FF 24"					10	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA150BR22	15	OLB5 BL	RF 22"					5	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA1508R24	15	OLBS BL	RF 24"					100	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA150WRXH24	15	OLBS WI	N RF XH	24"				-5	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA300BR20	30	OLBS BL	RF 20"					10	N13378	12.5	50.0		364	S06	32	65.5	143	146	123	129	112	121
BA300WR4024	30	OLBS WI	N RF \$40	24"				10	N13378	12,5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA6008R18	60	OLBS BL	RF 18"					5	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
BA900BR18	90	OLBS BL	RF 18"					5	N13378	12.5	50.0		364	506	32	65.5	143	146	123	129	112	121
					1	1		1	Chemical C	omposi	tion (%)										NDE	
Heat No./		¢c	V Si	Min	P	Vs	V NI	V Cr	Mo	V Cu	V v								CE		1	
Batch No.	Max	0.350	0.350	1.050	0.035	0.040	0.400	0.30	0 0.120	0.400	0.080									UT	MT	PT
	Min		0.100	0.600																		
	н	0.199	0.220	1.040	0.014	0.005	0.005	0.014	4 0.002	0.013	0.001								0.37	5		
N08178	P	0.195	0.216	1.050	0.012	0.003	800.0	0.02	1 0.001	0.012	0.001								0.37	5		
	н	0.169	0.273	0.964	0.015	0.004	0.009	0.018	B 0.002	0.013	0.002								0.33	5		2000
N13378	Р	0.173	0.271	0.952	0.011	0.002	0.009	0.022	2 0.002	0.012	0.001								0.33	8		19hora
		• • -								BLANK									0.00	-		SP
										22												

REMARK * H : Heat Analysis P : Product Analysis

* Impact Test performed according to ASTM A370 & MESC 76/210/2017 Paragraph 8.5 / Table 4 & 5.

* C:î∕rîn = 1≤5

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

2376



Witnessed by / H. J. LEE

Manager of Q.A Dept. / JAY KIM ST&H CORPORATION

ST-801-14-02

Matorial Test Poport

۰. •

,

.....

EVC	watenan	estReport	Forged Vessel	Connections
	Heat Co	de: DVB	An AFGIc	bal Company
		137	70 Industrial Rd. Houst	ton. TX 77015
	ISO 9001:2	015 Certified	Sales: (7	13) 393-4200
Eaton Metal Produc 0001175	6 PO: 0045008	Sales Order:	169271 Lir	ne:1
4800 York Street	Item Code: HBN06	0150090A001A1	Qty Shipped: 2	<u>_</u>
Denver, CO 80216	Item Desc: HBN RI	E 6"150X9" SA105		
		Mill I	leat: A181215	
Spec: ASTM A105/A105M-(18)/ASM	1E SA 105/SA 105	M-(17) Section II Pa	art A	
Element (%wt) Ladle Product	EPCRA CAS#	Element (%wt) Ladle	Product EPCRA	CAS#
C Carbon 0.19	10 7430 06 5	Cr Chromium 0.14	lo	7440-47-3
Mn:C 5.9	VG /439-90-5	V Vanadium	2	
P Phosphorous 0.006		Cb Columbium 0.001		
S Sulphur 0.003		C.E. 0.43		
Si Silicon 0.27		CuNiCrMoV 0.422	2	
Cu Copper 0.15	Va 7440-50-8	CrMo 0,17		
NI NICKEL 0,07	Va /440-02-0			
		5361-1		
		MK# 10-3	ξ.	÷.
				ļ
Mechanical Testing			Other	1
Test Lab A	rG i	VD	YES	
Test Bar Size Si	ACRIFICIAL PIECE	Fully Killed	YES	
	53 - 163	·		
(51g (%) 20 DA (%) 50	5			
Tensile Specimen Size (in)	194			
Tensile (kai)	7.8			
Yield (ksi)	1.4			
Gauge Length (in) 2				
				[
			000//0	
	i		Selector Cha	
			IS SPD S	
			A QUALITY S	
			Que alla se	
	i I		10 8	

The recording of false, fictilious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification. This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning end Community Righl-to-Know Act (Tille III of the Supertund Amendments and Resultorization Act of 1886) and 40 C.F.R. Pert 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your meponsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.:	1348576
Certification Date:	10/27/2018
Issued By:	John Sauceda
This report is issued in compliance	with the requirements of EN10204 3.1 / ISO 10474 3.1.b

		Forged Vessel Connections
	Heat Code: DVB	An AFGlobal Company
		13770 Industrial Rd. Houston, TX 77018
	ISO 9001:2015 Certified	Sales: (713) 393-4200
Eaton Metal Produc 00011756	PO: 0045008	Sales Order: 169271 Line: 1
4800 York Street	Item Code: HBN060150090A00	OIA1 Qty Shipped: 2
Denver, CO 80216	Item Desc: HBN RF 6"150X9"	' SA105
		Mill Heat: A181215
Spec: ASTM A105/A105M-(18)/ASME	S SA 105/SA 105M-(17) Sec	ction II Part A
Spec: ASTM A105/A105M-(18)/ASME MARK #1D-3 Product compliant with NACE MR017 * No Weld repair performed. * Ladle Chemical Analysis results * Tensile taken from a round spec * Yield strength was determined u * All material supplied under this mercury bearing equipment was * When reported on MTR; Tensile 7 Per ASTM E23 * AF Global manufactures material to ISO 9001:2015 Unless otherwise noted on PO, Din to NPS 24) per ASME B16.5-2013 , Orifice flanges per ASME B16.36-2 * FVC FLANGE DIMENSIONS & BOLTING SELF-REINFORCING NOZZLES COMPLY & DESIGN/FVC DESIGN.	5 SA 105/SA 105M-(17) Sec 75/ISO 15156-2:2015, Annex as are reported from the raw cimen. Measurement of elong using the .2% offset method is order is certified to be used in manufacturing, fab Testing Per ASTM E8; Brinel Is according to a certified mensions of all standard pi large diameter steel flang 2015. G COMPLY - ASME B16.5 WITH SPECIFICATION OF SECTI	ction II Part A A (A.2.1.2, A2.1.3). material suppliers MTR. material suppliers MTR. free of mercury contamination and no prication or testing. I Hardness Per ASTM E10; Charpy Testing I Quality Management System conforming pe flanges and flange fittings (NPS 1/2 material suppliers (NPS 26 to 60) per ASME B16.47-2011, TON VIII DIV. 1 OR DIV. 2 PER CUSTOMER
		RODUCIS COMPANIES

The recording of felse, fictilious, or traudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility elone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1348576 Certification Date: 10/27/2018 Issued By: John Sauceda This report is issued in compliance with the requirements of EN10204 3.1/ ISO 10474 3.1.b

,

m

. .

Rina Sane - Metallurgical Lab Manager

8

	Material T	est Report	Formed Vessel Connections
	Heat Co	de: EKR	An AEGlobal Company
	nout of	1377	0 Industrial Rd. Houston, TX 77015
	ISO 9001:2	015 Certified	Sales: (713) 393-4200
Eaton Metal Produc 00011	756 PO: 0045008	Sales Order: 1	.69271 Line: 2
4800 York Street	Item Code: HBN040	0150140A001SP	Qty Shipped: 1
Denver, CO 80216	Item Desc: HBN SA	105 150# 4 <mark>" x 12.25</mark> "	RF
		Mill He	eat: C149949
Spec: ASTM A105/A105M-(18)/	ASME SA 105/SA 105	M-(17) Section II Par	t A
Element (%wt) Ladle Prod	uct EPCRA CAS#	Element (%vrt) Ladle	Product EPCRA CAS#
C Carbon 0.18	10 7430 00 5	Cr Chromium 0.09	№ 7440-47-3
P Phosphorous 0.009	40 /409-90-0	V Vanadium	
S Sulphur 0.003		Cb Columbium 0.001	
Si Silicon 0.26		С.Б. 0.42	
Cu Copper 0.18	Ne 7440-50-8	CuNiCrMoV 0.554	
NI WICKEL N 0.21	vs /440~02-0	CrMo 0.13	
		5211-1	
		2791-1	
		MK# 10-4	
		IST IP /	
Mechanical Tes	ting		Other
Test Lab	AFG	VD	YES
HBW	163 - 163	Fully Killed	YES
Elg (%)	56	Made to Fine Grain Pract	ice YES
RA (%)	72		
Tensile (kst)	80		
Yield (ksi)	\$ 54.9		
Gauge Length (in)	2		-
			PRODUCE
			S CDD
			S QUALITY S
			the arts
		:	

The recording of false, fictilious, or frauduloni statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplior Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Righi-to-Know Act (Tille III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whather your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1350715 Certification Date: 11/10/2018 Issued By: John Sauceda This report is Issued in compliance with the regularaments of EN10204 3.1 / ISO 10474 3.1.b

Forged Vessel Connections Heat Code: EKR An AFGlobal Company 13770 Industrial Rd. Houston, TX 77015 ISO 9001:2015 Certified Sales: (713) 393-4200 Eaton Metal Produc 00011756 PO: 0045008 Sales Order: 169271 Line: 2 4800 York Street Item Code: HBN040150140A001SP Qty Shipped: 1 Denver, CO 80216 Item Desc: HBN SA105 150# 4" x 12.25" RF Mill Heat: C149949 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK #1D-4 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specimen. Measurement of elongation after fracture. * Yield strength was determined using the .2% offset method, unless otherwise specified. * All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. * When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, * FVC FLANGE DIMENSIONS & BOLTING COMPLY - ASME 816.5 SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN.

The recording of felse, fictilious, or fraudulent statement or entries on this document may be punisheble as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Tille III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each chemical in addition to the percent by weight of the chemical present in this product. If is your responsibility atoms to determine whether your facility is required to submit a Toxic Release inventory Report under EPCRA Section 313.

Certification No.: 1350715 Certification Date: 11/10/2018 Issued By: John Sauceda This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Rina Sane - Metallurgical Lab Manager Pege 2 of 2

PVC an AFGKSDal Company	Material T Heat Co ISO 9001:2	est Report de: DXN 1377 015 Certified	Forged Vessel Connections An AFGlobal Company 0 Industrial Rd. Houston, TX 77015 Sales: (713) 393-4200
Eaton Metal Produc 00011756	5 PO: 0045008	Sales Order: 1	L69271 Line: 3
4800 York Street	Item Code: HBN03	150090A001A1	Qty Shipped; 1
Denver, CO 80216	Item Desc: HBN RE	3"150X9" SA105	-
		Mill He	eat: A181216
Spec: ASTM A105/A105M-(18)/ASM	E SA 105/SA 1051	4-(17) Section II Par	st A
Element (%wt) Ladle Product	EPCRA CAS#	Element (%wt) Ladle	Product EPCRA CAS#
C Carbon 0.17 Mn Manganese 1.12 Mn:C 6.5 P Phospitorous 0.006 S Sulphur 0.002 Si Silicon 0.26 Cu Copper 0.18 Ni Nickel 0.07	\varepsilon 7439-96-5 \varepsilon 7440-50-8 \varepsilon 7440-02-0	Cr Chronium Mo Molybdanum V Vanadium Cb Columbium C.E. CuNiCrMoV CrMo 0.034 0.035 0.034 0.035 0.034 0.035 0.034 0.035 0.034 0.035 0.055 0.	16 7440-47-3
Mechanical Testing			Other
Test LabAFTest Bar Size3.HBW16Elg (%)30RA (%)71Tensile Specimen Size (in)74Tensile (ksi)72Yield (ksi)52Gauge Length (in)2	G 5x3.5x12 3 - 163 90 .3 .8	VD Fully Killed	YES YES
			NO QUALITY NO

The recording of false, ficilitous, or fraudulent statement or entries on this document may be punishable as a felony under federal atalute.

EPCRA Supplier Notification: This product may contain one or more toxic chamicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chamicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1350283 Certification Date: 11/8/2018 Issued By: John Sauceda This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.6

Heat Code: DXN ISO 0001:2015 Certified ISO 0001:2015 Certified Iso 0001:2015 Certified Item Code: IBNN 30150090A001A1 Item: 3 Item: 3 Item Code: IBNN 30150090A001A1 Item: 3 Item:		Material Test Rep	Forged Vessel Connections
13770 Industrial R4. Houston, TX 770 is ISO 9001;2015 Certified Eaton Metal Produc 00011756 PD: 0045008 Sales Order: 169271 Line: 3 4800 York Street Imem Code: HBN030150090A001A1 Qty Shipped: 1 Item Code: HBN030150090A001A1 Item Code: HBN030150090A001A Item Code: HBN03015015156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladie Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specified, New Addie this order is certified to be free of the crucy contamination and no mercury bearing equipment was used in manufacturing, fabrication or tosteling. * MF Tibes Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM S10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to 180 9001:2015 Unless otherwise noted on P0, Dimensions of all standard pipe flanges and flange fittings (NFS 1/2 to NFS 24) per ASME B16.5-2013, large diameter steel flanges (NFS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015. * FVC FLANCE DIMENSIONS 4 BOITING COMPLY - ASME B16.5 SELF-ASINFORCING NO22L		Heat Code: DXN	An AFGlobal Company
ISO 9001:2015 Certified Sales: (713) 393-4200 Eaton Metal Produc 00011756 PC: 0045008 Sales Order: 169271 Line: 3 4800 York Street Hem Code: HBN030150/90001A1 [dty.Shipped: 1] Denver, C0 80216 Hem Code: HBN030150/90001A1 [dty.Shipped: 1] Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MIII Heat: A181216 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK 410-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * * No Weld repair performed. * Ladio Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specimen. Measurement of elongation after fracture. * * Heid strength was det in manufacturing, fubrication of testing. * * Mark 1020 MTR: Tensile Testing Per ASTM 85, briell Hardness Per ASTM 850 Charpy Testing Per ASTM 850 * AG 0bbil manufactures materials according to a certified Quality Management System conforming to ISO 9001:2015 * * On S001:2015 MTR 616-5013. Iarge diameter steel flanges (NFS 26 to 60) per ASME B16.47-2011, Grifice flanges per ASME B16.36-2015. * FVC PLANCE DIMINSIONS & DOLTING COMPLY - ASME B16.5 SSICH-RIPMORING NOZLES COMPLY WITH SPECI			13770 Industrial Rd. Houston, TX 77015
Baton Metal Produc 00011756 PO:0045008 Sales Order: 169271 Line: 3 4800 York Street Hem Code: HBN030150090A001A1 Qty Shiped: 1 Denver, CO 80216 Hem Desc: HBN RF 3"150X9" SA105 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK 41D-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * Mo Weld repair performed. * Lacho Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from around spocimen. Measurement of elongation after fracture. * Hild strength was determined using the .2% offset method, unless otherwise specified. * Hild strength was used in manufacturing, fabrication or testing. * Mast MAX23 * AF Global manufactures materials according to a certified Quality Management System conforming to N90 90012015 Unless otherwise noted on EO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 2/4) per ASME B16.56-2013 , large diameter steel flanges (NPS 2/6 to 60) per ASME D16.47-2011, Orifice flanges Pr ASME B16.56-2013 , large diameter steel flanges (NPS 2/6 to 60) per ASME D16.47-2011, Orifice flanges Pr ASME B16.56-2013 , MEM ESCIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN. BSIGN/FVC DESIGN. SEDERECOMPLY WITH SECTICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN.		ISO 9001:2015 Certified	Sales: (713) 393-4200
4600 York Street Item Dedc: HBN030150090A001A1 Qty Shipped: 1 Denver, CO 80216 Item Desc: HBN RF 3"150X9" SA105 Spec: ASTM A105/A105M-(18) /ASME SA 105/SA 105M-(17) Section II Part A MARK #10-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from around specimen. Measurement of elongation after fracture. * Yield strength was determined using the .2% offset method, unless otherwise specified. * All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. * When reported on MTR: Tensile Testing PEr ASTM B5 Brinell Bardness Per ASTM E10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to INS 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NFS 1/2 to NPS 24) per ASME B16.57-2013, large diameter steel flanges (NFS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2013. * FVC FLANCE DIMENSIONS & BOLTING COMPLY - ASME B16.5 SELP-RSINFORCING NOZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN. DESIGN/FVC DESIGN.	Eaton Metal Produc 00011756	PO: 0045008	Sales Order: 169271 Line: 3
Denver, CO 80216 Item Desc: HBN RF 3"150X9" SA105 Mill Heat: A181216 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK 41D-5 Product compliant with NACE MR0175/IS0 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specimen. Measurement of elongation after fracture. * Vield strength was determined using the .2% offset method, unless otherwise specified. * All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. * When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to IS0 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NFS 1/2 to NFS 24) per ASME B16.36-2015. * FVC FLANCE DIMENSIONS & BOLTING COMPLY - ASME B16.5 SELP-REINFORCING NOZZES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER COSTOMER DESIGN/FVC DESIGN.	4800 York Street	Item Code: HBN030150090A00	01A1 Qty Shipped: 1
Mill Heat: A181216 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK #1D-5 Product compliant with NACE MR0175/IS0 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specime. Measurement of elongation after fracture. * Yield strength was determined using the .2% offset method, unless otherwise specified. * All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. * When reported on MR: Tensile Testing Per ASTM ES prinell Hardmess Per ASTM EIO; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NFS 1/2 to NS 241 per ASME B16.3-2015. * FVC FLANCE DIMENSIONS & BOLTING COMPLY - ASME B16.05 SELF-REINFORCING MOZILES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 FER CUSTOMER DESIGN/FVC DESIGN.	Denver, CO 80216	Item Desc: HBN RF 3"150X9"	SA105
Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK #1D-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). • No Weld repair performed. • Ladle Chemical Analysis results are reported from the raw material suppliers MTR. • Tensile taken from a round specime. Measurement of elongation after fracture. • Yield strength was determined using the .2% offset method, unless otherwise specified. • All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. • When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23 • AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.55-2013, large diameter steel flanges (NPS 26 to 60) par ASME B16.47-2011, Orifice flanges per ASME B16.56-2013. • FVC FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5 SELF-REINFORCING NOZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN.			Mill Heat: A181216
MARK #1D-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specimen. Measurement of elongation after fracture. * Yield strength was determined using the .2% offset method, unless otherwise specified. * All materials supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. * When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to NS 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (MPS 1/2 to NPS 24) per ASME B16.35-2013, large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASHE B16.36-2013. * FVC FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5 SELP-REINFORCING NOZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN.	Spec: ASTM A105/A105M-(18)/ASME	E SA 105/SA 105M-(17) Sec	ction II Part A
NOUALITY A	Spec: ASTM A105/A105M-(18)/ASME MARK #1D-5 Product compliant with NACE MR017 * No Weld repair performed. * Ladle Chemical Analysis results * Tensile taken from a round spec * Yield strength was determined u * All material supplied under thi mercury bearing equipment was * When reported on MTR: Tensile 7 Per ASTM E23 * AF Global manufactures material to ISO 9001:2015 Unless otherwise noted on PO, Dir to NPS 24) per ASME B16.5-2013 , Orifice flanges per ASME B16.36-2 * FVC FLANGE DIMENSIONS & BOLTING SELF-REINFORCING NOZZLES COMPLY TO DESIGN/FVC DESIGN.	E SA 105/SA 105M-(17) Sec 75/ISO 15156-2:2015, Annex s are reported from the raw cimen. Measurement of elong using the .2% offset method is order is certified to be used in manufacturing, fab Testing Per ASTM E8; Brinel Is according to a certified mensions of all standard pi large diameter steel flang 2015. G COMPLY - ASME B16.5 WITH SPECIFICATION OF SECTI	A (A.2.1.2, A2.1.3). material suppliers MTR. ation after fracture. , unless otherwise specified. free of mercury contamination and no rication or testing. 1 Hardness Per ASTM E10; Charpy Testing Quality Management System conforming pe flanges and flange fittings (NPS 1/2 es (NPS 26 to 60) per ASME B16.47-2011, ON VIII DIV. 1 OR DIV. 2 PER CUSTOMER WINT DIV. 1 OR DIV. 2 PER CUSTOMER
			NO QUALITY AND OTHER

The recording of false, fictilious, or fraudulent statement or entries on this document may be punishable as a fetony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emargency Planning and Community Right-to-Know Act (Tills III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number le provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility elone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1350283 Certification Date: 11/8/2018 Issued By: John Sauceda This report is (ssued in compliance with the requiroments of EN10204 3.1 / ISO 10474 3.1.b

Rina Sane - Metallurgical Lab Manager Page 2 of 2



4800 York Street

Denver, CO 80216

Material Test Report

Heat Code: BWL

Forged Vessel Connections An AFGlobal Company 13770 Industrial Rd. Houston, TX 77015 Sales: (713) 393-4200

Line: 3

ISO 9001:2015 Certified 00011756 PO: 0045008 Sales Order: 169271 Eaton Metal Produc Item Code: HBN030150090A001A1 Qty Shipped: 2 Item Desc: HBN RF 3"150X9" SA105 Mill Heat: A171871 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A

Clément	(%wt) Ladle	Product	EPCRA	CAS#	Element (%v	vt) Ladle	Product	EPCRA	CAS#
C Carbon	0.19				Cr Chromium	V0.0B		10	7440-47-3
Mn Mangan	еве ү 1.10		სტ	7439-96-5	Mo Molybdenum	V0.03			
P Phosph	orous 0.009				V Vanadium	0.014			
S Sulphu	r 0.004				Cb Columbium	0.000			
Si Silico	n 0.26				C.E.	0.41			
Cu Copper	0.13		10	7440-50-8	CuNiCrMoV	0.314			
Ni Nickel	0.06		l@	7440-02-0	CrMo	0,11			
1					CNI				
					5361	-1			
					MK#	10-5			
						10 5			
					-				
					1				
	Mechanic	al Testing			;	0	ther		
Test Lab	Mechanic	cal Testing			VD	0	ther YE	s	
Test Lab	Mechanic	cal Testing AFG	x3 5x12)	VD Fully Killed	0	ther YE YE	S S	
Test Lab Test Bar :	Mechanic Size	cal Testing AFG 3.5 149	x3.5x12	2	VD Fully Killed	0	ther YE YE	s s	
Test Lab Test Bar : HBW	Mechanic Size	cal Testing AFG 3.5 149 34	x3.5x12 - 156	2	VD Fully Killed	0	ther YE YE	s s	
Test Lab Test Bar S HBW Elg (%)	Mechanic Size	cal Testing AFG 3.5 149 34	x3.5x12 - 156	2	VD Fully Killed	0	ther YE YE	s s	
Test Lab Test Bar S HBW Elg (%) RA (%) Tansilo Si	Mechanic Size	cal Testing AFG 3.5 149 34 64	x3.5x12 - 156	2	VD Fully Killed	0	ther YE YE	S S	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile Sj	Mechanic Size pecimen Size (in)	cal Testing AFG 3.5 149 34 64 ,49 7°	x3.5x12 - 156 3	2	VD Fully Killed	o	ther YE YE	S S	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile Sy Tensile ()	Mechanic Size pecimen Size (in) ksi)	cal Testing AFG 3.5 149 34 64 .49 78.	x3.5x12 - 156 3 8	2	VD Fully Killed	o	ther YE YE	S S	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile S Tensile (% Yield (ks.	Mechanic Size pecimen Size (in) ksi) i)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	s s	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile S) Tensile (Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 ,49 78. 51, 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	s s	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile S) Tensile (S) Yield (ks Gauge Leng	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 ,49 78. 51, 2	X3.5X12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile S) Tensile (S) Yield (ks. Gauge Leng	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S	
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (S) Yield (ks) Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S	
Test Lab Test Bar S HBW Elg (%) RA (%) Tensile S Tensile (Yield (ks Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	RODUC	
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Leng	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	s S S P D	200
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	s SPD	COMP
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S S S S D UALITY	COMPAN
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S S S S D UALITY	COMPAN
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	cal Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S S S S DUALITY	COMPANY
Test Lab Test Bar 3 HBW Elg (%) RA (%) Tensile S) Tensile (%) Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	2al Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	s s S S S S D UALITY	COMPAN
Test Lab Test Bar : HBW Elg (%) RA (%) Tensile S) Tensile () Yield (ks. Gauge Lend	Mechanic Size pecimen Size (in) ksi) i) gth (ln)	2al Testing AFG 3.5 149 34 64 .49 78. 51. 2	x3.5x12 - 156 3 8 9	2	VD Fully Killed	0	ther YE YE	S S S S S S D UALITY	COMPANY

The recording of false, ficilitious, or inauduloni statement or entries on this document may be purishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting raquirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amandments end Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a chockmark in the "EPCRA" column and a Chemical Abatract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility along to determine whether your facility is required to eubmit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1350027 Certification Date: 11/7/2018 Issued By: Nancy Loos This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Page 1 of 2

i

	Material Test Rep	Forged Vessel Connections
5	Heat Code: BWL	An AEGlobal Company
		13770 Industrial Rd. Houston, TX 77015
	ISO 9001:2015 Certified	Sales: (713) 393-4200
Eaton Metal Produc 00011756	PO: 0045008	Sales Order: 169271 Line: 3
4800 York Street	Item Code: HBN030150090A00	01A1 Qty Shipped; 2
Denver, CO 80216	Item Desc: HBN RF 3"150X9"	SA105
		Mill Heat: A171871
Spec: ASTM A105/A105M-(18)/ASME	S SA 105/SA 105M-(17) Sec	ction II Part A
MARK #1D-5		
Product compliant with NACE MR017	75/ISO 15156-2:2015, Annex	A (A.2.1.2, A2.1.3).
* No Weld repair performed. * Ladle Chemical Analysis results * Tensile taken from a round spectory * Yield strength was determined ut * All material supplied under this mercury bearing equipment was * When reported on MTR: Tensile The Per ASTM E23 * AF Global manufactures material to ISO 9001:2015 Unless otherwise noted on PO, Dimits to NPS 24) per ASME B16 5-2013	a are reported from the raw timen. Measurement of elong- using the .2% offset method is order is certified to be used in manufacturing, fab Testing Per ASTM E8; Brinel is according to a certified mensions of all standard pi	material suppliers MTR. ation after fracture. , unless otherwise specified. free of mercury contamination and no rication or testing. 1 Hardness Per ASTM E10; Charpy Testing Quality Management System conforming pe flanges and flange fittings (NPS 1/2 es (NPS 26 to 60) per ASME B16.47-2011.
Orifice flanges per ASME B16.36-2 * FVC FLANGE DIMENSIONS & BOLTING SELF-REINFORCING NOZZLES COMPLY W DESIGN/FVC DESIGN.	2015. 3 COMPLY - ASME B16,5 WITH SPECIFICATION OF SECTI	ON VIII DIV. 1 OR DIV. 2 PER CUSTOMER
		NO QUALITY WIND OUT

The recording of false, fictitious, or fraudulent statament or entries on this document may be punishable as a felony under (ederal statule.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Tille iii of the Superiund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Sorvices (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your fecility is required to submit a Toxic Release inventory Report under EPCRA Section 313.

Certification No.:	1350027
Certification Date:	11/7/2018
lssued By;	Nancy Loos
This report is issued in compliance	e with the requirements of EN10204 3.1 / ISO 10474 3.1.b

.

Im . .

Rina Sane - Metallurgical Lab Manager Page 2 of 2

CERTIFICATE OF INSPECTION & TEST (EN 10204 3.1)



ST&H CORPORATION 74, Jwadongsunhwan-ro, Haeundae-gu, Busan, Korea Tel : +82.51.744-4680(5 line) Fax : +82.51.744-4670 E-mail :qm@stnhcorp.com





RepS 0 (60300 / 01

Certified to ISO9001:2008, ISO14001:2004, PED2014/68/EC by LRQA

Certificate No. MJH9943-01/08 Customer Date : AUG. 01. 2018

5361-1 MK# 1D-6

Contract No. 199005-00

Spec. For Material ASTM A105N-14,ASME SA105N-17,NACE MR0175/ISO 15156-2:2015,NACE MR0103/ISO 17495-1:2016

near treatment				Diffea	SIONALI	nspec	doity-	SIALE D	10.5 -	2017						
				Size of	f Test		Ten	sion 1	Fest		Hard	Iness	C	harpy In	npact Tes	it .
		ļ	Heat No /	Spec	imen		VY.S	T.S	E.L	R.A	Te	st	(10)	10mm S	pecimen	Size)
	ITEM / SIZE	Q'ty	Batch No	D	GL		MPa	MPa	%	%	(H	18)	Indiv.	Ave.	Notch	Temp.
			butch No.	mm	mm	Max					18	87	21J	27J	V	-29℃
	· · · · · · · · · · · · · · · · · · ·			12.5	50.0	Min	250	485	22.0	30. 0			Tes	st Result	(J)	Ave.(J)
BA900WRXH3	900LBS WN RF XH 3"	350	012898E	12.5	50.0		345	540	35	75	160	163	120	103	155	126
BA150BR1	150LBS BL RF 1*	500	012898F	12.5	50.0		345	540	35	75	160	163	120	103	155	126
A150WRXXH3	150LBS WN RF XXH 3"	25	012898F	12.5	S0.0		345	540	35	75	160	163	120	103	155	126
BA900WRXH3	900L8S WN RF XH 3"	350	012898F	12.5	50.0		345	540	35	75	160	163	120	103	155	126
•	BLANK		BLANK					BL/	NK		BLA	ANK .				

			1		1	1	1) C	emical	Compo	sition (%)								NDE	
Heat No., Batch No	/ Max Min	• c 0.350	• si 0.350 0.100	Mn 1.050 0.600	0.035	• s 0.040	0.400	0.300	0.120	9.400	• v 0.080						(E	л	мт	PT
• <u>•</u> ••	н	0.170	0.261	1.000	0.015	0.003	0.062	0.083	0.012	0.104	0.002						0.3	67			
012898E	Р	0.174	0.280	1.020	0.020	0.002	0.108	0.131	0.002	0.123	0.001						0.3	86			
	н	0.170	0.261	1.000	0.015	0.003	0.062	0.083	0.012	0.104	0.002						0.3	67			
-012898F	p	0.174	0.280	1.020	0.020	0.002	0.108	0.131	0.002	0.123	0.001			1	ODUCE	15	0.3	86			
										BLAN	κ			13	- 3	2					
REMARK	* H : Heat * Impact T * C:Mn = * * Mn is Pe	Analysis est perfo I ≤5 rmitted (P : Pro prmed ac	oduct An cording ax 1.65%	alysis to ASTM 6 (ASTM	A A370 8 A105-14	& MESC	76/210, 1, NOTE	/2017 Pa	iragraph	8.5 / Tai	ble 4 &	s.	A STOR MEL		OMPANY	(* C)	H COR	ANAG	ATION ++	
We hereby o	ertify that the	material	herein ha	is been n	nade and	tested in	accorda	nce				14.00		<u></u>		-					
with the abo	ve specificat	on and a	iso with t	he require	ements ca	alled for b	y the abo	ove order				Witr	lesseg	бу/ Н.	J. LEI	-	Manager	of Q.A	Dept	./ JAY	кім
ST-801-14-0	2																		ST80	H CORPO	RATION





1

Heat Code: DGT

Forged Vessel Connections An AFGlobal Company 13770 Industrial Rd. Houston, TX 77015 Sales: (713) 393-4200

ISO 9001:2015 Certified 00011756 PO: 0045008 Sales Order: 169271 Line: 4 Eaton Metal Produc Qty Shipped: 3 Item Code: LWN020150090A001A1 4800 York Street 2"150X9" \$A105 Denver, CO 80216 Item Desc: LWN RF Mill Heat: C140139 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A EPCRA CAS# Ladle Product EPCRA CAS# Element (%wt) Ladle Product Element (%wt) Carbon Chromium 0.05 7440-47-3 \mathbf{Cr} IQ. С 0.18 Molybdenum 0.02 7439-96-5 Manganese 1.09 Мо 10 Mn Phosphorous 0.005 v Vanadium 0.035 P Sulphur • 0.002 Сb Columbium 0.001 s C.E Si Silicon 0.26 0.41 7440-50-B 0.485 Cu Copper 0.18 1/2 CuNiCrMoV 0.07 Ni Nickel 0,20 æ 7440-02-0 СтМо 5361 MK# 10-> **Mechanical Testing** Other VD YES Test Lab AFG YES Test Bar Size SACRIFICIAL PIECE Fully Killed 179 - 179 HBW Elg (%) 28 RA (%) 65 Tensile Specimen Size (in) .490 86.6 Tensile (ksi) 56.8 Yield (ksi) Gauge Length (in) 2

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more loxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Tile III of the Superfund Amendmente and Reauthorization Act of 1886) and 40 C.F.R. Port 372. Potentially reportable chemicals are indicated with a checkmerk in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release inventory Report under EPCRA Section 313.

Certification No.:	1348577
Certification Date:	10/27/2018
Issued By:	John Sauceda
This report is issued in compliance	with the requirements of EN10204 3.1 / ISO 10474 3.1.b

•

1

	•	Porgea vessel Connections
	Heat Code: DGT	An AFGlobal Company
		13770 Industrial Rd. Houston, TX 77015
	ISO 9001:2015 Certified	Sales: (713) 393-4200
Eaton Metal Produc 00011756	PO: 0045008 Sales C	Order: 169271 Line: 4
4800 York Street	Item Code: LWN020150090A001A1	Qty Shipped: 3
Denver, CO 80216	Item Desc: LWN RF 2"150X9" SA10	5
		Mill Heat: C140139
Spec: ASTM A105/A105M-(18)/ASM	E SA 105/SA 105M-(17) Section I	I Part A
Spec: ASTM A105/A105M-(18)/ASMI MARK #1D-7 Product compliant with NACE MR01' * No Weld repair performed. * Ladle Chemical Analysis results * Tensile taken from a round spec * Yield strength was determined u * All material supplied under th: mercury bearing equipment was * When reported on MTR: Tensile ' Per ASTM E23 * AF Global manufactures material to ISO 9001:2015 Unless otherwise noted on PO, Did to NPS 24) per ASME B16.5-2013 , Orifice flanges per ASME B16.36-2 * FVC FLANGE DIMENSIONS & BOLTING SELF-REINFORCING NOZZLES COMPLY TO DESIGN/FVC DESIGN.	SA 105/SA 105M-(17) Section I SA 105/SA 105M-(17) Section I Sare reported from the raw materi timen. Measurement of elongation a using the .2% offset method, unles is order is certified to be free o used in manufacturing, fabricatio Pesting Per ASTM E8; Brinell Hardn Is according to a certified Qualit mensions of all standard pipe flan large diameter steel flanges (NPS 2015. G COMPLY - ASME B16.5 WITH SPECIFICATION OF SECTION VIII	I Part A .1.2, A2.1.3). al suppliers MTR. fter fracture. s otherwise specified. f mercury contamination and no n or testing. ess Per ASTM E10; Charpy Testing y Management System conforming ges and flange fittings (NPS 1/2 26 to 60) per ASME B16.47-2011, DIV. 1 OR DIV. 2 PER CUSTOMER DIV. 1 OR DIV. 2 PER CUSTOMER
	18	COLUMN STREET

The recording of false, ficilitious, or fraudulent statement or entries on this document may be punishable as a felony under faderal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Tills III of the Superfund Amendmania and Reauthorization Act of 1986) and 40 C, F, R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your (calify is required to submit a Toxic Release inventory Report under EPCRA Section 313.

Certification No.: 1348577 Certification Date: 10/27/2018 Issued By: John Sauceda This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

ami . .

Rina Sane - Metallurgical Lab Manager Page 2 of 2





MILL TEST REPORTS

Bonney Forge 14496 Croghan Pike Mt. Union, PA 17066

CERTIFIED MILL TEST REPORT

Industrial Piping Products 9/26/2018

LOT NO.

1133

CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS

1	2	" 6M A	105 Ç	oupling	g Thre	aded	1	N.
C 0.160	MN,	1.020	P	0 .010	S N	0.020	SI	0.250
NI 0.060	CR	0.130	MO	0.020	CU	0.180	CO	0.006
V 0.023	AL	0.025	CB	0.000				
CE(LONG	FOR	MULÀ) = 0.3	881				
T/S(PSI) 8	0000	Y/S(PS	I) [¥] 518	00 EL(%) 25	5.000 R	A(%)	43.000
BRINELL	HAR	DNESS	164,	163				



- 1. CERTIFYING ASTM A105-14 / ASME SA105-17 EDITION.
- 2. THE MATERIAL SUPPLIED MEETS THE REQUIREMENTS OF NACE MR0175/ISO 15156-2.
- 3. THE MATERIAL SUPPLIED WAS INSPECTED AND MANUFACTURED IN ACCORDANCE WITH EN DIN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT.
- 4. THE ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.

THIS DOCUMENT HAS BEEN ELECTRONICALLY SUBMITTED.

		 the second se	
10	Cancel	Logout	

5361-1 MK# 1D-9

Reviewed to 2017 ASME Code Edition

USS UNITED STA	ates st	'ecl			⊂e CORD/	TUER	DLAR FIED WITH IS	PRODI TEST	JCTS RBP (FN10	ORT	N-50649	"trah 3.1"	2	SER	da ti Ial	te : Me : No :	03/23 05:19 L0035	/11 :12 412	
DROODSB 01		SH RA3	PPERS NO.		1094	F.O. N	WMBER			V	EHICLEL	0							·
	A OT DJOS	DAESS						NAR TO	ADDRE	33			US 21 LO	S TU 99 K Rain	BULA AST , OH	VENDO R PRO 2 BTH 4405	ST.		
							SPECIF-C	AYIOR AN	D GRAD	e									
ABRE SAIIS- SEA FOR TRANS& APPLICABLE REQ	LONG F	DITION LAWS P NTS OF	GRADE ER APIS	6 AST	25 A1 .3.1 RD b	CR-0	-08 G D E.6 1-75	#=200		REC OR.1	SA10	6-*201 L COAT 5 AND	PE B MR010	TION EV 3 3-20	GRA 0 DE 07	DE B (] NE)	OD/ID	ALL T	HE
COND: PULL BO	DY NOR	MALIZE			+	VIELO	24	1.000	(605	. 600	<u>, </u>		100	0.	500	(12.7	700)	NYDRA	
PRODUCT	TEST IN DAIEMI	476/ ATION	TEST COND.	GAUGE	Min:	3.	PSI 5000	1.50	Mik:	PS1	c 0000	MAX:	(N 2**		SCALL MIN:	EHRB	PS	I 900	5
MA2116 S500NA MA2116 S500NA	STRIP	/L/B /L/B	: ; 58M : N2M * •	1.500 1.500 83800 0	גם ז	5. 5.	5500 4500 This	.50 .50	2 ***	78	1000	0.71 0.70		46.2	B	80.0	6	900	5
LEGENG: L-LONG U-UPSE	T		T - TRANSVER	1 13E 120	0 	T-OLE	NCH & TE	MPERED		AR TR-	AS ROLL	ED MECHANISCA) Bi-	800*			W-WE	LD	
PRODUCY	TYPE		V V	P	5	SI V	V Cart	NI	CR	NO	AL	N	8	π	CB	ca			C.E." MAX
MA2116 MA2116 S500NA MA2116 S500NA	BEAT PROD PROD		20 10 20 10 20 10	2 010 9 014 9 013 END	003 006 005)F D	21 25 25 ATA	09 12 12 CHIS	05 05 05 Shee	10 10 10	02 03 03	028 042 039	03 34 04	0900 0907 0005	002 004 004	.002 011 010	-			.41 .43 .42
C.E. IS BASED ON THE FO	RLLOWING EI	QUATION(S):	CE=	C+ (MN/	/5]+	(CR+)/5+	(NI	+CD}	/15		÷					·	

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT.

PRODUCIS COMPANY SPD SPD QUALITY WILLITY OUALITY OUALITY OUALITY

PAGE 1 OF 2

~												DATI	Βι ά	03/2	3/11		
UNITED STATES	S STEEL	L .			TUBULAR	PRODU	CTS					TIM	B: (05:1	9:12		
<u> </u>				CI IN ACCORD	BRTIFIED	TEST	RBPORT	HN50049 *1	VINA 20171		SER	IAL M	0: 1	2003	5412		
MILL ORDERITEM NO		SHIPPE	BRS ND.		P.O. NUHBER				<u>, , , , , , , , , , , , , , , , , , , </u>								
DRODO9B 01		R8370	28	109	454-00					00	207	76					
ATERIAL					0.0.:				In-	(718) ¥	WLL:						in [ma
FULL BODY	NORMAL	IZED			24	1.000 (609.60	0)			0.	<u>500 (</u> :	12.71	00)			
			1						CHARINY V-NO		CT TES				K SHEAT		
PRODUCT	FLAT	đEND	GRN4		DIR DIR	LOC.	TEMP	SIZE	COND.		2	3	AVG	11	2	3	AVE
			Jue	COLOGIS	*		DEGR	<u>. </u>		<u></u>							
MA2116 5500NA	OR			END OF	DATA TE:	B SSKB	- 50 ET **	FULL	8724	75	68	71	71	20	20	20	2
LEGERD L-LOMONUE	DINAL		7 - 172A	NSVERSE	8-80	EY		W-WELD		н	AZ - HE	AT AFFECT	ed zome	<u>د_</u>			
· ·					TESTING INS	PECTION IN	ORMATION									·	
TEST / IN:	SPECTION			YES					RESULTSICO	W VENTS							
FULL LENGTH VISUAL				<u></u>												_	
				x	00_	<u> </u>			L	L	π	_ 10	-0%	NOTO	<u></u>		
FULL LENGTH (IT												10		110000			
FINT AREA INSDECTION OF ANIA				X .		<u> </u>	0010	_	L <u>X</u>	L	π		.08	NOTO	UR		_
SPECIAL END ADEA INTEN					<u>MP(</u>		<u> </u>							_			
FILL LENGTH DRIFT					MP1		<u>VT</u>										
					DRIFT	MANDREL	SIZE:										
														_			
																-	
					ADDITIONA	L HOTES CO	MIMENTS			<u>`</u>							
COMPOUNDS ARE AN OF CONTAINMENT.	DDED T		THE US STREL	A. NO R AND ALL	MERCURY	Y WELD Beari	ng eqt	IO MERC	IS PR	OTEC7	CURY CED	by a	DOUB	LE I	BOUND	ARY	
															METAL	SP	D
THIS IS TO CERTIFY THAT TH SAMPLED. TEATED AND/OR I AND FULFILLS THE REQUIRE	E PRODUCT (NSPECTED IN MENTS (N SU)	ACCORDA CH RESPEC	HEREIN WAS I AGE WITH THE 119.	KANL FACTURE SPECIFICATION	ad. N										120	(ba	3

PREPARED BY THE OFFICE OF: R. HARRIS - MANAGER, Q.A.

DATE 03/23/11

• •

•

5361-1 M K# 1D-10 Reviewed to 2017 ASME Section I

. . .

. . .

TUBE TEST REPORT

•

	040998	004	HEAT	: 478063	P.C	.: M31010	394	PART NO.	
DPECIFICA	(10N(S) ;	API PSL CERTIFI	1 GR B/X4 ED NACE	2 FORTY FO MR-01-75 DA	URTH EDITIO	N			
GRADE: 1	023M	SIZE	: 3.500 X	(0.600 DR	L WPF:	8.60	QUALIT	Y: SEAMLESS HOT	INISH
	1	L .21 . P .21 . P .21 . P .21 .	Mn V S 651.002 631.003 65 .003	V P Si .008 .29 .009 .28 .009 .30	VCr Ni VI .14 .10 .0 .16 .09 .0 .15 .09 .0	10/VCu) 04/.231. 04/.19/.	AI VY Cb 013 .005 .001 010 .003 .002 013 .003 .002	Ti B .0020 .0003 .0020[.0001 .0020 .0003	
	Specimen		MATER Yisld To	ensile ELN	IG I	C.E.	Rockwell	Hydrotest	
	A\$ 74 E6	EUL	KSI	KSI 2'	, R/A			/#	
	.750 " STR	0.5	49.3	77.4 40.	.0	.38	77.7 79.2 79.6 78	.8 RB 3000 PSI 5 Sec Hole	d l
EN 10204 FLAT(S) EMI INSP	4 TYPE 3.1E - SATISFAC PECTION - S	DATED (CTORY SATISFAC	01/2005 TORY	ALON META	SPD COMPALITY AND		(Pursie Bus	rette
						8/31/1			
						DATE	QUA	LIT ASSORANCE/KU	TT CL
		N	NO WELC	WA3 NOT EX ING OR WEL MATERIAL I	(POSED TO M D REPAIR PE S FREE OF H	IERCURY RFORMEI ARMFUL F	DURING PROCES DON THIS MATER RADIATION.	SING. IAL.	

IPSCO KOPPEL WORKS P.O. BOX 750 BEAVER FALLS, PA 15010

IPSCO AMBRIDGE WORKS P.O. 80X 410 AMBRIDGE, PA 15003

IPSCO BAYTOWN WORKS 2800 SPUR 55 BAYTOWN, TX 77523

.

5361-1 mk# 1D-11

5361-1 Reviewed to ASME code Edition 2017

Peacehaven V P O Box 48 South Africa	ereenigi Vereeni	ing 1939 iging 19	9 30	Tele Fax	phone	+	27 (0) 27 (0)	16 4 16 4	50 42 23 49	20 06				SL - SCT -	0319 0419		Yest Cer	tificate p4 TIPILL1		Arcel	orMi
Customer: Order No: Certificate Refe Product: Specification: Product Markin	rence No g:		400 044 FU 150 A.R. pst	00023418 0062154010 LLY KIELET 0183:2012/AJ CELORMITT CAST NO: 1	HOT F 1 5L:201 AL SA 1 609658 1	DNISHE 2 1.245 SO3183 PROD/C	D CARE /L290/B/ /Spec 5L > NO: Tr	ON ST K42 PS -0319 N 2442341	EEL SE LI AST7 40NOG 810 MA	AMILES M ASSE BAM OF DE IN	S TUBE 12 A10 5-17 AS SOUTH	S MB/C.14 TM/ASN AFRIC	Custo Miner Cast/ AL 30.1 RE A/SA A NDE	nner Or rial No Heat N 2 ASME 1068/C	rder/Co ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	15 SA 500 0.	No: 068/C.1	S 1 15 SA53 000 L24	US4 15 000042 609658 9.15 5/8 1.29	55556 255 Page 1 of 6/X42 PSL1 S	1 MIS TI
General Info	rmation	1															_			·	
Ωυωτάτγ	Mass				Dimenai	01.4				Total i	ength.		S	teel susi	ling	(Final I	Rolling	Operatio	n.	
			Tube	OD	Thic	knins.s	Len	10					PI	0085			As Ho	Dec			
126	51,7	758.673(lb)		3.500(*)	V	0.300(*)	40.0	00 (ft)		5,040.00	0(#)	E	lasic Oxy	gen Fun	arce	Final h	ot rellin	g finishe	d above 1580	'l and
		1																			
Chemical Co	mpositi	ION	R22-1V	+ND+TIL	1	1	R24 IN	b+V)	1		,						,		· · · · ·		
Element(%)	C	V SI V	Mn	SPV	Cr	NI	NIO	Cu	VV	AI	<u></u>	Sn	C.s	N	B	Nb	CE	<u>R22</u>	R24		
Minamaina						· ·	-			~	-			-	•	-		<u> </u>			
Maximum	0.2	200 -	1.30	0.030 0.03	0.50	0.50	0.150	0.500	<u> </u>	-	-		-	-	-		0.41	0.15	0.060		
Heat	0.1	120 0.16	1.05	0.004 0.01	<u>3 0,03</u>	0.01	0.001	0.005	0.043	0.030	0.002	0.001	0.0017	0.0026	0.0004	0.0005	0.31	0.05	0.043		
Product	0.1	204 0.1620	1.0460	0.0039 0.01	0.028	0.014	0 0.0010	0.0050	0.0429	0.0300	0.0018	0.0007	0.0317	0.0026	0.0004	0.0005	0.3104	0.0452	0.0434		
Product (ADD	0 0.1	204 0.1620	1.0460	0.0039 0.01	13 0.028	0.014	0 0.0010	0.005	0.0429	0.0300	0.0018	0.0007	0.0017	0.0026	0.0004	0.0005	0.3104	0.0452	0.0434		<u>}</u>
Mechanical P	ronerti	05							-							r~-					
Specification	UTS (Run	1	Yiei	d (0.5%)	96 E				UTS (5	imi		Vie	H (0.69	6)	96 EL	;		~~	OTHER	TESTS	
Linoita	MPa	pai	MPa	psi	2 10	- ah			MPa	psi		MPa	05		2 inch	C	tegary		Res	ult	
สนุกษณฑ	•	70000		42000	30.0		(5) Act	uai								H	drostat	ic	300	0 psi for 5 Se	c
B#Baxdssauwn				1 -	-		(6) Act	ual								N	n: emi		PAS	SS - ASTM E	70 - 12
(1) Actual		70343		51343		<u> </u>	(7) Act	ual								N	H: UT		UT	not nequired	
(3) Actual		10778	+	51923	39.0	└-\ -	Unientat		ype of	tensile Analat	test	10	TE Lask	tel, Son	>	- <u>m</u>	22 1	\$	150	153 153	
(4) Actual			1				Orientat	ion of	lannact 1	uncity		. 0.	/2 NC			i ⊢					
Remarks:							Criential														
Material in accords The material confo	unce with I rm to the o the visus	NACE MRO hot yield st al and dimen	0175:2015 rength re- nsional re-	/ISO15156-2:2 quirements as quirements an	015, MR per ASM d is mad	0103:20 E, Sect to a s	15. Dine II, Pt D minble fi	nsions , Table oc grain Releas	to ASME Y-1, 20 practice	E B36.0	0M-2015 the	i.				Ce	rtified	bu: (Ale	£	

333

609658

5361-) mk#1E-1



SEPARATION PL# : 4 To: AMISTCO 623284 ... 315

INC.

.

PRODUCTS, INC.

STEEL, From: AMERICAN ALLOY

lasuing Data : Vehicle No:	03/2 NO	0/2018 (L 725178	BA	. No. : 61	4118		Load	No. : 53 Sold T	2348 o: AM 621	OI IERICAN IO N HOU	II ORRE N ALLOY 8 STON RC	io. : 1592 TEEL ING	46/7 2	81	Cust. O iip To .	rder Ne Ame 1124	0. : 1163 RICAN / W 600 /	13-UT	STEEL	NC	
Specification:	0.50 AST Nor Sec	100* x 120.0 TH AS16 70 mailzed Pla tion 2.1.2 C	00" x 480 35/60-17/ in NACE ompliant	L090° (ASME 9/ MR0175 (2015) 1:	4516-70/68 Annex 2.1 8.1.1, 13.1.	260 PVQ ; .2 (2015), .2)Vacuum	2015/2017 MR0103 (J n Dogazsa	2010) d	PO No	BOX 404	69 JSTON,T	x 77091				UP-H TRAC COD	KSVL-U CK 725 S ENJUT 8	icry Static H404	n under	5	
	ing: 11	\$318-UT	1	<u>\</u>		_															
119rat 840 V 0505498	C \/ M1 0.19 1.	1 1 P 02 0.007	_\/s €,000	 	Cu 0.15	NR 0.08	C7 0.08	Ma 0.01	Ai(tol) 0.020	V	0.002	11 0.002	0.0060	0.0042	B 0.000	00 0	5n 1.008	0.4D	Pam 0.26		
Plata Soriel No	Piscaa	Tons Dir	berry (lac)	T Tenstlo (اتعم)	ettsile Ter Eong. %sin 2*	Elong. Kin 8		1,	Norm ("F)	Heat Tr Time (mb)	sat Tomper (°F)	Time (min)									
8505498-02	3	12.25 H-T	49,400	73,300	45.6				1650	23									<u>,</u> .		
				-Absorbed	Energy (Ft-	b \$)(\$\$!	lataral Exp	Cherpy I) ansion (in.)	mpacts			Shear (%)-		-					
Ptate Serial No	Pleces	Tona Dir.	(ft-fbs) 7	(h-5os) 2	(fHb4) 8	(H-Kri) Ave	k-Bn	(%n.) 1	(m.) (i 2	ín.) (br 3 Áv	.) (ka.) na Mita	(%) 1	(%) 2	(%) 3	(%) Ave	₽⁄¥n	титр (°F)	8(m			
8505498-02	3	12.25 H-L	119.4	1 44.0	132.7	132.0	15										-50	10a	າກາ		1
									m	V-+	+ 1 r	\~! `	、.	~ .		•				1	
										in t	t (r) 'l <	$\langle , $	D-1	1911	V D	-17	7,1	E~,	3 1	Z QI
			•			6	53	61			IH	- 2				Cert	ified a l	sue ci	my of th	e	No.
								il		(ልኬሳ	ugito Ofga	eNAI	nined i	a our fil STSAL	le. 	
							TU)7	- 30	$\mathcal{I}\mathcal{U}$	-				1.417 EH	11	Rsvi	cived I	};; }	a	
HOT ROLLED CAR	BON STEE	LPLATE					5.A	4	Jane -)	J.¥	101	24	12015		
TEST COUPONS Place frequency	TAKEN FROM charpy	HEATTRE	ATED PLAT	ΓE		ï	POP	- 4.	53.	55	_										
Manufactured to fi	ity killed fins en used in th	profin practice e circci manu	by Electric (acturing o	Arc Furna I this mater	ca. Waking tal. Produce	of weld top d as contin	ait waa noi p wous cost da	sorote bio	i on this me to, unless o	aterial. Utrerwise f	W Qo baro	e hareby ce anations pa	with that t	te cotilens y the mate	an eich ha e buneara luis scienceae	Contain Sciurer	ere in com	npilance	with the lay	st results an opticable	ď
Contraction F		smente:nno-si	anoa wux isi n	roca, com							4	00110000179		o fior official	ار مسمحین	200	and the second	<u> </u>			

; ;

. . .

12/12/2018 From: AMERICAN ALLOY STEEL, INC. T P.O.#: 4700687702 S.O.#: 619274 Item: 1 (1 PC) 1/2" X 120" X 120"

PLATE MIL		P.O.Box 279 Winton, NC (252) 355-37	27986 00				ITe	est F Page 2	2epc)rt		-	1 Cofie {2	505 River Id, NC 279 52) 358-37	Rd 222	and the	 (\$ ()	ur Nationel Sta
Issuing Date :	10/07/2018	B/L	No. : 51	4849		Load	No. : 52	5223	Ou	Order No	p.: 15943	9/1 .	С	ust. Ordei	r No. : 45	00893647	r	
Vehicle No:	ATW 53005	5					Sold Te	o: RYE	RSON P	ROCURE	MENT CO	RP	Ship	To: R	YERSON	INC. DE	NVER	
Specification: Marking :	1.0000" x 9 ASTM A510 MR0175 Ar 13.1.2) Con 160005134	6.000" x 240.0 5 70-17/ASME Inex 2.1.2 (201 npliant	000" SA616 7 15), MR01	0 SA516≁ 103 (2010	485 PVQ 2) Section 2	015/2017 .1.2(2015	NACE } 13.1.1,	LUB	BOX 9160 BOCK,T	9 79490				C	OMMERC	E CITY,C	0 80022	
		$\langle \rangle$										_						
Heat No 🗘 C	V Mn V	PVS	V si	Cu	Ní	Çı	Mo	AI(tot)	v	NÞ	Ti	N	Са	8	ຣິກ	Ceq	Pcm	
8505555 0.20	1.05 0	0.003 0.000	0.20	0.24	0.10	0.07	0.01	0.039	0,004	0.002	0.002		0.0020	0.0001	0,011	0.41	0.28	
Plake Serial Pie No 8503555-07 4	cces Tons	Dir, (psi) T 46,600	(psi) Tensile 75,500	ensile Te: Elong. % in 2°	st Elong. % in 8' 20.2													

5361-1 PLID#280 MK# 15-14,10-13



Manufactured to turby killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as rolled, unless otherwise noted in Specification. For Mexico shipments:hic-SalesMX@Nucor.com Yield by 0.5EUE method unless otherwise specified. Ceq = C+(M)/05+((Cr+Mo+V)/5)+((Cu+Ni)/15) Pron = C+(SiSD)+Mid(2D)+(Ci)/00+(Cr)/00+(Cr)/00+(Ci))

Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B

Mellod and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System Registrar (#0985-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14 MMPQA-723

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

· 、·

10/7/2018 2:60:14 PM

T. A. Depretis, Metallurgist

	1770 Bill Sharp Boulovard,	Muscathe, IA 52761-941	2, US		MIII Ordan No. 41	5/0855 07 M	in allow Maniford a Ad	110
Customert JOSEPH.T. RJ ACCOUNTS.P PO BOX 91601 L(IIIROCK TX 79490-1601	YERSON & SON, INC. AYADLE DEPI', I	Customer P.O. (An. Product Description	ASU0399993	ASME \$4516-70(17	(val) OF4CF 110.: 41	Ship Dalet 12 (CertiDate: 12 (Def 18 Cert No: 4 Def 18 Cert No: 4 Def 19 (Puge 1 c	(359173)61736667 (1)
<u> </u>	Tested Pleces	5220: 0 - NOU A	. Teasiles		C:	arpy Impact Test		
I leal Id	Piece Tested Id Thlekne	Tsi YS 13 Loc (KSI)	(I(SI) %KA Klon Zin	g % Tst Bin Dir Hurdness	Abs. Energy(F.P.L.B 1 .2 3 Avg) % Shear 1 2 3	Tat Tat Tet	111747171. Toin %St
MERCURY IS	STREET & MARTINELLUDGERT	T CORPORED OF T	THE RUTHER VIND NO	D MURCORY WAS	TWURNTTONAUPA	VODED DOSTOR	· THE MINUPACTU	KE .
OF THIE PR KILLED STE CEV (IIW) MTR EN 102 100% MELTR NO WELD RE	NOT A TOTAL TOTAL TOTAL OF A CONTENT OF A TOTAL OF A THE ACTION THE ACTION OF AND MENOPACTURED FOR THE AND MENOPACTURED FOR THE AND MENOPACTURED FOR THE AND MENOPACTURED FOR AN	'ING GRAIN PRACTI (040)/5 + (NI4CU) CERTIFICATH 3.1 IN THE UGA. RMED ON THIS MAIN	CB /15 Compliant Skial.					
OF THIS PR KILLED STB CEV (IIN) HTR EN 102 100% MELTR NO WELD RE PRODUCTS 6 ASI210	CONVET, EL, PRODUCED TO. A F $= C + MN/6 + (CK+h)OA_{1,2004} INSPECTIOND AND MENOPACTURED PAIR MAS BEEN PERPONITIPED; C09$	THE GRAIN PRACTI WINJS + (NI+CU) CERTIFICATH 3.1 IN THE USA. REED ON THIS MAIN PCH9: 2, LES	Св /15 сомрыллт SRIЛь. 9007.		· · · · ·		P04533	5
OF THIS PR KILLED STE CEV (IIW) HTR HN 102 100% MELTR NO WEJD RE PRODUCTS S A\$1210	CODUCT, EL, PRODUCED TO A F = C + MN/6 + (CK+A 04.2004 INSPECTION D AND MENOPACTURED PAIR MAS BEEN PERFO NIIPED; C09	VINE GRAIN PRACTI W+V)/5 + (NI+CU) CERTIFICATH 3.1 (IN THE USA. NUMED ON THIS MAIN PCN9: 2, LBS	CB /15 Compliant Erial. 9007.	nk# (c-	19		P04533	5 U

. . . WE REREDY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE YITTI, AND MEETS THE REQUIRDMENTS OF, THE APPROPRIATE SPECIFICATION Cust Part # : 160004840 **(**N Brian Weles SENIOR METALLURUNT - PRUDUCT

. Ξ. · . .

.

.

.

.

6" 150# A105 RF Blind Flange

536(-1 MK井 1D-18

Reviewed to ASME Section I

R.N. GUPTA & COMPANY LTD., C-55, FOCAL POINT, LUDHIANA -141 010 (INDIA) MATERIAL / MILL TEST CERTIFICATE EN 10204 : 2004 - 3.1 NAME OF BUYER

MECHANICAL DECHIDENENTS

MOUNTAIN WEST PIPE AND SUPPLY U.S.A.



CERTIFICATE NO. 11447 DATE 30/08/2017 RAW MATERIAL SPECIFICATION :

SPECIFICATION FOR INSPECTION :

P	O NO. 68434 DT. 14/04/2017
ľ	VOICE NO. RNG/EXP/17-2143 DT. 26/08/2017

For R.N. GUPTA & COMPANY LTD. Page No: 5

			V 13 M.			1 1 1 4 181	LINIQ					
Sr. No.	Description		Qty (PCS)	Heat No.	Supp. Code	Y.S(PSI) Min 36,000	T.S(PSI) Min 70,000	- E% Min 22%	R.A% Min 30%	Heat Treatment	Soaking Time (Min.)	Hardness BHN 137-187
33	3/4 300# BLRF FLGS		50	H 5842	6	49486	79962	32.94	67.16	AS FORGED		160 - 162
34	1 150# BLRF RLGS		100	H 5899	6	52525	76814	34.60	64.02	AS FORGED	ł	156 - 158
35	6 150# BLRF FLG		77	H 5956	19	\$1093	81122	34.46	\$6.49	AS FORGED		152 - 154
36	6 150# BLRF FLG	-4	- 3	₩ 5912 <⊐	20	46865	74586	33.20	64.77	AS FORGED		144 - 146
37	3 (50# ELRF		120	H 5913	20	50056	80353	32.20	65,00	AS FORGED		152 - 154
38	1 1/2 150% SORF FLGS		100	H 5932	6	48162	79678	31.84	68.52	AS FORGED	Į į	148 - 150
39	2 150# SORF FLGS		166	H 5915	20	50607	75801	33.14	64.29	AS FORGED	1	148 - 150
40	2 150# SORF FLGS		84	H 5914	20	49683	79640	32.00	65.35	AS FORGED		150 - 152
	······			····	СН	EMICA	AL RE	QUIREI	VENT	S		<u> </u>
			SPEC	IFIED EI	EMENT	rs		UNSPEC	IFIED	ELEMENT	s	
Sr. No.	Heat No.	C.E. 0.47% Max	C 0.35 Max	Mn 0.60-1.25	P 0.035 Max.	S 0.04 Max	51 . .10 -0.35	Си 0.40 Мах.	Nî 0.40 Max	Cr 0.30 Max.	Mo D.12 Max.	V 0.05 Max.
33	H 5842	0.38	0.21	1.00	0.021	0,011	0.22	0.005	800.0	0.006	0,003	0.003
34	H 5899	0.40	0.21	1.10	0.020	0.013	0.23	0.006	0.014	0.007	0.007	0.003
35	H 5956	0.41	0.20	1.23	0.025	0.019	0.21	0.003	0.010	0.015	∑ 0.003	0.002
36	H 5912	0.40	0.20	0.92	0.031	0.018	♦ 0.25	V 0.120	0.070	0.150	0.033	0.004
37	H 5913	D.41	0.21	D.93	0.029	0.016	0.22	0.170	· 0.057	0.120	. 0.019	0.004
38	H 5932	0.36	0,20	0.90	0.016	e00.0	0.24	0.021	0.014	0.033	0.003	0.003
39	H 5915	0.39	0.19	0.92	0.030	0.016	0.20	0.150	0.065	0.130	0.024	0.004
40	H 5914	· 0.41	0.20	0.95	0.031	0.015	0.25	0 120	0.071	0.170	0.044	0.005

Material in accordance with NACE MRO 175-2003 and NACE MRO 103

All Products were manufactured, Sampled, Tested and Inspected Solely by the manufacturer shown on

this Test Report in accordance with indicated specification and were found to meet the requirements.

METALLURGIST

No Weid Repair was performed and all products are free of Weid Repair All Products are free of Mercury Contamination and Radioactivity, We hereby confirm that our DA system comply with the requirements of Annex Leaden 4.3 of PED 2014/60/EU and it is certified by M/s DNV BUSINESS ASSURANCE vide Certificate No.4487-2014-CE-IND-DNV GL valid upto 31-: 03-2020, ISO 9001-2015 Continents of ASTM A105-05(ASIME SA105

ALL NORMALISED MATERIALS ARE HEAT TREATED AT TEMP. 920 DEGREE CENTIGRADE.



51480

٢



			Heat Co	000:1217		MOUNTAIN WEST	PIPE AND SUPPLY
			[TEM			
Lr#	Cty	Description	Mat Spec	H: Cd	Mill Heat Number		CE
00 İ	1	3" 150 RE SUND	SA 105-18	3217	CM3071639		0.4042

Heat Code: T217

	ំ ៤៩:ទីត ហ៊ែងស	and Stoper	thes inspealed,	with an Asta	(*) H			CHEMI	CALP	ROPE	TIES	2						
_	HI CO	VC.	Si Si	Min.	A A	5	Y Cr	AI	Cu	V NI	Mo	VV	ND	Sn	N	В	Рь	П
	7217	0.1900	0.2200	1.0500	0.0120	0.0170	0.0700	0,0010	0,2600	0.0700	0,0150	0.0010	0.0010	0.0060	0,0000	0.0001	0.0000	0,0000
	•	6.1900	0.2200	1.0500	0.0120	0.0170	0.0700	0.0010	0.2600	0.0700	0,0150	0.0010	0,0010	0,0090	0,0000	0.0001	00000,0	0.0000

				P	HYSICAL F	ROPERTI	ES			
Ht Cd	Tonsl	Yield	#Elantg	%R.A.	HEW	Charpy	Ft-Lba	Lat Expsn	%-Shear	โดยไ โดกค
T217	AC800	48300	35.00	64.85	159/163					
					NO	TES				
Ht Cal					No	fə			•	

New Heat Code

All products bearing the "BCLTEX" name on logo "b" with the heat number prefix listed on the legend below have been manufactured at our Houston, TX facilities from steel mellod and forged in the U.S.A. All other products have been manufactured at our Houston, TX facilities from steel melted where indicated,

AR = Arkanses Steel (USA) NU = Nucor Steel (USA) WR = Warren Steel (USA) CM or Si = Commercial Metals Corp. (USA) RE ≈ Republic Steel (USA) A8 = A83 (tialy)

GER e Gerdau Steel (USA) 11 = Timken Steel (USA)

We certify our flanges are capable of passing a hydrostatic test compatible with their ming and all test results and process information contained herein are correct and true as contained in company records. All flanges meet NACE MRC-175 and/or MRC-100 Lativel Revision.

Our quality system has been registered by DNV-GL to ISO 9001, Certificate No.: 142240-2013-AQ-RVA. Test radults comply with: EN 10204-3.1. Our flanges satisfy the material requirements for PED 97/23/EC Annox 1-4.3.

Not withstanding the absence of a signature, the organization submitting either a printed contribute or an EDI transmitted contributes is responsible for content or the report. (ASTM/A 001-04a Saction 19.4)

NOTICE: Any unauthorized downloading, reproduction, distribution, or use of this electronic media is hereby prohibited. Vibialors shall be prosecued to the fullest extent of the law.

5361-1 MK# 10-19



52104

	5361~1 PLID#290	MK	# 15-1, 15>3 16-7-10	518-4
NAS NORTH AMER STAINLES	RICAN SS	METALLUP	RGICAL TEST RE	EPORT 6870 Highway 42 East Ghent, KY 41045-9615 (502) 347-6000
Cortificate: 464901 01	Mail To: RVERSON INC	S	Ship To: VYERSON INC	Date: 11/29/2018 Page: 1
Customer: 0075 809	6600 HIGHWAY 85 COMMERCE CITY, CO 80022	E C	COMMERCE CITY, CO 80022	Steel: 304/304L
				Finish: BRAP
Your Order: 450090084	5	NAS Order:	AN 0822184 01	Corrosion: ASTM A262/15 A 180Bend-OK
PRODUCT DESCR	<u>IPTION:</u>		<u>REMARKS</u> :	м. «Слудовали на различения на различите на на на различите собрад (Срекстика) на различите на различите со с На подавления на различите на различите на на на подавление собрад (Срекстика) на различите на различите со соб
STAINLESS STEEL PLATE, HRJ ASTM A240/17,A480/16b,A666 CHEM ONLY ON FOLLOWING AST CHEM ONLY ON FOLLOWING AST	AP; UNS 30400/30403 5/15 <mark>;ASME SA240/17,S</mark> A480/1 ME: A276/17,A479/17,A484/1 ME: SA312/13,SA479/13	17,SA666/17 16,A312/16	Mat'l is Free of F EN 10204:2004 3.1; Material is Free o Steel Making Proce	Nercury Contamination. No weld repairs. RoHS 1 & 2 Compliant f Radioactive Contamination ss: EAF, AOD, & Cont. Casting
AMS 5511H/5513J XMRK; MIL- NACE MR0175/ISO 15156-3:20 MIN. SOLUTION ANNEAL TEMP	-S-5059D AMD3(X CRN MEAS), 109 A, MR0103/07;QQS766D-1 1900F, WATER QUENCHED	; MIL-S-4043B A X MAG PERM	Product Mfg.by a (*Melted & Manufact *Melted & Manufact	wality Mgt.Sys. in Conf. w/ISO 9001 ured in the USA; Mat'l is DFARs Compliant ured in the USA; Mat'l is DFARs Compliant
Product ID # Coil #	Thickness Width	Weight	Length Mark	Pieces COMMODITY CODE NO.
04A19W HC * 04A19W	HC .5000 60.000	0 1,050 PLAT	E 120.00 11	1 161001129
CHEMICAL ANAI	YSIS CM(Country of M	elt) ES(Spain) US(United States) ZA(South Africa) JP	ANAB, ISO/IEC 17025, Certificate# L2323 (Japan) Chemical Analysis per ASTM A751/14a
HEAT CM	C % CR % CU %	MIN %	MO % N % NI %	P % S %
A19W US	.0198 18.0380 .398	30 1.8105	.3280 .0708 \$.010	5 .0320 .0010
	SI %			
	.2780			
MECHANICAL PR	OPERTIES			
Product ID # Coil #	la oiUTS 20C.2% cr, KSI %	YS 20C ELONG SI %-2"	% Hard RofA RB %	
04A19W HC 04A19W HC	FT 87.33 34.	59 68.20	80.00 73.25	NO QUALITY MAN

.

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr.

11/29/2018

KRIS LARK



Reviewed to 2017 ASME Section II

James MARTA Martha James

Outokumpu Stainless Pipe, Inc.

ADORESS 241 W Clarke Street Wildwood, FlorIda 34785-9601

TELEPHONE (352) 748-1313

TELEFAX Administration; Purchasing: Production Control: Quality Assurance,

(352) 748-2751 (352) 748-6576 (352) 748-6533 (352) 748-0633



P.O. BOX 40443 HOUSTON, TX 77240-0443

MATERIAL CERTIFICATION

1450100 MTR#: 857

Page : 1 of 1

SOLD 1	го:				SHIP TO:		
DAT	E	SALES ORDER #	CUST P.O.#	TAG N	IUMBER	SPECIFICATION	
04/0	8/2016	160414	S630278			SA105	
ITEM #	QTY	ITEM DESCRIPTION				HEAT CODE	
	7	36" 150# RF WN XH "	B" ASME B16.47			ACDXJ	



		PHY	SICAL PROPE	RTIES		HEAT TREATMENT
Tensile PSI	Yield PSI	Elongation	REDUCTION OF AREA %	BHN	BHN	
¥75565	√ 47427	33	60	149	147	AND SPD CONNELLITY AND OUALITY AND OUALITY AND OTHER

SUPPLEMENTAL INFORMATION

I hereby certify that the reported figures are correct, as contained in the records of the corporation and that the material was manufactured in the United States of America under a ISO:9001:2008 certified Quality Management System. NACE MRO175 EN 10204 3.1

Production Assister



CUSTOMER NO.

844 S. CHESTNUT STREET SALT LAKE CITY, UT 84104

DESCRIPTION

SA516-70

(.375"MIN)

1H-3

SOLD TO: EATON METAL PRODUCTS*

SHIP TO: EATON METAL PRODUCTS

USA

1 4939400121

ITEM PART NO.

4800 YORK ST.

DENVER, CO 80216

17913

SALES ORDER

999119

Commercial Metal Forming - O 341 West Collins Ave Orange, CA 92867 PHONE: 714.532.6321 FAX:

PACKING LIST

SHIPMENT NO.300227PAGE NO.3

 P.O. NUMBER
 P.O. DATE
 S.O. DATE
 PLANT

 0044997
 09/21/18
 09/21/18
 OCW

SHIP DATE: 11/16/18

PREPAID&ALLOW-FOB DE B/L NO. 259767

MTR'S WITH SHIPMENT

REL	REQ	DATE	DUE	QTY	SHIP	QTY

1 11/05/18 1 1

HEAT: KGH=85005299 SLAB: 08

36"OD X .50"NOM SE 2:1

2"SF OSB 30 DEG .06"LAND SA516-70 N MTRS 240#







PLATE	MILL	, {;	262) 356-37	uu					Page 1	A.				(2	bz) 355-3	700 =		∐'s Ou
issuing Date Vehicle No: Specification	: 8 T : 0 A C S	8/15/2018 TPX 804814 .6030" x 96.0 .STM A516 7 Coupons at 1 .ection 2.1.2(B/L 000" x 480.0 0-17 <mark>/ASME</mark> 650 F NACI (2015) 13.1.	No. : 509 00" SA516 70 MR0175 1, 13.1.2)	940 PVQ 20 Annex 2) <mark>15/2017 N</mark> 2.1.2 (2015)	Loa Iormalize), MR010	d No. : 52 Sold T ed Test 13 (2010)	0530 o: SAN 6411 LOS	Ou (UEL SO 5 E COR 5 ANGEL	r Order N N AND C VETTE SI ES,CA 90	Io. : 15912 O INC F 040	20/5	C Shi	ust. Orde o To: S 9 F	AMUEL 600 KAIS NSF SPI	33157,8 C/O TRIS SER WAY JR #2142 L,CA 9233	FAR FLC
. Mar	king: 1	344087			•												'	
Heat No	Vc V	MD	-Vs	1 st	Cu	NI	Gr	Mo	Al(tot)	v	Nb	 Ti	N	Ca	В	Sn	' Ceg	Pcm
8505299	0,19	1.04 0.00	0,001	0.19	0,26	0.09	0.10	0.01	0,030	0,004	0.002	0,003		0.0027	0,0003	0.011	0.41	0.27
Plate Seria	l Pieces	Tons	lisd) (isd)	i e (psl) Tenslie	Elong. % In 2"	Elong. % In 8"								•			`	
▲ 8505299-05	6	19.60 T	60,400	77,200		23.8											•	
KGF	a	T 1960 T	51,800	72,200		26.6		N		•	4	536	1-10	1			'	
KGG	~	13.00 T	51,500	72,900		25.1		N			N	6-11-	11	1 -			•	PRO
KGH	Ž	13.06 T T	52,600 51,200	77,100		23,6 27,1		N			1-1	K-H		1-3			•	SI SI
8505299-09	4	13.06 T	52,600 50,600	77,300 72,300		23.0 26.4		N					-				•	O QUAL
Kal	ч. С																	2 3
•		•															t	
and the second	£	APPRO	VED ·															
	201r	SME SE ∎Ed.	C, II	c	•											•	•	•
		ÇMF	/~	ц,		,												
														-			•	
Test coupons o	nly, norma	lized 60 minut	tes per Inch o	of thicknes	s at 1650	F±25 F. Ho	id 30 mln	utes minim	ium. ;	torial		a berabut ce	tin mail	a contante	of this repo	et ore accr	'	ment All test res
Mercury has not	been used in Specifica	In the direct ma atton. Fpr Mext	nufactoring o so shipments:	f this mater nkc-SalesN	al. Produc	ed as contin com	uous cast	discrete pla	ale as-rolled	, unless	. or sp	erations per erations per ecifications,	formed by including	y the materi customer s	al manufaci pecification	iurer are in	compliance	with the applica

,

the second
5361-1 MK#1H-4



R.N. GUPTA & COMPANY LTD., C-55, FOCAL POINT, LUDHIANA -141 010 (INDIA) MATERIAL / MILL TEST CERTIFICATE EN 10204 : 2004 - 3.1



CERTIFICATE NO. 12560 DATE 27/03/2018

NAME OF BUYER

RAW MATERIAL SPECIFICATION : ASTM A105-14/ASME SA105-13

SPECIFICATION FOR INSPECTION : ANS/ASME B18.5-2013

P.O NO. 68906 DT. 17/10/2017 INVOICE NO. EXP/17-2448 DT. 23/03/2018

Description		(PCS)	Heat No.	Supp. Code	Y.S(PSI) Min 38,000	7.5(PSI) Min 70,000	E% Min 22%	RA% Min 30%	Heat Treament	Soalding Time (Min_)	Hardhess BHN 137-187
4 1600 WHRF XH FLGS 4 1500 WHRF XH FLGS 4 1600 WHRF XH FLGS		134 1460 1081	H 6336 H 6342 H 6343	20 20 20	49086 48755 49887	V 78514 78585 79793	33.40 33.70 33.70	66.94 69.37 67.09	AS FORGED AS FORGED AS FORGED		152 - 154 152 - 154 152 - 154
		SPEC	IFIED EI	CH	EMIC	ALRE	QUIRE	MENT	S	s	
Heat No.	C.E. 0.47% Max	C 0.35 Max	Mn	P 0.035 Max	S 0.04 Max	Si .10 -0.35	Cu 0.40 Max.	Ni 0.40 Max	Cr 0,30 Max.	Mo 0,12 Max.	V 0.05 Max.
H 6336 H 6342 H 6343	0.38 0.40 0.40	0.20	0.89 0.93 0.93	0.029 0.032 0.031	0.020 0.022 0.021	0.24 0.24 0.23	0.130 0.073 0.078	0.045 0.034 0.030	0.092 0.075 0.077	0.021 0.007 0.008	0.004
	Description 4 160/ WNRF XH FLGS 4 150/ WNRF XH FLGS 4 160/ WNRF XH FLGS H631 NO. H 6336 H 6342 H 6343	Description 4 1608 WNRF XH FLGS 4 1508 WNRF XH FLGS 4 1608 WNRF XH FLGS 4 1608 WNRF XH FLGS Heat No. C.E. 0.47% Max H 6336 0.38 H 6342 0.40 H 6343 0.40	Description City (PCS) 4 160# WNRF XH FLGS 134 4 150# WNRF XH FLGS 1460 4 160# WNRF XH FLGS 1081 4 160# WNRF XH FLGS 1081 Heal No. C.E. 0.47% Max C.B. 0.35 Max H 6336 0.38 0.20 0.22 H 6342 0.40 0.22 H 6343 0.40 0.22	Description City (PCS) Heat No. 4 160# WNRF XH PLGS 134 H 6336 4 150# WNRF XH PLGS 1460 H 6342 4 160# WNRF XH PLGS 1081 H 6343 4 160# WNRF XH FLGS 1081 H 6343 Heat No. C.E. 0.47% C.A. 0.35 Mn Heat No. C.E. 0.47% C.A. 0.40 0.20 V 0.89 H 6343 0.40 0.22 0.93 H 6343	Description City (PCS) Heat No. Supp. Code 4 1600 WNRF XH PLGS 134 H 6336 20 4 1500 WNRF XH PLGS 1460 H 6342 20 4 1500 WNRF XH PLGS 1460 H 6342 20 4 1500 WNRF XH PLGS 1081 H 6343 20 C H Heat No. C H H 6343 0.035 Max 0.35 Mn 0.035 H 6343 0.40 0.22 0.93 0.032 H 6343 0.40 0.22 0.93 0.031	Description City (PCS) Heat No. Supp. Code Y 3(FSi) Min. 36,000 4 1600r WNRF XH PLGS 134 H 6336 20 Y 4900k 4 1500r WNRF XH PLGS 134 H 6336 20 Y 4900k 4 1500r WNRF XH PLGS 1460 H 6342 20 48755 4 1500r WNRF XH FLGS 1081 H 6343 20 49867 Heat No. C H E M I C. C H E M I C. O A77% 0.35 Mn 0.035 0.04 Heat No. C.E. C P S 0.47% 0.35 Mn 0.035 0.04 Max Max 0.60-1.25 Max. Max. H 6342 0.40 0.22 0.93 0.032 0.022 H 6343 0.40 0.22 0.93 0.031 0.021	Description City (PCS) Heat No. Supe Code V3(PS) bin 34,000 Y3(PS) Win 70,000 4 1600 WINRF XH FLGS 134 H 6336 20 V 49006 V 78614 4 1500 WINRF XH FLGS 134 H 6342 20 43755 78585 4 1500 WINRF XH FLGS 1081 H 6343 20 49907 78793 4 1500 WINRF XH FLGS 1081 H 6343 20 49987 78793 Healt No. C.E. C P S SI Healt No. C.E. C P S SI Max Max 0.60-1.25 Max. Max. Max. H 6336 0.38 0.20 0.089 0.029 0.024 H 6343 0.40 0.22 0.93 0.031 0.021 0.23	Description City (PCS) Heat No. Supp. Code V3(P30) bits 30,000 V3(P30) V3(P30) V3(P30) V3(P30) V3(P30) V3(P30) 4 1600r White XH PLGS 134 H 63386 20 V 40000/c V 78614 33.40 4 1500r White XH PLGS 1460 H 6342 20 43755 78565 33.70 4 1500r White XH FLGS 1081 H 6343 20 49987 79793 33.70 C H E M 1 C A L R ÉQ U I R E E S P E C I F I E D E L É M E N T S UN S P E Heat No. C C.E. 0.47% 0.35 Mn 0.035 0.04 10 -0.35 0.40 H 6343 0.40 0.22 0.93 0.032 0.022 0.24 0.130 H 6343 0.40 0.22 0.93 0.031 0.021 0.23 0.078	Description Cry (PCS) Heat No. Supp. Code Y.3(HSI) Man. 38,000 Y.3(HSI) Man. 38,000 Exk. Man. 70,000 KAX. Man. Man. 38,000 4 1600r WNRPF XH PLGS 134 H 6336 20 Y 4900K Y 8614 33.40 66.94 4 1500r WNRPF XH PLGS 1460 H 6342 20 48755 78565 33.70 69.37 4 1500r WNRF XH FLGS 1081 H 6343 20 49867 79793 33.70 67.09 C H E M I C A L R ÉQ U I R E M E N T UN S PECIFIED ELEMENTS Heat No. C.E. 0.47% 0.35 Mn 0.035 0.04 10 -0.35 0.40 0.40 H 6336 0.36 0.22 0.93 0.032 0.022 0.24 0.130 0.046 H 6342 0.40 0.22 0.93 0.031 0.021 0.23 0.078 0.030	Description Ory (PCS) Heat No. Supp. Code Y3(PSI) Min 39,000 Y3(PSI) Y3(PSI) Y3(PSI) Exit Min 39,000 RAX: Min 30% Heat Treatment 4 1608 WNRF XH FLGS 134 H 6336 20 Y 4900F Y 78514 33.40 66.94 AS PORGED 4 1508 WNRF XH FLGS 1460 H 6342 20 48755 78565 33.70 69.37 AS PORGED 4 1508 WNRF XH FLGS 1081 H 6343 20 49967 78793 33.70 67.09 AS PORGED A 1508 WNRF XH FLGS 1081 H 6343 20 49967 78793 33.70 67.09 AS PORGED A 1508 WNRF XH FLGS 1081 H 6343 20 49967 78793 33.70 67.09 AS PORGED A 1608 WNRF XH FLGS 1081 H 6343 20 49967 78793 33.70 67.09 AS PORGED Heat No. C.E. C P S Si Cu Ni Cr Heat No. C.E. C P<	Description Ory (PCS) Heat No. Support Code V31F30 bits PKS Nan RAS Nan Heat Treatment Stable Time (Min.) 1 1608 WNRF XH FLGS 134 H 6536 20 V 4900E V 78514 33.40 66.94 AS PORGED 1 1508 WNRF XH FLGS 134 H 6536 20 V 4900E V 78514 33.40 66.94 AS PORGED 4 1508 WNRF XH FLGS 1081 H 6342 20 48755 78565 33.70 69.37 AS PORGED 4 1508 WNRF XH FLGS 1081 H 6343 20 49987 79793 33.70 67.09 AS PORGED 4 1508 WNRF XH FLGS 1081 H 6343 20 49987 79793 33.70 67.09 AS PORGED C H E M I C A L R EQ UI R E M E N T S UN S PECIFIED ELEMENTS UN S PECIFIED ELEMENTS Max Heat No. C.E. 0.47% Max 0.60-1.25 Max Max Max Max Max Heat No. 0.38 <



All Products were manufactured, Sampied, Testad and Impected Solely by the manufacturer shown on

For R.N. GUPTA & COMPANY LTD. Page No : 1

METALLURGIST

i

this Test Report in accurdance with indicated specification and were found to meet the requirements.

No Weld Repair was performed and all products are free of Weld Repair. All Products are free of Mercury Contamination and Radioactivity. Note: We have y configuration outply with the requirements of Annex Lescion. 43 of PED 2014/06/EU and X1: certified by Mit DNV BUSHESS ASSURANCE vide Centificate No.4437-2014-CE-IND-DNV GL valid upto 31-60-2028, IAD 3001-2015 Certificate N.L is 35752-2008-ACMU-RvA Veide upto 2007/2020. Products and conform to requirements of ASTM A1051ACME XA105



Heat Code: C1000AF

Forged Vessel Connections An AFGlobal Company 13770 Industrial Rd. Houston, TX 77015 Sales: (713) 393-4200

ISO 9001:2015 Certified Eaton Metal Produc 00011756 PO: 0045008 Sales Order: 169271 Line: 5 Item Code: LWN030150090A001A1 4800 York Street Qty Shipped: 5 Item Desc: LWN RF 3"150X9" SA105 Denver, CO 80216 Mill Heat: A141747 Spec: ASTM A105/A105M-(18) /ASME SA 105/SA 105M-(17) Section II Part A Element (%wt) Ladle Product EPCRA CAS# Element Ladle Product EPCRA CAS# (%wt) С Carbon 0.18 Cr Chromium 0.10 10 7440-47-3 0.02 Manganese 1.10 Molybdenum Mn 20 7439-96-5 Мо 0.022 v Vanadium Mn:C 6.1 Ρ Phosphorous 0.007 Cb Columbium 0.000 Sulphur •0.005 s C.E. 0.40 Silicon 0.24 si CuNiCrMoV 0.352 Copper 0.16 7440-50-8 CrMo 0,120 Cu Ni Nickel 0.05 læ 7440-02-0 5361 MK# 14-5 Mechanical Testing Other EF Test Lab AFG Y нвж 156 - 156Elg (%) 33 65 RA (%) Tensiie Specimen Size (in) .492 Tensile (ksi) 77.4 Yield (ksi) 48.6 2 Gauge Length (in)

The recording of faise, fictitious, or fraudulent atelement or entries on this document may be punishable as a telony under federal statute.

EPCRA Supplier Notification: This product may contain one or more taxic chemicals subject to the reporting requirements of Saction 313 of the Emergency Plenning and Community Right-to-Know Act (Tille III of tha Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Port 372. Potentially reportabla chemicals are indicated with a cheokmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of this chemical present in this product. It is your responsibility alone to determine whether your (acility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

 Certification No.:
 1347385

 Certification Date:
 10/17/2018

 Issued By:
 John Sauceda

 This report is issued in compliance with the regularements of EN10204 3.1/ISO 10474 3.1.5

Material Test Report Heat Code: C1000AF

Forged Vessel Connections An AFGlobal Company 13770 Industrial Rd. Houston, TX 77015

ISO 9001:2015 Certified Sales: (713) 393-4200 00011756 PO: 0045008 Sales Order: 169271 Line: 5 Eaton Metal Produc Item Code: LWN030150090A001A1 4800 York Street Qty Shipped: 5 Item Desc: LWN RF 3"150X9" SA105 Denver, CO 80216 Mill Heat: A141747 Spec: ASTM A105/A105M-(18)/ASME SA 105/SA 105M-(17) Section II Part A MARK # 18-5 Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3). * No Weld repair performed. * Ladle Chemical Analysis results are reported from the raw material suppliers MTR. * Tensile taken from a round specimen. Measurement of elongation after fracture. * Yield strength was determined using the .2% offset method, unless otherwise specified. * All material supplied under this order is certified to be free of mercury contamination and no mercurv bearing equipment was used in manufacturing, fabrication or testing. * When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23 * AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2015 Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015. * FVC FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5 SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN.

The recording of false, fictitious, or fraudulont statement or entries on this document may be punishable as a fetony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title II) of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmerk in the "EPCRA" column and a Chemical Abstract Sarvices (CAS) registry number is provided for each such chemical in addition to the parcent by weight of the chemical present in this product. It is your responsibility elone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1347385 Certification Date: 10/17/2018 Issued By: John Sauceda This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Rina Sane - Metallurgical Lab Manager Paga 2 of 2

53617 MINTHIH-7,1H-6 Reviewed to 2017 ASME Section I

CUSTOMER :

SĕAH css

INSPECTION-CERTIFICATE

SUPPLIER :	POSCO Pro	ocessin	g & Serv	vice Co.	Ltd		-	Se	AH Cha	ngwa	on Int	egrat	ed Spe	ecial St	eel	CERT. NO.	:	150430-3043
PURCHASE ORDE	FRINO. :	5349)				_	147 J	eokhycan-ro, S	Seongsan,	Changwo	an, Gyeong	mam, Kore	=0		MANUFACTURE I	10.:	KP0UU558A5450
REF.CD:5349																		
STEEL GRA	DE: TP:	304/304	L					SPECIFIC	ATION	: ,	ASTN AS	312				MELTING PROC	ESS :	E.A.F.
SIZE	IN OD	4 NPS	X WT SCH	180S X	18 - 20	FT		EDITION/	ADDENDA		11 ED11	TION /	NO ADDE	NDA				V.O.D.
ARTICLE	: VSE	AMLESS	AUSTENT	TIC STA	INLESS S	TEEL PI	PES	STATE OF	DELIVERY		SOLUTIO	ON TREA	TMENT					STRAND CASTING
	1 +					1					HOT FIN	NISHED,	FLAIN	END				
Heat No		1	1		1	1-1	Chemical	Compost t	on(wt.%)									In the local Test
neat no.	I C	VSI	V MIN	9 V	VS	VNI	VCR										0~1601211	to Inclusion lest
SDPC MIN	1.	-				8.000	18.000]		
I MAX	035	1.000	2.000	.0450	.0300	11.000	20.000	l i										
- N08288 L	.013	.270	1.712	.0330	.0067	8.207	18.245		Ţ									
N08288 P	.014	.264	1.745	.0329	.0073	8.298	18.219								1			
Test No.	L	Tensi	le Proper	ties		Hardnes	98	Impact	Test	Decarb	urized	Grain				Additional	Tests	
(Lot No.)	Y.:	S. (KSI)		T.S.	EL.	Body				Depth	(mm)	Size	Flatte	ening te	st: GOOD	}		
	0.2%			(KSI)	(%)	HRb				TOTAL	FERR.	No.	Hydros	static t	est: GOC	0 (2300PSI)		ODUCS
Spec, MIN	1. 30.0			75.0	35.0													Let a
MA:	<. \	-	V			90												SPD S
5001-1	36.0		V	35.0	55.0	78		1										AN AN AN
5001-2	36.0			85.0	54.0	78	1			}	1							Z QUALITY Z
ł				l l							1							the st
ł	1		1								}	1						
				;						L								
Lot No.	Bund H	e No.	Length	h (ft)	Number	То	tal	Weight	Case					An	ditional	Tests / Rem	arks	
590462500	1 500400	150011	10		or or.	Lengi	(h (F)	Kg	NO.	Co	rrosior	1 Test:	GOOD					
JF 0402300	0 000402	250011	18	- 20	5	1	98.5	686	F40359	1								1 10TH 10TO 00/
ł						1	i				RITEY	IU ASIN	A312-9	S/ASME	SA312-90	ED. LODADD. TH	304130	H., ADIM A3/0-96/
1									1	AS	ME SA3	/6-98ED	. (00ADU	.)17304	. UNS So	0400/530403		
(1		}				1			HE	AL TRE	AIMENT	1050	C FUH 5	NIN, WAI	EH QUENCHEU)		T- 100 TD WIL D 04001/
ſ	[1			HA	HONESS	ACCORD	ING TC	NACE MR	-0175(02	(EU.), COHRO	SION IE	SI: ACC. 10 MIL-P-246917
1					1	}				IN	SPECT	ON CENT	IF ICATE	DIN 50	049 3.1/	EN 10204 3.1.	150 10	4/4 3.1B
			ļ		ļ					{ EN	10204	Туре З	1.1 / 140	DREPATH	WELDING	3. FHEE FROM	MERCURY	CONTAMINATION.
1						l.												
				-	-	. 1												
Our qualit	V SVSten is	s certif	ied in a	IAL COLDOC	l j			68	0									
150 9001:	2008 by DN	V.		con catto	- a tti											.]	K	1-0
						M - 4		1 dec - 61- 1		2 - 1 - 1							,	
}						tes	ted and r	uny, thai complies w	i ine mater With the te	(a) Des rais of	the ord	adove ha	act			Testo bat	DATE	: WAY. 01, 2015

48,Site 1V Tel: 91-120-	NORMA (I industrial Area, Sal 2896091, 2895404 Fax:	NDIA) hibabad, Ghaz 91-120-289593	LIMITI ziabad-201010 0 E-mail: normai	ED (U.P) INDIA india@gmail.com		Wo	rks Test (Certificate			
NORMA/LAB	NO-6539/14-15		INVO	DICE NO. E-400			DATE:-13-1	0-14			
P. Order. No; 503/005034			Customer:-	. 7 .		Forgi	ng specification	ASME SA105 -09			
Drouging No.	20"-150# WNRF XH	FLG.					1	ASTM A105 -12			
Machining	ANSI B16 5- 2009		Quantitu		Nad	Ste	el Supplier	Adhunik Metaliks Ltd.			
STD	ASME B16.5- 2009		Quantity:-	09.	NOS.		III Lieot No	1441145			
	TEST RESU	LTS		<u> </u>			JORMA HEA	T NO.1231			
	CHEMICAL COM	POSTION		MECHANICAL DRODEDTIES							
				MILCHANIC							
Elements %	Composition	AC	tual	PROPERTIES	SPECIFIED	OBTAINED	Specified carb 0.25n	on as per Purchase Order nax.			
Carbon	0.35max.	0.20	0.20	Yield Strength	250.00	321.65	Second from	a not MSS SD 6 With in limit			
Manganese	0.60-1.05	1.11	1.10	V (mpa)	min.		of 125-250A A	RH			
Silicon	0.10-0.35	0.18	0.20	-							
Sulphur	0.040max.	V 0.012	0.015	Tensile Strength	485.00	521.86					
Phosphorous	0.035max	0016	0.015	(mpa)	min	5200	CARBON EQ	CARBON EQUIVALENT (CE)			
Chromium	0.30max	10012	0.013	9/Elenentian in	22.00	21.76	$\frac{1}{6} = \frac{1}{5} + \frac{1}$				
	0.50,110,1	0.012	0.014	50mm / 4D	min	31.70	Ŭ	2			
Nickel	0.40max.	0.009	0.007	Hardness	187.	149-163	MARKING AS PER MSS-SP-25-2008 207-150 XH SA/A 105 1231 B16.5 NORMA INDIA.				
Copper	0.40max.	0.012	0.009	HB.	max.						
Molybdenum	0.12max.	0.004	0.001	% Reduction of	30.00	61.01					
ļ ļ		<u> </u>		Area	min.						
Vanadium	0.080max.	∖ 0.004	0.002	Remarks:- We here	e by certify th	at the materia	Checked by:				
Carbon	0.47max.	0.390	0.387	with the applicable	specifications	referred abov		Metallurgist			
Equivalent (CE				and meets the requir	rements as per l	EN10204/3.18	Certified by:				
				"At DET ASTM A	MRU175-2003.	Notes-For eac		Quality Control Manage			
				reduction of 0.01%	below the sp	pecified carbo	n	_			
				maximum(0.35%).a	a increase	of 0.06%	4	PRODUCE			
				(1.05%)will be perm	nitted up to man	kimum 1.35%		SPD S			
				&NACE Standard N	RO175/1SO1	156 Standard		E OFU E			


CERTIFICATE OF INSPECTION & TEST (EN 10204 3.1)



ST&H CORPORATION

74, Jwadongsunhwan-ro, Haeundae-gu, Busan, Korea Tel: +82.51.744-4680(5 line) Fax: +82.51.744-4670 E-mail :gm@stnhcorp.com



CE

R25 0 60306 / 0

Ave.(J) 127

127

Certificate No. MJH0003A-19/25 Date : AUG. 21. 2018 Customer Certified to ISO9001/ ISO14001:2015,PED2014/68/EC by LRQA Contract No. 202261-00-1ST Spec. For Material ASTM A105N-14, ASME SA105N-17, NACE MR0175/ISO 15156-2:2015, NACE MR0103/ISO 17495-1:2016 Heat Treatment 930°C NORMALIZED & A.C Dimensional inspectionASME B16.5 - 2017 Tension Test **Charpy Impact Test** Size of Test Hardness (10X10mm Specimen Size) Specimen Test V.S. T.S EL R.A Heat No./ (HB) Indiv. Notch Temp. Ave. ITEM / SIZE Q'ty GL MPa MPa Ð 94 % Batch No. 187 271 211 V -29℃

				1	111111	INIGY								213	-
				12.5	50.0	Min	250	485	22.0	30.0			Te	st Result	(J)
BA1508R16	150LBS BL RF 16"	60	805820D	12.5	50.0		323	518	33	75	152	156	143	120	118
- BA150BR20	150LBS BL RF 20"	- 60	805820E	12.5	50.0		323	518	33	75	152	156	143	120	118
	BLANK		BLANK					BL/	ANK .		BLA	N K			

Heat No./ Batch No. V c V Si V Mn V P V S NNi V C V Mo V C V Mo V C V Mo V C V V Other Componential Componenticonte Componential C			1		1			CA	emical	Compos	sition (%)						NDE	
Batch No. Max Min 0.350 0.100 0.350 0.600 1.050 0.600 0.035 0.040 0.400 0.300 0.120 0.400 0.080 0.080 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.000 0.012 0.035 0.040 0.300 0.120 0.400 0.080 0		Vc	V Sî	Mn	V P	V S	Ni	Cr	V Mo	V Cu	VV				CE			
Min 0.100 0.600 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 05820D P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 0.353 H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.353 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.353 05820E P 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 0.001 0.353	Max	0.350	0.350	1.050	0.035	0.040	0.400	0.300	0.120	0.400	0.080					UT	MT	PT
H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 05820D P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 0.353 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.353 05820E P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 0.363 05820E P 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 0.001 0.353	Min		0.100	0.600														L
D5820D P 0.175 0.250 1.030 0.014 0.004 0.019 0.003 0.023 0.001 0.353 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 D5820E P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 0.363	н	0.184	0.258	1.040	0.012	0.005	0.007	0.016	0.002	0.023	0.001				0.363			
H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 05820E P 0.175 0.250 1.030 0.014 0.004 0.019 0.003 0.023 0.001 0.353	P	0.175	0.250	1.030	0.014	0.004	0.007	0.019	0.003	0.023	0.001				0.353			
05820E P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 0.353	н	0.184	0.258	1.040	0.012	0.005	0.007	0.016	0.002	0.023	0.001				0,363			
	P	0.175	0.250	1.030	0.014	0.004	0.007	0.019	0.003	0.023	0.001				0.353			
		Max Min H P H P	Max 0.350 Min 0.184 P 0.175 H 0.184 P 0.175	V c V si 0.350 0.350 Min 0.100 H 0.184 0.258 P 0.175 0.250 H 0.184 0.258 P 0.175 0.250 H 0.184 0.258 P 0.175 0.250	V c V si V mn Max 0.350 0.350 1.050 Min 0.100 0.600 0.600 H 0.184 0.258 1.040 P 0.175 0.250 1.030 H 0.184 0.258 1.040 P 0.175 0.250 1.030 H 0.184 0.258 1.040 P 0.175 0.250 1.030	Max c V Si Mn P Max 0.350 0.350 1.050 0.035 Min 0.100 0.600 0.012 H 0.184 0.258 1.040 0.012 P 0.175 0.250 1.030 0.014 H 0.184 0.258 1.040 0.012 P 0.175 0.250 1.030 0.014 H 0.184 0.258 1.040 0.012 P 0.175 0.250 1.030 0.014	Max C V Si Mn P S Max 0.350 0.350 1.050 0.035 0.040 Min 0.100 0.600 0.012 0.005 H 0.184 0.258 1.040 0.012 0.005 P 0.175 0.250 1.030 0.014 0.004 H 0.184 0.258 1.040 0.012 0.005 P 0.175 0.250 1.030 0.014 0.004 H 0.184 0.258 1.040 0.012 0.005 P 0.175 0.250 1.030 0.014 0.004	Max c V Si Mn P S Ni Max 0.350 0.350 1.050 0.035 0.040 0.400 Min 0.184 0.258 1.040 0.012 0.005 0.007 P 0.175 0.250 1.030 0.014 0.004 0.007 H 0.184 0.258 1.040 0.012 0.005 0.007 P 0.175 0.250 1.030 0.014 0.004 0.007 P 0.175 0.250 1.030 0.014 0.004 0.007	Max C V Si Mn P V S Ni Cr Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 Min 0.100 0.600 0.012 0.005 0.007 0.016 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019	Max C Si Mn P S Ni Cr Mo Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 Min 0.100 0.600 0.012 0.005 0.007 0.016 0.002 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003	Max C Si Mn P S Ni Cr Mo V cu Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 Min 0.100 0.600 0.012 0.005 0.007 0.016 0.002 0.023 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 P 0.175 0.250 1.030 0.014 0.004 0.007 0.016 0.002 0.023 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 P 0.175 0.250 1.030 0.014 <	Max C Si Mn P S Ni Cr Mo V V Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.000 Min 0.100 0.600 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003	Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.002 Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.001 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 </td <td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.880 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007<td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023<td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE CE</td><td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 UT Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 0.363 0.363 0.363 0.363 0.011 0.363 0.363 0.363 0.011 0.363 0.363 0.023 0.001 0.363 0.353 0.363 0.353 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.023 0.001 0.353 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353</td><td>Max 0.350 0.350 1.050 0.012 0.040 0.300 0.120 0.400 0.080 0.011 0.363 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.019 0.003 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.353 0.363 UT 0.363 U</td></td></td>	Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.880 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 <td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023<td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE CE</td><td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 UT Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 0.363 0.363 0.363 0.363 0.011 0.363 0.363 0.363 0.011 0.363 0.363 0.023 0.001 0.363 0.353 0.363 0.353 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.023 0.001 0.353 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353</td><td>Max 0.350 0.350 1.050 0.012 0.040 0.300 0.120 0.400 0.080 0.011 0.363 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.019 0.003 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.353 0.363 UT 0.363 U</td></td>	Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 P 0.175 0.250 1.030 0.014 0.004 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.019 0.003 0.023 0.001 H 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 H 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 0.001 P 0.175 0.250 1.030 0.014 0.007 0.019 0.003 0.023 <td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE CE</td> <td>Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 UT Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 0.363 0.363 0.363 0.363 0.011 0.363 0.363 0.363 0.011 0.363 0.363 0.023 0.001 0.363 0.353 0.363 0.353 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.023 0.001 0.353 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353</td> <td>Max 0.350 0.350 1.050 0.012 0.040 0.300 0.120 0.400 0.080 0.011 0.363 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.019 0.003 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.353 0.363 UT 0.363 U</td>	Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 CE CE	Max 0.350 0.350 1.050 0.035 0.040 0.400 0.300 0.120 0.400 0.080 UT Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 0.363 0.363 0.363 0.363 0.011 0.363 0.363 0.363 0.011 0.363 0.363 0.023 0.001 0.363 0.353 0.363 0.353 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.353 0.011 0.363 0.023 0.001 0.353 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.363 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353 0.353	Max 0.350 0.350 1.050 0.012 0.040 0.300 0.120 0.400 0.080 0.011 0.363 Min 0.184 0.258 1.040 0.012 0.005 0.007 0.016 0.002 0.023 0.001 0.363 0.353 0.014 0.004 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.019 0.003 0.023 0.001 0.363 UT MT H 0.184 0.258 1.040 0.012 0.007 0.016 0.002 0.023 0.001 0.353 0.363 UT 0.363 U

REMARK * H : Heat Analysis P : Product Analysis

* Impact Test performed according to ASTM A370 & MESC 76/210/2017 Paragraph 8.5 / Table 4 & 5.

* C:Mn ≃ 1≤5

* Mn is Permitted up to Max 1.65% (A5TM A105-14 TABLE 1, NOTE 1.)

The second s

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Witnessed by / H. J. LEE



Manager of Q.A Dept. / JAY KIM ST&H CORPORATION

ST-801-14-02



NUCOR CORPORATION NUCOR STEEL UTAH

Mill Certification 10/11/2016

MTR #: U1-357740 PO Box 100 7285 West 21200 North PLYMOUTH, UT 84330 (435) 458-2300 Fax: (435) 458-2309

Sold To: INTSEL STEEL WEST LLC PO BOX 21119 HOUSTON, TX 77226-1119 Ship To: INTSEL STEEL WEST 1887 SOUTH 700 WEST SALT LAKE CITY, UT 84104 (801) 433-2210 Fax: (801) 972-6145

Customer P.O.	SLC-12130	Sales Order	268246.4
Product Group	Merchant Bar Quality	Part Number	3000075024004W0
Grade	A36/A529GR50/CSA44W/50W	Lot #	PL1610567651
Size	3/4* (.7500) Round	Heat #	PL16105676
Product	3/4* (.7500) Round 20'A36/A529-50/44W/50W	B.L. Number	U1-548929
Description	A36/A529-50/44W/50W	Load Number	U1-357740
Customer Spec		Customer Part #	

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

Roll Date: 8/13/2016 Melt Date: 8/10/2016 Qty Shipped LBS: 11,895 Qty Shipped Pcs: 396

ASTM A36/A36M-12, A709/709M-13 GR36, ASME SA36-10 Ed '11 Ad.

ASME SASE ASTM A709 C 0.19%	Mn 0.72%	0.010%	S 0.045%	Si 0.24%	Cu 0.23%	Nì 0.09%	Cr 0.13%	М о 0.018%	V 0.0016%	Cb 0.000%	
Yield 1: 51,4 Yield 2: 50,7 Weight Varia	198psi 764psi ation 000.0%			Tensile Tensile	1: 73,816psi 2: 73,645psi		_	Eld	ongation: 28%	in 8"(% in 203.3mm) in 8"(% in 203.3mm)	

Specification Comments: MEETS THE REQUIREMENTS OF: ASTM A36/A36M-12, A529/A529-05 GR50, CSA G40.21-04 GR44W(300W)&GR50W(350W) AASHTO M270/M270M-12 GR36(270), ASME SA36/SA36M-07

Comments: NUCOR - PLYMOUTH IS AN I.S.O. 9001 AND AN A.B.S. CERTIFIED MILL CMTR COMPLIES WITH DIN EN 10204 - 3.1

1. ALL MANUFACTURING PROCESSES OF THE STEEL MATERIALS IN THIS PRODUCT, INCLUDING MELTING, CASTING, AND HOT ROLLING HAVE OCCURRED WITHIN THE UNITED STATES. ALL PRODUCTS PRODUCED ARE WELD FREE. MERCURY, IN ANY FORM, HAS NOT BEEN USED IN THE PRODUCTION OR TESTING OF THIS MATERIAL. 2. PROPOSITION 65 WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND/OR BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM. FOR MORE INFORMATION, PLEASE CALL 1-435-458-2300.

Reviewed to 2017 ASME Section II

5361-1 MK# 1C-8, 1J-8



hype high

Ryan Pennington Division Metallurgist

Page 4 of 9

N8MG-10 January 1, 2012

	2														
	m	At in													
	-11	4413	5-13												
D		1 1	~	- 0		· · ·	1	-11	-						
N.	ev.ewr	q 70	501	7 A.	SUNC	75	ct. c	in 1	1				_		
ONITED STA	TES STREI.	CORPORAT	TON	77	TRUT.AR	PROD	UCTS					TIM	51 6 2 -	04:05:47	
(USS)				CERT	TIFIED	TEST	RBPO	RT			SERI	AL NO	D: 3	L0054107	
MILL OF DEBUTEN NO		SHIPDEDENO	(IN ACC	ORDANCE	WITH ISC	D 10474/E	EN10204	DIN50049	"type 3.1"	<u>)</u>					
DR00652 08	at	03446	:	1091570	1-CA			GONK3	10910	1					
	SOLD TO ADDRESS		1			MAIL TO A	DORESS			TINT	רקיידי	STAT	ENDOR	TERL CORE	>
										LOI	RAIN	TUBU	LAR	OPERATION	IS
			:							219	99 EA	ST 2	BTH	ST.	
			{							LOI	RAIN,	он	4405	5	
Transa anna					SPECIFICA	TION AND	GRADE								
A53-#12 GRADE	LS STD PIP	E API 51	-*45TH	EDITI(DN DAT	ED 12	71/12 PANCE	PSL-2	GRADI	6 B A AN 12013 1	U GRA	ON G	4∠ R RADE	BASME	AD IN
SA106-+2013 ED	ITION GRAI	E B/C BL	K REG I	MILL CO	DAT PE	BEV	30 DE	G MEET	ING A	L THE	APPI	LICAB	LE R	EQUIREME	TS
OF NACE STANDA	RD MR-01-7	5 *:ISO	15156-	2 2009	ED AN	D MR-	0103-	2012 E	D						
,							•								
MATERIAL COND: AS ROLL	ED				0.0.:	.000 (508.0			th (mmo) M	VALL: O. 5	500 (12.7	100)	in (mm)
MATERIAL COND: AS ROLL	ED TENSILL		 T	YIEL	0.0.: 20	.000 (508.0	000)	YiT	tn (mro) W ELON	VALL: 0.5	500 (HAR	12.7 DNESS	OO)	in (mm) DWELL(SEC
MATERIAL CONO: A.S ROILL PRODUCT IDENTIFICATION	ED TBNSILLE TEST TYPE/ ORIENTATION	TEST	GAUGE	YIEL	0.D.: 20 PSI	.000 (EXT%	508.0 Te	000) NSILE 2SI	Y/T MAY-	ELONI (IN 2 H	VALL: 0.5 G%)	500 (HAR SCALE:	12.7 DNESS	00) Min Hydro PSI 1900	in (mm)
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION	ED TRNSILL TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIEL MIN: MAX:	0.D.: 20 PSI 42100 71800	.000 (EXT %	508.0 TE MIN: MAX	900) NSILE 951 95000	۲/T MAX: 0.33	(IN 2 II (IN 2 II (IN 2 II NUN:	VALL: 0.5 G%) 29.0	500 (HAR SCALE: NIN: MAX:	12.7 DNESS	200) Min Hydro PSI 1900	In (mm) DWELL(SEC
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA	ED TENSILE TESTYPE ORENTATION STRIP/L/F	TEST COND. A.R	GAUGE WEDTH IN 1.500	YIEL NIN: MAX	0.D.: 20 PSI 42100 71800 50500	.000 (EXT % .50	508.0 TEI MIN: MAN	000) NSILE PSI 70000 95000 78500	V/T MAX: 0.33 0.65	In (mm) V ELON (IN 2 P NIN:	VALL: 0, 5 6%) 29.0 39.7	500 (HAR SCALE: NUN: MAX:	12.7 DNESS	200) MIN HYDRO PSI 1900 1900	In (mm)
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 P157AA X83582 E795AA	ED TENSILE TESTYPE ORENTATION STRIP/L/I STRIP/L/I	TEST COND. AR AR	GAUGE WIDTH IN 1.500 1.500	YIEL MIN: MAX:	0.D.: 20 PSI 42100 71800 50500 49700	.000 (EXT % .50 .50	508.0 TEI MAN: MAX	000) NSLE 2SI 70000 95000 78500 73000	¥/Т МлХ: 0.33 0.63	In (mvo) V ELONI (IN 2 II NIN:	VALL: 0.5 0%) 29.0 39.7 45.5	500 (HAR SCALE: MIN: MAX:	12.7 DNESS	200) MIN HYDRO PSI 1900 1900 1900	In Drami D DWELL(SEC 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA	ED TENSILE TESTIVPE ORENTATION STRIP/L/H STRIP/L/H	TEST COND. AR AR **	GAUGE WIDTH IN 1.500 1.500 END C	YIEL MIN: MAX- F DATA	0.D.: 20 PSI 42100 71800 50500 49700 THIS	.000 (ET % .50 .50 .50 .50	508.0 TEI 1914 MAX	000) NSLE 2SI 70000 95000 78500 73000	WT 0.33 0.65 0.63	In (avo) V ELONI (IN 2 H NEN:	vall: 0.5 6%) 29.0 39.7 45.5	500 (HAR SCALE: MUN: MAX:	12.7 DNESS	00) MIN HYDRO PSI 1900 1900 1900	In Ommi D DWELL(SEC 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA	ED TENSILI TEST TYPE ORIENTATION STRIP/L/F STRIP/L/F	TEST COND. AR AR AR	GAUGE WIDTH IN 1.500 1.500 END Q	YIEL MIN: MAX F DATA	0.D.: 20 PSI 42100 71800 50500 49700 THIS	.000 (ET% .50 .50 SHRET	508.0 TEI INN: MAX	000) NSILE 2SI 70000 95000 78500 73000	уіт млх; 0.33 0.65 0.68	ts (men) V ELON (TN 2 ^m MiN:	vall: 0.5 6%) 29.0 39.7 45.5	500 (HAR SCALE: MIN: MAX:	12.7 DNESS	00) MIN HYDR PSI 1900 1900 1900	in (mm)
MATERIAL CONO: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA	ED TENSILE TEST TYPE ORIENTATION STRIP/L/I STRIP/L/I	TEST COMD. AR AR AR	GAUGE WDTH IN 1.500 1.500 END O	YIEL MIN: MAX: F DATA	0.D.: 20 PSI 42100 71800 50500 49700 THIS	.000 (50%) .50 .50 .50	508.0	000) NSILE 2SI 70000 95000 78500 73000	viт мох: 0.33 0.63 0.63	In (meo) V ELONI (IN 2 ^m Nih:	vall: 0.5 0%) 29.0 39.7 45.5	500 (HAR SCALE: MIN: MAX:	12.7 DNESS	00) MIN HYDRG PSI 1900 1900 1900	In Drimi D DWELL(SEC 5 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 P157AA X83582 E795AA	ED TENSILE TESTYPE ORENIATION STRIP/L/F STRIP/L/F	TEST COND. A.R A.R **	GAUGE WIDTH IN 1.500 1.500 END O END O	YIEL MIN: MAX F DATA	0.D.: 200 PSI 42100 71800 50500 49700 THIS	.000 (EXT % .50 .50 .50 .50	508.0 TEI I MAX	AR - AS ROLL	V/T M/XX: 0.33 0.65 0.68	DI (INIC) V ELONI (IN 2 11 NIN: NIN: 8 -	vall: 0.5 9%) 29.0 39.7 45.5 Bddy	500 { HAR SCALE: MUN: MAX:	12.7 DNESS	00) MIN HYDRO PSI 1900 1900 1900 1900 W-WELD	In Drimmi D DWELL(SEC 5 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE	ED TENSILE TESTIPE ORENTATION STRIP/L/E STRIP/L/E	TEST COND. A.R A.R ** T-TRANSVE NM-NORMAL	GAUGE WIDTH IN 1.500 I.500 END C END C RSE ZED	F DATA	D.D.: 20 PSI 42100 71800 50500 49700 THIS	. 000 (EXT % . 50 . 50 . 50 . 50 . 50 . 50 . 50 . 50	508.0	AR - AS ROLL TR - THERMO	чт млс: 0.33 0.63 0.63 0.63 меснал:с	Dr (mvo) V ELONI (IN 2 79 MIN: MIN: G. AL ROLLED B	vall: 0.5 8%) 29.0 39.7 45.5 BdDy	500 (HAR SCALE: MIN: MAX: MAX:	12.7 DNESS	00) MIN HYDRO PSI 1900 1900 1900 W-WELD	In Ommi D DWELL(SEC 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION	ED TENSILI TEST TYPE ORIENTATION STRIP/L/F STRIP/L/F	TEST COND. AR AR ** T - TRANSVE MM - NORMALL I CM	GAUGE WIDTH IN 1.500 I.500 END O END O	F DATA QT-Q SR-ST S S	D.D.: 20 PSI 42100 71800 50500 49700 THIS UENCH & THIS	.000 (EXT % .50 .50 SHRET SHRET NPERED VED NI	508.0 TE SMIN: MAX	000) NSILE 2SI 70000 95000 78500 78500 73000 AR - AS ROLL TR - THERMO O AL	WT MAX: 0.33 0.65 0.68	b (mec) V ELONI (IN 2 ^m MiN: MIN: 3 - AL ROLLED	VALL: 0.5 8%) 29.0 39.7 45.5 BODY	500 (HAR SCALE: MIN: MAX: MAX:	12.7 DNESS	00) MIN HYDR PSI 1900 1900 1900 W-WELD	In Ommi D DWELL(SEC 5 5 5 5 5
MATERIAL CONO: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT DENTIFICATION	ED TENSILI TEST TYPE ORIENTATION STRIP/L/I STRIP/L/I TUDINAL T	T - TRANSVE NM - NORMALL C M	GAUGE WDTH IN 1.500 I.500 END O END O	YIEL MIN: MAX: F DATA GT-OU SR-ST S V SI	0.D.: 20 PSI 42100 71800 50500 49700 THIS	. 000 (EXT % . 50 . 50 . 50 . 50 . 50 . 50 . 50 . 50	508.0 TEI SMIN: MAX	000) NSILE 2SI 70000 95000 78500 78500 73000 AR - AS ROLL TR - THERMO 0 AL 0 AL	V/T M/X; 0.33 0.65 0.63	In (mon) V ELONI (IN 2 ^m MIN: B AL ROLLED B	vall: 0.5 8%) 29.0 39.7 45.5 Bdby	500 (HAR SCALE: MIN: MAX: CB	12.7 DNESS	00) MIN HYDR PSI 1900 1900 1900 W-WELD	In Ommi
MATERIAL CONO: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION MA6721 F157AA	ED TENSILE TEST TYPE ORIENTATION STRIP/L/I STRIP/L/I STRIP/L/I ITUDINAL T TYPE REAT PROD	T-TRANSVE NM-NORMALL C M 1-120 100	GAUGE WDTH IN 1.500 I.500 END O END O RSE ZED N P O 4 010 04 010	YIEL MIN: MAX: F DATA GT-QC SR-ST S BI 003:23 002:24	0.D.: 20 PSI 42100 71800 50500 49700 THIS VENCH & TEH RESS RELE CU 116 15	.000 (EXT % 50 50 3HRET WPERED VED NI	508.0 TEI MIN: MAX **	AR-AS ROLL TR-THERMO 0 AL 2 025 3 025	V/T MAXX: 0.33 0.65 0.68	b (me) V ELONI (N 2 ** MIN: AL ROLLED B 3 0003	VALL: 0.5 6%) 29.0 39.7 45.5 BODY 7 1 .002 :001	500 (HAR SCALE: MM: MAX: MAX: CB CB	12.7 DNESS	W-WELD	In (hmr) D DWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5
MATERIAL CONO: AS ROLL PRODUCT IDENTIFICATION MA6721 P157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION MA6721 F157AA MA6721 F157AA	ED TENSILE TESTYPE ORENTATION STRIP/L/I STRIP/L/I STRIP/L/I TYPE REAT PROD PROD	T-TRANSVE NM-NORMALL C M 120 10 20 10	GAUGE WDTH IN 1.500 1.500 END O END O END O END O 4 000 4 007 04 006	YIEL MIN: MAX: F DATA SR - 57 S V 51 003 223 002 24 003 24	0.D.: 200 PSI 42100 71800 50500 49700 THIS WENCH & TELE CU 1 16 1 15 1 16	.000 (EXT % .50 .50 .50 .50 .50 .50 .50 .50 .50 .50	508.0 TEI IMN: MAX CR M CR M CR M CR M CR M CR M CR M CR M	AR - AS ROLL TR - THERMO 0 AL 2 025 3 026 2 027	V/T MAX: 0.33 0.65 0.63	Dr (mec) V ELONI (N 2 ** NIN: NIN: AL, ROLLED B B 000 D 3 3 000 D 3 3 000 D 3	vall: 0.5 8%) 29.0 39.7 45.5 Boby 71 8002 001 001	500 { HAR SCALE: MIN: MAX: MAX: CD CD CD CD CD CD CD CD CD CD	12.7 DNESS	00) MIN HYDRO PSI 1900 1900 1900 W-WELD	In Drami D DWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION MA6721 F157AA MA6721 F157AA X83582	ED TENSILE TESTYPE ORENIATION STRIP/L/F STRIP/L/F STRIP/L/F TYPE REAT PROD FROD HEAT	TEST COND. A.R A.R ** T-TRANSVE NM-NORMALL C M 19 10 20 10 20 10 20 10 20 10	GAUGE WDTH IN 1.500 1.500 END C END C END C END C C END C C END C C END C C END C END C C END C END C	YIEL MIN: MAX: F DATA SR-SI S SI 003 23 002 24 003 24 003 24 007 23	0.D.: 200 PSI 42100 71800 50500 49700 THIS UENCH & THE RESS RELE CU 16 15 16 15 16 15 16 15 16	.000 (EXT % .50 .50 .50 .50 .50 .50 .50 .50 .50 .50	508.0 TEI IMN: MAX 09 08 00 08 00 09 00 09 00	2000) NSILE 2SI 70000 95000 78500 78500 73000 AR-AS ROLL TR-THERMO 0 AL 2 025 3 026 2 027 1 038	VT MAX: 0.33 0.65 0.68 MECHAN:C	0 (mmo) V ELONI (N 2 " MIN: AL ROLLED B 3 0003 3 0002 3 0002	VALL: 0.5 8%) 29.0 39.7 45.5 Bdby 77 45.5 Bdby 77 002 001 002	500 (HAR SCALE: MIN: MAX: MAX: 003 001 001 001	12.7 DNESS	00) MIN HYDR(PSI 1900 1900 1900 W-WELD	In Ommi D DWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION * MA6721 F157AA X83582 E795AA LEGEND: L.LONG U.UPSE PRODUCT IDENTIFICATION MA6721 F157AA MA6721 F157AA X83582 E795AA X83582 E795AA	ED TENSILE TESTYPE ORENTATION STRIP/L/E STRIP/L/E STRIP/L/E TUDINAL T TYPE REAT PROD HEAT PROD HEAT PROD PROD	TEST COND. AR AR AR ** **	GAUGE WDTH IN 1.500 END C END C END C END C C END C C END C C END C C END C C END C C END C C END C C END C END C	YIEL MIN: MAX F DATA GT - OU SR - ST S V EI 003 23 002 24 003 23 002 24 003 23 005 25	D.D.: 20 PSI 42100 71800 50500 49700 THIS UENCH & THE RESS RELIE CU 16 15 16 15 16 15 16 15 16	.000 (EXT % .50 .50 .50 .50 .50 .50 .50 .50 .50 .50	508.0 TEI IMN: MAX 09000800090008000900	AR-AS ROLL 70000 95000 78500 78500 73000 AR-AS ROLL TR-THERMO AL 2 025 3 026 2 027 1 038 1 041 1 041	чт млх: 0.33 0.65 0.68 меснал.с о. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	Dr (mmo) V ELONIN (IN 2 " (IN 2 " MIN: MIN: MIN: AL ROLLED B 3 0002 3 0002 3 0002 3 0002	VALL: 0.5 8%) 29.0 39.7 45.5 BODY TI 002 001 801 002 002	CB CD CD CD CD CD CD CD CD CD CD CD CD CD	12.7 DNESS	W-WELD	in (mm) D DWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5
MATERIAL COND: AS ROLL PRODUCT IDENTIFICATION * MA6721 F157AA X83582 E795AA LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION MA6721 F157AA X83582 E795AA X83582 E795AA	ED TENSILE GRENIATION STRIP/L/F STRIP/L/F STRIP/L/F STRIP/L/F RUDINAL T TYPE REAT PROD PROD PROD PROD	TEST COND. AR AR AR 	GAUGE WDTH IN 1.500 1.500 END Q END Q RSE ZED N P 04 010 04 007 04 006 04 008 05 004 5 003	YIEL MIN: MAX F DATA GT-QC SR-ST S S SI 003 23 002 24 003 23 002 24 003 23 002 24 003 23 005 25 009 25 009 25	D.D.: 20 PSI 42100 71800 50500 49700 THIS VENCH & THE RESS RELIE CU 16 16 15 16 16 15 16 16 15 16 16 15 16 16 10 20 00 20 00 00 00 00 00 00 00 00 00 00	.000 (EXT % .50 .50 .50 .50 .50 .50 .50 .50 .50 .50	508.0 TEI IMN: MAX 090008000800 08000800080008000800080008	AR-AS ROLL 70000 95000 78500 78500 73000 AR-AS ROLL 1R-THERMO 0 AL 2 025 3 026 2 027 1 038 1 041 1 042	WT MAX: 0.33 0.65 0.68 0.68 MECHANIC IC: 0.00 00 00 00 00 00	Dr (mmo) V ELONIN (IN 2 " (IN 2 " MIN: MIN: MIN: AL ROLLED B 3 0002 3 0002 3 0002 3 0002 3 0002 3 0002	VALL: 0.5 8%) 29.0 39.7 45.5 BODY 7 1002 001 002 002 002	CB CD CD CD CD CD CD CD CD CD CD CD CD CD	12.7 DNESS	W-WELD	In (mm) D DWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5
MATERIAL CONO: AS ROLL PRODUCT IDENTIFICATION * * MA6721 F157AA X83582 E795AA * LEGEND: L-LONG U-UPSE PRODUCT IDENTIFICATION * MA6721 F157AA MA6721 F157AA MA6721 F157AA X83582 E795AA X83582 E795AA	ED TENSILI TEST TYPE ORENTATION STRIP/L/I STRIP/L/I STRIP/L/I TUDINAL T TYPE REAT PROD PROD HEAT PROD PROD	TEST COND. AR AR AR ** ** ** ** ** ** ** **	GAUGE WIDTH IN 1.500 I.500 END C END C END C C C C C C C C C C C C C C C C C C C	YIEL MIN: MAX F DATA GT-QC SR-ST S B 003 23 002 24 003 24 003 24 007 23 005 25 009 25 009 25 007 25	D.D.: 20 PSI 42100 71800 50500 49700 THIS UENCH & THIS CU CU CU CU CU CU CU CU CU CU CU CU CU	.000 (EXT % .50 .50 .50 .50 .50 .50 .50 .50 .50 .50	508.0 TE MIN: MAX MAX 09 09 08 08 08 08 08 08 08 08 08 08 0 8 0	AR-AS ROLL 251 70000 95000 78500 78500 73000 78500 73000 2025 3026 2025 3026 2025 1038 1041 1042	WT MAX: 0.33 0.65 0.68 U.68 U.68 U.60 U.60 U.60 U.60 U.60 U.60 U.60 U.60	bx (mvc) V ELONIN (RN 2 ** (RN 2 ** MIN: MIN: MIN: AL: ROLLED B 3 000 3 3 000 2 3 000 2 3 000 2 3 000 2 3 000 2 3 000 2	VALL: 0.5 6%) 29.0 39.7 45.5 BODY 7 1 002 001 001 002 002	CB CB CD CD CD CD CD CD CD CD CD CD CD CD CD	12.7 DNESS	00) MIN HYDR PSI 1900 1900 1900 W-WELD	In formi DOWELL(SEC 5 5 5 5 5 5 5 5 5 5 5 5 5

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL PONT. ELEMENTS REPORTED IN MASS FRACTION (%)

`

PAGE 1 OF 2

à

\frown													DAT	Έ.	11/3	30/1	4	
USS) UNITED STATES	S STEEL	CORP	ORATIO	N	т	DBULAI	R PRODI	JCTS					TIM	œ:	04:0	5:4	7	
<u> </u>					CERI	FIFIEI) TEST	REPORT				SER.	IAL N	IO: 1	L005	5410	7	
MILL ORDER/ITEM NO	T	SHIPPE		IN ACCO	RDANCE	WITH IS	U 104/4/E	NTUZU4/DI	N50849 **	typ() 3.1")								
DR00652 08	{	*****	£	17.0	F.U.						~							
ATERIAL		KU344	<u> </u>	(10	<u>771570</u>	DI-CA						190.	12					in (max)
AS ROLLED						20		508.000))	-	···· .	0.9	500 (12.7	(00			,
						· · ·				CHASOPY V-NO	TCH IMP	ACT TES	TING					
PRODUCT	FLAT	8END	GRAIN	M I.	N	DIR	TEST	TEMP	SIZE	TEST	h	-FT-	LBS			% SHE	AR	410
	}		SIZE	6011	APSE			<u> </u>		V(nu)	<u>↓ · · · ↓</u>	<u></u>	3	AVG		2	_ <u>3</u> _!	AVG
MA6721 F157AA	OF			+				DEG F	7/4	T # 12	1 60			CE I		60	50	50
¥83582 8795AA	OF						D D	+ 32	3/4	1510	100	0.4	104	00	100	100	100	100
	0.0			ENT C	יארד קור			+ 34	3/%	45.45	1-00	74	10-1	33	100	100	200	100
				HEAD C	JE DAJ	FA TH.	B SHE	1 I		1.	1	1	1		1		1	
	1			ł			}	1 1		J	1 1	1	1		1	1	1	
						1	ł	· 1		1	1 1		}		1			
FORM				1		1		<u> </u>										
EGEND L.LONGITU	INAL		T - TRA	NSVERSE		6.80	DY		W - WELD		1	AZ - HE	AT AFFEC	TED ZON	E			_
					TE	STING / INS	PECTION INF	ORMATION										
TEST / IN:	SPECTION			YES	{					RESULTS / CO	MMENTS	•						
FULL LENGTH VISUAL				x														
ULL LENGTH EMI				x		00 _	X	OD/ID		L_X_		π	_ 1	0.0%	NOT	CH		
FULL LENGTH MPI					1													
FULL LENGTH UT				x		lD .	x	OD/ID		I X		π	1	0.0%	NOT	CH		
END AREA INSPECTION (PLAIN I	IND)			X	1	MPI	x	UT										
SPECIAL END AREA (SEA) INSP					1	MDI		197										
FULL LENGTH DRIFT					+	DRIF	MANDREI	SIZE:										
					+													
					1													
							I NOTERICO	MACHITE										
MEY MOD AND AND						ADUCTIONA	L NOTENCO	MMCN13								<u> </u>		
NANUFACTURED IN PRODUCT WAS HOT	D ALL 1 AN ISC ROLLEI	MERCUE D9003 DAND	Y BEAR CERTI HOT FI	ING Eq FIED 1 NISHE1	QUIPM FACIL D	ENT I. ITY -	S PROT CERTI	BCTED FICATE	BY A 1 #3202	DOUBLE 22.	BCUN	DARY	OF	CONT	INM	ENT.		
THIS IS TO CERTIFY THAT TH SAMPLED, TESTED AND/OR II AND FULFILLS THE REQUIRE PREPARED BY THE OFFICE O	E PRODUCT D NSPECTED IN MENTS IN SUC	ESCRIBED ACCORDAI CH RESPEC	HEREIN WAS I	MANUFACTI SPECIFICA	Lired, Thon										-		ALPO	SP
DATE11/30/1	4	AD KOT	RY - M	ANAGEI	R, Q.	Α.											TAMET	QUI

.

MPANY



UNITED STATES STEEL CORPORATION

 \sim

TUBULAR PRODUCTS ADDITIONAL COMMENTS SHEET

DATE: 11/30/14 TIME: 04:05:51 PAGE: 1 OF 1

.

MILL ORDERITEM NO. DROO652 08	SHIPPERS NO.	P.O. NUMBER 10P15701-CA	HEAT	SERIAL NUMBER: L0054107
SOLD TO	ADDRESS	MAIL TO ADD	RESS	VENDOR UNITED STATES STEBL CORP LORAIN TUBULAR OPERATIONS 2199 EAST 28TH ST. LORAIN, OH 44055
HEAT MA6721 - 1 HEAT X83582 - 1 END OF DATA	MELTED AT:NUCOR STE MELTED AT:FAIRFIELD	EL MEMPHIS, MEMPHIS, WORKS, FAIRFIELD,)	, TN 38109 AL 35064	
				PALANA CUALITY COMPANY
				EATA

•	PLATE MILL		P.O.B Winto (252)	Box 279 on, NC 2 356-370	7986 00				Te	St F Page 2	kepa)rt			15 Cofiel (25	505 River Id, NC 279 52) 356-37	Rd 922		lis Our Na	and the second se
. 0	Issuing Date :	10/07/201	8	B/L	No. : 514	1849		Load	No. : 52	5223	Our	Order N	o.: 15943	3/1	C	ust. Orde	r No. : 45	00893647	-	
	Vehicle No:	ATW 530	05						Sold To	: RYE	RSON P	ROCUREI	MENT CO	₹₽	Ship	To: R	YERSON	INC. DEN	NVÉR	
	Specification:	1.0000" x ASTM A5 MR0175 / 13.1.2) Co	96.000" 16 70-17 Annex 2.1 Ompliant	x 240.00 /ASME 3 1.2 (201	00" SA516 70 5), MR01	0 <mark>SA516-4</mark> 103 (2010)	85 PVQ 20 Section 2	0 <mark>15/2017</mark> 1.2(2015)	NACE) 13.1.1,	PO LUE	вох 9160 380ск,т)	79490 (79490				C	OMMERC	E CITY,C	0 80022	
	Marking :	16000513	4	1																
ſ	Heat No C	Mn	P	vs	Vsi	Cu	Ni	Cr	No	Al(tot)	v	NÞ	Tî	N	Са	6	Sn	Ceq	Pcm	
	8505555 0.20	1.05	0.008	0.000	0.20	0.24	0.10	0.07	0.01	0.039	0.004	0.002	0.002		0.0028	0.0001	0.011	0.41	0.28	
	Plate Serial Pier No 8505555-07 4	ces Tons 13.06	Dir.	(psi) Yield 45,600	Tensile 75,500	ensile Tes Elong, % in 2"	st Elong. % in 8" 20.2													

5361-1 PLID#280 MK# 15-14,10-13



Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repeir was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as -rolled, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@Nucor.com Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mr/6)+{(Cr+Mo+V)/5}+((Cu+Ni)/15) We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

10/7/2018

.

Pern = C+(Si30)+(Mu/20)+(Ci/20)+(Ni60)+(Ci/20)+(Mo/15)+(Vi/10)+5B Meited and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System: Registrar (#0985-08). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14-MMPQA-723

T. A. Deprelis, Metallurgist

10/7/2018 2:00:14 PM



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

NDE Reports

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

	Law Visi	()	Salt Lake	City, UT	Denv	er, CO	Billing	s, MT	Farming	ton, NM				Client:	EA	TON METAL		Date	e: 3/2	2/2019	
	調合調												Job L	ocation:		SLC, Utah		Team W.C	D: 1116	5-001390	
	11 - 12 - 12 - 12 - 12 - 12 - 12 - 12 -		(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	-4115			Job Ref	erence:		5361-1		Client P.O	.: 4	5650	
	Customer					Туре (Of Weld					_ ^B	adiation S	<u>Source</u>	_	Film Type	Film Size		<u>Penetrameter T</u>	уре	
EA	TON MET	AL				Butt	Weld				IR- 192		CO- 60		X-Ray	AGFA D5	4.5 X 17		ASTM WIRE	В	
	Specification	L				<u>Drawing</u>	Number					<u>Sourc</u>	e Strengli	n or MA/K	V	Emulsion Number	Exp. Date		Penetrameter Ma	iterial	
Boile	er/ Pressure V	essel										8	37		CI	8250802N	1/1/21		Stainless Ste	ei	
	Procedure			Pipe O.	.DJ Pipe T	hickness		<u>81</u>	ate Thickne	225	Foo	al Spot Siz	:e (F)	Ex	p. Time	Single Load			Penetrameter Loc	noite:	
R	T.ASME.1 R	24				.875"						0.124"		2 MIN	. 30 SEC.	Double Load		Source Side	Film Side		
<u>A0</u>	ceptance Crit	eria			Joint Typ	e			Material			Thickness	Wilh Rei	nforcemei 70	<u>nl (d)</u>	Film Tech	nique	Shim Ma	aterial	Thickness	
RT	- ASME Sec.	. VIII			Butt Wei	d 0	O a a divisa	C	arbon Sie	el.			1.16/	his at (D)		SWE/S	ielee ee	N/A		INA .	
Ext	osure Lechn	ique				Surraca	Condition					500	<u>יימכי שסוג</u>	olect (D)		Screen In	ICKRESS		IU Placement	<u>u</u>	
	Viewing					Film 90	ocessino						20			Screip m			Location Marker Pla	Icement	
Sincle 7	Double		Auto			FILLER	Manus	al	J							lea	d	Film Side	Source Source	e Side	
	DODDIA	 ISO Line #	7010				Inatio	31							Report #	Lea	0	7 1011 5106	<u></u>	e olde	
		130 L(ile #				1						1								~	
								5				5	5							nsit	
								.isn	ъĘ	- -	۲ ۴	21	Insi	2						Der	sity
			ept	SC	Sity	0g	중	e e	nati rati			ğ	르	avi						Ē	en le
			CO	Ĝ.	8	Si Si	Ca	olet	E E	l de			G	l 2						Let L	
					<u> </u>			Ē	Pel	5	L L	Tac	dst	Ŭ						etra	Vel V
								l			<u>۵</u>	Sul	_ <u>ح</u>							ene	- I
Weld No.	View	Weld I.D.					L						ļ.				Remarks			<u> </u>	
GS HD/32U	0-1	LK	Х																	2.64	2.54
									L												
GS 32U/37U	0-1	LK		X				Х					ļ							2.34	2.57
					L																
GS 37U/35U	0-1	LK	Х		L				L		ļ									2.65	2.64
		l											ļ								
GS 35U/31U	0-1	LK		• X		<u> </u>	L	X					·					•		2.61	2.43
					_										· ·						
												<u> </u>									
						+															
					<u> </u>																
												<u> </u>									
					-							<u> </u>	<u> </u>								
					<u> </u>							<u> </u>	<u> </u>								
				<u> </u>	<u> </u>						<u> </u>	<u> </u>	<u> </u>							1	
					<u> </u>	+															
						1						<u> </u>									
												<u> </u>	<u> </u>						AL PROON		
						1							+	<u> </u>				13	Co Ch		
																		2	0000		
																-		12	900. 0 8		
													<u> </u>					13	5 412 81		
												<u> </u>						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	A THE		
																				1	
							† • • • • •					<u> </u>								1	
							t			·	<u>+</u>									1	
					<u> </u>										/	1 /					
· · · · ·					1							L			1/					•	
	Chent:						Dale:					NDE	Inspector		h/h		Date: 3/	22/2019			
Form MS.RT	ASME										-				Andrev	Gruber			_		
				"Clien	t has fir	al autho	nity and	respon	sibility fr	or intern	efation	and acc	entance	ofexan	nination an	d reports"					

[&]quot;Client has final authority and responsibility for interpetation and acceptance of examination and reports"

the state of	1.1	(3)	Salt Lake	e City, UT	Denv	er, CO	Billing	gs. MT	Farming	ston, NM				Client:	E	aton Metals		Da	te:	3/28/2019	
	- W - W												Job La	ocation:		SLC, UT		Team W.	0: 11	16-001390	
Contraction of the local division of the	all in the little	and the second se	(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	-4115			Job Ref	erence:		5361-1		Client P.(D.:	45650	
F	Customer aton Meta	ls				<u>Type (</u> Bult	<u>) Weld</u> Weld				IR- 192	ß	adiation S CO- 60	Source D	X-Ray 0	Film Type AGEA D5	<u>Film Size</u>		Penelramele ASTM "B"	er Type Wire	
	Specification	1				Drawing	Number					Source	e Strengtt	n or MA/K	<u>v</u>	Emulsion Number	Exp. Date		Penetrameter	Malerial	
Both	er/ Pressure V	essel		Dies 0	0 (Dires 7				ata Thiaka			0	5 <u>2</u>			Sicolo Lond	(11)21		Stainless	steel	
F	T.ASME.1 R	22		Pipe U	U/Pipe I	<u>nickness</u> 1		P		255	100	0.124	e (r)	1	kp, nime 12 min	Double Load	_	Source Side	B Film Side		
Ac	ceplanca Cril	eria			Joint Typ	e			Material			Thickness	With Rei	nforceme	ent <u>(d)</u>	Film Tec	hnique	Shim N	haterial	Thickness	È
RI	- ASME Sec.	. VIII	Butt Weld Surface Condition						arbon Ste	séi		Sou	1.00	V biect (D)		SWE/		N		NA Pent	
	C	iidae				As V	Velded					300	40"			.005"	010"		Flash on	Film	
	Viewing		Film Processing Maoura													Screen	nalerial		Localion Marker	Placement	
Single 2	Double	0	Auto	0			Manu	al	Ø							Lea	ld	Film Side	Z So	urce Side	<u>o</u>
		ISO Line #				1									Report #						
Weld No.	View	Weld I.D.	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Density	Weld Density
GS 32U/37U	0-1	LK	Х																_	2.87	3.00
	1-2			Х				Х							F 1					2.87	2.74
	3-0		X		X						<u> </u>				QC R	5-6 GZ Z3.	9-19			3.02	3.03
00.05/1/04/	0.1		v		<u> </u>			<u> </u>				<u> </u>								2.27	0.00
65 350/310	1.2		÷																	3.37	3.32
	3-0		Ŷ		× ×															3.74	3.03
	0-0			<u> </u>	<u>† ^</u>			<u> </u>		<u> </u>										0.24	0.00
		ļ			-														-		
					-										1						
												<u> </u>									
																				_	
							<u>+ </u>														-
														<u> </u>							
			 	<u> </u>															aDDU	37.0	
			<u> </u>	<u> </u>		-		<u> </u>		<u> </u>			<u> </u>						1º CD	0 0	
										<u> </u>					<u> </u>				- I [∉] SP	U El	
																			12	TV P	1
																			TE QUAL	11 5	-
																			12	22	
				_															-		
										<u> </u>										_	
									<u> </u>												
L		I	I		1	1	1			I											1
Form MS.RT	Client ASME			"Clien	it has fir	nal authr	_Date [.]	respon	sibilîtv fr	or intern	- etation	NDE		e of exa	Trevor	Woolsey	Date: 3/	/28/2019	_		
				2			,			P						- p - · · ·					

1	ALLE VALUE	······································	Salt Lake	e City, UT	Denv	er, CO	Billing	gs, MT	Farming	ton, NM				Client:	EA	TON METAL		Date:	4	/2/2019	
	1111	14											Job L	ocation:	5	SLC, Utah		Team W.O:	111	6-001390	
		and an and a state of the	(801)397	-2202	(720)570	9-0660	(406)371	1-5822	(505)599	-4115			Job Ref	erence:		5361		Client P.O.:		45650	
	<u>Customer</u>					Түре (Of Weld					<u> </u>	adiation S	* <u>emuoi</u>		<u>Film Type</u>	Film_Size		Penetrameter	Түре	
EA	TON MET	AL				Sutt	Weld				IR- 192	<u> </u>	CO- 60		X-Ray	AGFA D5	4.5 X 17		ASTM WIRE	ЕВ	
	Specification	1				Drawing	<u>a Number</u>					Sourc	e Strength	1 or MA/K	¥	Emulsion Number	Exp. Dele		Penetrameter N	taterial	
Boile	er/ Pressure V	essel	<u> </u>									7	78		CI	8250602N	1/1/21		Stainless St	eel	
	Procedure			Pipe O.	DJ Pipe T	hickness		P	lale Thickne	<u>855</u>	Foc	al Spot Siz	e (F)	Ex Ex	p, Time	Single Load			Penetrameter Lo		
R	T.ASME.1 R	24				.875					<u> </u>	0.124	MAGNE DA	3		Double Load L	·	Source Side	J Film Side	Diekaase	
<u>Acc</u>	ceptance Crit	<u>éria</u>	<u>e</u>			Malenal		-	INCKNESS	1 1 87	niorceme	<u>nt (a)</u>	FIIM TECH	nque	Shini Malena	1	NA				
R1	- ASME Sec.		0 Surdaaa	Coordilion		Jarbon Ste	ei			1.107	biect (D)		Screen This	vv							
Exb	osure recnni p	lque	Velded	1				300	65"			010"- 01	0"		Lead on Fil	im					
	Meuring		<u> </u>			Film Pr	ncessing					_				Screien ma	lerial		ocation Marker P	lacement	
. 🖸	Double		Auto			<u></u>	Manu	al	2							Lead		Film Side	Sour	ce Side	
<u> </u>	Docola	ISO Line #	/1010				mana								Report #						
						1												1		≥	
								io.				io.	io							isusi	<u> </u>
			1		>			L S	ion ete	Ħ	lĝn	cat	SILS	<u>i</u>						De la	Sity
			, da	ject	osit	ag	ž	te	npl∉ trati	e C	L Pro	Indí	Ĕ							iter	Ger
			Acc	Rej	Joc 1	5	ö	ple	L COL	lnd	<u>~</u>	8	ten	ŭ						j me	10
					<u>۲</u>			l B	Pe T		Bur	ILI ar	ngs	0						etra	Ne
	N.C.	Mala 1 5									-	l no	Lu				Doradic			en	
Id No.	View	Weld I.D.														LA LA L	Kemarks	l in to		2.02	2.00
20/370	2-3	LK	<u> </u>													vvei	d Area Ground	i in lo.		2.92	2,99
	3-4	LK	<u> </u>	X				X	•					<u> </u>						3.02	3.03
	4-5	LK		X																2.09	3.02
	5-6		<u> </u>					+												3.00	2.99
	6-/	LK	<u> </u>			<u> </u>	<u> </u>	X												3.02	3.03
	7-8	LK	<u> </u>					<u> </u>					_	<u> </u>						2.70	3.02
	8-9		×			<u>i</u>		İ —												2.85	3.00
	9-10			<u> </u>	<u> </u>	<u> </u>	<u> </u>												*	3.04	2.02
	11.10		L Ŷ			┼╾──	<u> </u>													3.02	3.03
	12.13		x x											╞╼───		*				2.91	2.95
	13.14		x			x	-												-	3.02	3.03
	14-15	IK	x																	3.04	3.02
	15-16	IK	x			+								<u> </u>						3.00	2,99
	16-17	LK	X			+	1													3.02	3.03
	17-18	LK	X				 													3.04	3.02
	18-19	LK		X	Х															3.02	3.03
	19-20	LK	X																	3.04	3.02
	20-21	LK	Х																	3.00	2.99
	21-22	LK	X		[3.02	3.03
	22-23	LK	Х												REJ	Eaton Q	C SD C	4-3-19		3,00	2.99
	23-24	LK		X		X														3.02	3.03
	24-25	LΚ	Х																	3.04	3.02
	25-26	LK	X							<i>,</i>										2.98	2.99
	26-27	LK	X																	2.78	2.80
	27-28	LK		X		X														2.89	2.85
	28-3	LK	X				L	L													
						L	<u> </u>	<u> </u>													
							L	<u> </u>													
					L	<u> </u>	ļ														RODU
					<u> </u>		ļ							L						<u> </u>	Yan
		1				í									//					1	SP SP
		1-	-		-	-														1	0
	Client:	the second		-	5		Date:					NDE	Inspector	_\$4	<u>r</u>	0	ale: 4/	2/2019			QUALI
VIS.RI.	ASIVE (10.0					-11-10- C						Anorew						13

	Δ	M	Salt Løke	City, UT	Denv	er, CO	Bitling	is, MT	Farming	llon, NM			Job L	Client: ocation:	EA	TON METAL		Date: Team W.O:	4/9	/2019 -001390	
			(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	-4115			Job Rel	егелсе:		5361		Client P.O.:	4	5650	
EA	Customer TON MET	TAL				IR- 192		ediation 1 CO- 60		X-Ray	AGFA D5	<u>F≬m Size</u> 4.5 X 17		ASTM WIRE	8 <u>0</u> 28						
Boile	Specification	<u>)</u> 'essel					<u>Souro</u> S	e Strengt 95	n or MA/K	⊻ Cl	Emulsion Number 8250602N	Exp. Date 1/1/21	E	enetrameter Ma Stainless Stee	teria) M						
	Procedure Proc O.D./ Proc Trickness RT.ASME.1 R24 .875"								lale Thickn	8559	Foc	al Spot Siz	c (F)	Ex	p. Time	Single Load			anetrameter Loc	alion	
R	EASME.1 R			Materiel			U.124 Thickness	With Rei	morceme	nt (d)	Film Tech	mique	Source Side C	Film Side	Thickness						
RT	- ASME Sec.			arbon Ste	el			1.187	,,,		SWE/S	w	NA		NA						
Exp	osure Techn	<u>Condition</u> /elded					<u>501</u>	<u>10 or son</u> 65	bject (D)		Screen Thi	ick <u>ness</u> 110°		JD Placement Lead on Film	<u>L</u>						
	Viewing		-			Film Pro	cessing									Screan m	aterial	Lea	ation Marker Ple	cement	
Single 🗹	Double		Auto				Manu	al							Becod #	Lead	±	Film Side 🗸	Source	Side	□
1		ISO Line #			1								-		Report #						
Weld No.	View	Weld I.D.	Crack Crack						Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Densi	Weld Density
GS 32U/37U	1-2	LK	Х												5361-1					3.06	3.00
	2-3	λ. ΣΚ																		3.02	3.03
	3-4		X	v	- v	Y											· · · · · · · · · · · · · · · · · · ·			3.08	3.02
	5-6			x		<u> </u>		X												3.02	3.03
	6-7	LK		X				X												3.00	3.02
	7-8	LK		Х				Х												2.95	3.00
	9-10	ĽK	X														-			3.04	3.02
	17-18	LK	<u> </u>																	3.00	2.99
	18-19	LK	×																	3.09	2 95
	22-23		x																	3.02	3.03
	26-27	LK	X												Scuff mart	ks				3.10	3.02
	3-0	LK		Х	Х															3.02	3.03
																			_		
											_										
																				-	
												-							PRO	UC ?	1-1-
																			12 51	D C	
			ļ														_		201	Ug	
├									···-										2 QUAL	ITY E	
									<u> </u>										13	my	0
																			-	-	
																			_		
		1012-00													1 All	- market					
Form MS.RT.	Cliane ASME						Date:					NDE	Inspector	_	Andrew	Gruber	Date: 4	9/2019			

	Ā	Ŵ	Salt Lake	e City, UT	Denv	er, CO	Billing	gs, MT	Farming	ilon, NM			Job L	Client: ocation:	EA S	TON METAL SLC, Utah		Da Team W.	te: O:	4/11 1116-	1/2019 -001390	
STREET, STREET	and the second second	and with the little	(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	-4115			Job Rei	ference:		5361		Client P.(D.:	4	5650	
F4	Customer	ΓΔΙ				Type (Butt	Of Weld				IR- 192	<u>ء</u> ا	CO- 60		X-Ray		Film Size		1	ASTM MIDE	/pe	
	Specification	1				Drawing	Number				1	Sourc	a Strengt	h or MA/k	<u>v</u>	Emulsion Number	Exp. Date		P	enelrameter Mat	enel	
Boile	er/ Pressure V	/essel										Ş	95		CI	8250602N	1/1/21			Staintess Stee	ıl	
	Procedure			Pipe C	D/ Pipe Ti	hickness		<u>е</u>	ale Thickne	355	Foo	al Spot Siz	:e (F)	E)	op. Time	Single Load			E E	enetrameter Loc	ation	
R	T.ASME.1 R	24			laist Tuo	.875"			Maladal			0.124"	Mills Oal	information and	26 MIN	Double Load	balava	Source Side	년	Film Side		
RT	- ASME Sec	. VIII			Butt Weld	e d			arbon Ste	el	· ·	THICKNESS	1.187	7"	<u>ak (0)</u>	SWE/S	SWV	N	A		NA	
· <u>Exp</u>	osure Techn	lique				Surface	Condition					Sou	urce To Q	bject (D)		Screen Th	ickness			ID Placement		
	В					As V	Velded				<u> </u>		65"			.010"/	010"			Lead on Film		
Single 1	<u>Viewing</u>		Auto			Film Pr	<u>ocessing</u> Manu	al								Screen n	l <u>aterial</u> d	Silm Sido	<u>یەما</u> را	ation Marker Plac	cement Side	· 🗖
	Double	ISO Line #	7010				TYTCHTC								Report #	CGa	u	FIGU SIDE	<u> </u>	300108	Side	<u>.</u>
								6				_						1			ity	
			·					lsio	ພ⊊		чб	atior	usio								Jens	ity
			ept	ect e	sity	Dg	중	L L L	ratic	SICU	lou	ndic	Inc!	avit							ter	lens
			Acc	Rej	oro	ŭ,	U U U	plei	COL	pug	1 2	e e	fen	ouc							, me	2
					_			5	드십		Bur	urfa	Sur	0							letra	We
Weld No.	View	Weld I.D.						<u> م</u>				S	٦ ۲				Remarks				Per	
GS 32U/37U	2-3	LK	Х												5361-1	-					2.89	2.99
	4-5	LK		Χ.																	2.81	2.88
	5-6 6-7		X								+	<u> </u>									2.95	3.02
	7-8	LK	X								+										2.89	3.03
	27-28	LK	Х																		3.00	3.02
	3-0	LK	Х																		3.00	· 3.00
																	·					
																	_					
												1			<u> </u>							
															<u> </u>							
											<u>+</u>											
																	_					
				_																	UCT	
																				1920		A
							·								<u> </u>					- [ž S	PD	No.
																				1	IALITY	3
																				10	1	1
																				1	3	
		<u>}</u>					-12-							L	1							
	Client	t	12			-	Date:					NDF	Inspector	ß	L		Date: 4/	11/2019				
Form MS.RT	ASME	/					-				-				Andrew	Gruber		=				

[&]quot;Client has final authority and responsibility for interpetation and acceptance of examination and reports"

			Salt Lake	e City, UT	Denv	er, CO	Billing	js, MT	Farming	ton, NM				Client:	EA1	FON METAL		Date	4	/12/2019	
	HZAN.		(00/1007		(700) 50								Job Lo	cation:	8	SLC, Utah		Team W.O	: 11	16-001390	
	0.11	and the second	(801)397	-2202	(720)5/5	9-0660	(406)371	-5822	(505)599	-4115		-	Job Refe	erence:		5361		Client P.O.		45650	
E	Cusiomer ATON MET					<u>I ype (</u> Butt					IR- 192	ा <u>स</u>	CO- 60		X-Ray		Film Size		Penetramete	r Type	
U	Specification	1				Drawing	Number					Source	Strength	or MA/K	/	Emulsion Number	Exp. Date		Penelremeter	Material	
Boil	er/ Pressure V	essel										9	5		CI	8250602N	1/1/21		Stainless Stainless	iteel	
	Procedure			Pipe O.	.Q./ Pipe T	hic <u>kness</u>		P	lale Thickne	<u>155</u>	Foc	al Spot Siz	9 (F)	Ex	e. Time	Single Load			Penetrameter	ocation	
9	RT.ASME.1 R	24				.875"						0.124"		2	6 MIN	Double Load		Source Side	Film Side		
Ac	ceptance Crit	teria		,	Joint Typ	<u>e</u>			Meterial		1 1	<u>Chickness</u>	With Rein	nforce <u>mer</u> "	<u>nt (d)</u>	Film Tech	nique	Shim Ma	enal	Thickness	
- RI Evi	- ASME SEC.	. VIII			SOLL MAD	0 Surface	Condition	<u> </u>	arbon Ste	ei		Sou	1.10/ rce To Ob	viect (D)		Style/Sv Screen Thic	WV	NA	ID Placer	NA eol	
	B					As W	Velded					000	65"			.010"01	10"		Lead on F	ilm	
	Viewing					<u>Film Pr</u>	ocessing									Screen ma	terial		Location Marker	Plecement	
yle 🖸	Double		Auto				Мапи	al	<u>_</u>							Lead		Film Side	Sou Sou	irce Side	<u> </u>
		ISO Line #													Report #						
Veld No	View	Weld I.D.	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Density	Weld Density
320/370	4-5	LK	Х												5361-1					2.89	2.86
																			-		
								_													
																			-		
					 		<u> </u>	<u> </u>										_	· · · · · · · · · · · · · · · · · · ·		
						+														-	
																				-	
																				_	
																		_			
						<u> </u>	<u> </u>														
					_																
																				_	
								<u> </u>													
—							<u> </u>												1280	100	
										-									IS SI	20 3	
																			12 01	US	
																			2 QUAL	ITY S	
																	_	_	VA3	- N	
							<u> </u>													2	
																			_		
						1									<i>¢</i>			-			I
							Oale:					NOF	orpector			$\langle -$		10/0010			

Cusic EATON Specifi Boiler/ Press Proce RT.ASM Acceptanc RT - ASM Exposure 1 B Single ☑ Dout View Single ☑ Dout Us 32U 0-1 1.2 2.1	stomer N METAL cification essure Vessel incedure SME.1 R24 ince Criteria ME Sec. Vill e Technique B uble ISO Line # riew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	(801)397		(720)579 D./ Pipe It Joint Type Butt Welc	Drawing Drawing Drawing Drawing Drawing Surface Surface Surface Surface	(406)371- 27 Weld Weld Weld Number Condilion /elded <u>bcessing</u> Manua	-5822	(505)599- ale Thicknee Material arbon Stee	-4115 	IR- 192	Source 10 at Spot Size 0.124" Thickness Sou	Job Refr adiation S CO-60 = Strength D2 = (F) = 1.187 rcce To Ot 20"		X-Ray (CI 145 SEC. 145 SEC. 141 (d) Report #	5361-1 Film Type AGFA D5 Emulsion Number 8250602N Single Load Double Load Film Tech SWE/S Screen Thi .010°-0 Screen m	Film Size 4,5 X 17 Exp Date 1/1/21 mique WV Ckness N0" aterial d	Client P.C Source Side Shim M N	D.: Pr Pr Internal A Loca	4 Penetrameter T ASTM WiRE i anetrameter Ma Stainless Ster Anetrameter Loc Film Side ID Placemen Lead on Film Source Source	S650 pe a lerial ation Thickness NA ceinent a Side	
Cusic EATON Specifi Boiler/ Press Proce RT.ASM Acceptanc RT - ASM Exposure 1 E Single ☑ Ooul Single ☑ Ooul Usa Single ☑ Ooul Coll Coll Coll Coll Coll Coll Coll C	stomer N METAL cification essure Vessel codure sME.1 R24 moe Criteria ME Sec. Vill e Technique B ISO Line # fiew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	at a contract of the second se	Seile C	O./ Pipe Tr Joint Type Butt Welc	Type C Butt Drawing bickness .875" 8 5 <u>Surface</u> As W Film Pro	21 Weld Weld Number Condition /elded jocessing Manuz	e Fusion	ate Thicknee Malerial arbon Stee	el	IR- 192	B: Source 1(at Spot Siz 0.124" Thickness Source	adiation S CO-60 Strength D2 a (F) With Rein 1.187 rice To Ot 20"	Exp Cor MA/KN Exp 1 MIN nforcemer " iject (D)	X-Ray / CI Jime 45 SEC. (d) Report #	Film Type AGFA D5 Emulsion Number 8250602N Single Load Double Load Film Tech SWE/S Screen Thi .010°- C Screen m Leac	Film Size 4,5 X 17 Exp Date 1/1/21 mique WV ckness w0° aterial d	Source Side Shim M N Film Side	Pr Pr Iaterial A Locz	Penetrameter T ASTM WIRE i anetrameter Ma Stainless Ster enetrameter Loo Film Side ID Placemen Lead on Film attion Marker Pla Source	International Sectors American Americ American American Ameri American American Ame American	
Er (r) (r) (r) (r) (r) (r) (r) (r) (r) (r	//iew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	Auto 4 PCCC PCCC PCCC PCCC PCCC PCCC PCCC P	Seiect	O./ Pipe Tr Joint Type Butt Welc	Drawing Drawing 	Condition /elded ccessing Manua	e Fusion	Malerial Arbon Ste	el 55		Source 1(at Spot Siz 0.124" Thickness Sou	e Strength)2 ≥ (F) With Rein 1.187 rce To Ot 20"	er MA/K) Exp 1 MIN nforcemen " " iect (D)	CI 5 Time 45 SEC. 4(d) Report #	Emulsion Number 8250602N Single Load Double Load Film Tech SWE/S Screen Thi .010°- 0 Screen m Lead	Exp Date 1/1/21 mique wvv ckness w10" aterial d	Source Side Shim M N Film Side	Pi Piateriat A Loca	enetrameter Ma Stainless Stee enetrameter Loc Film Side ID Placemen Lead on Film stoon Marker Pla Source	terial alion Thickness NA ceinent a Side	
Boller/ Press Proce RT.ASMI Acceptanc RT - ASME Exposure 1 B Single ☑ Dout Weld No. Vie LS 32U 0- 1-: 2-: 3	riew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	Auto P	Segiect	A Pipe If Joint Type Butt Welc	Surface - As W Film Pro	Condition /elded pcessing Manua		Alerial Alerial arbon Ste	el		11 at Spot Size 0.124" Thickness Sou	JZ a (F) With Rein 1.187 rce To Ob 20"	Exp 1 MIN nforcemen " " iject (D)	CT j Time 45 SEC. at (d) Report #	Single Load Single Load <u>Film Tech</u> <u>SwE/S</u> <u>Screen Thi</u> <u>.010°-0</u> <u>Screen m</u> Leag	1/1/21 mique WVV ckness pro" aterial d	Source Side Shim M N Film Side	Provide the second seco	Stainless Ster enetrameter Loc Film Side ID Placemen Lead on Film source Source	All alion <u>Thickness</u> NA <u>ceinent</u> a Side	
RTASM Acceptanc RT - ASME Exposure 1 B Single ☑ Dout Weld No. Vie LS 32U 0- 1-2- 2-1	ME.1 R24 mcce Criteria ME Sec. VIII e Technique B rewring ouble ISO Line # Veld I.D. 0-1 RC 1-2 RC 2-3 RC	Auto 4 PCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	Reject		.875" e <u>s</u> <u>surface</u> As W Film Pro	Condition /elded ocessing Manua	al c	Material arbon Ste	el		0.124" Thickness Sou	With Rem 1.187 irce To Ot 20"	1 MIN	A5 SEC.	Double Load Film Tech SWE/S Screen Thi .010°- 0 Screen m Lead	inique WV <u>ckness</u> MO" aterial	Source Side Shim M N Film Side		Film Side ID Placemen Lead on Film tion Marker Pla Source	Thickness NA cement a Side	
ALLEMAIN RT - ASME Exposure 1 Bingle Ooul Single Ooul Weld No. View LS 32U 0-1 1-2 2-1	View Weld I.D. 0-1 RC 2-3 RC	atua Auto	Reject		Surface - Surface - As W Film Pro	Condition /elded ocessing Manua	e Fusion	arbon Ste	el		Sou	1.187 Ince To Ot 20"	Heci (D)	Report #	SWE/S Screen Th .010"- C <u>Screen m</u> Leac	2000 2000 2000 2000 2000 2000 2000 200	Film Side		ID Placemen Lead on Film ation Marker Pla Source	NA	
Exposure 1 B Single ☑ Dout Weld No. Vie LS 32U 0- 1-: 2-: 3	<u>e Technique</u> B ISO Line # //ew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	Auto 4 Accept Ac	Reject	Porosity	Surface - As W Film Pro	Condition /elded bccessing Manua	e Fusion	ete ion		4	501	rice To Ot 20"	<u>leci (D)</u>	Report #	<u>Screen Thi</u> .010"- Q <u>Screen m</u> Lead	<u>ckness</u>)10" eleriël J	Film Side	<u>Loca</u>	ID Placemen Lead on Film Ition Marker Pla Source	cement side	
View Single Oout Weld No. View LS 32U 0-1 1-2 2-1 3-4 3-2	/////////////////////////////////////	Auto	Reject	Porosity		Manua Manua	e Fusion	ete ion		4	чо	Б		Report #	<u>Screen m</u> Leac	aterial J	Film Side		ation Marker Pla Source	Side	
Single ☑ Doul Weld No. Vie LS 32U 0- 1-: 2-: 3-: 3-:	/iew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	ature by Autore	Reject	Porosity	Slag	Manua	e Fusion	ete ion		ų	ю	ч		Report #	Lead	j	Film Side		Source	Side	
Weld No. Vie LS 32U 0- 1-2 2-3	fiew Weld I.D. 0-1 RC 1-2 RC 2-3 RC	Accept	Reject	Parosity	Slag	rack	e Fusion	ete ion		.e	6	ч								2	
LS 32U 0 1-3 2 3	0-1 RC 1-2 RC 2-3 RC	X				Ō	Incomplete	Incomple Penetrat	Undercu	Bum Throug	Surface Indicati	Tungsten Inclusi	Concavity			Remarks				Penetrameter Densit	Weld Density
1-3 2-3	1-2 RC 2-3 RC														\$					2.80	2.7
2-3	2-3 RC	X																		2.76	2.8
3.4		X																		2.83	2.8
	3-4 RC	X			<u> </u>															2.67	2.6
4-3	4-5 RC	1 x			<u> </u>															2.72	2.0
6-	6-7 RC	X																		2.82	2.9
7-1	7-8 RC	X															-			2.77	2.7
8-1	8-9 RC	X																		2.89	2.8
. 9-1	9-10 RC.		X				X													2.89	2.8
																					<u> </u>
																					<u> </u>
																					\square
		$\left \right $																-	PROL	UC	-
																		_	SP	0 8	
																		_	2 QUALI	TY A	_
																			20	22	
																					<u> </u>
																			-		<u> </u>
		+																			├──

		W Or	Sall Lake	City, UT	Denv	er, CO	8illing	s, MT	Farming	lon, NM			Job Le	Client: ocation:	EA	TON METAL		Dai Team W.	e 0:	3/13	/2019 001390	
	H.D.E		(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	4115			Job Ref	erence:	530	61-1 Repairs		Client P.0).: 	45	650	
	Customer					Туре (Of Weld					8	adiation S	bource .		Film Type	Film Size		Į	Penetrameter Ty	pe	
E/	TON MET	AL				Bull	Weld				IR- 192	~	CO- 60		X-Ray	AGFA D5	4 5 X 17			ASTM WIRE B		
	Specification	1				Drawing	Number					Sourc	e Strengti	or MA/M	<u>(V</u>	Emulsion Number	Exp. Date		Pe	enetrameter Mat	erial	
Boit	er/ Pressure V	essel										9	94		CI	8250602N	1/1/21			Stainless Steel		
	Proceoure			Pipe O	0./ Pipe T	hickness		P	ale Thickne	55	Fac	cal Spot Siz	e (F)	E>	kp. Time	Single Load				netrameter Loca	ation	
F	T.ASME,1 R	24		_,		.875						0 124"			2 MIN	Double Load		Source Side		Film Side		
Ac	ceptance C <u>ri</u>	lena			Joint Typ	<u>ie</u>			<u>Matenal</u>			Thickness	s With Rei	nforceme	ent (<u>d)</u>	Film Tech	nique	Shim M	alenal		Thickness	
RT	- ASME Sec	Vill			Butt Wel	đ		Ċ	arbon Ste	el			1.187			SWE/SV	Ŵ	N	A		NA	_
Ex	osure Techn	lique				Surface	Condition					Sou	Jrce To Q	bject (D)		Screen The	skness			ID Placement		
<u> </u>	В			_		As V	Velded						20			010"- 0	10"			Lead on Film		
Single [7]		m	A.110	П		<u>Fum 81</u>	Aanu:	al	P							Screen ma	alenaj	Eilen Sirdo	[2]	llion Marker Plac	<u>ement</u>	
Single car	Odulie		4				Waltu	<u> </u>							Report #	1		Form Side	<u> </u>	300168	Side	
					1			1	1	-		<u>}</u>	· · · · ·	1	l	<u> </u>					>	
								ion				<u>o</u>	ion							Ì	nsít	
			_		≥			L.	ion	Ľ	l6no	icat	clus	₹							ő	lsity
			6 de)ec	osi	gg	ack	ge	Irat	ero	Ĕ	p	Ē	Cav							eler	0er
			AC AC	ar R	Por	S	Ö	đ	BUB	Pu	Ξ	8	ster	l							ame	P
								L OO	- ₽ đ	-	B.	nfa	őű								etre	We
Weld No.	View	Weld I D						<u>ے</u>				Š	F				Remarks				Pen	
LS 34U	0-1	RC	X								1	i	1	<u> </u>							2.66	2 24
	8-9	RC		х	×									<u> </u>							2.90	2.95
LS 35U	0-1	RC	X			X						1									2.92	2.69
L\$ 36U	0-1	RČ	X																		3,15	3.16
	1-2	RC	X		1										<u> </u>					,	3.08	3 05
	2-3	RC	X			<u> </u>								L	scuff on f	ilm at 3 loction					3,18	3.17
	3-4	RC		X				_ X													3.15	3.16
L	4-5	RC	×											<u> </u>							2.87	2.89
	5-6		<u> </u>					<u> </u>				<u> </u>									2.86	2.84
	7.0	RC	$-\hat{}$			<u> </u>						<u> </u>									2.80	2.00
	8.9	80	x			<u> </u>						<u> </u>		<u> </u>							3.04	3.11
	9-10	RC	X									1		-	scuff om						3.16	3 20
	• / •					+															0.10	0.00
LS 32U	9-10	RC	X																-		2.90	2.90
									-			1										
LS 38U	0-1	RC		Х	Х			Х													2.84	2.74
L\$ 33U	0-1	RC		Х	X																2.45	2.94
	1-2	RC		Х		<u> </u>		Х					ļ					_			2.87	2.42
	2-3	RC	×				 					<u> </u>		<u> </u>				000	ODU?	5	2.82	2.81
l	3-4	RC	<u> </u>				<u> </u>		<u> </u>					<u> </u>				AN C	10-1	10	3.24	3.25
	4-5	RČ			_		<u> </u>					<u> </u>		<u> </u>				14 0	1PM	C	3.22	3 24
	5-6	RC	<u> </u>											<u> </u>				17 ()//	A.	2	3.21	3 24
	7.0	RC	+ <u>×</u>	v	<u> </u>		<u> </u>	~						<u> </u>				0.00	ILITY-	st	3.02	2,97
	8.0	RC PC	- v	~		Y	<u> </u>											12	Tre	-	3.02	3 15
	9,10	RC	Ŷ										<u> </u>					1	5-10-15-12		2.01	2.01
	V.10					+			<u> </u>		1							5 × 1			2.31	2.01
				· ·		+			<u> </u>													
L /		L.	I	_	,	1	L					1				/						
	Client						Date					NDE	Inspector	1.			Date 3/	13/2019				
Form MS.RT	ASME			107					-1-12					,	Andrev	w Gruber						
				"C'lion	u hae fir	nation three terr	only and	100000	cubulity fo	ur intern	notelor	one hne	ontonco	ot ovar	minokon or	nd reporte"						

authority and responsibility for interpetation and acceptance of examination and reports"

1988 E210 -		11/188											Job Lo	ocation:	<u></u>	SLC, Utah		Date: Team W.O:	<u>3/4/2019</u> 1116-001390)
A DECKET OF THE OWNER	A state	and and and the second	(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599-	4115			Job Ref	erence:		5361-1		Client P.O.:	45650	_
E	Cuslomer ATON MET	AL				<u>Type (</u> Butt	Of Weld Weld				IR- 192	2	CO- 60		X-Ray	Film Type AGFA D5	Film Size 4.5 X 17		ASTM WIRE B	
Boil	Specification ler/ Pressure V	essel				<u>Drawing</u>	<u>Number</u>					<u>Sourc</u> 10	<u>e Strengli</u> 02	or M <u>A</u> /K	⊻ CI	Emulsion Number 6250602N	<u>Exp. Date</u> 1/1/21	<u>P</u> e	enetrameter Material Stainless Steel	
	Procedure			Pipe O	.O./ Plpe TI	hickness		р	late Thicknet	<u>ss</u>	Foc	al Spot Siz	e (F)	Ex	p. Time	Single Load 🗹			netrameter Location	
F	RT.ASME.1 R	24			loiot Typ	.875"			Molarial			0.124"	Mills Dai		N.45 SEC.	Double Load		Source Side	Film Side	
RT	- ASME Sec.	VIII			Butt Wek	5 1			Materier Carbon Stee	el		Inckness	1.187	milliorcenter m	<u>rk (u)</u>	SWE/SW	ii <u>que</u> W	NA	NA	55
<u>Ex</u>	posure Techni	ique				Surface	Condition					Sou	urc <u>e To O</u>	pject (D)		Screen Thick	kness		ID Placement	
	8					As W	Velded						20"			.010"01	<u>0"</u>		Lead on Film	
ingle 🗹	Double		Auto			<u>E180, E19</u>	Manua Manua	al	\checkmark							Lead	lenal	Film Side	Source Side	Π
		ISO Line #													Report #					
Weld No.	View	Weld LD	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks		Penetrameter Density	Weld Density
LS 38U	0-1	RC		x				- <u>x</u>									Remains		2.75	2.77
	1-2	RC	Х																2.85	2.80
	2-3	RC	X																2.84	2.85
	3-4	RC	X						+										2.67	2.69
	5-6	RC	X																2.00	2.85
	6-7	RC	Х																3.00	2.99
	7-8	RC	Х																2.89	2.78
10 2411	8-9	RC	X																2.87	2.84
23 310	1-2	RC	x																2.78	2.77
	2-3	RC	Х																2.90	2.91
	3-4	RC	X																2.89	2.88
	4-5	RC	X				·												3.02	3.00
	5-6	RC	X																2.78	2.79
	7-8	RC	X						+										2.89	2.88
	8-9	RĈ	X																2.84	2.95
	9-10	RC	Х																3.00	3.02
LS 37U	0-1	RC	Х		_											_			2.87	2.84
	1-2	RC	X						┦									_	2.78	2.77
	2-3	RC	X					•							<u> </u>				2.80	2.81
	4-5	RĈ	X												<u> </u>			0800	2.90	2.91
	5-6	RC	X															AT 0. 54	3.02	3.00
	6-7	RC	Х															" OPD o	2.78	2.79
	7-8	RC	X															Z QUA	2.89	2.88
	8-9	RC	X				·		┨									LITY NO	2.99	3.00
	9-10		^														_	TIL	2.84	2.95
									+								_			+
													I	1		and the second s				_
orm MS PT	Client:	_					Date:					NDEI	Inspector	<u> </u> _	Andrew	Da	ale:3/	4/2019		

Stan Strong	Carl Mar	(0)	Salt Lake	City, UT	Denve	er, CO	Billings	5, MT	Farming	ton, NM				Client:	EAT	TON METAL	-	Date.	3/13/2019	
													Job Lo	ocation:		SLC, Utah	_	Team W.O:	1116-001390	
AND A CONTRACT	alt and and	CONTRACTOR OF	(801)397	-2202	(720)579	9-0660	(406)371-	5822	(505)599	4115			Job Ref	erence:	536	51-1 Repairs		Client P.O.,	45650	
	Customer					Түре (Of Weld					R	adiation S	ource		Film Type	Film Size	P	enetremeter Type	
<u></u> E/	ATON MET	AL				Butt	Weld				IR- 192	0_	CO- 60		X-Ray	AGFA 05	4.5 × 17	_	ASTM WIRE B	
	Specification)				Drewing	Number					Sourc	e Strengti	or MA/K	V	Emulsion Number	Exp. Date	Per	netrameter Material	
Boil	er/ Pressure V	essel											34	1	CI	8250602N	1/1/21		Stainless Steel	
	Procedure			Pipe O	D./ Pipe ŢI	hickness		P	late Thickne	853	Foo	cal Spol Siz	e (F)	E>	o Time	Single Load		Per	netrameter Location	
F	RT.ASME.1 R	24				.875"					I	0.124"			2 MIN	Double Load		Source Side	Film Side	
Ac	ceptance Crit	lena			<u> Joint Typ</u>	e			Material			Thickness	With Re	nforceme	ent (ợ)	Film Teo	chnique	Shim Material	Thickne	55
RT	- ASME Sec	. VIII	L		Bull Weld	đ			arbon Ste	el			1.187			SWE/	SWV	NA	NA	
Ex	posure Techn	lique				Surface	Condition					Sou	<u>irce To O</u>	bject (D)		Screen T	hickness		ID Placement	
	В					As V	Velded					_	20"			.010"-	010"		Lead on Film	
	Viewing					<u>Film Pr</u>	ocessing									Screen	material		idn Marker Placement	
Single	Double		Auto				Manua	<u> </u>							- Danad #		ad	Film Side (2)	Source Side	
		ISO LINE #			1	τ	1			1		1			T Report #	·				
								UQ		5		5	5		1				Sity	
		1	'					nsi	ु ध	_	L L Br	ztic] ISI	~					Der	sity
]de	G	Sity	g	5	u. a	atio	្រក្ខ	l õ	dic	lnc	avit					er	eus
			Ŭ	Seje	20	Sla	l a	olet	et a	de	È	ei	S) ë					Tet	0
			4		<u>م</u>		Ĩ	line in the second seco	Per	5	L L L	fac	gst	Ŭ					trar	Vei
								ŭ			<u>۵</u>	Sur	5						ene	>
Weld No.	View	Weld I.D.			<u> </u>					L				<u> </u>			Remarks			
L\$ 34U	0-1	RC	X			 					<u> </u>								2 66	2.24
	8-9	RC		X	×		┣			<u> </u>									2 90	2.95
			<u> </u>						ļ	<u> </u>										
LS 35U	0-1	RC	X			X													2,92	2.69
10.0011	2.4	D C			l						<u> </u>	<u> </u>		┝───						2.16
LS 360	0.1	RC RC	⊢ Ŷ									┨╼───	<u> </u>						3.13	3.10
	1-2		⊢≎–		1	1					i —		<u> </u>		000 ff 00 fi	Im at 2 loction			3.00	2.05
	2-3		+^	—	<u> </u>		$\left \right $		<u> </u>		<u> </u>	<u> </u>			scon on i	im at 5 loction			3,10	3.16
	3-4	RC RC		<u> </u>				^			<u> </u>	-		<u> </u>	<u> </u>				2.97	2.00
	4-0																		2,07	2.03
	5-6		÷			<u> </u>				<u> </u>	<u> </u>							-	2.80	2.04
	7.0	RC		· · ·							<u> </u>		<u> </u>	<u> </u>					2.00	3.11
	8-0	RC	Ŷ											<u> </u>					3.04	3.07
	9-10	RC	X			<u> </u>			<u> </u>					<u> </u>	scuff om f				3.16	3.20
	3-10					<u> </u>				<u> </u>	1			1	Soundaria				0.10	0.20
1.\$ 3211	9-10	80	×																2 90	2,90
20 020						<u> </u>	1													-
LS 38U	0-1	RČ		х	X		1	Х		<u> </u>									2.84	2.74
						1				<u> </u>										
LS 33U	0-1	RC		Х	X				<u> </u>										2.45	2 94
	1-2	RC	1	Х				Х											2 87	2,42
	2-3	RC	X															(POD)	2.82	2.81
	3-4	RC	X		<u> </u>							1	<u> </u>					(Preparocy	3.24	3.25
	4-5	RC	X							<u> </u>	1		<u> </u>					15 SDN	3.22	3.24
	5-6	RC	X															12 OLD	3.21	3.24
	6-7	RC	X						-									QUALITY.	3.02	2.97
	7-8	RC		Х				Х		["								I'dy a	3.02	3.15
	8-9	RC	X			X												2 271	3.01	3.12
	9-10	RC	X																2.91	2.01
															11					
			-											/						
	Client						Date				_	NDE	Inspector	1.1	<u></u>		_Date:3/	/13/2019		
Form MS.RT	.ASME			"Clice	1 600 6-		acity and		aibilib. f		alalias	and acc	0010000		Andrev minotion	w Gruber				

[&]quot;Client has final authority and responsibility for interpetation and acceptance of examination and reports"

Í			W S	Sall Lake	City, UT	Denve	ər, CO	Billing	s, MT	Farminglo	MA , no			Job Lo	Client: cation:	EA1	FON METAL SLC, Utah		Date: Team W.O:	3/15 1116-	5/2019 001390	
		Custamer		(801)397-	2202	(720)579	0-0660 <u>Type C</u>	(406)371 01 Weld	-5822	(505)599-4	1115		<u> </u>	Job Refe adiation S	erence:	536	51-1 Repairs	Film Size	Client P.O.:	45 Penetramater Ty	5650 rpe	
	EA	ATON MET	AL				Butt	Weld				IR- 192		CO- 60		X-Ray	AGFA D5	4.5 X 17		ASTM WIRE E)	
	Boile	Specification en/ Pressure Ve	essel				<u>Urawing</u>	Number					50010	<u>e suengu</u> }4		CI	8250602N	1/1/21	<u> </u>	Stainless Stee	de <u>na</u>	
-		Procedure			Pipe O.	O / Pipe Ti	nickness		 <u>Pi</u>	ate Thicknes	<u>s</u>	Fac	al Spot Siz	e (F)	Ēx	p. Time	Single Load		- <u>-</u>	enetrameter Loc	ation	
-	R	Centance Crit	24 <u> </u>			Joint TrioL	.875"			Маtелаі			0,124" Thickness	Wilh Rei	níorceme	2 MIN ni (d)	Double Load LJ Film Techr	nane	Source Side L	Film Side	 Thickness	
L	RT	- ASME Sec.	VIII			Butt Weld	- t		с	arbon Stee	H			1.187	70)		SWE/SV	Ŵ			NA	
	Exp	posure Techni P	lque				Surface	Condition					<u>Soi</u>	<u>irce To Ol</u> 20"	blect (D)		Screen Thic 010''- 01	kness korr		<u>ID Placement</u> (ead on Film		
_		Viewing					Film Pro	ocessing									Screen ma	lerial	Leca	ation Marker Plac	cement	
s	ingle 🔽	Double		Auto				Manu	al	2						Bonart #	Lead		Film Side 📿	Source	Side	
-			15 <u>0 Line #</u>						_							Report #					t∡	v
	Weld No.	View	Weld I.D.	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Densi	Weld Density
F	LS 34U	8-9	RC	Х																	3.30	3.33
	-	9-10	RC		X	X			X												3.16	3.14
AN AL	LS 38U	0-1	RC		Х	Х			Х											_	2.92	2,69
F	10 2011	2.4	80																		3 31	3 30
-	13 300	3-4		^																	0.01	3.50
	LS 33U	0-1	RC	X																	3.09	3.07
_		2-3	RČ	X																	2.98	2.99
-																						
-																						
ŀ							<u> </u>															
ŀ																						
ļ																						
┝							-														DUCS	
						· ·															5	2
																				-6-0	PD	8
┝																				1-2 01	ALITY	ž)
Ľ				<u> </u>																	(تر	2
┝										$\left \right $												
-																<u></u>	where whe					
	Form MS.R	Chent T.ASME				the f		Date:		eibilib: f-	e inter-	-	NDE	Inspector	<u> </u>	Andrey	w Gruber	Date:3/	15/2019			

10. 10			Salt Lake	e City J	Qenv	er CO	Bulling	s Mī	Farming	ton NM				Chent	EAT	TON METALS		Dale	3/19	2019	
1. 1. 1. 1.		115	(801)397	-2202	(720)579	9-0660	(4081371	-5822	15051699	-4115			Job Li	ocation.	536	S.L.C UL		Team W O	1116-	001390	
	Custoper				11201010	Type (2: Wela	0022	1444100			R	acial pri s	erence.		Film Type	Film Size		40 editionated Tw	000	
EA	TON MET.	ALS				Bult	Weid				IR- 192		CO 60	2 Profes	X-Ray	AGFA D5	45×17	-	ASTIME WIRE	10	
	Specification	3				Drawing	Number					Source	e Strengtr	DI MAK	v	Emy alon Number	Exc Date	Per	leh anjetar Mate	tha.	
Ba	e:/ Pressure V	lessei										1	02			9150609N	10/1/21		Stamless Steel		
	Procesure			<u>⊇: *(</u> 0	O/Pipe T	076		2	igte Trica <u>n</u> e	685	For	Car Spit El	o (†)	Ex	g Time	Single Load		2.er	ettangter Loga	11211	
	Ceptance Co	14/12			loant Typ	.070 F			Vaterial			Truckness	Witt Ale	ito/ceme	n 45 SEC	Couble Loss	hratise	Shim Material	F100 2106	Transass	
	- ASME Sec	V.II			Bull We	a		C	arbon Ste	eei			1.18	7		SWEA	SWV	Sciente Dissociation		4.00	
Ę,	ucsure Techr	NCLIE				Surface	Congiuen					Şo.	iroe To O	bject (O)		Screen Tr	TICKJIGSS		D Puerement		
	G					As M	Veioed						18 00	0		005"-	010"	2010223	Lead on Film		
Closer	Viewing		Auro			<u>Film Pr</u>	o <u>cessing</u> Manus) i								Screena	nateria	i ocaj	on Varker Plac	ement Victo	
Single	00000	ISO Line #	- Au				manua							_	Report #			Fullaus	300.08	alle	
			<u> </u>				<u> </u>		["												
Weld No.	View	Weld I.D.	Accept	Reject	Porosity	Stag	Crack	Incomplete Fusior	Incompiele Penelration	Undercut	Burn Through	Surface Indrcation	Tungsten Inclusion	Concavity			Remarks			^D enetrameter Dens	Weld Densily
LS 33U	7-8	RC	X		X	X								r						2 03	2 03
							[-												
LS 34U	8-9	RC	X		X															2.02	2 04
	9-10	RC	X		X					l			-		<u> </u>					2 03	2 02
1 S 38U	0-1	RC	x	-	X	X														2 07	2.04
				-				-													
										í					 						
													-		<u> </u>						
																				-	
										. <u> </u>				<u> </u>							
				<u>+</u>			<u> </u>														
									i												
															_						
						-	-														
									<u> </u>									00	DU		
												-						1000	e co		
																		14 5	PD SI		
																		2-000	~ <u>₹</u>		
																		10,40,4	LITY A		
		<u> </u>																63	500-		
			-																		
															[1_0_0	//				
														/	(\].		L				
Form MS R	Cherri TIASME	· · · · · ·					Date				-	50:4	'nsbaclor		Chao	d Cross	Date 3	19/2018			

		M &	Sall Lake	City, UT	Uenv	er, CO	Banuð	95 M I	Farming	lon, NM			Job Lo	Client.	EA	TON METAL SLC, Utah		Date Team W O:	3/5/20	19 1390	_
		- N. A 28	(801)397	2202	(720)579	9-0660	(406)371	1-5822	(505)599	-4115			Job Ref	arence.		5361-1		Client P.O.:	4565	0	_
	Cuştomer					Туре (Dí Weld					R	agiation S	ource		Film Type	Film Size		Peneirameter Type		
E/	ATON MET	AL				Buti	Weld				IR- 192	1	CO- 60	LJ	X-Ray 🗌	AGFA D5	4 5 X 17		ASTM WIRE B		
D -4	Specification]				<u>Drawing</u>	<u>Number</u>					Source 11	e Strength	or MA/K	⊻ CI	Emulsion Number 8250602M	Exp_Date 1/1/21	Ē	Staulass Steel	4	
BOH	Procedure	esse		Pipe O	D / Pilor TI	hickness		P	late Thurn	:55	Foc	al Spot Sizi	24 2 (F)	Ex	p Time	Single Load	17 172)	реника и страници, конструкци, конс	enetrameter Localion	n	-
F	RT ASME) R	24				.875"						0.124"		1 Mil	N 45 SEC	Double Load		Source Side	Film Side		
Ac	ceptance Crit	ena	-		<u>Joint Typ</u>	ē			Material			Thickness	With Rea	nforceme	ni (d)	Film Lechn	ique	Shim Material	Th	ickness	
RT	- ASME Sec	. VIN			Butt Weld	d		(Carbon Ste	el			1.187	"		SWE/SW	N	NA		NA	_
Exi	posure Techn	llquê				Surface	Condition	1				Sou	<u>rce To Ot</u> 20"	<u>yect (D)</u>		Screen Thic	Kness Of		I <u>D Placement</u>		
	Viewing					Edm Pr	ocessing		_							Screen ma	enal	Loc	alion Marker Placem	ent	-
ingle 🖸	Double		Aulo	D			Manu	al	2					_		Lead		Film Side 🕗	Source Sid	ie	
		ISO Line #												_	Report #	<u></u>					_
Weld No.	View	Weld I D.	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	(ncomplete Penetration	Undercu!	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Density	
LS 33U	0-1	RC		Х				X												2.75	Γ
	1-2	RC	Х					ļ							Scuff mar	k on film at the 2 loca	ation		:	2 78	Ļ
	2-3	RC	X		<u> </u>										Scuff mar	k on film at the 2 loca	ation.			2,77	╀
	3-4	RC		X		-		X												2.67	╀
	4.5	RC		X				<u>⊢</u>												2.00	t
	6-7	RC		X				X												2.75	t
	7-8	RC	Х						-											2.89	I
	8-9	RC	X																	2.87	4
10.0014	9-10	RC	X																	2.77	╀
15 360	0-1	RC			<u> </u>						···-									2.80	t
	2.3	RC		x		<u> </u>		X							<u> </u>					2.89	t
	3-4	RC		X				X												3 02	T
	4-5	RC		Х				X												2.78	I
	5-6	RC	X					<u> </u>												2 89	╞
	6-7	RC	X							<u> </u>										2.99	╀
	7-8 8-9	RC		X				<u> </u>												2.04 3.00	t
	9-10	RC	x			<u> </u>														2.87	t
LS 35U	0-1	RC		X	Х															2.78	t
	1-2	RC	Х							<u> </u>								- 60000-S		2 66	I
	2-3	RC	X		l	<u> </u>	 	<u> </u>				 						A	1	2.90	4
	3-4	RC	X															15 SPn	6	2.50	╉
	4-5	80	X							<u> </u>								ZOUL	a.	∠.55 2.60	+
	6.7	RC	x					+		<u> </u>								CONLITY .	2	2 89	t
	7-8	RC	Х															Con S		2.78	T
	8-9	RC	X																	2.75	Ţ
	9-10	RC	Х		<u> </u>																+
																					╋
		L	ι	I	1		1	1	1	1	I	1	I								T

in the second	Time with	69	Salt Lake	City, UT	Denv	er, CO	Billing	s. MT	Farming	ton, NM				Client:	EA	TON METAL		Date:	3/13/201	9	
	100 1 10	14											Job Lo	cation:	,	SLC, Ulah		Team W.O:	1116-0013	90	
the state	All and a little		(801)397	-2202	(720)579	9-0660	(406)371-	5822	(505)599	-4115			Job Ref	erence.	536	31-1 Repairs		Client P.O.:	45650		
	Customer					Type (Dí Weld					R	adiation S	OUTOP		Film Type	Film Size		Penetrameter Type		
EA	ATON MET	AL				Bult	Weld				IR- 192	Ū	CO- 60	Ō	X-Ray 🗌	AGFA D5	4 5 X 17		ASTM WIRE 8		
	Specification	<u>)</u>				Drawing	Number					Source	e Strengt/	or MA/K	N	Emulsion Number	Exp_Date	P	enetrameter Material		
Boil	er/ Pressure V	- 'essel										9)4		CI	8250602N	1/1/21	-	Stainless Steel		
	Procedure			Pice O	D / Pipe Ti	hickness		PI	ate Thickno	155	Foo	al Spot Siz	e (F)	E×	p. Time	Single Load		P	enetrameter Location		
	ACME 1 P	24				875"		_				0.124"	- ()		2 MIN			Source Side	Film Side	<u> </u>	
	ceolance Cór	27	-		Joint Type				Materiel			Thickness	With Rei	nforceme	nt (d)	Film Tec	hnioue	Shim Material	Thick	iness	
	ASME Soc	Ma			Built Male	<u>e</u>		0	arbon Ste	el		1110111033	1.187	10		SWEIS	ŴV	NA	N	A	
	- ASINE SEC				DOIL THEN	Surface	Condition		210011010	Ç.		Sou	Irce To O	piect (D)		Screen Th	lickness		ID Placement		
50		nque				Ac M	Vetded					000	20"	5100((15)		010**	010"		Lead on Film		
) (aution					Eim Pr							10			Screen n	naterial	Lec	alion Marker Placemer		
	Viewijaj		0.00			1 100 - 0	Manus										d	Film Side 7	Source Side	<u>n</u>	
Single C	Donpie	1801 inc. #	Auto				Walluc	31							Peport #	Lea	u.	Film Side CS	300108 3108		<u>ц</u>
		ISO Line #				1									T T T	,			·		
								5				5	5								
								'ISIC	ως	_	Чĝ	atio	nsi	~							λ
			ă	ក	ţ,	<u> </u>	×	ιĨ	atic	5	0	dic	UC	1×						.	sus
			8 S	÷.	ŝ) aí	2aC	ete	etr	der	Ē	Ē		33					ŝ		ð
			Ă	æ	6	"	0	đ	e g	5	E	l Se	ste	8					2	6	eld
													í	3							
Weld No.	View	WeidLD						5				S	٦				Remarks				
	0-1	PC RC				<u> </u>											11011101110		2	66	2.24
L3 340	0-1 8 0	RC	Â	×	×						<u> </u>		┣━─						2.	an	2.95
	0-9	RC		<u> </u>	<u> </u>															30	2.35
	0.4		~																2	02	2.60
LS 350	0-1	RC	~			<u> </u>					<u> </u>		<u> </u>						۷.	92	2.09
			~ ~ ~								<u> </u>		<u> </u>							1.5	2.46
LS 36U	0-1	RC	X								<u> </u>								3.	15	3.16
-	1-2	RC	X		Ì		<u> </u>				 								3.	1 80	3.05
	2-3	RC	X												scuff on fi	Im at 3 loction			3.	18	3.17
	3-4	RC	<u> </u>	X				X											3	15	3.16
	4-5	RC	X																2.	87	2.89
	5-6	RC	Х																2.	86	2.84
	6-7	RC	Х																2.	86	2,88
	7-8	RĈ	Х																3.	12	3.11
	8-9	RĆ	Х																3.	04	3.07
	9-10	RC	Х								L				scuff om f	him			3.	16	3.20
LS 32U	9-10	RC	Х																2.	90	2,90
LS 38U	0-1	RC		Х	Х			Х											2.	84	2.74
LS 33U	0-1	RC		X	Х	1													2.	45	2.94
	1-2	RC		X				Х											2	87	2.42
	2-3	RC	X				1				-							Coone	2	82	2.81
	3-4	BC.	X			1					<u> </u>							12	3.	24	3.25
	4.5	80	X												1			15 SDA	3.	22	3.24
	5.6	RC	x										t		1		_	TE OFD	3	21	3.24
	67		Ŷ															QUAL	5 3	02	2.97
	70-/	RC PC	^	- · _				- <u>x</u>				1	<u> </u>		1			Are marth	\$/ 3	02	3.15
	/-0		~	<u> </u>				^				<u> </u>						- 19 - 19	2	01	3.12
	8-9	<u></u>	<u>`</u>			<u> </u>													3.	01	2.01
	9-10	RC	X				<u> </u>			L			<u> </u>	<u> </u>					2.	<u>,</u>	2.01
			 -			 							<u> </u>								
																		_	I		
																		10/0010			
	Client.						Date:				-	NDE	Inspector	_And		 Quitau	Date. 3/	13/2019			
Form MS.RT	ASME														Andrev	v Gruber					

1

Radiographic Inspection Report

No. BI42919

Customer	Eaton me	tal produc	ts				Dol	e 4/29/19			Job No. 1	9-0357-11	
Item des	cription 536	1-1				Job Loc	ation P(ocatello ida	ho		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	P.O. No.	45758
Procedure	No. Rt 131	0				Code S	pecifica	tion Asme v				Type Materia	C/s
Acceptan	ce Standard A	sme VIII u	w-52		Pip	e		Plat	eχ		Other	Perc	ent Inspection Spot
Geometric	Unsharpness	(∪9).005		Penetrameter	В	Effec	tive Foc	al Spot .124		Sourc	ce size .10	6x.064	Density 2.0-4.0
Source 1	192	Curies	62.3		Pb Screens	back .01	0	Pb Screens fr	ont .01	0	Single	V boo	Single wall X
Exposure	time 3m 10	sec		Develop time 5	min@ 68	¥	Shir	πN/A			Double	bool	Double wail
Reinforce	ment 1/8"		Sourc	e to 21			Distor	ice from source	.875		Single V	Vall X	Double wall
Film No.	Weld No.	Serial No./Pi	ece No	View	Film si	ze Th	ickness	S.F.D	Accept	Reject	Defect code		Comments
		31u-3	3u	9-10	4.5x1	7.	875	21.875	V		Ei		
											and a statement of the	,	
				a									
								,,/······					
												······································	
												· · · · · · · · · · · · · · · · · · ·	
				· · · · · · · · · · · · · · · · · · ·									
	,								·				
						_							
											A	CERTIFIED RADIO	GRAPHIC INTERPRETER
											K A	S EXP. 9/0	1/2021
											<u> </u>		11 tourant
					— <u> </u>							/	
IP - Incor CV - Cond IF - Incor C - Crack	nplete penetro cavity Root mplete fusian	ation ET - 1 CX - UC - OX - FI	DEFEC Elongato Convexi Underca Oxidati	T CODE ed Inclusion RI ty Root DT it BT- on FA- ED:	- Rounded In - Drop Throug Burn through Film Artifac	nclusion gh t					зно	OTING SKETCH	
Totel hrs.	FILM	15 <u>4.5</u> 15 5 Total Mileage	_ × _ × _ ×	17 1 1 Numb	TYPE <u>Agfa</u> TYPE TYPE her of Welds	a d5 	- - 	(*				
Brand Rodiog Cinthi Rodiogra	a latimer pher Assit		ير)	Aluadati	Leve Leve	1 	-						UINEN SEE SKETCH
Film de	livery				Date	2	_	_		<u>u-I</u>			
T	he recorded res	ults are the opi	nion of t	he technician to t	he best of his	knowledge	a based o	in the informatio	n provide	ed to him i	by line custor	ner at the time of the ir	nspection.

	Λ	N 1 1 1	Salt Lake	e City, UT	Denve	er, CO	Billing	≱s, MT	Farming	ton, NM			Job I -	Client:	EA		Dale:	3/	5/2019	
	. A.		(801)397	-2202	(720)579	-0660	(406)371	-5822	(505)599	-4115			Job Ref	erence:		5361-1	Client P.O.:	4	5650	
	Customer					Туре (X Weld					R	adiation S	ource		Film Type Film Size		Penetrameter]	<u>vpe</u>	
ÉA	ATON MET	´AL				Butt	Weld				IR- 192	9	CO- 60		X-Ray 🗌	AGFA D5 4.5 X 17	L	ASTM WIRE	В	
	Specification	2				Drawing	Number					Source	e Strength	or MA/K	⊻ Cl	Emulsion Number Exp Date		Penetrameter Ma	atenal	
8016	Pressure V Procedure	essel		Pine ()	0 / Pine Th	ickness		6	late Thickne		Eor	al Soot Size	02 e (E)	Fr		Single Load		Staintess Ste	el calion	
R	T ASME.1 R	24				.875"						0.124"	- (,)	1 MB	N 45 SEC	Double Load	Source Side	Film Side		
Act	ceptance Crit	teria			Joint Type	ę			Material			Thickness	With Rei	nlorceme	<u>nt (d)</u>	<u>Film Technique</u>	Shim Male	eriəl	Thickness	<u>s</u>
RT	- ASME Sec.	. VIII			Butt Weld	t		(Carbon Ste	el			1.187	NI		SWE/SWV	NA		NA	
<u>Ext</u>	posure Techn R	liquê				Surface As W	Condition					500	<u>rce To Ol</u> 20"	ojeci (D)		OID"- 010"		ID Placemer	μ L	
	Viewing					Film Pr	ocessing						20			Screen material		Location Marker Pla	acement	
Single 🗹	Double		Auto				Manu	al	1							Lead	Film Side	Source	e Side	
		ISO Line #													Report #				1	
						l		ų				5	jo						nsily	
					≥			Fus	ele	Ę	-dgn	icati	clus	Ϊζ					Dei	
			de og	ejec	rosi	Slag	Lack	ete	Plrat	derc	Ц Ц Ц	Pul	, c	Cav					eler	
			Ă	œ	6	0,00	0		Pen	ñ	5	lace	gste	ð					Lan	
				l				l ncc			m	Sur	l S						enel	
Weld No.	View	Weld I.D.														Remarks			2.75	+
13 330	1-2	RČ	X												Scuff mar	k on film at the 2 location.			2.78	+
	2-3	RC	Х												Scuff mar	k on film at the 2 location.			2.77	
	3-4	RC		X				X											2.67	
	4-5	RC																	2.66	+
	6-7	RC		Â				Â											2.75	+
	7-8	RC	Х																2.89	
	8-9	RC	X										_						2.87	
10.2611	9-10	RC	<u> </u>	- v										-					2.77	╀
LS 300	1-2	RC		Γ <u>x</u>				x			- î		-						2.00	+
	2-3	RC		X				Х											2.89	
	3-4	RC		X				X							<u> </u>				3.02	
	4-5	RC	v	<u>⊢×</u>			<u> </u>	<u> </u>											2.78	+
	6-7	RC	Â			<u> </u>													2.89	+
	7-8	RC		X				Х											2.84	
	8-9	RC		X				X			L								3.00	
1135 21	9-10	RC	X	- v	v	<u> </u>			+			<u> </u>							2.87	+
L3 330	1-2	RC	X														-00		2.66	+
	2-3	RĆ	Х														Sphon	C>	2.90	
	3-4	RC	Х														SP SP	n al	2.50	
	4-5	RC	X														2 011	š	2.55	-
	6-7	RC	x														P. SUALIT	YSI	2.89	
	7-8	RC	Х														2 27	n'	2.78	
	8-9	RC	X																2.75	
	9-10	RC	<u> </u>																	-
																			1	+
L							•	<u> </u>			• • •	• • • •	••••	•						

Signation of the local division of the local	Pat and	(H)	Salt Lake	City, UT	Denv	er, CO	Billing	s, MT	Farming	ton, NM				Client.	EA	TON METAL		Date	3/13/201	9	
													Job L	ocalion [.]	5	SLC, Utah		Team W.O [.]	1116-0013	390	
Constant of the second	Handlands.	and the second second	(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599	-4115			Job Ref	erence	536	51-1 Repairs		Client P.O.:	45650		
	Customer					Туре (Of Weld					R	adjation S	Source		Film Type	Film Size	P	enetrameter Type		
E/	ATON MET	AL				Buti	Weld				IR- 192	Ū.	CO- 60		X-Ray	AGFA D5	4.5 X 17		ASTM WIRE B		
	Specification	1				Drawing	<u>Number</u>					Source	e Strengt	s or MA/K	Ŷ	Emulsion Number	Exp Date	Pe	netrameter Material		
801	er/ Pressure V	essel										9	4		CI	8250602N	1/1/21		Stainless Steel		
	Procedure			<u>Pipe O</u>	D./ Pipe T	hickness		P	ale Thickne		Foo	al Spot Siz	e (F)	Ex	κρ. Time			Pei	netrameter Location	-	
F	RT.ASME,1 R	24				875"						0.124"			2 MIN	Double Load		Source Side L	Film Side		
<u>Ac</u>	ceptance Cnt	ena			Joint Typ	<u>e</u>		_	Material			Thickness	With Rei	nforceme	ent (d)	Film Tec	hnique	Shim Material	Thic	kness	
	ASME Sec.	. VIII			Bull Wel	d		C	arbon Ste	el	<u> </u>		1.18			SWE/	SWV	NA		IA	
EX	posure Techn	ldřie				Surface	Condition					Sou	rce To Q	bject (D)		Screen Th	<u>lickness</u>		ID Placement		
	B)(inverse					AS V	velded						20			010 Second	010	1	Leao on Film		
Sunale [7]	Double	Ē	Auto	П		<u>P10(1 P1</u>	Manus	ai	Ð							Screen	natenat		Source Side	<u>11</u>	
Single	QUODIE	ISO Line #	1 7000				141¢11/Lit								Report #				300000 3000		()
						T						1			incport #					~	
								G				6	<u>io</u>								
		Į						Isn-	o te	5	ļ ģ	cali	lus	≥							sity
			lda	ect	Silt	őe	1 X	т С	rati	SC 1	Pro	<u>Id</u>	<u> </u>	a vi						<u>u</u>	(eu
			ACC	Rej	Jor	ŝ	Š	ple	Det of	po		8	ten	ouc							Q Q
					L ar			шo	E &		l Ing	rfac	Số	O I							Vel
								oul				Su	T _U							<u>ย</u> มี	_
Weld No.	View	Weld I.D.			<u> </u>												Remarks			L	
LS <u>340</u>	0-1	RC	X								<u> </u>		<u> </u>						2	66	2.24
	8-9	RC		X	<u>×</u>	<u> </u>			<u> </u>			<u> </u>							2.	90	2.95
1 \$ 2611	0.1		v			×													2	0.2	2.60
13 330																			Z,	52	2.09
LS 36U	0-1	RC	X			<u> </u>													3	15	3.16
	1-2	RC	X																3	08	3.05
	2-3	RC	X											<u> </u>	scuff on fi	Im at 3 loction			3.	18	3.17
	3-4	RC		х				_ x											3.	15	3.16
	4-5	RC	X																2.	87	2.89
	5-6	RC	X																2.	86	2.84
	6-7	RC	Х																2	86	2.88
	7-8	RC	X																3.	12	3.11
	8-9	RC	X								ļ			<u> </u>					3.	04	3.07
	9-10	RC	X		L				<u> </u>		L			L	scuff om t	film			3.	16	3.20
			<u> </u>		<u> </u>							<u> </u>		<u> </u>							0.0-
LS 32U	9-10	RC RC	X							<u> </u>	<u> </u>								- 2.	90	2,90
10.0011	0.1			¥	~			¥			<u> </u>			<u> </u>						. I	2.74
LS 380	0-1	, KU		~	<u> </u>		+			— —	<u> </u>			<u> </u>					2	04	2./4
15 2311	0.1	RC		¥			+								<u> </u>					45	2 94
10 330	1.2	BC		X		<u> </u>		X				<u> </u>							2	87	2.04
	2.3	RC	x	~						l	<u> </u>	<u> </u>		<u> </u>				(anno	2	82	2.81
	3.4	RÔ	x									··· —			1			Contra Contraction	2	24	3.25
	4-5	RC	$\frac{1}{x}$												+			10 SDA	0 3	22	3.24
	5-6	RC	X			1						<u> </u>			<u> </u>			18 ort	2 3	21	3.24
	6-7	RC	X								1	<u> </u>						O QUALIT	3	02	2.97
	7-8	RC		X		<u> </u>		Х						<u> </u>				1th any	3	02	3.15
	8-9	RC	X			X	-											1 2TC	3	01	3.12
	9-10	RĆ	X																2	91	2.01
											J				L/						
														/		1000					
Face 140.07	Client						Date.				_	NDE	Inspector	1.1	1	Cruba	Date 3	13/2019			
POINT MS.RT	ASIVIE			°Cheo	t has fir	hal auth	ority and	resono	sibililv fr	n intero	elation	and acc	eplance	ofever	mination ar	id renods"					
				\ue1		-ar aban		. copon	subouty it	- merb			optionice	ALC: NO		o opono					

		V 68 00	Sall Lake	Cíty, UT	Denvé	er, CO	Billing	s, MT	Faming	ion, NM				Client:	EAT	TON METAL		Date	;	3/1	5/2019	
			19011202	1100	17001470	0660	(406)274	5900	15051500	4115			Job Lo	calion,	5	SLC, Ulah		Team W.C)	1116	-001390	
			(801)397-	2202	(720)579	-0000 Turne ((400)3/1-	-3022	(202)289	-4112		,	Job Refe	erence	536	Ello Tugo	Eilm Size	Client P.O	·	4	5650	
ÉA	Costomer TON MET	AI				<u>Type (</u> Bull	Weld				IR- 192	2	CO- 60		X-Ray	AGFA D5	4 5 X 17		Ē	ASTM WIRF	<u>үре</u> 8	
	Specification					Drawing	Nomber					Source	e Strength	or MA/K	<u>/</u>	Emotsion Number	Exp Date		 <u>Pe</u>	enetrameter Ma	lienal	
Boile	er/ Pressure Ve	essel							_			9	4		CI	8250602N	1/1/21			Slamless Ste	el	
	Procedure			Pipe O	D/Pipe T≀	lickness		<u>Pl</u>	ale Thickne	55 62	Fac	al Spot Size	e (F)	Exp	o Time	Single Load			_ <u>Pe</u>	netrameter Lo	calion	
R	T.ASME 1 R2	24				.875"						0.124"		2	MIN	Double Load		Source Side	4	Film Side	<u> </u>	
Ac	ceptance Crit	ena		3	Jaint Type	<u>e</u>		_	Matenal	-1	1 1	hickness	1 1 97	nlorcemer 	<u>n (q)</u>	Filin Teci	nique	Shim Ma	alerial		Thickness	
RT	ASME Sec	VB			Buil Weil	Sudace	Condition	C	arbon ate	ei		Sou	107 (Ce To O	prect (D)		Streen Th	ICKOess			ID Placemer		
<u>CA</u>	6					As V	velded						20"	DELLE?		010"0	010"			Lead on Film	2)	
	Viewing					<u>Film Pr</u>	ocessing									Screen m	alenal		Loca	Mon Marker Pla	acement	
Single 🖸	Double		Auto				Manua	al	2							Lea	u	Film Side	2	Source	e Side	\Box
		ISO Line #	•									·			Report #							
Weld No.	View	Weld I.D	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks				Penetrameter Density	Weld Density
LS 34U	8-9	RC	X																		3 30	3.33
	9-10	RC		X	Х			X													3 16	3.14
LS 38U	0-1	RC		x	X			х													2.92	2.69
																			_			
LS 36U	3-4	RC	X								<u> </u>			<u> </u>							3.31	3.30
16 2211	0.1	80	×																		3.09	3.07
13 330	1-2	RC	X	<u> </u>			-		-		-		1								3.03	2 99
	2-3	RC	Х																		2.98	2.99
					ļ	-					<u> </u>			···								
			-							<u> </u>	-								_		+	
																					1	
										L			<u> </u>								·	
																					· {	
																			_			
																					-	
					1																	
· · · · · · · · · · · · · · · · · · ·			-																			
						<u> </u>															UDUC?	<u> </u>
	ļ		-		· ·										-					$-\lambda$	ton	b,
				<u></u>		+							-							- un	450-	5
			_							<u> </u>	1		1							<u> </u>	U ALITY	<u>=j</u>
		1															•					2
																					<u> </u>	
																_						-
								1			1	I			1	and the second s						
Form MS P	Client TASME	·					Date				_	NDE	Inspecto	<u>///</u>	Andre	w Gruber	Date	8/15/2019				

[&]quot;Client has final authority and responsibility for interpetation and acceptance of examination and reports"

古 (語:	N'I	Ne	Sar Lake	City 37	Daux	er CO	Biling	is, MT	Farming	NOT NV			Job Lo	Client cation	EA	S.L.C. UL		Date Team W O	3/1	9/2019 -001390	
11-18han	all all all	الكيلاناتيا	(801)397	-2202	(720)579	0660-0	(406)371	-5822	1505,599	-4115			Job Refe	erence	536	1-1 REPAIRS		Client P O	4	5650	
	Customer					lyge	O. Meio					R	advation S	<u>ource</u>		Eam Just	Fim Size		Pyretranieter 1	y.p=	
EA	ION MET	ALS				But	Weld	_			IR- 192		CC- 80		X.Ray	AGEA D5	45×17		ASTM B WIR	5	
Sector	Specification	2 Install				经推动用	8 Struitzei					500104	e Stens	UL MAYK	V	Eniu siun Nuniber avenantik	20/1/21		Penetramiter Ma	ognal	
20%	Procedure	e > 30'		a ce D	O / Pitat Ti	1.1.5		5	ure Thickn	ess	ŕo	cal Supt Size	c (F)	E>	a Time	Single Load	10/1/21		Penetramèter Lui	lation	
R	TASMEIR	24				875	1					0 117		ì m	in 45 sec	050.5% K.580		Source Side	Firm Stae	and the second se	
Aga	oggiance Crit	stia			Joint Typ	e			Mater II			Inceress	Wat Ber	'or center	nt (a)	Film Tech	1124	Şhim Mater	a:	Inckness	
27	- ASME Sec	VIII			Butt We d	0		(larton Ste	100			1.187	-	-	SWE	w	1122		_	
<u>5 x</u>	Dosure Techn	ndrē				Surface	Congision					S5	19.00	0 1901 (L)		Soleen In	ICRITESS		ىيەريەتغۇرىي	± 11	
-	Viewita			-		Fum Pr	CESSIO			-		-				Screen 7	atenal		Lead on Marker Pa	corren:	
ngie	Double		Auto			1.000	Manu	al								Lea	d .	Film Side	Sourc	e Sive	
		ISO Line #													Report						
Werd No	View	Werd I.D	Accept	Reject	Porosity	Stæg	Crack	Incomptete Fusion	Incomplete Perretration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Density	Maria Descrit
LS 33U	7-8	RC	Х		X	X		. <u> </u>												2.03	2
	0.0				- v	. <u></u> .															1
LS 340	8-9	RC	X		X									-						2.02	2
	5110				<u> </u>	+				-										- 203	
LS 38U	0-1	RC	X		X	X														2 07	2
																					-
						[-	ļ		İ	·		·		i						<u> </u>
															-						
																	_				-
										·		1								1	-
									ļ												-
																					1
															+						
																				+	
															1						1
																				L	
									ļ												-
																				<u> </u>	<u> </u>
																			0000		
									<u> </u>									1	onouce		+
															_			1ú	SPDA		
																		W			
												_						10	UALITY 2	+	_
				l														1	2-002	+	
					+										+				~		
							-					-					11				
					L		-	·			·				777	1/1/	/				-1

Radiographic Inspection Report

No. BI33019

Customer	Eaton me	tal products						Date;	3/30/19			Job N	». 1 9-03	57-11		
Item des	cription 536	1-1				J₀Þ L	ocation	Poc	atello ida	ho				P.O.	. No. 4	15758
Procedure	×∾. Rt 131	0				Code	Specif	ficatio	n Asme v			, <u>, , , , , , , , , , , , , , , , , , </u>		Type Mat	terial (C/s
Acceptore	ce Stordard A	sme VIII uw	-52		Pip	e			Plat	eX		Oth	er		Perce	ent Inspection 100%
Geometric	: Unsharpness	005. (و ^ل)		Penetrometer B		Eff	ective	Focol :	5pot .124		Sour	ce size .	106x.0	64		Density 2.0-4,0
Source r	192	Curies 8	6.6	1	Pb Screens	back .O	10	P	b Screens fr	ant .01	0	Sir	gle load X	[Single wall X
Exposure	time 2 min	45 sec		Develop time 5m	nin@ 68	*	 	Shim	V/A		<u> </u>	Do	uble load			Double wall view
Reinforce	ment 1/8"	1	ourc	e to t distance 21			Di	stance	from source	.875		Sir	ie Wali X		la	Double wall
Film No.	Weld No.	Serial No./Piec	e No.	. View	. Film s	ize	Thickne	ess	S.F.D	Accept	Reject	Defect	code			Comments
and the second second second		33 u- 38ι	1	0-1	4.5x1	7	1.45	5	21.875		\geq	Ei		ار میں میں دور میں میں ا لمام میں		nnn ar he fan de sen en
/////																
	•														۰.	
		and a local data and a local data and a local data and a local data and a local data and a local data and a loc														
		a														
																The second second second second second second second second second second second second second second second se
			<u>.</u>		u Netoway			_			h					
				··												
																······
														·		
						\rightarrow										
						\rightarrow										
			_													
						_										
			_										_			
								+								
								+							68	NGR
															<u> </u>	le al
																N B
														<u>[</u>]	LQU	ALITY S
														1	<u> X17</u>	<u></u>
								+					_			
			550	T CODE	**					,			SHOOTHA			
IP - Incom	nplete penetri	ation EI - Elo	ngate	d Inclusion RI -	Rounded I	nclusion		:	14			ריד		A CON		
IF - Incon	nplete fusion	UC - Un	lercu	it BT-B	urn through	9n 1				X)))(2] [\/î}	4	
C - Crock		OX - Ox	idatio	on FA-F	ilm Artifac	t 		_			V		Jel 6		111100	
1	FILM	s <u>4.5</u>	X	<u>17</u> ту	PE Agfa	a d5				0	4		_		40	
	FILM	5	×	ту	'PE				and the second se					÷, \		
	FILM	5	x	ту	PE						γT	(<u> </u>		
fotal hrs.		Total Mileage		Number	r of Welds			_	,		<u>, i.</u>	- \		Ш,		
Brande	on Latime			Bule	li			-		я Т	P				• *	OTHER
Radiogr	opher		• • •	Alia Lur	R	1					Ţ,		1	l l		SEESKETCH
<u>Cinthia</u> Radiograp	her Ass't	(ىر		Leve				l		()))))))))))))))))))))))))))))))))))))			l		
Film de	ivery				Date				,	I	0月					
Th	e recorded res	ults are the opinio	n of th	he technician to the	e best of his	knowled	ge base	ed on t	he information	n provide	d to him t	by the cu	stomer at	ihe time of t	he ins	pection.

Radiographic Inspection Report

No. BI4-319

· · · · ·	Cat.		Turn Boo L			1.			I	-		0087 11	
Customer	- L: aton me	tal products			1	Dat	re 4/3/19			J05 1	vo. 19	1-0357-11	, ۱., ۲۰۰۰ میں میں میں میں میں میں میں میں میں میں
Item des	cription 536	1-1			Job Loc	ation PC	ocatello ida	aho				P.O. No.	45758
Procedure	×№. RI 13 1	0			Code 5	pecifica	tion Asme V	1				Type Materia	C/s
Acceptan	ce Standard A	sme VIII uw-	52	Pip	e		Pla	te X		01	her	Pero	ent Inspection 100%
Geometric	Unsharpness	(Vg).005	Penetrometer	B	Effec	tive Foc	of Spot .124		Sour	ce size	.106	x.064	Density 2.0-4.0
Ir	100				010	<u>،</u>		1		T			Single woll v
Source II	192	Curies 80	.o	PD Screens	DOCK .O I) 	Po Screens fr	UI, tro	0		ingle la	and X	view X
Exposure	time 2 min	45 sec	Develop time {	5min@ 68	*	Shir	™N/A	-		0	ouble I	lood	view
Reinforce	ment 1/8"	So	urce to			Distor	ce from source	3.875		Si	ngle W	/ªll X	Double wall
Film No.	Weld No.	Serial No./Piece	No. View	Film si	ze Th	ckness	S.F.D	Accept	Reject	Defec	t code		Comments
1994 (1994)		33 u-3 8u	0-1	4.5x1	7	875	21.875	V		R	i	• .	• · · · · · · · · · · · · · · · · · · ·
20 00000			2-0					V		R	i v		
			2-3					1		R	i	·	للمي ميرين المريني ا
								† T	í –				
			-										
										-			
				· · _ · _ · _ · · · · · · · · · ·									
							······································						
				-					+				
											_		
					_								·····
				<u> </u>									
			_		_								
				· ·				•				CERTIFIED	RADIOGRAPHIC INTERPRETER
											4	CANS S EXF	2. 9/01/2021 GR
												Jac	COD MOWAL
											- -	SIGNE	0-provous
		_											
	L	DEF	ECT CODE							_	SHOO	TING SKETCH	0
IP - Incon CV - Conc	nplete penetro avity Root	ation EI - Elong CX - Conv	ated Inclusion Ri exity Root DT	I - Rounded Ir - Deap Throw	nclusion ah		6	>	N)TT			(<u>A</u>	
IF - Incon	npiete fusion	UC - Unde	rcut BT	Burn through				X	駅に	.) [[]		
C - Crack		OX • Oxio	ation FA	Film Artifact	t			S	VI				
1	ET 14	FILM ا م 4 5	JSED: ∨ 17	TVDC Act	dE			-a 5	<u>-</u> ++			· 1	
	FTLM	< <u>+.0</u>	× <u></u>	TYPE Agin	100	-	and the second s	1		٦	/		9 9
	FILM	s	<u> </u>			-			入具				
atal here	FILM	Total Nilsons	^ <u> </u>	ТУРЕ		• .	A.		1 de				
0100 Hrs.		Tatal Mileoge	Num	per of Welds						-			
Brand	on Latimer		Byle	11				7	- 9				OTKER
Radiogr	opher		Mun Pin	Leve	,	-						A	SEE SKETCH
<u>Cinthia</u> Bodiograp	a latimer	C	Jul mar Close			-			(-		1	
	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1			Leve					a :1		\Box	isi -	and the second sec
Film de	livery			Date	kaassta (:								Ella
11	ie recorded res	uns are the opinion	or the technician to	ine best of his	knowledge	pased o	n the informatio	n provide	ed to him	oy the o	ustom	ier at the time of the in	ispectop // Z

Radiographic Inspection Report

No. BI33019

	Eaton mo	tal produ	ote				Dot	e 2/20/10			Tab Na 10	0.0357-11	
Customer Ttom day			C13	····		Tables			ho		400100.12	100.11	16760
Tiemdes	CTIPITON 530	0				JODLOCO			no			[P,0, 100, 2	+0700 C/a
Procedure	NO. HI 131	0		promocore 11 11 11 11 11 11 11 11 11 11 11 11 11		Code S	pecifica		X		I	Type Material	U/S
Acceptan	ce Standord A	sme vill	uw-52	generation and an and a second second	Pipa	e T		PI01	e X	- <u>1</u>	Other	rerce	ant inspection 100%
Geometric	: Unsharpness	.005 (س)	71017	Penetrameter	B	Effect	tive Foce	al Spot .124		Sour	ce size , 100	5x.064	Density 2.0-4.0
Source Ir	192	Curie	es 86.6		Pb Screens b	oack .01()	Pb Screens fr	ont .01	0	Single I	ood X	Single wall X view
Exposure	time 2 min	45 sec		Develop time 5	50 @min	1	Shir	mN/A			Double	lood	Double wall
Reinforce	ment 1/8"	ter hereiter	Sourc	e to 21			Distan	ice from source	.875		Single V	X	Double wall
Film No.	Weld No.	3 Serial No./I	Piece No.	t distance View	Film siz	ze Thi	ckness	S.F.D	Accept	Reject	Defect code	e	Comments
0.000		38u-3	36u	0-1	4.5x1	7 1	.45	21.875		$\overline{}$	Ei		1. Shanna china china marga.
										\sim			5-20-00-0000000000000000000000000000000
		77211717.00 = 1 = 4.44 Million Million											
												••••••••••••••••••••••••••••••••••••••	
							745.4.1					<u></u>	
					<u> </u>							·····	
												,	
						_							
			-										
													alify
													(etca S)
													AD M
													S ATLALINY S
						_							
				- 4									
IP - Incor	nplete penetro	ation EI -	DEFEC Elongate	T CODE 2d Inclusion - Ri	I - Rounded In	clusion		,			оке	OTING SKETCH	g g
CY - Cond	cavity Root	CX -	- Convexi - Lindera	tyRoot DT t BT.	- Drop Throug Burn through	ìp	[\searrow	1) ([111	<u>ا ۲۹ کار ج</u>	
C - Crack	inprete tasion	OX ·	- Oxidati	on FA	- Film Artifact	-		14	Ŵ				
		F	TLM US	ED;					-D-		·		
<u> </u>	FIL#	15 <u>4.0</u>	— č	17	TYPE AGIE	1 05	-	Å		(7 /	111	° - °
	FILM	۱۵ <u> </u>	—				-	l.		入小			
Total hrs.		Total Milean	^	hlum	19Pt		- .	A.		<u>Anna</u>	」 \{{	1)84176	
			<u> </u>		DEF 01 WEIUS		_				-		
Brand	on Latime	r		byfo			_		Ŧ	- P		<u>A</u>	OTHER SEE SKETCH
Rodiogi Cinthi	ropher a latimer		Ċн	Aluader	r~~R_I							Λ	
Radiogro	pher Ass't	_			Leve		-		()	1			
Film de	livery	<u> </u>			Date	:	-	_	Ś	<u>U-</u> [<u>.</u>		
T	he recorded res	ults are the op	pinion of I	he lechnician to	the best of his	knowledge	based o	on the information	n provid	ed to him	by the custor	ner at the time of the in	spection.

Radiographic Inspection Report

No. <u>BI4319</u>

Customer	Eaton me	tal pro	ducts			<u></u>	Da	te 4/3/19		T	Job No. 19-	0357-11	[
Item des	cription 536	1-1				Job Loc	ation P(ocatello ida	iho				P.O. No.	45758
Procedure	No. Rt 131	0				Code S	pecifica	tion Asme v				Туре	Materiol	C/s
Acceptan	ce Standard A	sme V	III uw-52		Pip	re	and the Call	Plat	te X	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Other		Perc	ent Inspection 100%
Geometric	: Unsharpness	(Ug).00	5	Penetrameter	B	Effec	tive Foc	ol Spot .124		Source	e size . 106x	.064		Density 2.0-4.0
Source r	192	6	uries 86.6		Pb Screens	back .01	0	Pb Screens fr	ont .01	0	Single loo	чХ		Single wall X
Exposure	time 2 min	45 sec		Develop time 5	min@ 68	*	Shi	mN/A			Double loc	id		Double wall
Reinforce	ment 1/8"		Sourc	e to 21			Dista	nce from source	.875	10000999 Lab	Single Wa	'x		Double wall
Film No.	Weld No.	Serial N	lo./Piece No.	View.	Film ≤i	ize Th	ickness	S.F.D	Accept	Reject D	efect code			Comments
·····		38	u-36u	0-1	4.5x1	7.	875	21.875	~					annonentrannan annonentrannany <u>e</u> Panament
LAC distances				2-0					V		Fa			
				2-3					V					
					-									
									-					
L														<u> </u>
						<u> </u>								
					<u> </u>									
												CE	RTIFIED I	RADIOGRAPHIC INTERPRETER
												all(S)	EXP.	9/01/2021
					_						4	S S	IGNED	Aloviat
						_								
													_	<u> </u>
												_		
.1P - Incan	nplete penetro	ation I	DEFEG EI - Elongate	T CODE d Inclusion RI	- Rounded I	nclusion					тооне ———————————————————————————————————	180 SKETC	2 H 777	q q
CV - Conc IF - Incor	avity Root nplete fusion	(CX - Convexi JC - Undercu	hyRoot DT∘ it BT•	Drop Thrau Burn through	gh h			\times	$\mathbb{A}(\frac{1}{2})$		1 1		
C - Crack			DX - Oxidati	n FA-	Film Artifec	t		Y Y	Ś	NF				
1	FTLM	s 4.5	FILM USE X	ם: 17 י	EXPE Adfa	a d5			•	-04		·	· ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
	FIL#	5	×		LYPE		-	đ	T			4	\mathbf{i}	
	FILM	s	×	ı	ГУРЕ		-							
Total hrs.		Total Mile	eoge	Numb	er of Welds					<u>Andre</u>		2011		
Brand	on Latime	 r		Buff					ĩ	- 9		Ţ	_	OTHER
Rodiogr	opher		<u> </u>	Mug Luc	-Leve	:1	-		4			A		SEE SKETCH
<u>Cinthia</u> Radiograp	a latimer her Ass't		U		Leve	:l	-		()	5]			
Film de	livery				Det	e	_		U.	Q <u>.</u>]			1	19119
TT	ve recorded res	ults are th	e opinion of t	he technician to t	he best of his	knowledge	e based e	on the informatio	n provide	ed to him b	y the customer	at the time	e of the in	ispection.

	A	N/	(801)397	-2202	(720)579	9-0660	(406)371	1.5822	(505)599	-4115			Job Lo	ocalion;		SLC, Ulah		Team W.O:	1116-00	390	_
	Customer		(001,007		(120)011	Type (Dí Weid		(000)000		-	B	adiation S	erence.		5301-1 Film Type	Film Size	Client P.O.:	2009 Penetramener Tyne	<u> </u>	-
EA	ATON MET	AL				But	Weld				(R+ 192		CO- 60		х-яау 🗔	AGFA D5	4,5 X 17		ASTM WIRE 8		
	Specification	2				Drawing	Number					Source	Strengt	ar MA/K	<u>(v</u>	Emulsion Number	Exp Qale	Pe	netrameter Materia		
Boile	er/ Pressure V	essei						-			_	1	02		CI	8250602N	1/1/21		Stainless Steel		_
8	Procedure	24		Pipe O	D / Pipe Ti	hickness 875"		5	<u>late Teickni</u>	235	Fu	C 124"	e (F)	Ex L MIR	op Time N 45 SEC	Single Load		Source Side 7	Eilm Side		
Ac	ceptance Cri	lena			Joint Typ	e 0.0			Matenal			Thickness	With Rei	niorceme	ent (d)	Elim Techniqu	ue	Shim Material	Th	ckness	5
RT	- ASME Sec	VIII			Butt Wel	d			Carbon Ste	eel			1.187			SWE/SWV		NA		NA	•
Exi	posure Techn	lique				Surface	Condition	!				Sou	rce To O	Diect (D)		Screen Thickn	ess		ID Placement		
	8					As V	Velded						20"			010*010*			Lead on Film		_
Single 2	Double	П	Auto			<u>ram Pr</u>	<u>ocessing</u> Manu	al	1							Screen mater	a	Edm Side [7]	Source Sid	<u>= 11</u>	
ingle as	0000.0	ISO Line #	71010				mario								Report #					<u> </u>	-
								L C					<u>د</u>							Ity	Γ
								ioisc	ωc		ЧĎ	alior	Isio							ens)	
			1de	ŭ	sity	6	5	ี นี้	pletatio	l D	D0	dic	- SC	live						۹ ۲	
			CC.	Seje	o o	l Sa	Ca	Diel	Del	nde	Ê	2	e	j č						la E	
				-	<u>م</u>			L Lo	Per Pe	5	L L R	Lac	Ispe	Ŭ						elrai	
Mold No.	vid No. View Weld (D.							<u> </u>			—	l s	L L				Romarka			ene	
1 S 33U	0.1	RC		x				×				+					Neidaris_			2 75	t
20 000	1.2	RC	х												Scuff mar	k on film at the 2 locate	on			2 78	t
	2-3	RC	Х												Scuff mar	k on film at the 2 locati	on			2.77	t
	3-4	RC		Х				X												2.67	I
	4.5	RC		X				<u>×</u>												2.66	╀
	5-6	RC		X				X												2.77	╉
	7-8	RC	x					<u> </u>	+											2.75	╀
	8-9	RC	X												<u> </u>					2.87	t
	9.10	RC	Х																	2.77	I
LS 36U	0-1	RC		X				X							L				:	2 80	∔
	1-2	RC		X				X												2.90	╀
	2-3	RC		X				$-\hat{x}$												2.89	╉
	4-5	RC		-x				x							1					2.78	╋
	5-6	RC	Х																	2 89	t
	6-7	RC	X																	2.99	
	7-8	RC		X				X												2.84	╇
	8-9	RC		X			<u> </u>	X												3.00	+
1.\$ 350	0-1	RC	<u>⊢^</u>	x	x			<u> </u>							+					2.78	+
20 300	1-2	RC	X	1														Page.		2.66	†
	2-3	RC	Х														_	PARODUC		2 90	1
	3-4	RC	Х		_													15 Son	1	2.50	4
	4-5	RC	X					<u> </u>	_									N OF	21	2 55	+
	5-6	RC RC	X						· [·									S QUALITY 3	1	2.60	╉
	7-8	RC	Â			<u> </u>	-	<u> </u>	+						<u> </u>		-	an ch	f	2,78	+
	8-9	RC	X			<u> </u>														2.75	1
	9-10	RC	Х						_												1
																	_				1
		1	1		1				1	1	1	1			1						

-

		60	Sall Lake	e City, UT	Denv	er, CO	8illing	gs, MT	Farmingto	n, NM				Client:	EAT	FON METAL		Date:	3/13/2019	_
													Job Lo	ocation:		SLC <u>, Ut</u> ah		Team W.O [.]	1116-001390	0
		Service Star	(801)397	-2202	(720)57	9-0660	(406)371	1-5822	(505)599-4	115			Job Ref	erence:	536	51-1 Repairs		Client P.O.:	45650	
F /	Customer					<u>Түре (</u>	Of Weld				ID 400	E3 E	adiation S		v Bay 🗇	Film Type	Film Size		Penetrameter Type	
E/		AL				Butt	Weld				IR- 192		CU- 60	لبــَــــــــــــــــــــــــــــــــــ	V-Ray C	AGFA D5	4.5 X 1/		ASTM WIRE 8	
Boil	er/ Pressure V	<u>1</u> lessel				Orawing	<u>a Number</u>					<u>30016</u>	e <u>streng</u> u)4		CI	8250602N	1/1/21		Stainless Steel	
Gen	Procedure	0000		Pipe O	.OJ Pipe T	hickness		P	late Thickness		Foo	al Spot Siz	e (F)	Ex	. Time	Single Load		P	enetrameter Location	
۶	RT.ASME.1 R	24				.875"						0.124"			2 MIN	Double Load		Source Side 🗹	Film Side 🛛 🗌	
Ac	ceplance Cri	lena			Joint Typ	<u>e</u>			<u>Material</u>		-	Thickness	: Wilh <u>Rei</u>	<u>ntorceme</u>	nl (<u>d)</u>	Film Techn	nique	Shim Material	Thickne	55
RT	ASME Sec	. VIII			Butt Wel	d			Carbon Steel				1.187			SWE/SV	W	NA	NA	
ĒX	posure Techn	lique				Surface	Condition					501	Ince To Ol	bject (D)		Screen Thic	<u>kness</u>		ID Placement	
	Viewing					Eilm Po	ncession						20			Screen ma	iterial	Loc	elion Madrer Placement	
ingle 🖸	Double		Aulo			1 10 1 10	Manua	al	I							Lead		Film Side	Source Side	
	•	ISO Line #						-							Report #					
								_				_	-			•			Ę	
								sion			Ę	tion	sior						eus	
			5	ಕ	≧		*	Ē	ation	Ğ	ůno,	dica	l du						0	
			ece e	eje	Sol	Slag	Lac	lete	elra	der	μ	Ĕ	5	5					le le	
			Ă	æ	۲ A		0	Ĕ	Pen	5	un	face	gste	ပီ					tran	
								lnco			8	Sur	Ĩ,						anet	
Weld No.	View	Weld I.D.										<u> </u>				Remarks		<u> </u>		
LS 34U	0-1	RC	X	~															2.66	
	8-8	RC		×															. 2.90	
1.5.3511	. View Weld I.D. 0-1 RC X 8-9 RC X 0-1 RC X 0-1 RC X 0-1 RC X					×													2.92	
20 000	• •																			
LS 36U	0-1	RC	X																3.15	
	1-2	RC	X																3.08	
	2-3	RC	X		<u> </u>	<u> </u>									scuff on fil	Im at 3 loction			3.18	
	3-4	RC		Х				<u> </u>											3.15	
	4-5	RC																	2.8/	
	0-0 6-7	RC	×			-													2.60	
	7-8	RC	X																3.12	
	8-9	RĈ	X						<u> </u>										3.04	
	9-10	RĈ	Х												scuff om f	ilm			3.16	
LS 32U	9-10	RC	X																2.90	
10.001	0.4			· · ·																
L3 38U	U-1			~					+										2.84	<u>'</u>
LS 33U	0-1	RC		х	x														2.45	; †-
	1-2	RC		X				x											2.87	,
	2-3	RC	Х															CORODII.	2.82	2
	3-4	RC	Х															1 and a	3.24	
	4-5	RC	X		<u> </u>										ļ			12 SPN	3.22	<u>-</u>
	5-6	RC RC	X	l	<u> </u>										ļ			1ª U	3.21	
		RC RC	X	v					+									VAL ITY	3.02	
	/-0 8_0		Y	~		Y		\vdash	+									2 271	3.02	
	9-10	RC	X	<u> </u>															2.91	
																				\top
		İ			1	1	1					1			İ					

Anorew Gruber "Client has final authority and responsibility for interpetation and acceptance of examination and reports"

		V/ N "	Sait Lake	City, UT	Denve	er, CO	Billing	s, MT	Farmingk	on, NM			Job Lo	Client.	EA	TON METAL SLC, Ulah	Date Team W.O.	3/15	/2019 001390	
			(801)397-	2202	(720)579	-0660	(406)371	-5822	(505)599-	4115			Job Ref	erence:	536	61-1 Repairs	Client P.O.	45	650	
EA	Customer TON MET	AL				<u>Type C</u> Bult	Of Weld Weld				IR- 192	R I	adiation <u>S</u> CO-60		X-Ray	Film Type Film Size AGFA D5 4.5 X 17		Penetrameter Ty ASTM WIRE B	96	
	Specification					Drawing	Number					Source	e Strengtt	or MA/K	⊻ Cl	Emulsion Number Exp Date		Penetrameter Mat	enal	
Boile	Riocedure	essel		Pion O	D / Pipe Ti	ickness			ale Thicknes		For	al Spot Siz	14 # (F)	Еx	0. Time	8250602N 1/1/21 Single Load [2]		Stainless Stee Penetrameter Loca		
R	T.ASME.LR	24		: •••• •	21.42.11	.875"						0.124"	- , ,	2	2 MIN	Double Lbad	Source Side	Film Side		
Acc	 ceptance Crit	eria		:	<u>Ιοιηί Τγρι</u>	È		_	Material			Thickness	With Rep	ulorcente	<u>irr (a)</u>	Film Technoge	Shim Materiai		Thickness	
RT	- ASME Sec.	Vill			Butt Weld	i Surface	Conoilion	C	arbon Stee	el		Sou	1.187 Irce To Ol	Diect (D)		SWE/SWV Screen Thickness	NA	ID Placement	<u> </u>	
<u></u>	B					As W	/elded						20"			.010"010"		Lead on Film		
	Viewing	C 1		П		<u>Film Pr</u>			IJ							Screen material	19 19	calion Marker Plac	ement	
Single 🛄	Oouble	ISO Line #	Auto				Manua	aı							Report #	Leao			2104	4.1
Weld No.	View	Weld I D.	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity		Remarks	-		Penetrameter Density	Weld Density
LS 34U	8-9	RC	Х															_	3.30	3 33
	9-10	RĊ		X	X			×											3.16	3.14
LS 38U	0-1	RC	 	х	Х			х											2.92	2 69
LS 36U	3-4	RC	×																3.31	3.30
LS 33U	0-1	RC	X																3.09	3.07
	1-2	RC	X																3 03	2 99
	2-3	RC	×				+								<u> </u>				2 98	2.99
													_							
													<u> </u>		<u> </u>					
					<u> </u>								<u> </u>							
															_					
														<u> </u>						
					<u> </u>					L										
												+	+							
																			1000-57 57	
						_													חק	et -
																		10:		0
																		12 11		1
						1								· ·					·,	
										<u> </u>	+		<u> </u>							<u> </u>
						1	1		1						<u> </u>				L	
Form MS.R	Clien/ T ASME	l					Date		a ailaílite d			NDE	Inspecto		Andre	Date 3	/15/2019			

Radiographic Inspection Report

No BI33019

r	none. 20	0-232-2003	rax. 200-23	2-2112								140. 0100010
Custome	Eaton me	tal products				Da	te 3/30/19			Job No.	19-0357-11	
Item des	cription 536	1-1			Job Loca	ation P(ocatello ida	tho			P.O.	. №. 45758
Procedure	e No. Bt 131	Λ		ſ	Code Si	necifico	tion Acmo v				l	
				<u>_</u>				- V		-1	Type Mot	
Acceptan	ce Standard A	sme vill uw-		Pipe	- <mark> </mark>		Plat	e X		Other		Percent Inspection 100%
Geometri	c Unsharpness	005. (و ^ر)	Penetrameter [3	Effect	ive Foc	ol Spot.124		Sour	ce size .1(06x.064	Density 2.0-4.0
Source	192	Curies 86.	6	Pb Screens t	ock .010)	Pb Screens fr	ont .01	0	Single	e lood X	Single wall X
Exposure	time 2 min	45 680	Develop time Fr	min@ 69*			N/A			Doub	e lood	Double wall
	μ	40 500	urce to			Shi	m IN/M			Sicala	Wall	view
Reinforce	ement 1/8"		ject distance 21	-		side of	object to film	.875		exposi	re X	exposure
Film No.	Weld No.	Serial No./Piece	vo. View	Film siz	te Thi	ckness	S.F.D	Accept	Reject	Defect co	Je ·	Comments
		36u-34u	0-1	4.5x17	7 1	.45	21.875		\geq	Ri	Repair	in long Scour
											NSIL Sha	+ 150
												ະຊົ ້າມແຕກເຮັ້ມໃຫ້_ເຊູຊັ້ນ_{ນເຂ}ັ້ນ ແ ລະການແຮງແຮງເຫຼົ່າມີ ແລະ ແລະ ແລະ ແລະ ແລະ ແລະ ແລະ ແລະ ແລະ ແລະ
- <u>11</u>		· · · · · · · · · · · · · · · · · · ·										
											····	
												and the second s
				······································								
	· ·											
							_					
			-		_							1.9 Ph. 2000a.
					_			ŀ				CONT CTO
							+					
												- Contraction
					_							r annar martine
					_							
IP - Incor	nplete penetro	DEFI ntion EI - Elonow	CT CODE	- Rounded Tra	clusion					эн 	OUTING SKETCH	9 - 9
CV - Cond	avity Root	CX - Conve	xity Root DT-	Drop Throug	h			\checkmark	MЛ			
IF - Incor	nplete fusion	UC - Under OX - Oxid	rcut BT-é	Burn through Film Actifact				$\langle \rangle$	例と		本剧体生	
C - OI UCK			15ED:						VX U	×	La Comp	
1	FILM	s 4.5	(17 т	ype Aqfa	d5			- - -	4			
_	FILM	s >	кт	YPE		•	(And a second se	T		1 /		
	FILM	s >	т			•			$\lambda \pi$			
Fotal hrs.		Total Mileage	Numbe	er of Welde		•			And	ן \(小汎相上	
						_				- /		
Brand	on Latimer		byp	!!				茶	- 1		Å	OTHER
Rodiogr	opher	Ċ	Martin	Level				j];				SEE SXETCH
Rodioarer	a latime <u>r</u> her Asst			Level		-			(前:			
							ļ.	I.	() 目	3		
Filmde	livery	sits are the oninion	f the technicises to th	Date best of his h	mauladas	harodo	o the information	n provid-	d to him	-	mar at the K-a of the	the interaction
11	ie recurded res	ours and rus ob(11:01 0	a mie recciniscian to m	IN DAPPORTUNE K	nomeoge	vased 0	i ule mormatio	n bioaqe	u la Uilli	uy ute custo	amer at the time of t	ure inspection.

	100	(6)	Sall Lake	e City, UT	Denv	er, CO	Billing	gs, MT	Farmingt	on, NM				Client:	EA	TON METAL		Date:	3/5/201	9		
	-167 A												Job L	ocation;		SLC, Utah		Team W.O:	1116-001	390		
and the second second	all the		(801)397	-2202	(720)579	9-0660	(406)371	-5822	(505)599-	4115			Job Rei	ference:		5361~1		Client P.O.:	45650)		
E	<u>Customer</u> ATON ME1	TAL		-		<u>Type (</u> Butt	<u>)í Weld</u> Weld				IR- 192	5	CO- 60		X-Ray	Film Type AGFA D5	Film Size 4.5 X 17		Penetrameter Type ASTM WIRE B			
Boil	Specification	<u>1</u> /essel				Drawing	Number					<u>Sourc</u> 1	e Strengli 02	h or MA/K	CI	Emulsion Number 8250602N	<u>Exp. Date</u> 1/1/21	e	enetrameter Material Stainless Steel			
	Procedure			Pipe O	0.0./ Pipe T	hickness		P	late_Thicknes	<u>ss</u>	Foo	cal Spot Siz	:e (F)	Ð	φ. Time	Single Load 🛛		2	enetrameter Location			
4	RT.ASME.1 R	24				.875"						0.124"		1 MI	N.45 SEC.	Double Load		Source Side 🗹	Film Side			
<u>Ac</u>	xeplance Cri	<u>teria</u>			Joint Typ	e			Malerial			Thickness	With Rei	inforceme	ent (d)	<u>Film Tech</u>	nigue	Shim Material	Thi	<u>cknass</u>		
RT	- ASME Sec	. VHI			Butt Wel	d Surface	Onedition		Carbon Stee	el		<u></u>	1.18	/" hind (0)		SWE/S	wv	NA	IO Planamani	NA		
<u>EX</u>	posure rechr R	iique				As W	/elded					30	20"			.010"- 0	10"		Lead on Film			
	Viewing					Film Po	ocessing						_	_		Screen ma	alerial	Loc	ation Marker Placeme	ent		
Single 🗹	Double		Auto				Manu	al	-							Lead	l	Film Side 🗸	Source Side	9		
		ISO Line #										1		1	Report #	£					_	
Weld No.	B Viewing Double □ Aute ISO Line # ISO Line # No. View Weld I.D. 4U 0-1 RC 1-2 RC X 2-3 RC X 3-4 RC X				Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity			Remarks			Penetrameter Density	Weld Density	
LS 34U	0-1	RC		Х				X											2	.60	2.61	
	1-2	RC	Х												ļ				2	.69	2.70	
	2-3	RC	X						┥──┤										2	.83	2.85	
	3-4		X						┼──┼											.07	2.00	
	5-6	RC	x																2	.77	2.85	
	6-7	RC	X	·	1	·					1								2	.82	2.99	
	7-8	RC	X																2	.77_	2.73	
	8-9	RC		Х				X											2	.89	2.84	
	9-10	RC	X																2	.70	2.80	
					<u> </u>	<u> </u>																
				L																		
									$\left \right $													
									· -	-	· · ·											
														-								
		<u>├──</u> ──																				
									\downarrow \downarrow]		
				<u> </u>				<u> </u>	┥──┤									PRODUC				
									+									19 SPA	0			
			<u> </u>															IZ OF	0			
																		P. SUALITY	2			
•																		S mi	1			
									\downarrow \downarrow													
									┼──┤													
		<u> </u>												I		and the second se						
	Client						Oate:						Inspector	h	1_	<u> </u>)ate: 3	/5/2019				
Form MS.R	T.ASME	·									-				Andrev	v Gruber						
	1	N N N	Salt Lake	City, UT	Denve	er, CO	Billing:	s, MT	Farming	ion, NM			Job Le	Client: ocation:	EA	TON METAL SLC, Ulah		Da Team W.	le O [.]	3/13	/2019 001390	
------------	---------------	---------------	-----------	----------------	-------------	----------	-----------	-------------------	---------------------------	----------	--------------	--------------------	------------------------	---------------------	-------------	------------------------	-----------	---------------	----------------------	-------------------	---------------------	----------
		at the second	(801)397	-2202	(720)579	-0660	(406)371-	-5822	(505)599-	4115			Job Ref	erence:	536	31-1 Repairs		Client P.(о.:	45	650	
	Customer	-				Түре (Of Weld					R	adjation S	Source		Film Type	Film Size			Penetrameter Ty	pe	
EA	TON MET	AL				Butt	Weld				IR- 192	2	CO- 60		X-Ray	AGFA D5	45X17	L		ASTM WIRE B		
	Specification	2				Drawing	Number					<u>Source</u>	e Strengti	<u>or MA/K</u>		Emulsion Number	Exp. Date		1	Penetrameter Mate	erial	
Bode	Procedure	essel		Pipa O	D / Pine Ti	hickness		F	lale Thickne		For	al Spot Stz	94 ve /6\	Ev		Single Load	1/1/21		-	Stainless Steel	ation	
R	T ASME 1 R	24		<u>r 9.0 0</u>	0.1 1.000 1	875"	.	Ľ	tere Triterite			0.124"			2 MIN	Double Load		Source Side	Ø	Film Side		
Acc	eptance Crit	lena			Joint Typ	ē			Material			Thickness	With Rei	nlorceme	ini (d)	Film Tech	níque	Shim M	Jatenal		Thickness	
<u></u> 81	- ASME Sec	. VIII			Bult Wek	d		(Carbon Ste	el			1.187	7°		SWE/SV	ŴV	N N	IA		NA	
Exp	osure Techn	Nque				Surface	Condition					Sou	<u>исе То О</u> "Ос	bječl (D)		Screen Thic	kness			ID Placement		
	Viewina		<u> </u>			Film Pr	ocessing				-		20			Screen ma	ilerial		Lo	alion Marker Plan	ement	
Single 🗹	Double		Auto				Manua	al	\Box							Lead		Film Side	0	Source	Side	C
		ISO Line #			_								1		Report #	ŧ						
			Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity							enetrameter Density	
Weld No.	View	Weld I.D.				<u> </u>					<u> </u>		·				Remarks				ď	<u> </u>
LS 34U	0-1	RC RC	X		v	<u> </u>			-												2 66	
	0-9	RC		^	^																2.90	<u> </u>
LS 35U	0-1	RC	Х			X															2.92	:
LS 36U	0-1	RC	X																		3.15	1
	1-2	RC	X		ļ					_											3.08] :
	2-3	RC	X									ļ			scuff on fi	Im at 3 loction			_		3,18	
	3-4	RC RC	- Y	X		<u> </u>		X			<u> </u>			<u> </u>	-						3.15	
	5-6	RC	X		r				-												2.86	
	6-7	RC	Х																		2.86	
	7-8	RC	X								L										3.12	
	8-9	RC	X		-		<u> </u>														3.04	
	9-10	RC	<u> </u>												scuff om	[ilm					3.16	
LS 32U	9-10	RC	X																		2.90	
LS 38U	0-1	RC		Х	X			х													2.84	
16 2211	0.1	PC			v						<u> </u>										2 15	1_
10 330	1-2	RC		x				x							-						2.45	
	2-3	RC	X					~	1									6	1000	2	2.82	
	3-4	RĈ	Х															1º	ot	in la	3.24	
]	4-5	RC	X									ļ	<u> </u>					18 0	pr	13	3,22	
	5-6	RC	X									<u> </u>		<u> </u>				12 01	1		3.21	-
	7-8	RC RC	^	×		<u> </u>		X	+									10 -0	ALITY	St	3.02	-
	8-9	RC	X		-	X		~										13	on	1	3.01	
	9-10	RC	X																		2.91	
												<u> </u>										
				L																		
							Date						losses!			1		10/0010				

1		B.N		Salt Lake	Cily, UT	Denve	r, CO	Billings	s, MT	Farmingto	on, NM			Job Lo	Client: _	EA	TON METAL SLC. Utah		Dat Team W (le'	3/15	/2019	
di la		Sec. A.		(801)397-;	2202	(720)579	-0660	(406)371-	5822	(505)599-4	1115			lob Refe	erence	536	51-1 Repairs		Client P C)	45	650	
	FA	Customer TON MET	AL				<u>Түре О</u> ВиЦ ^у	ií Weld Weld				IR- 192	21 []	adiation <u>S</u> CO+60	<u>ourra</u> []]	X-Ray 🗋	Film Type Film S AGFA D5 4 5 X	1 <u>ze</u> 17		<u>-</u>	ASTM WIRE B) <u>e</u>	
		Specification					Drawing	Number					Source	Strangth	or MA/KV	!	Emulsion Number Exp D)ate	-	<u>Pe</u>	nelrameter Mate	enal	
	Soile	r/ Pressure Va	essel										9	4		CI	8250602N 3/1/2	21			Stainless Steel		
		Procedure			Pipe 0	07Pipe Th	ICKNESS		<u>P</u>	ale Thicknes	<u>19</u>	Foc	al Spot Size	: (F)	Exp	ີນກະ	Single Load [2]			Ee C	neirameter Loca		
	R	T ASME.1 R2	24				.875"			Motorel			U.124"	Malb Dou	2	MIN	Double Load		Source Side		Film Side		
	Acc	teptance Crite	ena Val		2	Joint Type	2			Material Serbon Sier		_	nickness	1 187	"	<u>n (u)</u>	SWE/SWV		<u>51101 N</u>	A		<u>Trickness</u> NA	
	Exp	osure Techni	que				Surface (Condition					Sou	ice l'o Ot	ject (D)		Screen Thickness				ID Placement		
		в	·				As W	elded						20"			.010"- 010"				Lead on Film		
		Viewing			-		<u>Film Pro</u>	cessing		-							Screen material				lion Marker Plac	ement	-
Single	. U	Double		Auto	LJ			Manua	al	Ľ						Deset	Lead		Film Side		Source	Side	<u> </u>
			ISO Line #	f						1						<u>кероп</u>	μ						
We	eld No.	View	Weld I.D	Accept	Reject	Porosity	Slag	Crack	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Through	Surface Indication	Tungsten Inclusion	Concavity		Rem	narks				Penetrameter Density	Weld Density
LS	5 34U	8-9	RC	Х																		3.30	3.33
		9-10	RC		Х	Х			Х													3.16	3.14
LS	S 38U	0-1	RC		х	x			X													2 92	2.69
LS	S 36U	3-4	RC	x																		3 31	3.30
	0.0011	0.1	00																			3.09	3.07
	5 3 3 0	1-2	RC	X																		3.03	2 99
		2-3	RC	X																		2.98	2 99
				_																			
								<u> </u>		-													
					<u> </u>																		
					<u> </u>		ļ																
						l						+											
¦		<u> </u>				├-	<u> </u>						<u> </u>										
				-																			
												<u> </u>	<u> </u>	ļ							pul	UUU	· —
						· ·			<u> </u>			<u> </u>									$-\sqrt{2}$	100	6\
																		_				50	
								·- ·													1-2 01	ALTY.	=1
		-																				(Z;	12
									-						+								
						I			1			1	1	1								1	1
For		Client T A SME						Date				-	NDE	Inspecto	<u>///</u>	Andre	w Gruber	3/*	15/2019				

		# 1' / E																			
the contract of the second		And the second sec	48013397	.2202	(720)579	2.0660	(406)371	-5822	(506)489-	4115			Job Ref	cation	536			Cliept P.O.		001390 3650	
	Cusiom		10011007		(120)311	Type (Vela	-3022	10031133			2	Adiation S	ource		Film Type	Film Size		Henetranister Ty	0000	
E	ATON ME	TALS				Butt	Weld				IR- 192	10	CO- 60		X-Ray	AGFA D5	45×17		AST N B Wirks	-	
	Specificat	ion				Drawing	Number					Source	e <u>Streng</u> in	o. MA/K	¥	Eatusion Number	Exel Date		Perivitation Mai	21cal	
a	olei/ Pressure	e Vessel								-		11)2			9150609N	10/1/21		Stan/ass Stee	1	
	Procedu	LÉ .		Pijze O	C/Pipe T	075			ate Thuring	22	ŕuć	al Sput Size	z lift)	Ex.	p Time	Single Load		Source Euro	Penetrameter Loc	alión	
	RI ASMell Accemence (RZ4			Joint Tvo	e 075			Material	-		Inickness	With Ret	forcenter	nt (d)	Film Techn	ique	Shint Material	-13 IN 2004	Trickness	_
7	RT - ASME S	ec Vill			Bug Wei	đ		c.	arbon Ste	el			1 187			SIVE/SW	Ŵ	grinning strengthe			
Ę	xposure Tec	nnicue				Surface	Concilion			-		Sc.	rce To Ot	ect (D)		Screen Thick	kiness		្រាំ ខាង៩៩៣៩ល្		
	G					As W	/elded						18 00	0		005"- 01	0		Lead on Firm		
C. Aplic	Viewing Do wie	ì	Auto			High Hig	Manu	al								Leao	ienai	Film Sule	canon warker	i Side	
2111GIE	Dotible	ISO Line #	# #				Ter carres								Report #						
				<u> </u>				6				_	C							sity	
								IOIST	ωç		Чb	atio	nsio)eu	ıty
	}		đ	5	sity	D	ť	L L L	plet	Cut	Irou	gic	l'uci	1×						e	ens
			Acce	Seje	o.o	Sa	Cra	plet	netr	nde	1 L	e +	Б	S LO						Ъе	0 P
								E	Pe		Bun	urtac	sgn	0						e la	We
Weld No	View	Weld I.D.										ິ້	Ē				Remarks			Pen	
LS 33U	7-8	RC	×	·	X	X							-							2.03	2 03
															-						
LS 34U	8-9	RC	X		X												_			2.02	2 04
<u> </u>	9-10	RC	X		X															2.03	202
LS 38U	0-1	RC	X		X	X														2 07	2 04
		_				-		ļ										-,			
				-																	
					-			<u> </u>													
					-							-			-			· · · · · ·		-	
								<u> </u>													
																				-	
						_															
								_		_											
							<u> </u>														
																		P	2000		
																		152	1º and		
																		14-	가 U 삭		
							+				<u> </u>	-						13 00	ALITY ST		····-
																		14	- AL		-
																		6	0.0		
															<u> </u>		7			l 	
				<u> </u>	1										21	- ANH	/				
							Data					wither	1000000	(Ais	Al list	Sale 3/	19/2019			

[&]quot;Client has final authority and responsibility for interpetation and acceptance of examination and reports"

H & H X-Ray Services, Inc. 14251 U.S. Highway 30, Pocatello, ID 83202 Phone: 208-232-2663 Fax: 208-232-2772

Radiographic Inspection Report

No. BI33019

Customer	Eaton me	tal produc	cts					D,	ote 3/30/1	9			Job No. 1	9-03	57-1	1		
Item des	cription 5361	[-1					Job Loc	ation P	ocatello	ida	ho					P.O. No. 4	4578	58
Procedure	No. Rt 131	0					Code S	opecific	ation Asm	e v		•			Туре	Material	C/s	
Acceptanc	ce Stordard A	sme VIII	uw-52		1	Pipe				Plate	eX		Other			Perce	ent In	spection 100%
Geometric	Unsharpness	005. (و ^ل)		Penetrometer	B		Effec	tive Fo	cal Spot . 12	24		Sour	ce size .10	6x.06	64	<u></u>	1	Density 2.0-4.0
Source Ir	192	Curie	s 86.6		Pb Scree	ns b	ack .01	0	Pb Scree	ns fr	01, tno	0	Single	load X	- N		Sing! view	^{le wall} X
Exposure	time 2 min	45 sec	ľ	Develop time 5	min@ 6	8*		Sh	im N/A				Double	load			Dout	ble wall
Reinforce	ment 1/8"		Source	^{e to} 21	N			Dista	ince from so	Source	.875	10 -2 10	Single	Wal! X			Do	ouble wall
Film No.	Weld No.	Serial No.//	l objec Piece No.	View	Film	siz	e Th	ickness	S.F.D	film	Accept	Reject	Defect cod	e i	· · ·		Com	posure ments
		34u-h	nd2	0-1	4.5>	(17	, .	1.45	21.87	'5		\geq	Ei	-				anten et 1790 (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990) (1990)
				- Am-					******									
											more a la serie de la serie de la serie de la serie de la serie de la serie de la serie de la serie de la serie							
		um																
														ļ				
									_					ļ				
									-									
												+		-				
														<u> </u>				
										-+								
										1				^				
											-							· · · · · · · · · · · · · · · · · · ·
											·							
										_								
																	10	SUGNO S
·							_			+							ß	<u>AD %</u>
										+		—						OURLINY SI
							_			+							<u> </u>	Yes of
							+			-+					_		-	
							+			╉								
	- L-L-		DEFEC	T CODE	D	1 2							9H	ютіна	SKET	сн	ø	
CV - Conc	nplete penetro avity Root	CX-	Convexit	ballaciusion Rl hyRoot DT∺	- Rounded - Drop Thr	ougi	ciusion h		[(\bigcirc	N(71	7	0)(0	Â	5	1	
IF - Incon	nplete fusion	- UC - OX -	Undercu Oxidatio	1 BT-	Burn throu Film Artif	igh act					Ż	別ら	/ (,	. 1	汕	{ <i>‡</i>		
0 - GIVER		F	TLM USE	:D:					l			<u>A</u>			<u>UT</u>			
1	FILM	s <u>4.5</u>	_ ×	<u>17</u>	гуре <u>Ас</u>	gfa	d5	_					~ _	<u> </u>			0 0 1	~~ 9
	FILM	5	_ ×	ï	гуре			_					/	÷.	ې. م		[ļ.
	FILM	s	_ ×	ı ۱	гуре —			-		al a	LA	11] ((¢	
		Total Mileage	<u> </u>	Numb	er of Wek	s						- ,	- (<u>V(1)</u>			
Brand	on Latimer	·		Buff	1						Ť	- 1					0	INEA
Radiogr	apher .		с	Aleacher	~42 i	evel					4			- /	1		жE	JACIUN
Radiograp	oher Ass't				Le	evel		-		4			- F	4	1			
Film de	livery				D	ate		_			L.	U I	<u> </u>		<u> </u>			
T	ne recorded res	uils are the op	pinion of t	he technician to t	he best of h	nis k	nowledg	ə bəsed	on the inform	natio	n provide	ed to him	by the custo	mer al l	he tim	e of the in	specti	ion.

H & H X-Ray Services, Inc. 14251 U.S. Highway 30, Pocatello, ID 83202 Phone: 208-232-2663 For: 208-232-2720

Radiographic Inspection Report

No BI4319

۲	none: 20	8-232-260	53 r	ax: 208-23	2-2112	Contraction (Contraction)							INU. DI4313
Custome	-Eaton me	tal produc	ts				Da	10 4/3/19			Job No.	19-0357-11	
Item de:	scription 536	1-1				JobLog	ation P	ocatello ida	aho			P.O. No	. 45758
Procedury	e No. Rt 131	0				Code S	Specifica	tion Asme V	uine e			Tiga Hatari	al C/s
Acceptor	ce Stordord A	emo VIII u			Pin			Plat	te V			- Type Materi	creat Inspection 100%
neceptur			W-02	-	rp	-			~ ^	<u> </u>	Office		
Geometri	c Unsharpness	(Vg).005		Penetrameter [3	Effec	tive Foc	ol Spot .124		Sourc	ce size , 1	06x.064	Density 2.0-4.0
Source 1	192	Curies	86.6		Pb Screens	bock .01	0	Pb Screens fr	ont .01	0	Sing	le lood X	Single wall X
Exposure	e time 2 min	45 sec		Develop time 50	min@ 68	*	613	_ N/Δ			Dout	ole lood	Doubte wall
	4 11111	40 000	Sourc	e to			Dista	nce from source	2		Sinal	e Wall	Double wall
Reinforce	ement 1/8"		objec	t distance 21			side of	f object to film	.875		expo	sure X	exposure
Film No.	Weld No.	Serial No./Pi	ece No.	View	Film si	ize Tr	lickness	5.r.0	Accept	Reject I	Defect co	ode	Comments
		34u-ho	12	0-1	4.5x1	7	875	21.875	V	-	Ri		
-				0-2					V		Ri		and a second second second second second second second second second second second second second second second
				2-3					V		Ri		
										Cardon Ca			
	~						4						
												CERTIFIED	RADIOGRAPHIC INTERPRETER
												AWS EXP.	9/01/2021 GR
									-+			Jac	ob Mawat
			· · · · · · ·									Signer	- fr. Alander Colleman and the
						_							
						_					-		
											_		
IP - Inco	mplete penetra	ation ET-E	DEFEC longote	t CODE d'Inclusion RI	- Rounded I	nclusion					יי ברובי	HOOTING SKETCH	ş ş
CV - Con	covity Root	CX - 0	onvexi	tyR∞t DT-	Drop Throu	gh	1		Ŋ		<pre>{</pre>	9 1 191	
C - Crack	mplete tusion	0C-1 OX-0)ndercu Oxidotik	n 81- ≎n FA-	Burn Inrougi Film Artifac	1 t		1		別字			
		FI	LM USE	D;					-	v <u> </u>	¥		
1	FIL#	s <u>4.5</u>	×	<u>17</u> т	YPE Agfa	a d5	_		а А		-		· · · ·
_	FIL#	s	_ x	T	YPE		_	(P)			1	· · · · ·	<i>[:</i>
	FILM	s	_ x	т	YPE		-			1/1	()		
Fotal hr <i>s</i> .		Total Mileage		Numb	er of Welds		.			Landard	: \'		
				0					œ				
Brand	on Latime	r		BUSIE			_		Ţ.	Ĩ		Ā	OTHER SEE SKETCH
Cinthi	a latimer		CP	Aluachtr	~R_1	-			1	; <u>[:</u>	_		M
Rediogra	pher Ass't		~		Leve		-		()		1 -		
Film de	livery				- Det	~	_		Ś	0	.] {		1.1.4
, ni, de T	he recorded res	ults are the opin	nion of t	he technician to th	ne best of his	- knowledg	a based o	on the informatio	n provide	ed to him b	- by the cus	lomer at the time of the	inspection.
													/ ·



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 294-4000 TAX: (303) 294-5736

Weld Procedure Specifications

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

WELDING PROCEDURE SPECIFICATION (ASME IX) EATON METAL PRODUCTS COMPANY LLC

WPS No	P1-P1-EM14K1	-A	Revisio	n 0	Date	10/27/2014
Supporting PQR No			P1G1-P1G2	EM14KT-A20U-1		
Welding Process	SAW	Туре		Machine		
Impact Qualified WPS	No to	N/A	at N/A			
JOINTS (QW-402)				Typical		
		INSIDE	Ī	50°	ND	INS)
Joint Design	All	50	152°		~ LA	40°
Groove Type	Any				1/4	
Root Spacing	0" - 3/8"		/			
Fillet	All	T 50°		The f	T, '	50° -
Root Face	≥ 1/16"			1 30 A	- INSIDE	w
Backing	Yes	\sim		\sim	30°	\sim N
Backing Type Weld/Ba	se/Temporary Metal				/	30°
Groove Angle See Ty	pical Joint Details		300			
Back gouge Carbo	n Arc and/or Grind				30°	30°
Retainers	Prohibited		2			
Notes That Apply	1 & 2			[(2	{
Note 1: Customer representati	ve shall accept all weld jo	oint designs specified	l on job specific c	rawings.		
Note 2: Back gouge and/or grin	nd to sound metal is requ	ired when this proce	dure is used for	he first pass in a groove	e joint that requ	res cjp.
BASE METALS (QW-403)						
Thickness Qualified	1"					
Thickness Range: Groove	3/16" to	1-1/2" Fillet	No Min to	No Max		
P-No <u>1</u> Group No	D N/A to P-N	lo <u>1</u> G	roup No	I/A		
Maximum Pass Thickness	< 1/2"	_				
FILLER METALS (QW-404)		ELEC	TRICAL (QW-409)		
SFA #/Specification		5.17	Curre	nt and Polarity		DCEP
AWS Classification		EM14K	Heat	Input (MAX)		N/A
F-No		6	Othe	r		N/A
A-No		1				
Filler Metal Diameter	3	3/32" - 1/8"	PRE	HEAT (QW-406)		
Filler Metal Product Form		Solid	Minir	num Preheat Temp	100°F	Base Metal 3/16" - 1"
Filler Metal Trade Name	ESA	B Spoolarc 71	Minir	num Preheat Temp	200	°F Base Metal > 1"
Thickness Range:			Maxi	mum Interpass Temp		500°F
Groove	No Min	to1-1/2	2" Prehe	eat Maintenance		Prior During
Fillet	No Min		ax Othe		Maintain	until welding is complete
Electrode-Flux Class	F	7A2-EM14K	POS	inuits (Qvv-405)		10
	ESAB	Neutral	PUSIT	ing Progression		10 N/A
		N/A	Posit	on(s) of Fillet		1F 2F
Recrushed Slag		Prohibited	Othe	r		N/A
Supplemental Filler		None				
Alloy Elements		N/A				
		,	I			Page 1 of 2

Page I c

WPS No		P1-P1-EM1	4K1-A	Revision	0	Date	10/2	27/2014
Supporting PQR	No			P1G1-P1G2-E	M14KT-A20U-:	1		
POST WELD HEAT	T TREATME	NT (QW-407)						
Temperature Range		N	one					
Time at Temperature	Range		None					
TECHNIQUE (QW	/-410)							
String or Weave Bead	b			N/A				
Maximum Pass Widtl	h			7/8"				
Initial Cleaning			Brushi	ng and/or Chipping				
Interpass Cleaning			Bri	ushing/Chipping				
Multiple or Single Pa	ss (Per Side)		Sir	ngle or Multiple				
Multiple or Single Ele	ectrodes			Single				
Contact Tube to Wor	k Distance			3/4" - 1"				
Electrode Spacing (2	Arcs)			N/A				
Angle of Electrode (S	AW)		10°	Drag - 10° Push				
Peening				Prohibited				
Oscillation for Autom	natic/Machine	Welding		None				
ELECTRICAL (QW	-409)							
			Non-Way	eform Controlled W	/elding			
387.0 Inl		Filler	r Metal	Courses and			Iravel	
Pass(os)	Brocoss	Class	Diameter	Current and Polarity	Amps	Volts	(Inm)	(MAX)
Boot/Hot	SAM/	EM14K	3/32" - 1/9"	DCER	350 - 450	25 - 29	16 - 24	
Hot/Fill	SAW	EIVI14K	3/32 - 1/8"		400 - 500	23-23	18 - 22	
Can	SAW	EM14K	3/32 - 1/8		400 - 450	30-32	18 - 20	N/A
Cap			3/32 - 1/0		400-430	50-32	10-20	

Use amps, volts, and travel speed to calculate heat input. Amps x Volts x 60 ÷ Travel Speed = Heat Input

This Weld Procedure Specification was prepared and accepted by

10/27/2014

on

QC1 EXP. 3/1/2017

Daniel Durtschi

CWI 11030421

Accepted By

Accepted By

Accepted By

Plant 2 Salt Lake City, UT Plant 3 Pocatello, ID

Plant 1 Denver, CO

All units referenced on WPS are in English (Standard, e.g. psi, inches, etc.) unless specifically noted. Uncontrolled copy if not signed by plant representative

Page 2 of 2

PROCEDURE QUALIFICATIOIN RECORD (ASME IX) EATON METAL PRODUCTS COMPANY LLC

PQR No.		P1G1-P1G	2-EM14	KT-A20	U-1		Dat	te o	of We	elding		6,	3/2014		
Weld Process	(es)		(A) G	iMAWP	(B) SA\	N			Тур	pe(s)		Semia	utomatic/Ma	chin	e
JOINT DETAIL	s (OW-402)							-						
Joint Design		, Butt Joint													
Groove Type	Si	ngle V Groo	ve	C	JP >		\sim		~						
Root Spacing		0"			1	1	\sim								
Root Face		1/8"					~				E	33		7	
Backing		Yes						-						/	
Backing Type	Base	Metal/Weld	Metal					X				B2	7		
Groove Angle		60°							1						
Back gouged		No								X			\rightarrow		
Retainers		None										B1	/		
POSITION (OV	N-405)	Home									X				
Test Position	N-405)	16													
Progression		N/A									<	B4)			
		N/A													
BASE IVIETALS	(QW-403)						_								
Material Spec	(1)	A-36		to (2)		SA-516-7	0	P-N	•	1	Gr#	<u>1</u> to I	P-No <u>1</u>	- Gi	# 2
Type/Grade, or U	INS Number	N	/A	to	N/A	Hea	t Treated	Cor	nditio	on .			Hot Rolled		
Material Thickne	ss (T)			1"			Diar	nete	er of T	Test Coup	oon		N/A		
FILLER METAL	.S (QW-404	-)	(A)			(B)			GAS	s (QW-	408)				
SFA Specification			5.18			5.17	,				Ga	ses	Mixture (%)		Flow Rate (cfh)
AWS Classificatio	n	E	R70S-6			EM14	lk		Shie	lding	Ar/	CO2	90/10		35
F-No			6			6			Trail	ling	No	one	None		None
A-No			1			1			Back	king	No	one	None		None
Filler Metal Trade	e Name	Lincoln	SuperArc	L-59	ES	AB Spoo	lArc 71		Gas	Cup Size			5/8"		
Filler Metal Produ	uct Form		Solid			Solic	ł		PRE	EHEAT (QW-40	6)			
Supplemental Fill	ler Metal		None			Non	e		Mini	imum Te	mperatu	re	2	00	
Alloy Elements			N/A			N/A			Preh	neat Mair	ntenance		Prior/Du	uring	
Electrode Flux Cla	ass		N/A			F7A2-EN	114K								
Flux Trade Name			N/A		ESA	B OK FLU	JX 10.71		TEC	CHNIQU	IE (QW	-410)			
Flux Type			N/A			Neutr	al		Mult	tipass or	Single Pa	iss (per side)	(A) Sin	gle, (B) Multiple
Alloy Flux			N/A			N/A			Sing	le or Mu	tiple Eleo	ctrodes	(A) Single	e, (B)	Multiple
Recrushed Slag U	lsed		N/A			No			Initia	al and Int	erpass C	leaning	Brushi	ng/G	rinding
Weld Metal Thick	kness (t)	1/4" Cons	sumed by	/ SAW		1"			Tran	nsfer Moo	de		(A) Pulsed-Spr	ay, (E	5) N/A
Maximum Pass T	hickness		1/4"			5/32	"		Peer	ning Perf	ormed		Non	е	
ELECTRODE									Max	kimum Pa	ss Width	1	1"		
Electrode Spacing	g (2 Arcs)		N/A		3/4'	' Center 1	to Center		Osci	illation (N	/lachine)		Non	е	
Angle			N/A		Lead 0	° Drag,Tr	ail 12° Pu	sh	POS	ST WEL	D HEAT	TREATMEN	IT (QW-407)		
Contact Tube to	Work		3/8"			1"			Tem	perature	!		Non	е	
									Time	e			Non	е	
ELECTRICAL (C	QW-409)														
			Dian	neter	Curre	nt and	Δm	าตร		Vo	lts	Travel Sneed	Heat Innu	, I	Internass
Pass(es)	Process	Class	Lead	Trail	Lead	Trail	Lead	Tr	rail	Lead	Trail	(Ipm)	(J/in)	`	Temp (°F)
A1	GMAWP	ER70S-6	.0!	52"	DC	ЕP	23	30		23	5.5	15	21,620		Preheat
B1	SAW	EM14K	1/8"	1/8"	DCEP	AC	600	5	00	28	30	32	59,625		Preheat
B2	SAW	V EM14K 1/8" 1/8"			DCEP	AC	600	5	00	31	32	32	64,875		390°
B3	SAW	EM14K 1/8" 1/8"			DCEP	AC	600	5.	50	33	33	30	75,900		474°
B4	SAW	EM14K	1/8"	1/8"	DCEP	AC	800	4.	50	35	35	30	87,500		422°
													1		
			1												

Heat input calculated using QW-409.1 (a), No instantaneous energy readout.

Date

6/3/2014

TENSILE TESTS (QW-150)

Specimon No	Width	Thickness	Diameter	Area	Ultimate Total	Ultimate Stress	Location of Failuro
Specimen No	(in)	(in)	(in)	(in)	Load (lbs)	(psi)	Location of Failure
1	0.746"	0.695"	N/A	0.5185"	38,171	73,500	Base Metal
2	0.745"	0.692"	N/A	0.5155"	38,041	74,000	Base Metal

GUIDED-BEND TESTS (QW-160)

Type and Figure No	Result	Type and Figure No	Result
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass

TOUGHNESS TESTS (QW-170)

Specimen No	Notch Location	Specimen Size	Notch	Test	Impact Values	Shoar %	Mile	Drop Weight
Specimentito	Notell Ebeation	(in)	Size (in)	Temp (F)	(Ft LBS)	Shear 70	IVIIIS	Break
1	Weld Metal	.394x.394	0.315	-20	104	N/A	N/A	N/A
2	Weld Metal	.394x.395	0.315	-20	91	N/A	N/A	N/A
3	Weld Metal	.394x.395	0.315	-20	124	N/A	N/A	N/A
4	HAZ A-36	.394x.394	0.315	-20	83	N/A	N/A	N/A
5	HAZ A-36	.394x.395	0.315	-20	105	N/A	N/A	N/A
6	HAZ A-36	.394x.395	0.315	-20	106	N/A	N/A	N/A
7	HAZ SA-516	.394x.395	0.315	-20	111	N/A	N/A	N/A
8	HAZ SA-516	.394x.395	0.315	-20	82	N/A	N/A	N/A
9	HAZ SA-516	.394x.395	0.315	-20	75	N/A	N/A	N/A
Impact testing perfe	ormed to ASN	1E VIII						

Impact testing performed to

HARDNESS TEST - ROCKWELL B

Base Met	al			Неа	t Affected Z	one		Weld Metal	
A-36	75 Rb	77 Rb	77 Rb	81 Rb	80 Rb	81 Rb	00 Ph	01 Ph	01 Ph
SA-516	88 Rb	77 Rb	77 Rb	93 Rb	91 Rb	90 Rb	90 ND	91 KD	91 KD

DEPOSITED CHEMICAL ANALYSIS

С	Si Mn P S		Al	V	Cr	Ni	Fe	Ce	7		
0.100	0.590	1.410	0.015	0.013	N/A	N/A	0.051	0.059	N/A	N/A	
Chemical A	nalysis Confe	orms to A#		1							
MATERIA	L TRACABIL	ΙΤΥ									
ltem Descri	iption	A-	36	Heat N	umber	A2k	326	Manufa	cturer		SSAB
Item Descri	iption	SA-53	16-70	Heat N	umber	B2G	6551	Manufa	octurer		SSAB
WELDING	INFORMAT										
Welding ma	achine used	(,	A) Lincoln 4	55m/STT w/	25m Feed	er box (B) Pov	wer Wave A	C/DC 1000 v	v/ Lincoln Po	ower Feed	10A Controller
Welder Nar	me		Richard	d Carter		ID Num	ber	28117	Sta	mp	RC
TESTING I	NFORMATI	ON									
Tests Cond	ucted By	MSI	Testing Inc	. Lab	oratory Tes	st Number	14-15	54 Dat	e of Testing		6/5/2014
Preparatior	n and weldin	g of test cou	ipon was wi	tnessed by			Jao	cob Mowat			_
We certify	that the stat	ements in th	nis record ar	e correct an	d that the t	test welds we	ere preparec	l, welded, ar	nd tested		
in accordan	nce with the	requiremen	ts of ASME	IX.			1				
							da	ke Mo.	wat		
This Proced	lure Qualific	ation Record	d was prepa	red and acce	epted by		7	-	_	on	6/9/2014
Accepted	Ву				Pla	ant 1 Denve	r, CO	100	<u>ھ</u>		
Accepted	Ву				Pla	ant 2 Salt La	ke City, UT		Jac CW	ob Mowat I 1310054	41
Accepted	ccepted By					Plant 3 Pocatello, ID QC1 EXP. 10/1/2016					

All units referenced on PQR are in English (Standard, I.e. psi, inches, etc.) unless specifically noted. Uncontrolled copy if not signed by plant representative

WELDING PROCEDURE SPECIFICATION (ASME IX) EATON METAL PRODUCTS COMPANY LLC

WPS No	P1-P1-EM1	.4K2-A		Revisi	on	0	Date	6/19/2014
Supporting PQR No				P1G1-P1G	62-EM14KT-	A20U-1		
Welding Process	SAW		Туре		Machir	ne		
Impact Qualified WPS	No	to	N/A	atN/	۹			
JOINTS (QW-402)					•	Typical		
						50°	DN	INS
Joint Design	All		50	325	. *	~	. LA	10E 40°
Groove Type	Any				.325	$\sqrt{\gamma}$	1/1	
Root Spacing	0" - 1/4"			/ +		\downarrow \uparrow		
Fillet	Any		50	·	+ -/	50°	1.	
Root Face	0" - 3/8"			3	~		- INSIDE	ω
Backing	Yes			5/8		4 A P	9	
Backing Type Weld/Base	e Metal,Temporar	y	16" L			60-	" LAN	
Groove Angle See Typ	ical Joint Details		AND		.8/		1/8	
Back gouge Yes (Carbo	n Arc and/or Grind	d) _				\downarrow /		
Retainers P	rohibited		50	Co	+ 2	50° 2 4	1	
Notes That Apply	1,2			ω			- INSIDE	
Note 1: Customer representative	shall accept all w	eld joint	designs specified	d on job specifi	c drawings.			
Note 2: Back gouge and/or grind	to sound metal is	required	d when this proce	edure is used fo	or the first pass	in a groove j	joint that re	equires cjp.
BASE METALS (QW-403)								
Thickness Qualified	1"							
Thickness Range: Groove	3/16" to	1 - 1	1/2" Fillet	No Min. to	No Max			
P-No <u>1</u> Group No	N/A to	P-No	1 0	iroup No	N/A			
Maximum Pass Thickness	≤ 1/2"							
Heat Treated Condition	N/A							
FILLER METALS (QW-404)				EL	ECTRICAL (C	QW-409)		
SFA #/Specification			5.17	Cu	rrent and Polar	ity		DCEP
AWS Classification		E	M14K	He	at Input (MAX)			85,000 J/in.
F-No			6	Otl	ner			None
A-No			1					
Filler Metal Diameter		3/32	2" - 5/32"	PR	EHEAT (QW	-406)		
Filler Metal Product Form		5040.0	Solid	Mi	nimum Prehea	t Temp	100	"F Base Metal 3/16" - 1"
Filler Metal Trade Name		ESAB S	pool Arc 71	IVII N4a	nimum Prenea vizavza latorac	t Temp		200°F Base Metal > 1°
Groovo	2/16"	+	0 1 1/	'2" Dro	boot Mointon		Mainti	JUU F
Fillet	No Min	t	0 <u>1-1/</u> 0 No M	ax Ot	ner	ance	Ividifitio	None
Electrode-Elux Class		 F7A4	4-FM14K	PC		W-405)		None
Flux Trade Name		ESAB	OK 10.71	Po	sition(s) of Gro	ove		1G
Flux Type		N	leutral	We	Iding Progress	ion		N/A
Alloy Flux			N/A	Po	sition(s) of Fille	t		1F, 2F
Recrushed Slag		Pro	phibited	Otl	ner			None
Supplemental Filler			None					
Alloy Elements			N/A					

Page 1 of 2

WPS No		P1-P1-E	M14K2-A		Revision	0	Date	6/1	9/2014
Supporting PQR	No				P1G1-P1G2-EM14	KT-A20U-1			
POST WELD HEA	AT TREATME	NT (QW-4	07)						
Temperature Range			None						
Time at Temperatur	e Range		None						
Note: Vessels that v	vill be exposed	to environm	ents that could	cause stress corro	osion cracking shall hav	e a minimum ho	ld temperatu	re of 1150°F.	
Note: For welds tha	t may be expos	ed to enviro	ments that cou	Ild cause stress co	rosion cracking the mi	nimum PWHT ho	ld time shall	be one hour l	ber
nch for thicknesses	exceeding one	inch							
Note: A specific PW	HT procedure s	hall be deve	oped for each	job.					
TECHNIQUE (QV	V-410)								
String or Weave Bea	ad			N/A					
Maximum Pass Wid	th			1"					
nitial Cleaning				Grindin	g				
Interpass Cleaning				Chippir	g				
Multiple or Single P	ass (Per Side)		Sir	ngle or Multiple pa	ss(es) per side				
Multiple or Single El	ectrodes			Single or Multiple	Electrode(s)				
Contact Tube to Wo	ork Distance			3/4" - 7/	8"				
Electrode Spacing (2	2 Arcs)			5-16" - 3/8" Cente	er to Center				
Angle of Electrode (SAW)			5° Dra	8				
Peening				Prohibit	ed				
Oscillation for Autor	matic/Machine	Welding		No					
ELECTRICAL (QV	V-409)								
			No	on-Waveform	Controlled Weldin	g			
		Fillo	Motol	Current and				Travel	
Weld		Filler	Ivietai	Polarity	Amps	Vo	lts	Speed	Heat Inpu
Pass(es)	Process	Class	Diameter	. clarity				(lpm)	(MAX)
First Pass	SAW	EM14K	3/32"-5/32"	DCEP	450 - 600	28 -	28 - 30 26 - 32		
Fill Passes	SAW	EM14K	3/32"-5/32"	DCEP	600 - 700	28 -	33	20 - 30	85,000 J/ii
Cap Passes	SAW	EM14K	3/32"-5/32"	DCEP	550 - 600	33 -	35	24 - 30	85,000 J/i
	d travel speed t	o calculato k			aval Speed - Heat Ipp	.+			

This Weld Procedure Specification was prepared and accepted by

an mound 4

6/19/2014 on

Accepted By

Plant 1 Denver, CO

Accepted By

Accepted By

Plant 2 Salt Lake City, UT

Plant 3 Pocatello, ID

Jacob Mowat CWI 13100541 QC1 EXP. 10/1/2016

All units referenced on WPS are in English (Standard, e.g. psi, inches, etc.) unless specifically noted.

Uncontrolled copy if not signed by plant representative

Page 2 of 2

PROCEDURE QUALIFICATIOIN RECORD (ASME IX) EATON METAL PRODUCTS COMPANY LLC

PQR No.		P1G1-P1G	2-EM14	KT-A20	U-1		Dat	te o	of W	/elding		6/3/2014						
Weld Process	(es)		(A) G	imawp	(B) SA\	N			Тур	pe(s)		Semia	Semiautomatic/Machine					
JOINT DETAIL	s (OW-402)								_	-								
Joint Design	- (, Butt Joint			~													
Groove Type	Si	ngle V Groo	ve	C	JP >		\sim		~									
Root Spacing		0"			_/	1	\sim											
Root Face		1/8"					~				F	33		~				
Backing		Yes												/				
Backing Type	Base	Vetal/Weld	Metal					X				B2	7					
Groove Angle	Buser	60°	metar						1									
Back gouged		No								X			\rightarrow					
Retainers		None										B1						
POSITION (O)	N-405)										X	01						
Test Position	400)	1G										AT						
Progression		N/A										B4)-						
DACE METALC		,,,																
BASE IVIETALS	(QW-403)			. (2)							.							
Material Spec	(1)	A-36	1.	to (2)		SA-516-7	0	P-N	0	1	Gr#	<u>1</u> to F	2-No <u>1</u>	Gr	#			
Type/Grade, or U	INS Number	N	/A	to	N/A	Hea	t Treated	Cor	nditio	on			Hot Rolled					
Material Thickne	ss (T)			1"			Diar	nete	er of	Test Coup	oon		N/A					
FILLER METAL	.S (QW-404)	(A)			(B)			GA	s (QW-	408)							
SFA Specification			5.18			5.17					Ga	ses	Mixture (%)		Flow Rate (cfh)			
AWS Classificatio	n	E	R70S-6			EM14	k		Shie	elding	Ar/	CO2	90/10	-	35			
F-No			6			6			Trai	iling	No	one	None	-	None			
A-No			1			1			Bac	king	No	one	None	-	None			
Filler Metal Trade	e Name	Lincoln	SuperArc	L-59	ES	AB Spoo	lArc 71		Gas	S Cup Size			5/8"					
Filler Metal Prod	uct Form		Solid			Solic	1		PR	EHEAT (QW-40	6)						
Supplemental Fill	ler Metal		None			None	5		Min	nimum Te	mperatu	re	20	00				
Alloy Elements			N/A			N/A			Prel	heat Mair	ntenance		Prior/Du	ring				
Electrode Flux Cla	ass		N/A			F7A4-EN	114K											
Flux Trade Name			N/A		ESA	B OK FLL	JX 10.71		TEC	CHNIQU	IE (QW	-410)						
Flux Type			N/A			Neutr	al		Mul	ltipass or	Single Pa	iss (per side)	(A) Sin	gle, (I	B) Multiple			
Alloy Flux			N/A			N/A			Sing	gle or Mu	tiple Eleo	ctrodes	(A) Single	e, (B)	Multiple			
Recrushed Slag U	lsed		N/A			No			Initi	ial and Int	terpass C	leaning	Brushir	ng/Gr	inding			
Weld Metal Thick	kness (t)	1/4" Cons	sumed by	/ SAW		1"			Trar	nsfer Moo	de		(A) Pulsed-Spra	iy, (B) N/A			
Maximum Pass T	hickness		1/4"			5/32			Pee	ening Perf	ormed		None	2				
ELECTRODE									Max	ximum Pa	ss Width		1"					
Electrode Spacing	g (2 Arcs)		N/A		3/4'	' Center 1	o Center		Osc	illation (N	/lachine)		None	2				
Angle			N/A		Lead 0	° Drag,Tr	ail 12° Pu	sh	PO	ST WEL	D HEAT	TREATMEN	IT (QW-407)					
Contact Tube to	Work		3/8"			1"			Terr	nperature	1		None	2				
	214/ 400)								Tim	ne			None	2				
ELECTRICAL (C	JW-409)		1		6		1			1			- I					
			Dian	neter	Pola	nc and arity	Am	nps		Vo	lts	Travel Speed	Heat Input	:	Interpass			
Pass(es)	Process	Class	Lead	Trail	Lead	Trail	Lead	Tr	rail	Lead	Trail	(Ipm)	(J/in)		Temp (°F)			
A1	GMAWP	ER70S-6	.05	52"	DC	EP	23	30		23	8.5	15	21,620		Preheat			
B1	SAW	EM14K	1/8"	1/8"	DCEP	AC	600	5	00	28	30	32	119,625		Preheat			
B2	SAW	EM14K	1/8"	1/8"	DCEP	AC	600	5	00	31	32	32	129,937	-+	390°			
B3	SAW SAW	EIVI14K EM14K	1/8	1/8	DCEP	AC	800	5.	50	33	33	30	151,800		474 422°			
	3410	LINITHK	1/0	1/0	DCLI	AC	000	ч.	50	55	35	50	175,000		422			
			ļ															

Heat input calculated using QW-409.1 (a), No instantaneous energy readout.

Date

6/3/2014

TENSILE TESTS (QW-150)

Specimen No	Width (in)	Thickness (in)	Diameter (in)	Area (in)	Ultimate Total Load (lbs)	Ultimate Stress (psi)	Location of Failure
1	0.746"	0.695"	N/A	0.5185"	38,171	73,500	Base Metal
2	0.745"	0.692"	N/A	0.5155"	38,041	74,000	Base Metal

GUIDED-BEND TESTS (QW-160)

Type and Figure No	Result	Type and Figure No	Result
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass

TOUGHNESS TESTS (QW-170)

Specimen No	Notch Location	Specimen Size	Notch	Test	Impact Values	Shear %	Mils	Drop Weight
Specificitivo	Notell Eccation	(in)	Size (in)	Temp (F)	(Ft LBS)	Shear 70	IVIIIS	Break
1	Weld Metal	.394x.394	0.315	-20	104	N/A	N/A	N/A
2	Weld Metal	.394x.395	0.315	-20	91	N/A	N/A	N/A
3	Weld Metal	.394x.395	0.315	-20	124	N/A	N/A	N/A
4	HAZ A-36	.394x.394	0.315	-20	83	N/A	N/A	N/A
5	HAZ A-36	.394x.395	0.315	-20	105	N/A	N/A	N/A
6	HAZ A-36	.394x.395	0.315	-20	106	N/A	N/A	N/A
7	HAZ SA-516	.394x.395	0.315	-20	111	N/A	N/A	N/A
8	HAZ SA-516	.394x.395	0.315	-20	82	N/A	N/A	N/A
9	HAZ SA-516	.394x.395	0.315	-20	75	N/A	N/A	N/A
Impact testing perfe	ormed to ASM	IE VIII						

Impact testing performed to

HARDNESS TEST - ROCKWELL B

Base Met	al			Неа	t Affected Z	one	Weld Metal 0 90 Rb 91 Rb				
A-36	75 Rb	77 Rb	77 Rb	81 Rb	80 Rb	81 Rb	00 Ph	01 Ph	01 Ph		
SA-516	88 Rb	77 Rb	77 Rb	93 Rb	91 Rb	90 Rb	90 ND	91 KD	91 KD		

DEPOSITED CHEMICAL ANALYSIS

221 00112			•								
С	Si	Mn	Р	S	Al	V	Cr	Ni	Fe	Ce	
0.100	0.590	1.410	0.015	0.013	N/A	N/A	0.051	0.059	N/A	N/A	
Chemical A	nalysis Confe	orms to A#		1	-						
MATERIA	L TRACABIL	ΙΤΥ									
Item Descri	iption	A-	36	Heat N	umber	A2k	326	Manufa	acturer		SSAB
Item Descri	iption	SA-53	16-70	Heat N	umber	B2G	551	Manufa	acturer		SSAB
WELDING	INFORMAT	ΓΙΟΝ									
Welding ma	achine used	(A) Lincoln 4	55m/STT w/	25m Feede	er box (B) Pov	wer Wave A	C/DC 1000 v	v/ Lincoln Po	ower Feed	10A Controller
Welder Na	me		Richar	d Carter		ID Num	ber	28117	Sta	imp	RC
TESTING I	NFORMATI	ON									
Tests Cond	ucted By	MSI	Testing Inc	. Lab	oratory Tes	t Number	14-1	54 Dat	e of Testing	5	6/5/2014
Preparation	n and weldin	g of test coι	upon was wi	itnessed by			Ja	cob Mowat			
We certify	that the stat	ements in th	nis record ar	re correct an	d that the t	est welds we	ere prepareo	l, welded, ar	nd tested		
in accordar	nce with the	requiremen	ts of ASME	IX.			Δ				
							Aab	, Mor	ret		
This Proced	dure Qualific	ation Record	d was prepa	red and acce	epted by		9			on	6/9/2014
Accepted	Ву				Pla	ant 1 Denve	r, CO		•		
Accepted	Ву				Pla	ant 2 Salt La	ke City, UT			Jacob Mo	wat 00541
Accepted	Ву				Pla	ant 3 Pocate	ello, ID			QC1 EXP	. 10/1/2016

All units referenced on PQR are in English (Standard, I.e. psi, inches, etc.) unless specifically noted.

Uncontrolled copy if not signed by plant representative

WELDING PROCEDURE SPECIFICATION (ASME IX) EATON METAL PRODUCTS COMPANY LLC

WPS No		P1-P1-EM14	IKT-A	Ą	R	evision		2	Date	12/15/2014				
Supporting PQR	No				 P1G1	-P1G2-E	EM14KT-A	A20U-1						
Welding Proces	s	SAW		Туре			Machir	ne						
Impact Qualifie	d WPS	No	to	N/A	at	N/A	_							
JOINTS (QW-40)	2)						-	Typical						
	•			Single V Groov	e Joint			//						
Joint Design		All					_							
Groove Type		Any					\rightarrow		\sim					
Root Spacing	0"	- 3/16"					\sim	< /	· · · · · · · · · · · · · · · · · · ·					
Fillet		Any						\mathbf{X}	50.00"					
Root Face	1/16	5" - 3/16"						<u> </u>						
Backing		Yes		Double V Groo	ve Joint									
Backing Type	Weld/Base N	/letal, Temporary		_										
Groove Angle	50)° - 60°					\rightarrow	\langle / \langle	•					
Back gouge	No or Yes (Carb	on Arc and or Gri	nd)			54	0.00°	\mathbf{X}	50.00*					
Retainers	Pro	phibited					×_/							
Notes That Apply		1,2		_										
Note 1: Customer re	epresentative s	hall accept all we	ld joir	nt designs spec	ified on job s	pecific dra	awings.							
Note 2: For joints th	nat will not get	back gouged a GN	MAW	seal pass is req	juired as show	vn on pag	ge 2.							
Thickness Range: P-No <u>1</u> Maximum Pass Th	Groove Group No nickness	<u>3/16</u> " to <u>N/A</u> to ≤1/2"	1- P-No	- <u>1/2"</u> Fillet	No Min. Group No	toN/	No Max (A							
FILLER METALS	(QW-404)					ELECT	FRICAL (C	2W-409)						
SFA #/Specification				5.17		Curren	it and Polar	ity		DCEP/AC				
AWS Classification				EM14K		Heat Ir	nput (MAX)		95,000 J/In					
F-No				6		Other	None							
A-No				1										
Filler Metal Diamete	er			1/8"		PREH	EAT (QW	-406)						
Filler Metal Product	Form			Solid		Minim	um Prehea	t Temp	100°F	Base Metal 3/16" - 1"				
Filler Metal Trade N	lame		ESAB	Spool Arc 71			um Prehea	t Temp	20	0°F Base Metal > 1"				
Thickness Range:	_	N. M.		4 -	01	Maxim	ium Interpa	ass Temp		550°F				
Fillot	e	No Min		to N			at Maintena	ance	waintain					
Flectrode-Flux Class				A2-FM14K				W-405)		NUTE				
Flux Trade Name			ESAB (OK Flux 10.71		Positio	n(s) of Gro	ove		1G				
Flux Type				Neutral		Weldir	ng Progress	ion		N/A				
Alloy Flux				N/A		Position(s) of Fillet 1F, 2F								
Recrushed Slag		Ρ	rohibited		Other				None					
Supplemental Filler				None										
Alloy Elements				N/A										
POST WELD HEA	AT TREATME	NT (QW-407)												
Temperature Range	2	No	one											
Time at Temperatu	re Range		Nor	ne										
										Page 1 of 2				

WPS No		P1-P1-E	М14КТ-А			Revisio	on	2	Date	12/	15/2014			
Supporting PQR	No				P1G1-P1G	2-EM14KT-	A20U-1							
TECHNIQUE (QW	/-410)													
String or Weave Bea	d				Strin	g								
Maximum Pass Widt	h				1"									
nitial Cleaning				Brush	ing and/	or Grinding								
nterpass Cleaning				Br	ushing/C	hipping								
Multiple or Single Ele	ectrodes		Sin	ngle/Mult	iple (See	e electrical ta	ble)							
vultiple or Single Pa	ss Per Side		Sir	ngle/Mul	tiple (See	e weld diagrai	ms)							
Contact Tube to Wor	k Distance				7/8" -	1"								
ectrode Spacing (2	Arcs)				3/4" - 7	'/8"								
Angle of Electrode (S	AW)		Lea	d Arc 0°	- Trail Ar	c 10° to 15° P	ush							
eening					Prohibi	ted								
Oscillation for Autom	natic/Machine	e Welding			No									
ELECTRICAL (QW	/-409)		No	n-Wav	eform (Controlled	Welding							
-	-			For	Single \	/ Groove J	oints							
				Curre	nt and									
		Filler	Metal	Pola	arity	An	nps	Vo	olts	Travel				
Weld					.					Speed	Heat Input			
Pass(es)	Process	Class	Diameter	Lead	Trail	Lead	Trail	Lead	Trail	(Ipm)	(MAX)			
	SAW	EM14K	1/8"	DCEP	AC	AC 450-550 350-450 26-28 27-29 30-34 95,								
Fill Passes	SAW	EM14K	1/8"	DCEP	AC	650 - 750	350 - 750 500 - 600 28 - 32 30 - 32 30 - 34 95,0 100 - 600 100 - 500 20 - 22 20 - 35 20 - 24 95,0							
Cap Passes	SAW	EM14K	1/8"	DCEP	AC	500 - 600	400 - 500	- 500 29 - 32 32 - 35 30 - 34 95						
*Dig Pass	*Dig Pass SAW EM14K 1/8" DCEP N/A 700 - 725 N/A 34 - 35									29 - 30	95,000 J/In			
				For [Double	V Groove J	oints							
				Curre	nt and					Turnel				
Wold		Filler	Metal	Pola	arity I	An	nps	Vo	olts T	Spood				
Pass(es)	Process	Class	Diameter	Lead	Trail	Lead	Trail	Lead	Trail	(Ipm)	(MAX)			
1st Pass	SAW	EM14K	1/8"	DCEP	AC	450 - 550	350 - 450	26 - 28	27 - 29	30 - 34	95.000 J/In			
Fill Passes	SAW	EM14K	1/8"	DCEP	AC	675 - 800	550 - 650	28 - 32	30 - 32	30 - 34	95.000 J/In			
Can Passes	SAW	EM14K	1/8"	DCEP		500 - 600	400 - 500	29 - 32	32 - 35	30 - 34	95,000 J/In			
*Dig Pass	SAW	FM14K	1/8"	DCEP	AC	700 - 800	500 - 550	28 - 30	28 - 31	28 - 30	95.000 J/In			
	W/P-A or P1-P	1-GMΔ\//P-S	TT-A for Seal	Pass		,	500 550	10 00		20 00	55,000 t) III			
*Dig Pass is the first :	SAW pass on i	opposite side	of the seal p	ass. it sha	all consu	ne the root fa	ace and seal p	ass						
Use amps, volts, and	travel speed	to calculate h	neat input. Ar	nos x Vol	ts x 60 ÷	Travel Speed	= Heat Input							
				-										
		Fill	\geq						1711 1		>			
		SEAL												
		Ť						<u> </u>	1					
		DIG						\sim	SEAL					
		Fill							$\underline{\vee}$					
-									DIG					
							_							
This Weld Procedu	re Specificat	ion was pre	nared and a	n Dr	etel	2	on 13	2/15/2014						
	. e opeenieat		.puicu unu a	eccpieu	ر م مات	nt 1 Donyo	r (0				-, 13, 2017			
Accepted by					Pia					Ourtschi				
Accepted By					Pia	nt 2 Salt La	ike City, UT	Mile	QC1 EX	P. 3/1/2017	i			
Accepted By			(2) 1 1		Pla	nt 3 Pocate	ello, ID	*						
All units reference	d on WPS an	e in English	(Standard, e	e.g. psi, i	nches, e	tc.) unless s	pecifically n	oted.			Dage 2 ()			
Uncontrolled copy if not signed by plant representative Page 2 of 2								Page 2 of 2						

PROCEDURE QUALIFICATIOIN RECORD (ASME IX) EATON METAL PRODUCTS COMPANY LLC

PQR No.		P1G1-P1G	2-EM14	KT-A20	U-1		Date of Welding 6/3/2014												
Weld Process	(es)		(A) G	iMAWP	' (B) SA\	N			Type(s)		Semia	Semiautomatic/Machine						
JOINT DETAIL	s (OW-402)																	
Joint Design		, Butt Joint																	
Groove Type	Si	ngle V Groo	ve		JP ≻		$\overline{\sim}$												
Root Spacing		0"																	
Root Face		1/8"					-				E	33		~					
Backing		Yes		1				\					/						
Backing Type	Base	Metal/Weld	Metal	1				<				B2	7						
Groove Angle		60°																	
Back gouged		No											\rightarrow						
Retainers		None		1								B1							
POSITION (OV	N-405)			1							\mathbf{k}	A1							
Test Position	,	1G										\leq							
Progression		N/A									<	(B4)							
BACE METALS	(0)//_/02)	,																	
Matarial Saca	(1)	A 26		ta (2)			0	D N		1	C -#	1 40 0	No 1	C~# 3					
Trues (Casels and	(1) (1)	A-36	/ 4	.to (2)		5A-516-7	U	P-N	0	L	Gr#	to P							
Type/Grade, or U	INS Number	N	/Α	to	N/A	неа	t Treated	1 Cor	naition	C			Hot Rolled						
iviateriai i nickne	ss (1)			1			Diar	nete	er of Test	Cou	pon		N/A						
FILLER METAL	.s (QW-404	•)	(A)			(B)			GAS (C	۷W-	408)								
SFA Specification			5.18			5.17	,				Ga	ses	Mixture (%)	Flow Rate (cfh)					
AWS Classificatio	n	E	R70S-6			EM14	łk		Shieldin	g	Ar/	CO2	90/10 3						
F-No			6			6			Trailing		No	one	None N						
A-No			1			1			Backing		No	one	None N						
Filler Metal Trade	e Name	Lincoln S	SuperArc	L-59	ES	SAB Spoo	lArc 71		Gas Cup	Size	-		5/8"						
Filler Metal Prod	uct Form		Solid			Solic	ł		PREHE	AT (QW-40	16)							
Supplemental Fil	ler Metal		None			None	e		Minimu	m Te	mperatu	re	200						
Alloy Elements			N/A			N/A			Preheat	Mai	ntenance		Prior/Durin	g					
Electrode Flux Cla	ass		N/A			F7A2-EN	114K												
Flux Trade Name			N/A		ESA	B OK FLU	JX 10.71		TECHN	IQU	JE (QW	-410)							
Flux Type			N/A			Neutr	al		Multipas	ss or	Single Pa	ass (per side)	(A) Single	, (B) Multiple					
Alloy Flux			N/A			N/A	ı		Single or	r Mu	ltiple Ele	ctrodes _	(A) Single, (B) Multiple					
Recrushed Slag U	lsed		N/A			No			Initial an	nd In	terpass C	leaning	Brushing/	Grinding					
Weld Metal Thick	kness (t)	1/4" Cons	sumed by	/ SAW		1"			Transfer	Мо	de		(A) Pulsed-Spray,	(B) N/A					
Maximum Pass T	hickness		1/4"			5/32	11		Peening	Perf	ormed		None						
ELECTRODE									Maximu	m Pa	ass Width	ı 	1"						
Electrode Spacing	g (2 Arcs)		N/A		3/4'	' Center t	to Center		Oscillatio	on (N	Machine)		None						
Angle			N/A		Lead 0	° Drag,Tr	ail 12° Pu	ısh	POST V	NEL	D HEAT	TREATMEN	T (QW-407)						
Contact Tube to '	Work		3/8"			1"			Tempera	ature	2		None						
									Time				None						
ELECTRICAL (C	2W-409)								-					1					
			Dian	neter	Curre	nt and arity	An	nps		Vo	lts	Travel Speed	Heat Input	Interpass					
Pass(es)	Process	Class	Lead	Trail	Lead	Trail	Lead	Tr	rail Le	ad	Trail	(lpm)	(J/in)	Temp (°F)					
A1	GMAWP	ER70S-6	.0!	52"	DC	CEP	2	30		23	3.5	15	21,620	Preheat					
B1	SAW	EM14K	1/8"	1/8"	DCEP	AC	600	5	00 2	8	30	32	59,625	Preheat					
B2	SAW	EM14K	1/8"	1/8"	DCEP	AC	600	5	00 3	1	32	32	64,875	390°					
B3	SAW	EM14K	1/8"	1/8"	DCEP	AC	AC 600 550 33 33 30 75,900		75,900	4/4-									
D4	SAVV	EIVI14K	1/0	1/0	DCEP	AC	800	4	30 3	0		50	87,500	422					
										1									

Heat input calculated using QW-409.1 (a), No instantaneous energy readout.

PQR No.

P1G1-P1G2-EM14KT-A20U-1

Date

6/3/2014

TENSILE TESTS (QW-150)

Specimen No	Width	Thickness	Diameter	Area	Ultimate Total	Ultimate Stress	Location of Failure	
Specimen NO	(in)	(in)	(in)	(in)	Load (lbs)	(psi)		
1	0.746"	0.695"	N/A	0.5185"	38,171	73,500	Base Metal	
2	0.745"	0.692"	N/A	0.5155"	38,041	74,000	Base Metal	

GUIDED-BEND TESTS (QW-160)

Type and Figure No	Result	Type and Figure No	Result
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass
Transverse Side Bend (QW-462.2)	Pass	Transverse Side Bend (QW-462.2)	Pass

TOUGHNESS TESTS (QW-170)

Specimen No	Notch Location	Specimen Size	ecimen Size Notch Test		Impact Values	Shear %	Mile	Drop Weight
Specimen No	Noten Edeation	(in) Size (ir		Temp (F)	(Ft LBS)	Jilear 70	141113	Break
1	Weld Metal	.394x.394	0.315	-20	104	N/A	N/A	N/A
2	Weld Metal	.394x.395	0.315	-20	91	N/A	N/A	N/A
3	Weld Metal	.394x.395	0.315	-20	124	N/A	N/A	N/A
4	HAZ A-36	.394x.394	0.315	-20	83	N/A	N/A	N/A
5	HAZ A-36	.394x.395	0.315	-20	105	N/A	N/A	N/A
6	HAZ A-36	.394x.395	0.315	-20	106	N/A	N/A	N/A
7	HAZ SA-516	.394x.395	0.315	-20	111	N/A	N/A	N/A
8	HAZ SA-516	.394x.395	0.315	-20	82	N/A	N/A	N/A
9	HAZ SA-516	.394x.395	0.315	-20	75	N/A	N/A	N/A
Impact testing perfo	ormed to ASM	IE VIII						

Impact testing performed to

HARDNESS TEST - ROCKWELL B

		В	ase Metal				Heat Affected Zone Weld Metal					I	
	A-36	5		75 Rb	77 Rb	77 Rb	81 Rb	80 Rb	81 Rb	90 Rh	Q1 Rh	Q1 Rh	
	SA-51	16		88 Rb	77 Rb	77 Rb	93 Rb	91 Rb	90 Rb	30 ND	3110	9110	
DEPOSITE	D CHEMICA	AL ANALYSI	S										
С	Si	Mn	Р	S	AI	V	Cr	Ni	Fe	Ce			
0.100	0.590	1.410	0.015	0.013	3 N/A	N/A	۵.05 A	1 0.05	i9 N/A	. N/A	\		
Chamical A	nalucia Canfu			1									
Chemical A	nalysis Conic	orms to A#		1									
MATERIA	L TRACABIL	ITY											
Item Descri	iption	A-	36	Hea	it Number		A2K326	Ma	nufacturer		SSAB		
Item Descri	iption	SA-5	16-70	Hea	it Number		B2G551	Ma	nufacturer		SSAB		
WELDING	INFORMAT	ΓΙΟΝ											
Welding ma	achine used	(A) Lincoln	455m/STT	`w/ 25m Fe	eder box (B)) Power Wav	/e AC/DC 10	00 w/ Lincol	n Power Fee	ed 10A Conti	oller	
Welder Nar	me		Richa	rd Carter		ID I	Number	28	117	Stamp	RC	-	
TESTING I	NFORMATI	ON											
Tests Cond	ucted By	MS	Testing In	с.	Laboratory	Test Numbe	er1	4-154	Date of Tes	ting	6/5/20	014	
Preparation	n and weldin	g of test cou	ipon was v	vitnessed	by			Jacob Mo	wat				
We certify	that the stat	ements in th	nis record a	are correct	t and that th	ne test weld	s were prepa	ared, welde	d, and tested	1			
in accordar	nce with the	requiremen	ts of ASME	IX.				л					
		·						oh. l	Vour t	• •			
This Proced	lure Qualific	ation Record	d was prep	ared and a	accepted by	,	9	unce v		on	6/9/	2014	
Accepted	Ву					Plant 1 De	nver, CO						
Accepted By						Plant 2 Salt Lake City, UT				1			
A							QC1 EXP. 10/1/2016						

Accepted By Plant 3 Pocatello, ID

All units referenced on PQR are in English (Standard, I.e. psi, inches, etc.) unless specifically noted.

Uncontrolled copy if not signed by plant representative

Page 2 of 2

WELDING PROCEDURE SPECIFICATION (ASME)													
EATON METAL PRODUCTS COMPANY LLC													
WPS No			F	<u>1-P1-FC4</u>	W-AL				Date	8/15/2014	Revisio	on	3
Supporting	PQR No	o(s)				P10	<u>G1-P1G2</u>	-FCA	W-A20L				
BASE ME		/-403)				JJC	OINT (QV	V-402	2. QW-405)	,,			
P#	1 G	ir# -	to P#	1	Gr #	- Jo	pint Type		ANY/ALL	Fillet		ANY/AL	L
Thickness	Range	0.	1875	to	1.5	Gr	roove Typ	 De	Any	Fillet Weld	Size	AN	١Y
Backing	YES					Ro	oot Spaci	ng	0" - 3/8"	Groove An	igle –	See Ap	pendix
Backing M	aterial	BASE/	WELD/TEN	/PORAR)	MATERIA	AL Po	osition	Ū	All	Progressio	n	UPHI	L
										_			
POST WE	LD HEAT	TREAT	MENT (F) (QW-407)		PF	REHEAT	(F) ((QW-406)				
Temperatu	ire Range	e		-		Mi	inimum T	empe	erature	50<1.25	5 <mark>" -</mark> 200:	>1.25"	
Time Rang	le		-			Ma	aximum I	nterp	ass Tempera	ature		<u>400</u>	
See appen	dix for se	ervice con	siderations			Pro	reheat Ma	unten	iance <u>M</u>	aintain until v	welding	is com	olete
PROCES	SS / TY	PE			FCA	W					-		
FILLER MI	ETAL (Q	W-404)											
AWS Class	sification				<u>E</u> 71T	-1			_		-		
SFA# / AW	'S Specif	ication			5.20	0					-		
F #					6						-		
A # or Chei	mical Co	mposition			1				- <u> </u>		-		
Filler Metal	Trade N	ame		Lince	oln Outersh	nield 71	1 Elite				-		
Filler Metal	Diamete	er			0.045 /	1/16"					-		
Maximum V	Weld Me	tal Thickn	ess		1.5		_		·				
SHIELDING	G (QW-4)	08)		10									
Shielding G	ias / GFF	1		100	1/2 - 3	30-50 (GFH						
Gas Cup Si					Non	<u>5/4</u>			·				
Racking Ga					Non	e			· · · · · · · · · · · · · · · · · · ·				
		-410)			NOT				·		_		
Current		410)			DCE	Р					-		
GMAW.	FCAW					·			·				
Transfer Me	ode				SPRA	λY					-		
GTAW													
Electrode T	ype				-						-		
Electrode S	lize				-								
TECHNIQU	JE (QW-4	410)											
Beads				STRING	<u>ER - Each</u> l	bead ≤	5/8" wid	<u>e </u>			-		
Passes per	side				MULTI	PLE							
Number of	Electrode	es		_	1						-		
ELECTR	ODE SPA	CING											
Longitudina	l				-						-		
Angle	1- 14/-	de Distan			-	4 11			/	Dar Dar	niel Durt	schi	
		rk Distan	ce		1/2 - NON						1 FXP	<u>1421</u> 3/1/2017	
Feening	lina				Grinding/B	∟ ruebino							
Internass C	leaning				Chinning/C	rinding	a A				-		
niterpass o	Tearning	C 111 a.c.		Ourse			9			Maximum	Lloot In	nut for	0.01/
Pass or		Filler	Filler	Current			Ira	vei	Max		neat in	put for	any Vin
		Clean	Diameter	Type &	۸۳۳۵	Volte		200 200	Heat input				U/III
ANIV/ALL	FCAW	E71T-1		DOEP	200-250	22.2		<u>, (ii</u>	(0/11)		15	tot	
	FCAW	E71T-1	1/16	DOEP	200-250	22-2		8		Accented B	V PI AN		N
	-	-	-	-	-	-2-2	. 1	~) EAN		
-	-	-	_	-	-	-	_		-				
-	-	-	-	-	-		-		-	Accepted B	y PLAN	IT 2 SLO	с —
Interpass cleaning not considered peening													
Refer to Apr	Refer to Appendix WPS for all other variables.												
Non Wave I	From Col	ntrolled W	elding.							Accepted B	y PLAN	IT 3 PO	с –
This WPS is	This WPS is only used for material which does not require notch-toughness testing.												
Uncontrolled	d copy if	actual sig	nature not	signed by	plant repre	esentat	tive.						

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Date: 4/28/2014 Revision: 9	
This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not	
mentioned on the Welding Procedure Specification.	
* Any information on actual WPS supersedes this document if a conflict exists.	
QW-402	
1 Customer Representative shall accept all weld joint designs on job specific drawings.	ſ
2 Retainers prohibited.	ſ
3 Root spacing shall be sufficient to allow for complete joint penetration.	
4 Bevel angle for groove welds that can only be accessed from one side (i.e. no backgouge/grind) shall	
be 30° or greater.	
I NO pass greater than 1/2" allowed. (FCAVV, GMAVV, SAVV, SMAVV)	
1 Consumable inserts prohibited (GTAW)	
2 Filler metal used with weld test. (GTAW)	
3 Supplemental filler material not used in weld test. (FCAW, GMAW, SAW)	
4 Recrushed slag not used in weld test. (SAW)	
5 Flux not used in weld test. (FCAW, GMAW)	
QW-407 PWHT When Required	
1 For vessels that are exposed to environments that could cause stress corrosion cracking; a minimum	
hold time of 1 hour at a minimum temperature of 1150 °⊢ shall be applied.	
2 For welds that may be exposed to environments that could cause stress corrosion cracking the	
minimum PWHT noid time shall be one nour per inch for thicknesses exceeding one inch	
₩-410	
1 Backgouge performed with air carbon arc, plasma, and/or grinder	
2 Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW)	
3 Out of chamber welding only. (GTAW)	
4 a FCAW - semiautomatic	
b SMAW - manual	
c SAW - machine	
d GTAW - manual	
JG-84	
For weld procedures used when impact tests are required, production material must:	
a Be of the same P-Number and Group Number with the exception allowed by QW-403.5(c)	
D Be in the same heat treated condition	
The brand specific filler and/or flux listed on the WPS shall not be substituted.	
Applicable to WPS with Post Weld Heat Treatment (PWHT)	
A specific PWHT procedure shall be developed for each job.	
All units referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.	

ACCEPTED BY		PLANT 1 DENVER, CO
ACCEPTED BY		PLANT 2 SALT LAKE CITY, U
ACCEPTED BY		PLANT 3 POCATELLO, ID
Uncontrolled copy if actua	l signature not signed by plant representative.	Page 2 of 2

PROCEDURE QUALIFICATION RECORD (ASME)

		E	ATON ME		ODUCTS (OMPAN	VY LLC				
PQR No		P10	61-P1G2-FC	AW-A20L			_ Date _1	<u>1/11/2009</u> Re	evision <u> </u>		
BASE MET/ Material For Material Spe Material Spe * Weld thick PREHEAT (Minimum Te Maximum In Preheat Mai	AL (QW-40 m ec <u>S/</u> mess = to p F) (QW-40 mperature terpass Te ntenance	03) PLATE 1 SA-36 A-516-70N blate thickness 6) emperaturePR	Thickness* P # <u>1</u> P # <u>1</u> 50 30 10R / DURIN	0.75 Gr # Gr # 00 NG	JOINT (C Type	W-402, C DOU ening ge tion ELD HEA ture Rang	QW-405) JBLE BEV 0 YES 3G Ve T TREATM e	EL Gro Root Face Back Welded Prtical Progress /IENT (F) (QW	oove Angle <u>40</u> e <u>1/8</u> YES sion <u>UPHILL</u> -407)		
PROCESS	S / TYPE			FCA	W			-			
FILLER ME AWS Classif SFA# / AWS F # A # or Chem Filler Metal T Filler Metal I	TAL (QW- ication Specificat ical Comp rade Nam Diameter	404) – tion – osition – e –		E71T 5.20 6 1 -	-1						
SHIELDING Electrode-Flu Flux Trade N Shielding Ga Gas Cup Siz	(QW-408) ux (Class) lame / Typ is / CFH e	e _	1		35CFH		- - - -				
Trailing Gas Backing Gas ELECTRICA	/ CFH 5 / CFH L (QW-40			- -							
GMAW, F Transfer Moo GTAW	CAW de	-		SPRA	Y						
Electrode Ty Electrode Siz	pe ze E (QW-410) –		-							
Beads Pass Number of E	lectrodes			MULTI 1							
ELECTRO Longitudinal Angle Contact Tube Peening Internass Cle	e to Work	NG — Distance — —	ΜΔΝ	- 1/2" - NON	1" E CHANICAI		 				
	9 9	<u></u>									
Pass or Weld Layer (s) ALL	Process FCAW	Filler Metal Class E71T-1	Filler Metal Diameter 0.045	Current Type & Polarity DCEP	Amps 210	Volts 24	Fravel Speed (ipm) 6	Max Heat Input (J/in) 50,400	Remarks		
-	-	-	-	-		_	-	-	-		

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

_

_

_

-

_

_ -

_

_

_

-

_

_

J/in _ = Amps x Volts x 60 Travel Speed 50,400

-

_

_

_

-

_

_

-

-

_

-

-

-

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No		P1	G1-P1G2	2-FCAW-	A20L	. <u> </u>			D	ate <u>11/1</u>	1/2009	Rev	ision .	1	
TENSILE TEST (QW-150)															
SPECIMEN	WIDTH	THICK	A	REA	UL	TIMATE		UL	TIMATE						
NO.	(IN)	(IN)	(S	QIN)	тот	AL LOA	D	STR	ESS (PSI)	L	CATI	O NC	F FAI	LURE	
A	0.754	0.73	0.	550		38,1	60		69,382	BASE METAL SA-36					
В	0.746	0.721	0.	538		37.0	40		68,848	.848 BASE METAL SA-36			-36		
-	-	-		-		-			- '			_			
-	-	-		-		-			-			_			
-	_	-		-		-	1		-			_			
_	_	-													
-	-	_		_		-			-			_			
-		-		-		-			-			-			
				GUIDE	D BE	ND TES	БТ (С	-W2	160)		_				
FIGU	RE NO AND	ТҮРЕ		RESUL	TS			FIGI	URE NO AI				RES	ULTS	
(4) QV	V-462.2 SIDE	BEND		PASS					-	<u></u>				-	
(1) = 1	-			-					-					-	
				TOUG	HNE	SS TES	τίο)\//_1	70)				· · · · ·		
L							. (0		IMPACT	ΙΔΤ	ERAI	EXP			OP
SPECIMEN	,	NOTCH			сн	TEST	ГЕМ		VALUES	LP11					знт
NO	, , (/E))	" ,	(FT_LBS)	SHEAR	%	MIL	s	BRE	
1					Сн		<u>/</u>	+	63		//	0.05	1		<u>אר.</u> ר
2					СН	_2	n		65	40		0.00	5	NIC	5
2						-2	n		80	40 60		0.03	74		
3	5/					-2	0		16	20		0.07			
4 5	57					-21	n n		10	20		0.01	4		2
5	57					-20	5		29	20		0.0	3		
	54					-20	J		22	20		0.02		NC	2
	5/	A-516-70			CH	-20)		18	20		0.01		NO	
8	SA	A-516-70		V-NOI	CH	-20	J		22	20		0.02	.3	NO	
9	SA	A-516-70			СН	-20)		18	20		0.01	8	NC	
-		-		-		-			-	-		-		-	
-		-		-		-			-	-		-		-	
						_									
				HARDN	ESS	TEST -	Brin	<u>iell E</u>	<u>BHN</u>						
		BASE MET	AL				HE	EAT /	AFFECTEL	ZONE		WE	LD ME	TAL	
			1	2		3		1	2	3	1		2		3
	SA-36		130	127		-	17	72	159	-	190		165	1	-
5	SA-516-70		162	162		-	20	00	180	-	-		-		-
	-		-	-		-	•	-	-	-	-		-		-
18	-		-	-		-		-	-	-	-		-		-
N1: Interpa N2: Refer to	ss cleaning no o Appendix Po	ot consider QR for all c	ed peenii ther varia	ng. ables.											
N3. N4: N5: Origina	POR "CS-12	9-DS 5-5-	95"												
Welder Namo									Stame	14/		Mum	hor	04	5
Tooto Conduo	tod <u>Dr</u>						lah	oroto	Stamp.	vv mbori	1D	Num			5
POR was don	e and welding				<i></i>		Lab		TON META				10-209		
			was with	163360 bj	, .		. 1	<u> </u>							
we certify that	t the statemer	nts in this r	ecord are	correct	and ti	hat the t	est v	welds	s were prep	ared, weld	led, an	d tes	ted in		
accordance w	ith the require	ments of A	SMP Se	etion IX.				/m	Daniel D	Jurtschi					
BY		m	ma	1000						030421					
ACCEPTED BY															
ACCEPTED B	ACCEPTED BY														
ACCEPTED B	Y								PLANT 3	POCATEL	LO, ID			Page 2	of 2

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	6/3/2009	_Revision:3	
* This appendi mentioned or	ix addresses any Es n the Procedure Qua	sential, Supplementary Essential, a alification Test Record.	and Nonessential variables not
** Any informat	ion on actual PQR s	upercedes this document if a confl	ict exists.
QW-402 1 Approved join 2 Retainers no	nts shall be on detai t used for weld test.	led drawings for individual jobs.	
QW-403 1 No pass grea	ater than 1/2" used i	n weld test. (FCAW, GMAW, SAW	, SMAW)
QW-404 1 Consumable 2 Filler metal u 3 Supplementa 4 Recrushed sl 5 Flux not used	inserts not used for sed with weld test. (al filler material not u lag not used in weld d in weld test. (FCA)	weld test. (GTAW) GTAW) sed in weld test. (FCAW, GMAW, test. (SAW) V, GMAW)	SAW)
QW-410 1 Backgouge p 2 Oscillation nd 3 Out of chamb 4 a FCAW - s b SMAW - r c SAW - ma d GTAW - r	performed with air can be used with automat ber welding only. (G semiautomatic manual achine manual	rbon arc, plasma, and/or grinder. ic or machine welding. (FCAW, GN FAW)	MAW, GTAW, SAW)
Full size impact t	lest specimins used.	(10mm x 10mm)	
All units referenc	ed on PQR are in E	nglish (Standard, i.e. psi, inches, e	tc.) unless specifically noted.
ACCEPTED BY			PLANT 1 DENVER, CO
ACCEPTED BY			PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY			PLANT 3 POCATELLO, ID

WELC	ING PRO	CEDUF	RE SI	PECIFI	CATI	ION (A	SME)	
	EATON ME	TAL PR	ODUC	CTS COI	MPAN	IY LLC		
WPS No	P1-P1-GMA	WP-AL				_ Date _1	1/17/2011 Revisio	on <u>5</u>
Supporting PQR No(s)	P1G1-I	P1G2-GMA	WP-L	59-A50L, I	P1G1-F	P1G2-GM	AWP-L59-A50U	
BASE METAL (QW-403)			JO	INT (QW-	402, G	W-405)		
P#1_`Gr#´- to 1	°#1	Gr#	- Gre	oove	,	ALĹ	Fillet	ANY / ALL
Thickness Range 3/16	to	1 1/2	Po	stion		Fillet Weld Size	ALL	
Backing YES Backing Material	WELD / BA	ASE META	L Pro	ogression	U	IPHILL		
POST WELD HEAT TREATMENT	F) (O \ V /-407)		PR Mir	REHEAT (I	F) (QW mperal	/-406) ture	50<1 25" - 200	>1 25"
Temperature Range	None		Ma	aximum Int	terpass	s Tempera	ature 200	450
Time Range	None		Pre	eheat Mair	ntenand	ce	PRIOR / DUF	RING
		CRAAN						
		GIMAV	/V-P			-		
			6 6					
SEA# / AM/S Specification			3-0 A 5 19				-	
		<u>6</u>	A-0.10					
A # or Chemical Composition		1					-	
Filler Metal Trade Name	LINC		ERARC	CL-59			_	
Filler Metal Diameter	0	0.045"/0	0.052"				-	
Maximum Weld Metal Thickness		1.5'	н				-	
SHIELDING (QW-408)								
Electrode-Flux (Class)		-					-	
Flux Trade Name / Type		-			.	<u></u>		
Shielding Gas / CFH	90%	6 Ar 10%C	02735	omin				
Gas Cup Size		1/2° - 3	3/4			6		
Backing Gas / CEH								
Current		DCE	Р				-	
GMAW, FCAW			-					·
Transfer Mode		PULSED S	SPRAY				~	
GTAW								
Electrode Type		-						
Electrode Size		-					-	
TECHNIQUE (QW-410)	075110							
Beads			bead ≤	5/8" wide				
Pass Number of Electrodos			LE				-	
Longitudinal		_					-	
Angle							-	
Contact Tube to Work Distance		1/2 - 3.	/4"					
Peening		NON	E				Civil 110204	chi 124
Interpass Cleaning	MAN	IUAL / ME	CHANI	CAL			OC1 FXP 3/	1/2014
Pass or Filler Fille	er Current			Trave	el	Max	Maximum Heat Ir	put for any
Weld Metal Met	al Type &			Spee	d H	eat Input	Diameter =	J/in
Layer (s) Process Class Diam	eter Polarity	Amps	Volts	s (ipm)	(J/in)	By / / ,	4 - 1
ANY GMAW-P ER70S-6 0.04	5" DCEP	Any	Any	Any	·	-	mm m	70-60
ANY GMAW-P ER70S-6 0.05	2" DCEP	Any	Any	Any		-	Accepted By PLA	NT 1 DEN
- - - -	-	-	-	-		-		
- - -	~	-	-	-		-	Accorted By DLAN	
Internass cleaning not considered be	enina	-	-			_	Accepted by PLA	NT 2 OLU
Refer to Appendix WPS for all other	variables							
This WPS is only used for materia	that does no	ot require r	notch-t	toughnes	s testi	ng	Accepted By PLAN	NT 3 POC
Lincoln Invertec V350 PRO, Pulsed I	/IG Steel 0.04	5, 237 SPI	D, 180	WFS -3.0	arc col	ntrol		
Uncontroled copy if actual signature not signed	d by plant represe	entative.						

APPENDIX WPS (ASME)

EATON METAL PRODUCTS COMPANY LLC

Date:	11/10/2011	Revision:	<u>5 </u>	
 This apper mentione ** Any inform 	ৰাবাx addresses any E d on the Welding Pro mation on actual WPণ	Essential, Supplement cedure Specification. S supercedes this doct	ary Essential, and No ument if a conflict exis	nessential variables not sts.
QW-402 1 Approved 2 Retainers 3 Root space 4 Bevel ang	l joints shall be on det prohibited. cing shall be sufficien gle for groove welds s	ailed drawings for indi t to allow for complete hall be 30° or greater.	vidual jobs. joint penetration.	
QW-403 1 No pass (greater than 1/2" allov	ved. (FCAW, GMAW,	SAW, SMAW)	
QW-404 1 Consuma 2 Filler met 3 Suppleme 4 Recrushe 5 Flux not u	able inserts prohibited al used with weld test ental filler material no ed slag not used in we used in weld test. (FC	. (GTAW) (GTAW) t used in weld test. (F0 eld test. (SAW) AW, GMAW)	CAW, GMAW, SAW)	
QW-407 PV 1 For vesse hold time	VHT When Required als that are exposed to of 1 hour at a minimu	o enviornments that co im temperature of 115	ould cause stress corr 0°F shall be applied.	rosion cracking; a minimum
QW-410 1 Backgoug 2 Oscillation 3 Out of cha 4 a FCAW b SMAV c SAW d GTAW	ge performed with air n not used with autom amber welding only. (V - semiautomatic V - manual - machine V - manual	carbon arc, plasma, a natic or machine weldi GTAW)	nd/or grinder. ng. (FCAW, GMAW, (GTAW, SAW)
UG-84 For weld pro- a Be of b Be in t c Meet t	cedures used when ir the same P-Number a the same heat treated the minimum notch to	npact tests are requrie and Group Number wi d condition ughness requirements	ed, production materia th the exception allow	al must: ved by QW-403.5(c)
The brand sp	pecific filler and/or flux	listed on the WPS sh	all not be substituted.	
Applicable to A specific	WPS with Post Welc PWHT procedure sh	d Heat Treatment (PW hall be developed for e	HT) ach job.	
All units refer	renced on WPS are ir	n English (Standard, i.	e. psi, inches, etc.) un	less specifically noted.
ACCEPTED	BY			PLANT 1 DENVER, CO
ACCEPTED	BY			PLANT 2 SALT LAKE CITY, UT

PLANT 3 POCATELLO, ID

Uncontroled copy if actual signature not signed by plant representative.

ACCEPTED BY

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC												
PQR No		P1G <u>1-P</u>	1G2-GMAV	VP-L59-A5	iol			Date 4	<u>/12/2011</u> F	Revision	0	
BASE META	L (QW-40	3)			JO		W-402. G	W-405)				
Material Forn	1 1	PLATE T	nickness*	3/8	Tvp	De	S	INGLE V	G	Groove Angle	50	
Material Spec	: <u> </u>	A-516-70 F	P# 1	Gr# 2	2 Roc	ot Oper	nina	0	Root Fa	ice 1	/16	
Material Spec		SA-36	⊃# <u>1</u>	Gr #	1 Bad	ckaoua	e	YES	Back Welde	ed N	/ES	
*Weld thickne	thickness = to plate thickness				Tes	st Posit	ion	3G Ve	ertical Progre	ssion	JPHILL	
PREHEAT (F	(QW-40	3)					80	• INCLINA	TION ANGL	Е —		
Minimum Ter	nnerature		50° F		PO	ST WE			ENT (F) (Q)			
Maximum Int	ernass Te	mperature	450)° F	Ter	mperati	ire Rand	9	N	None		
Preheat Main	tenance		NONE		Tim	ne Rang	ge		None			
PROCESS	/ TYPE			GMAV	V-P				-	n		
FILLER MET	AL (QW-4	.04) —										
AWS Classifi	cation			ER708	5-6				-	-		
SFA# / AWS	Specificat	ion —		ASME SF.	A-5.18					-	_	
F#	•			6					-	-		
A # or Chemi	cal Compo	osition		1					-	-		
Filler Metal T	rade Name	e —	LINC	OLN SUPE	ERARC	CL-59			-	-		
Filler Metal D	iameter			0.045	5"					-		
SHIELDING	(QW-408)											
Electrode-Elux (Class)				-					-	-		
Flux Trade N	ame / Tvp	e —		-								
Shielding Gas / CFH			90%	Ar 10%C	02 / 35	ômin			-			
Gas Cup Size				5/8"	,				-	-		
Trailing Gas / CFH				-	-					-		
Backing Gas / CFH				_					-	-		
ELECTRICA	L (QW-40	9) —										
Current	- (- /		DCE	Р				-	-		
GMAW. FO	CAW			_								
Transfer Mod	e			PULSED S	SPRAY	•			-	-		
GTAW			-	_								
Electrode Tvr	be		-					-				
Electrode Siz	e											
TECHNIQUE	QW-410	<u> </u>										
Beads	(/		STRING	GER				-	-		
Pass				MULTI	PLE				-	-		
Number of Fl	ectrodes			1						-		
ELECTRO	DE SPACIN	NG —										
Longitudinal				-					-	_		
Angle				-					-			
Contact Tube	to Work	Distance		1/2-3/	/4					_		
Peening				NON	E				-			
Interpass Cle	aning	_	MAN	IUAL / ME	CHANI	CAL						
Pass		· · ·	Filler	Current				Travel	Max			
or Weld		Filler Metal	Metal	Type &				Speed	Heat Input	t		
Layer (s)	Process	Class	Diameter	Polarity	Am	nps	Volts	(ipm)	(J/in)	Rem	arks	
ROOT	GMAWP	ER70S-6	.045	DCEP	15	50	18.5	8	20,813	3 -		
FILL/COVER	GMAWP	ER70S-6	.045	DCEP	17	70	20.5	6.5	32,169) -		
-	-	-	-	-	-	-	-	-	-	-		
-	-	-	-	-	-	-	-	-	-	-		
-	-	-	-	-	-	-	-	-	-	-		
-	-	-	-	-	-	-	-	-	-	-		

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

32,169 J/in = Amps x Volts x 60 Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC											
PQR No		P1G1-P1	G2-GN	1AWP-L59)-A50L		D	ate	11 Revision	0	
				TENS	ILE TI	EST (QW	/-150)				
SPECIMEN	WIDTH	THICK	AF	REA	ULTIN	MATE	ULTIMATE				
NO.	(IN)	(IN)	(SC	RIN) T	OTAL	LOAD	STRESS (PSI)	FAI	LURE LOCAT	TION	
1	0.753	0.352	0.2	651		18,988	71,638	BA	BASE METAL SA36		
2	0.751	0.342	0.2	568		18,961	73,824	BA	SE METAL S	A36	
-	-	-		-	-	-	-		-		
-	-	-		-	-	-	-		-		
-	-	-		-	-	-	-		-		
-	-	-		-	-	-	-		-		
-	-	-	_			-			-		
GUIDED BEND TEST (QW-160)											
FIGURE NO AND TYPE				RESULTS	3		FIGURE NO A	ND TYPE	RE	SULTS	
(4) SIDE BEND, QW-462.2				ALL PASS	3		-			-	
-			-						-		
				TOUGH	NESS	TEST (C	(W-170)				
							IMPACT	LATER	AL EXP.	DROP	
SPECIMEN	٢	NOTCH		NOTCH	4 TI	EST TEN	IP VALUES			WEIGHT	
NO.	LC	CATION		TYPE		(F)	(FT-LBS)	SHEAR %	MILS	BREAK	
WELD 1		WELD		V-NOTC	:H	-55°	35	-	-	-	
WELD 2		WELD		V-NOTC	:H	-55°	30	-	-	-	
WELD 3		WELD		V-NOTC	:H	-55°	45	-	-	-	
HAZ 36-1		HAZ		V-NOTC	:H	-55°	50	-	-	-	
HAZ 36-2		HAZ		V-NOTC	:H	-55°	58	-	-	-	
HAZ 36-3		HAZ		V-NOTC	:H	-55°	44	-	-	-	
HAZ 516-1		HAZ		V-NOTC	:H	-55°	120	-	-	-	
HAZ 516-2		HAZ		V-NOTC	:H	-55°	106	-	-	-	
		1 1 4 7		VINOTO	- LL	550	110	_	-		
HAZ 510-5		HAZ		V-NOTC		-00		-			
		HAZ -		V-NOTC		-00	-	-	-	-	

-	_				-	-	-			
	HARDNESS TEST - Rockwell Hardness, B Scale									
BASE METAL						AFFECTE	D ZONE	W	ELD MET	AL
		1	2	3	1	2	3	1	2	3
	SA516-70	80.5	82.0	82.9	90.0	88.0	87.0	86.0	87.5	86.0
	SA36	80.0	80.0	79.5	83.0	81.0	80.0	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-

N1: Interpass cleaning not considered peening.

N2: Refer to Appendix PQR for all other variables.

N3:

N4: Lincoln Invertec V350Pro: Pulsed MIG Steel 0.045, SPD=237, WFS=180

N5: Test Plate:SA516-70, Nucor Heat# 9106648; SA36, SSAB Heat# A0J024

Welder Name:	Daniel Durtschi	Stamp:	DD	ID Number:	1240
Tests Conducted	By: MSI Testing, Inc.	Laboratory Test Nu	mber:	11-089 #1	
PQR was done a	id welding of coupon was witnessed by:	Eaton Meta	Products Co	ompany LLC	
	the first sector for the form and show a second second to			منا أم ما م م م ال سر ال	

Ne certify that the statements in this record are correct and that the "	test welds were prepared, welded, and tested in

accordance with the BY	requirements of ASME Section IX.	Daniel Durtschi CWI 11030421	
ACCEPTED BY		QC1 EXP. 3/1/2014 PLANT 1 DENVER, CO	
ACCEPTED BY		PLANT 2 SALT LAKE CITY, UT	
ACCEPTED BY		PLANT 3 POCATELLO, ID	Page 2 of 2

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date	e: <u>6/3/2009</u> Revision: <u>3</u>
* T	his appendix addresses any Essential, Supplementary Essential, and Nonessential variables not
n	mentioned on the Procedure Qualification Test Record.
** A	Any information on actual PQR supercedes this document if a conflict exists.
QW	-402
1 <i>A</i>	Approved joints shall be on detailed drawings for individual jobs.
2 F	Retainers not used for weld test.
QW-	-403
1 N	Io pass greater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)
QW-	404
1 C	Consumable inserts not used for weld test. (GTAW)
2 F	Filler metal used with weld test. (GTAW)
3 S	Supplemental filler material not used in weld test. (FCAW, GMAW, SAW)
4 F	Recrushed slag not used in weld test. (SAW)
5 F	Flux not used in weld test. (FCAW, GMAW)
QW-	e410
1 E	Backgouge performed with air carbon arc, plasma, and/or grinder.
2 C	Dscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW)
3 C	Dut of chamber welding only. (GTAW)
4 a	FCAW - semiautomatic
b	SMAW - manual
c	SAW - machine
c	GTAW - manual
Full	size impact test specimins used. (10mm x 10mm)
All u	nits referenced on PQR are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY	 PLANT 1 DENVER, CO
ACCEPTED BY	 PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY	 PLANT 3 POCATELLO, ID

PROCEDURE QUALIFICATION RECORD (ASME)										
	EATON METAL PRODUCTS COMPANY LLC									
PQR No		P1G1-P	IG2-GMAV	VP-L59-A5	JOU		_ Date	1/12/2011	Revision	0
BASE META	 (OW-40)3)			JOINT	(QW-402. C	W-405)			
Material Form	n	PLATE T	nickness*	3/4	Туре	(0,11 ,02, 0			Groove A	nale 50
Material Spe	c <u>s</u>	A-516-70	P# 1	Gr #	2 Root O	pening	0	Root F	ace	1/16
Material Spe	с	SA-36	p# <u>1</u>	- Gr #	1 Backoo	ude	YES	Back Weld	ded	YES
*Weld thickne	ess = to pl	late thickness			Test Po	sition	3G Ve	ertical Progr	ession	UPHILL
PREHEAT (F	F) (QW-40	6)				60		TION ANG	LE	
Minimum Ter	mperature	- /	50° F		POST	NELD HEA	T TREAT	MENT (F) (C	2W-407)	
Maximum Int	terpass Te	mperature	45	0° F	Tempe	rature Rano	e		None	
Preheat Mair	itenance		NONE		Time R	ange		None	Э	
DDOOFOO										
PROCESS	5/TYPE			GMA	<u>V-P</u>					
FILLER MET	「 AL (QW-∕	404)								
AWS Classifi	ication	. —		ER70	<u>S-6</u>				_	
SFA#/AWS	Specificat			ASME SF	A-5.18					
F#		—		6	_					
A # or Chemi	ical Comp	osition	1	1	<u></u>	0			-	
Filler Metal I	rade Nam	e	LINC	OLN SUP	ERARC L-5	9			-	
Filler Metal D	lameter			0.04	5"				-	
SHIELDING	(QW-408)									
Electrode-Flu	ix (Class)							_		
Flux Trade Name / Type				-					-	
Shielding Ga	90%	Ar 10%C	02/35min							
				5/8					<u> </u>	
Trailing Gas / CFH				-					-	
Backing Gas										
ELECTRICA	L (QVV-40	9)			-					
Current	~ ~				<u>۲ </u>					
GMAW, FC	JAW									
I ranster Mod	le			PULSED	SPRAT				-	
GIAW Tis stands Tu										
Electrode Typ	pe			-						
Electrode Siz										
Reade	: (QVV-410)		OTDIN/						
Beaus										
Pass Number of El	o otrodoo		_						-	
									-	
Longitudipol	DE SPACI	NG								
Anglo				-					-	
Contact Tube	to Mork	Distance —			14					
Booning				NON					-	
Internase Cle	ening		MAN							
	annig									
Pass			Filler	Current			Travel	Max		
or Weld		Filler Metal	Metal	Type &			Speed	Heat Inpu	ut	
Layer (s)	Process	Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	R	emarks
ROOT	GMAWP	ER70S-6	.045	DCEP	150	18.5	8	20,81	3	-
FILL	GMAWP	ER70S-6	.045	DCEP	170	20.5	6.5	32,16	9	-
COVER-	GMAWP	ER70S-6	.045	DCEP	150	18.5	8	20,81	3	-
-	-	-	-	-	-	-	-	-		-
-	-	-	-	-	-	-	-	-		-
-	-	-	-	-	-	<u> </u>	-	-		-

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

32,169 J/in <u>= Amps x Volts x 60</u> Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC														
PQR No		P1G1	-P1G2-GN	AWP-L5	9 - A50	00		C	ate _4	/12/201	<u>11</u> F	Revision _	0	
				TENS	SILE '	TEST (QW-1	50)						
SPECIMEN	WIDTH	THICK	C AF	REA	ULT	IMATE		ULTIMATE						
NO.	(IN)	(IN)	(SC	2IN) T	OTA	L LOA	D ST	RESS (PSI))	FAI	FAILURE LOCATION			
1	0.75	0.716	0.5	370		40,49	96	75,412	2	BA	SE M	ETAL SA	.36	
2	0.752	0.72	0.5	414		40,5	34	74,863	3	BA	SE M	ETAL SA	.36	
-	-	-		-		-		-				-		
-	-	-		-		-		-				-		
-	-	-		-		-		-				-		
-	-	-		-		-		-				-		
-	-	-		-								-		
GUIDED BEND TEST (QW-160)														
FIGU	RE <u>NO AND '</u>	TYPE		RESULT	<u>s</u>		FI	GURE NO A	ND TY	PE		RES	ULTS	
(4) SIDE BEND, QW-462.2				ALL PAS	S								-	
								-						
TOUGHNESS TEST (QW-170)														
								IMPACT	L	ATER	AL EX	(P.	DROP	
SPECIMEN	1	NOTCH		NOTC	н	TEST	FEMP	VALUES					WEIGHT	
NO.	LC	DCATION		TYPE		(F)	(FT-LBS)	SHE	AR %	N	/ILS	BREAK	
WELD 1		WELD		V-NOTO	CH	-50)°	94		-		-	-	
WELD 2		WELD		V-NOT	сн	-50)°	82		-		-	-	
WELD 3		WELD		V-NOT	сн	-50)0	90		-		-	-	
HAZ 36-1		HAZ		V-NOT	сн	-50)•	20		-		-	-	
HAZ 36-2		HAZ			сн	-50)°	60		-		-	-	
HAZ 36-3		HAZ		V-NOT	сн	-50) ⁰	98		-		-	-	
HAZ 516-1		HAZ		V-NOTO	сн	-50)°	180		-		-	-	
HAZ 516-2		HAZ		V-NOTO	сн	-50)°	146		-		-	-	
HAZ 516-3		HAZ			сн	-50)°	140		-		-	-	
-		-		-		-		-		-		-	-	
-		-		-				-		-		-	-	
-				-		-	_	-		-	-	-	-	
			HARDN	ESS TES	Γ - R	ockwe	ll Harc	dness, B Sca	ale					
		BASE ME	TAL				HEA	T AFFECTE	D ZON	Ξ	V		TAL	
			1	2		3	1	2	3		1	2	3	
S	SA516-70		82.0	82.0	8	0.5	90.0) 89.0	91.0		91.0	92.0	94.5	
	SA36		80.5	80.5	8	1.0	94.5	5 94.0	95.0		-	-	-	

N1: Interpass cleaning not considered peening.

-

_

N2: Refer to Appendix PQR for all other variables.

N3:

N4: Lincoln Invertec V350Pro: Pulsed MIG Steel 0.045, SPD=237, WFS=180

-

-

N5: Test Plate:SA516-70, Ipsco Heat# B7L791 SA36, EVRAZ Heat# NT7695

Welder Name:	Daniel Durtschi	Stamp:	DD	ID Number:	1240			
Tests Conducted By:	MSI Testing, Inc.	Laboratory Test Number: 11		11-089 #2				
PQR was done and weldir	ng of coupon was witnessed by:	Eaton Metal Products Company LLC						
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in								

-

_

_

-

_

accordance with the BY	requirements of ASME Section IX.	Daniel Durtschi CWI 11030421	
ACCEPTED BY		QC1 EXP. 3/1/2014 PLANT 1 DENVER, CO	
ACCEPTED BY		PLANT 2 SALT LAKE CITY, U	Т
ACCEPTED BY		PLANT 3 POCATELLO, ID	Page 2 of 2

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date	: <u>6/3/2009</u> Revision: <u>3</u>
* T	his appendix addresses any Essential, Supplementary Essential, and Nonessential variables not
m	nentioned on the Procedure Qualification Test Record.
** A	ny information on actual PQR supercedes this document if a conflict exists.
QW-	402
1 A	pproved joints shall be on detailed drawings for individual jobs.
2 R	retainers not used for weld test.
QW-	403
1 N	lo pass greater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)
QW-	404
1 C	consumable inserts not used for weld test. (GTAW)
2 F	iller metal used with weld test. (GTAW)
3 S	upplemental filler material not used in weld test. (FCAW, GMAW, SAW)
4 R	tecrushed slag not used in weld test. (SAW)
5 F	lux not used in weld test. (FCAW, GMAW)
QW-	410
1 B	ackgouge performed with air carbon arc, plasma, and/or grinder.
2 C	Descillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW)
3 C	but of chamber welding only. (GTAW)
4 a	FCAW - semiautomatic
b	SMAW - manual
c	SAW - machine
d	GTAW - manual
Full s	size impact test specimins used. (10mm x 10mm)
All u	nits referenced on PQR are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY	 PLANT 1 DENVER, CO
ACCEPTED BY	 PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY	 PLANT 3 POCATELLO, ID

WELDING PROCEDURE SPECIFICATION (ASME IX) EATON METAL PRODUCTS COMPANY LLC

WPS No	P1-P1-GMAWP	-STT-A	R	evision	1	Date	5/17/2017
Supporting PQR No			P1G1-P	1G2-GMAWP-	STT-A50U-1		
Welding Process	GMAW	Туре		Semi-A	utomatic		
Impact Qualified WPS	No	to N/A	at	N/A			
JOINTS (QW-402)					Typical		
		SNI		-			INS 1/2
Joint Design	All	IDE -	40°	1/16"	60°	LAND	
Groove Type	Any	<u><</u>	~	LAN	$\Delta \sim$	-9/1	
Root Spacing	0 - 3/8"		$\langle - \rangle$		/		
Fillet	Any](2 50° 2 T	1	50°
Root Face	0 - 1/8"	ω				- INSIDE	9
Backing	None	\frown	N	~			A P
Backing Type	N/A						
Groove Angle See	Typical Joint Details		300			2	
Back gouge When App	olicable (Carbon Arc/Grin	id)				2	
Retainers	None		(> {	}
Notes That Apply	1,2,3						
Note 1: Customer representa	tive shall accept all weld	l joint designs speci	ified on job s	pecific drawings.			
Note 2: Root spacing for groc	oves that will only be we	lded from one side	shall be suffi	cient to allow for	cjp.		
Note 3: Bevel angle for groov	es that will only be weld	ed from one side s	hall be 30° or	greater.			
BASE METALS (QW-403	3)						
Thickness Qualified	3/4"						
Thickness Range: Groove	e 3/16" to	1 - 1/2" Fillet	No Min.	to No Max	(
P-No <u>1</u> Group	No N/A to I	P-No 1	Group No	N/A			
Maximum Pass Thickness	3/16"						
Heat Treated Condition	N/A						
FILLER METALS (QW-40)4)			GAS (QW-4	08)		
Process	(A) GMAW STT Short A	Arc (B) GMA	N Pulse-Spra	/ Process		(A) GMAW STT Sł	nort Arc
AWS Classification	ER70S-6	EF	R70S-6		Gases	Mixture	Flow Rate
SFA #/Specification	5.18		5.18	Shielding	Ar/C02	90-10	35
F-No	6		6	Trailing	N/A	N/A	N/A
A-No	1		1	Backing	N/A	N/A	N/A
Filler Metal Diameter	.045"052"	.045	o"052"	Gas Cup Size	3/8" - 5/8"	Backing Gas	N/A
Filler Metal Product Form	Solid		Solid	Process		(B) GMAW Pulse	-Spray
Thickness Range:				_	Gases	Mixture	Flow Rate
Groove	No Min. to 3/16"	No Min. to	o <u>1 - 1/2"</u>	Shielding	Ar/C02	90-10	35
Fillet	N/A to N/A	No Min.	No Max	Trailing	N/A	N/A	N/A
Supplemental Filler	Prohibited	Pro	phibited	Backing	N/A	N/A	N/A
Alloy Elements	N/A Brobibitod		N/A	Gas Cup Size	3/8 - 5/8	Backing Gas	N/A
	FIOIIIbited	FIC			05)		
Minimum Preheat Temp	1	50°F	Positi	n(s) of Groove	05)		
Maximum Internass Temp		50°F	Weldi	ng Progression	(A) Ro	ot pass Downhill (R)	Fill and Cap Unhill
Preheat Maintenance	Maintain until w	elding is complete	Positi	on(s) of Fillet		ΔII	
Other		erang is complete	Other				
other			Uner				Page 1 of 2
							I UBC I OI Z
WPS No	P1-P1-GMAW/P	-STT-A	R	evision	1	Date	5/17/2017
Supporting POR No			P1G1_P	1G2-GMAWP.	STT-A5011-1		5, 1, , 201,

POST WELD HEAT TREATMENT (QW-407) Temperature Range None Time at Temperature Range N/A **TECHNIQUE (QW-410)** (A) GMAW STT Short Arc (B) GMAW Pulse-Spray String or Weave Bead String String or Weave Maximum Pass Width 5/16" 9/16" Brushing and/or Grinding Initial Cleaning Brushing and/or Grinding Brushing/Chipping Brushing/Chipping Interpass Cleaning Multiple or Single Pass (Per Side) Single Multiple Multiple or Single Electrodes Single Single 3/8" - 5/8" 1/4" - 1/2" Contact Tube to Work Distance Electrode Spacing (2 Arcs) N/A N/A Angle of Electrode (SAW) N/A N/A Peening Prohibited Prohibited

ELECTRICAL (QW-409)

Waveform Controlled Welding ----

Weld	Process and	Filler Metal		Current			Travel	Input		
Pass(es)	Transfer Mode	Class	Diameter	Type and	Amps	Volts	Speed	(MAX)		
Root	GMAW Pulse-Short	ER70S-6	.045"052"	DCEP	120 - 160	12.5 - 14	9 - 14	15,083 J/In		
Fill	GMAW Pulse-Spray	ER70S-6	.045"052"	DCEP	160 - 220	20 - 22	9 - 18	46,682 J/In		
Сар	GMAW Pulse-Spray	ER70S-6	.045"052"	DCEP	160 - 200	21 - 22	8 - 18	46,682 J/In		
OUT OF POSITION										
Weld	Process and	Filler	Metal	Current			Travel	Input		
Pass(es)	Transfer Mode	Class	Diameter	Type and	Amps	Volts	Speed	(MAX)		
Root	GMAW Pulse-Short	ER70S-6	.045"052"	DCEP	120 - 160	12.5 - 14	9 - 14	15,083 J/In		
Fill	GMAW Pulse-Spray	ER70S-6	.045"052"	DCEP	130 - 160	18 - 21.5	6 - 10	46,682 J/In		
Сар	GMAW Pulse-Spray	ER70S-6	.045"052"	DCEP	120 - 150	18 - 21.5	5 - 12	46,682 J/In		
Welding machines Lincoln V350 Pro and DC-600 use amps, volts, and travel speed to calculate heat input. Amps x Volts x 60 ÷ Travel Speed = Heat Input										

This Weld Procedure Specification was prepared and accepted by

fate blour

on 5/17/17

Plant 1 Denver, CO Plant 2 Salt Lake City, UT

Plant 3 Pocatello, ID

Accepted By All units referenced on WPS are in English (Standard, e.g. psi, inches, etc.) unless specifically noted.

Uncontrolled copy if not signed by plant representative

Accepted By

Accepted By

Page 2 of 2

PROCEDURE QUALIFICATIOIN RECORD (ASME IX) EATON METAL PRODUCTS COMPANY LLC

PQR No.	P1G1-P1G2-GMAWP-STT-A50U-1 Date of			te of Welding 5/12/2014							
Weld Process(es)		GN	1AW - G	MAWP Type(s)				,	Semi-Autor	natic	
JOINT DETAILS (QW-4	402)										
Joint Design	Butt Jo	oint	CJP	\rightarrow — —	^						
Groove Type	Single V G	Groove		/	$\langle \ \rangle$						
Root Spacing	3/32	п	1						Po		
Root Face	1/32) II	1			B7					\geq
Backing	Non	е			1	B5		<hr/>	B6	\geq	
Backing Type	N/A	۱.			1	83		B	4		
Groove Angle	70°								_ /		
Back gouged	No					\leq	B2		\geq		
Retainers	Non	e						<u> </u>			
POSITION (QW-405)						~	B1	/			
Test Position	3G						X A1				
Progression Ro	ot:Downhill I	ill/Cap:Uhill	1								
BASE METALS (QW-4	.03)										
Material Spec (1)	,	36	to (2)	SA-516-7	0 P-	No 1	Gr# 1	. to	P-No	1 Gr#	2
Type/Grade, or UNS Numb	ber	N/A	to	N/A Hea	t Treated Co	ondition			Hot Rolle	d	
Material Thickness (T)			3/4"		Diame	ter of Test Coup	pon		Ν	/A	
FILLER METALS (QW-	404)	(A)		(B)		GAS (QW-	408)				
SFA Specification		5.18		5.18	3	1	Gases		Mixture (S	%) F	low Rate (cfh)
AWS Classification		ER70S-6		ER70S	5-6	Shielding	Ar/CO2		90-10		35
F-No		6		6		Trailing	N/A		N/A		N/A
A-No		1		1		Backing	N/A		N/A		N/A
Filler Metal Trade Name	Linc	oln Super Arc	: L-59	Lincoln Supe	r Arc L-59	Gas Cup Size			1/2'	1	
Filler Metal Product Form		Solid		Solio	d	PREHEAT ((QW-406)				
Supplemental Filler Metal		None		Non	e	Minimum Te	mperature			150° F	
Electrode Flux Class		N/A		N/A	l l	Preheat Mair	ntenance		Pric	or During	
Flux Trade Name		N/A		N/A	١	TECHNIQU	JE (QW-410)			
Flux Type		N/A		N/A	١	Multipass or	Single Pass (p	er side)		Multip	le
Recrushed Slag Used		N/A		N/A	١	Single or Mul	ltiple Electrod	es		Single	
Weld Metal Thickness (t)		3/16"		9/16	;"	Initial and Int	terpass Cleani	ng	Br	ushing/Grin	ding
Maximum Pass Thickness		3/16"		3/16))	Peening Perf	ormed			No	
ELECTRODE						Maximum Pa	ass Width			9/16"	
Tungsten Type/Size		N/A		N/A	١	Oscillation (N	/lachine)			N/A	
Consumable Insert Used		N/A		N/A	١	In Chamber V	Welding (GTA	N)		N/A	
Electrode Spacing (2 Arcs)		N/A		N/A	١	POST WEL	D HEAT TR	EATME	NT (QW-40)7)	
Angle		5° Drag		5° Pu	sh	Temperature	<u> </u>		Non	е	
Contact Tube to Work		3/8"		3/8'	1	Time			N/A		
						Other			N/A		
ELECTRICAL (QW-409	9)										
	Transfer			Current &			Т	ravel	Heat Input	String or	Interpass

		Transfer			Current &			Travel	Heat Input	String or	Interpass							
Pass(es)	Process	Mode	Class	Diameter	Polarity	Amps	Volts	Speed (ipm)	(J/in)	Weave	Temp (°F)							
A1	GMAW	Pulse-Short	ER70S-6	.052"	DCEP	162	13.5	8.7	15,083	String	Preheat							
B1	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	140	21.2	5.9	30,183	Weave	180°							
B2	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	145	22	4.1	46,682	Weave	225°							
B3	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	163 138	163 138	163	163	21.5	5.9	29,735	Weave	250°				
B4	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP			21.1	5.1	34,256	Weave	322°						
B5	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	148	21.8	5.2	37,227	Weave	330°							
B6	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	145	21.6	5.1	36,847	Weave	362°							
B7	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	140	140	140	140	140	140	140	140	21.6	4.2	43,200	Weave	Preheat
B8	GMAW	Pulse-Spray	ER70S-6	.052"	DCEP	145	21.8	4.8	39,512	Weave	260°							

Heat input calculated using QW-409.1 (a) Voltage X Amperage X 60 / by Travel Speed

	13 (QW	Alidth	Thicknoss	Diamot	or	Aroa	Ultimate	Total	Ultim	ato Strocc			
Specimen	No	(in)	(in)	(in)	(in)				Ultima	nci)	Loc	ation of Failure	
1		0 745	0.738	(11)	0 5498				7	2 793	Base Metal		
2		0.749	0.742			0.5580	41,16	58	74	4,069		Base Metal	
UIDED-BEI	ND TESTS	6 (QW-16	50)	1			,			,			
	Type a	nd Figure	No		Result			Type an	d Figure N	lo		Result	
	Q۱	N 462.2			Pass			QV	/ 462.2			Pass	
QW 462.2					Pass			QV	/ 462.2			Pass	
OUGHNES	S TESTS (QW-170)										
Creativen No. Noteb Location		Specir	nen Size	Notch	Test	Impa	ct Values	Shoor %	Mile	Drop Weight			
specimen	NO	Notell Edeation			(in)	Size (in)	Temp (F)	(F	(Ft LBS)		IVIIIS	Break	
Top 1		Weld Metal		.395	x .395	0.315	-50°		73	N/A	N/A	N/A	
Top 2		W	eld Metal	.394	x .395	0.314	-50°		43	N/A	N/A	N/A	
Тор З		We	eld Metal	.394	x .395	0.315	-50°		53	N/A	N/A	N/A	
Bottom	1	We	eld Metal	.395	x .395	0.315	-50°	65		N/A	N/A	N/A	
Bottom	2	W	eld Metal	.395	x .395	0.315	-50°	40		N/A	N/A	N/A	
Bottom	3	W	eld Metal	.394	.394 x .395 0.31		-50°	63		N/A	N/A	N/A	
HAZ 1			A36	.395	x .395	0.315	-50°		28	N/A	N/A	N/A	
HAZ 2			A36	.394	x .395	0.315	-50°		27	N/A	N/A	N/A	
HAZ 3			A36	.395	x .395	0.315	-50°		29	N/A	N/A	N/A	
HAZ 1		SA	4-516-70	.395	x .394	0.315	-50°		31	N/A	N/A	N/A	
HAZ 2		SA	-516-70	.395	x .395	0.315	-50°		32	N/A	N/A	N/A	
HAZ 3		SA	4-516-70	.395	x .395	0.314	-50°		28	N/A	N/A	N/A	
npact testin	g perform	ed to		ASME VIII									
EPOSITED	CHEMIC		YSIS										
C	Si	Mn	P	S	Al	v	Cr		Ni	Fe	Ce		
		0.016	N/A	N//	0.04	4 0	0.031	Rem	N/A				

MATERIAL TRACABILITY

Item Description	A36	Heat Number	E3J357		Manufacturer		SSAB		
Item Description	SA-516-70	Heat Number	516998		Manufacturer		JSW		
WELDING INFORMATION									
Welding machine used Lincoln 455 STT W/ 25 M Feeder									
Welder Name	Clair N	Veff	ID Number		28005		CN		
TESTING INFORMATION									
Tests Conducted By	MSI Testing Inc.	Laboratory 1	Fest Number	14-136	Date of Te	sting	5/21/2014		
Preparation and welding of t	est coupon was witr	nessed by		Jacob I	Mowat				

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME IX.

This Procedure Qualification Record was prepared and accepted by

Jake Mount

on 5/22/2014

Accepted By Plant 1 Denver, CO

Accepted By

Accepted By

Plant 3 Pocatello, ID

Plant 2 Salt Lake City, UT

Jacob Mowat CWI 13100541 QC1 EXP. 10/1/2016

All units referenced on PQR are in English (Standard, I.e. psi, inches, etc.) unless specifically noted.

Uncontrolled copy if not signed by plant representative

Page 2 of 2

	WELDING PROCEDURE SPECIFICATION (ASME)												
	EATON METAL PRODUCTS COMPANY LLC												
WPS No			F	<u>P1-P1-GTA</u>	W-AL				Date 1	<u>2/17/2009</u> Re	evision <u>2</u>		
Supportir	Ig PQR No	o(s)				<u>P1</u> G	<u></u>	<u>STAV</u>	N-A50L				
BASE M	ETAL (QW	/-403)				JO	DINT (QW-	-402.	QW-405)			Γ	
Р#	1 G	ir# -	to P#	1	Gr #	- Gr	oove	,	ANY	Fillet	ANY		
Thicknes	s Range	1/	/16	to	0.56	Pro	ogression		UPHILL	Fillet Weld S	ize ANY		
Backing	NO E	Backing Ma	aterial		-		0			-			
		Ū				PR	REHEAT (F) (Q	€W-406)				
POST W	ELD HEAT	T TREATN	IENT (F) (QW-407)		Mir	nimum Te	mpe	rature	5	50		
Tempera	ture Range	e				Ma	aximum In	terpa	ass Tempera	iture	500	_	
Time Rar	ige					Pre	eheat Mai	ntena	ance		DURING		
PROCE	SS / TY	PE			GTA	W				-			
FILLER M	IETAL (Q	W-404)											
AWS Cla	ssification				ER708	S-6				-			
SFA# / A	WS Specif	ication			5.18	8				_			
F #	-				6					-			
A # or Ch	emical Co	mposition			1	_				-			
Filler Met	al Trade N	lame		L	INCOLN E	R70S-	-6			-			
Filler Met	al Diamete	er			3/32	2				-			
Maximum	Weld Me	tal Thickne	ess		0.56	6				_			
SHIELDII	NG (QW-4	08)											
Electrode	-Flux (Cla	ss)								-			
Flux Trad	e Name / '	Туре			-					-			
Shielding	Gas / CFI	4		100%	6 ARGON	- 30-60	0CFH			_			
Gas Cup	Size				ANY	Y				-			
Trailing G	as / CFH				-					-			
Backing C	Gas / CFH				-								
ELECTRI	CAL (QW	-410)											
Current					DCE	N							
GMAW	I, FCAW												
Transfer I	Mode				-								
GTAW													
Electrode	Туре			EWLa-1.5, 1.5% Lanthana (GOLD)						-			
Electrode	Size			3/32									
TECHNIC	UE (QW-	410)											
Beads				WEAVE					-				
Pass					MULTI	PLE				-			
Number o	f Electrod	es			1								
ELECT	RODE SP/	ACING											
Longitudir	nal									-			
Angle										-			
Contact T	ube to Wo	ork Distan	ce							-			
Peening					NON	E						_	
Interpass	Cleaning				NUAL / ME	CHANI					<u>A</u>		
Pass or		Filler	Filler	Current			Trav	el	Max	Maximum H	eat Inpution any		
Weld		Metal	Metal	Type &			Spee	ed	Heat Input	Diameter =	//- QC1 \	n	
Layer (s)	Process	Class	Diameter	Polarity	Amps	Volts	s (ipm	1)	(J/in)	By)	JASON L HART	\mathbb{N}	
ANY	GTAW	ER70S-6	3/32	DCEN	150max	15ma	ax 1mi	n	-		02030171	\square	
-	-	-	-	-	-	-	-		- 4	Accepted By	PLANT INFI		
-	-	-	-	-	-	-	-		-				
-	-	-	-	-	-	-	-		-				
-	-	-	-	-	-	-	-		-	Accepted By	PLANT 2 SLC	1	
Interpass	cleaning n	ot conside	ered peeni	ng.									
Refer to A	ppendix V	VPS for all	other vari	ables.									
This WPS	is only us	ed for mat	terial whic	h does not	require no	tch-tou	ighness te	sting].	Accepted By	PLANT 3 POC		
Uncontroled	copy if actua	al signature n	not signed by	plant represe	entative.								
APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	<u> </u>
* Th me ** An	is appendix addresses any Essential, Supplementary Essential, and Nonessential variables not entioned on the Welding Procedure Specification. y information on actual WPS supercedes this document if a conflict exists.
QW-4	02
1 Ap	proved joints shall be on detailed drawings for individual jobs.
2 1.6	tamers prohibited.
QW-40 1 No	03 pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QW-4	04
1 Co	nsumable inserts prohibited. (GTAW)
2 Fill 3 Su	er metal used with weld test. (GTAW)
4 Re	crushed slag not used in weld test. (SAW)
5 Flu	x not used in weld test. (FCAW, GMAW)
QW-47 1 Bac 2 Os 3 Ou 4 a b c d	10 ckgouge performed with air carbon arc, plasma, and/or grinder. cillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) t of chamber welding only. (GTAW) FCAW - semiautomatic SMAW - manual SAW - machine GTAW - manual
The br	and specific filler and/or flux listed on the WPS shall not be substituted.
Applica A s	able to WPS with Post Weld Heat Treatment (PWHT) pecific PWHT procedure shall be developed for each job.
All unit	s referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY		_PLANT 1_DENVER, CO
ACCEPTED BY		PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3 POCATELLO, ID
I incontroled copy if actua	I signature not signed by plant representative	-

ontrolea copy signature not signed

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC										
PQR No P	1G1-P1G2-GTAW-A50L		Date 12/16/2009	Revision 1						
BASE METAL (QW-403) Material Form PIPE Material Spec SA-106B Material Spec SA-106C * Weld thickness = to pipe thickness PREHEAT (F) (QW-406) Minimum Temperature	$ \begin{array}{c} - Thickness^{*} & 0.28 \\ - P \# & 1 & Gr \# & 1 \\ - P \# & 1 & Gr \# & 2 \\ - 3 & 50 \\ \end{array} $	JOINT (QW-402, Q) Type SINC Root Opening Backgouge Test Position POST WELD HEAT	W-405) <u>3LE BEVEL</u> <u>1/8</u> Root F <u>NO</u> Back Wel <u>5G</u> Verticle Prog TREATMENT (F) (¹	Groove Angle 60 ace 1/16 ded NO ression UPHILL QW-407)						
Maximum Interpass Temperature		Temperature Range	-	-						
PROCESS / TYPE FILLER METAL (QW-404) AWS Classification SFA# / AWS Specification F # A # or Chemical Composition	GTAW ER70S-6 5.18 6 1	·		- - - -						
Filler Metal Trade Name Filler Metal Diameter SHIELDING (QW-408) Electrode-Flux (Class)	LINCOLN ER7 3/32	0S-6								
Flux Trade Name / Type Shielding Gas / CFH Gas Cup Size Trailing Gas / CFH	- 100% ARGON - 4 5 -	45 CFH								
Backing Gas / CFH ELECTRICAL (QW-409) Current GMAW, FCAW	DCEN									
Transfer Mode GTAW Electrode Type Electrode Size	- EWTh-2, 2% TF 3/32	IORIA		-						
TECHNIQUE (QW-410) Beads Pass Number of Electrodes	WEAVE MULTIPLE 1	<u> </u>								
ELECTRODE SPACING Longitudinal Angle Contact Tube to Work Distance Peening Interpass Cleaning	- - - NONE MANUAL / MFCH									
Pass	Filler Current		Travel Max							

Pass			Filler	Current			Travel	Max	
or Weld		Filler Metal	Metal	Type &			Speed	Heat Input	
Layer (s)	Process	Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	Remarks
ANY	GTAW	ER70S-6	3/32	DCEN	110-150	10-15	1-3	135,000	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

135,000

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

J/in _ = Amps x Volts x 60 Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No		<u>P10</u>	<u> 31-P1G2</u>	-GTAW	-A50L			_	Da	ate <u>12/16</u>	5/2009	_ Revision	
				TE	NSILE	TES	T (QW	-150	D)(C				
SPECIMEN	WIDTH	THICK	Ā	REA	UĽ	TIMA	TE	UL	LTIMATE				
NO.	(IN)	(IN)	(S	QIN)	TOT	AL LO	DAD S	STR	ESS (PSI)	LOCATION OF F			ILURE
1	0.744	0.214	0.	159		12	2,823		80,648	BASE META			
2	0.748	0.211	0.	158	12,6		2,670	80,190		BASE META			L
- 1	-	-		-		-	·		-	-			
	-	-		-		-	1	-				-	
_	-	-		-		-			-			-	
_	-	_		-		-			-			-	
				GUIDE	D BE	ND T	EST (C	<u>2</u> W-	160)				
FIGU	<u>RE NO AND '</u>	TYPE		RESUL	.TS			FIG	URE NO AN	ID TYPE		RE	SULTS
(2) QW-	-462.3a FACE	BEND		PAS	S		(2)	QV	V-462.3a R0	DOT BENI	D		PASS
	-			-					-				-
	-			-				_	_				-
				TOUC	HNE	SS TI	EST (O	W-1	170)				
				1000		1		<u> </u>			FRAL	EXP	DROP
	,	иотен		NOT	сн	TES		P	VALUES				WEIGHT
						120	(F)	•	(FT-LBS)	SHEAR	%	MILS	BREAK
					ТСЦ	<u> </u>	-50		13 (26)		~	WILD	
							-50		10 (20)	-			NO
						{	-50		10 (20)	-		-	NO
	VVE						-50		10 (30)	-		-	NO
HAZ 1		HAZ			TCH		-50		33 (66)	-		-	NO
HAZ 2		HAZ		V-NO	TCH]	-50		36 (72)	-		-	NO
HAZ 3		HAZ		V-NOTCH			-50		29 (58)	-		-	NO
-		-		-		{	-		-	-		-	-
-		-		-			-					-	-
-		-		-			-		-	-		-	-
-		-		- 1		1	-		-	-		-	-
-		-					-		-	-		-	-
-							-		-	-		-	-
			HAR	DNESS	TES	T - Ro	ockwell	I R I	Hardness				
		BASE MET	41					AT	AFFECTER			WELDN	IETAL
	·		1	2		3		1	$\frac{1}{2}$	3	1	2	3
				<u> </u>		<u> </u>	_ <u>_</u>				-		-
	_		-	_		_		_	_	_	-	-	_
	_		_	l _		-		_	_	_	_	-	_
N1: Interpa N2: Refer t N3:	ss cleaning n o Appendix P	ot consider QR for all o	ed peeni ther varia	ng. ables.									
N4:													
N5:													
N6: Impact	specimins: 1	/2 size "Actu	al Value	s (Full S	Size C	onvei	rsion)"				. ·		
N7 Pine Te	est: USS Hea	t# X84474 [Jual Cer	tified SA	-106	B/C	,						
									Chaman	~		Number	9005
vveider Name	··						1 = h		_ Stamp:	<u>U</u>			8003
Tests Conduc	ted By:	IVIS	I IESII	NG, INC	·			orate	ON METAL				
PQR was don	e and welding	j ot coupon	was with	iessed l	by:		E	AI		PRODUC	1500		
We certify that	t the stateme	nts in this re	cord are	e correct	and t	hat th	ne test _v v	veld	is were prep	ared, weld	ded, ar	nd tested in	ì
accordance w	ith the require	ements of A	SME Se	ction_IX.					Daniel Durts	chi			
BY		that.	htt	A			ME>>	$ \rangle$	CWI 11030	1 21			
		<u></u>	- F				- 10	//	OC1 EXP. 3	/1/2014			
ACCEPTED E	BY								_PLANT 1	DENVER,	CO		
ACCEPTED E	BY				_				_PLANT 2	SALT LAP	KE CIT	Y, UT	
ACCEPTED B	BY								PLANT 3	POCATE	LO, IE	2	Page 2 of 2
Uncontroled copy	rif actual signatu	re not signed l	ov plant re	oresentati	ve.								

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Dat	e: <u>6/3/2009</u> Revision: <u>3</u>
*	This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Procedure Qualification Test Record. Any information on actual PQR supercedes this document if a conflict exists.
QW 1 2	-402 Approved joints shall be on detailed drawings for individual jobs. Retainers not used for weld test.
QW 1	-403 No pass greater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)
QW 1 2 3 4 5	-404 Consumable inserts not used for weld test. (GTAW) Filler metal used with weld test. (GTAW) Supplemental filler material not used in weld test. (FCAW, GMAW, SAW) Recrushed slag not used in weld test. (SAW) Flux not used in weld test. (FCAW, GMAW)
QW 1 2 (3 (4 a 0 (-410 Backgouge performed with air carbon arc, plasma, and/or grinder. Dscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) Dut of chamber welding only. (GTAW) a FCAW - semiautomatic b SMAW - manual c SAW - machine d GTAW - manual
Full	size impact test specimins used. (10mm x 10mm)
All u	nits referenced on PQR are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY	PLANT 1 DENVER, CO
ACCEPTED BY	PLANT 2_SALT LAKE CITY, UT
ACCEPTED BY	PLANT 3 POCATELLO, ID
Uncontroled conv if actual signature not signed by plant representative	

WELDING PROCEDURE SPECIFICATION (ASME)											
EATON METAL PRODUCTS COMPANY LLC											
WPS No	P1-P8-FCA	W-AL			Date _1	1/12/2009 Revision 1					
Supporting PQR No(s)				P1-P8-FCA	W-AL						
BASE METAL (QW-403)			JO								
P#8Gr# to	⊃#1	Gr #	Gr	oove	ALL	Fillet ALL					
Thickness Range 0.1875	to	2.5	Pro	ogression _	UPHILL	_Fillet Weld SizeANY	ʻ				
Backing <u>YES</u> Backing Material	WELD/BA	SE METAL	<u> </u>								
DOST WELD HEAT TREATMENT			PR	(EHEAT (F)	(QW-406)	50					
Tomporature Pango	(QVV-407)			nimum Tem	perature	50 250					
Time Range			IVIa Dra	ahoat Mainte	pass rempera	ature					
	_										
PROCESS / TYPE		FCA	W			=					
FILLER METAL (QW-404)	_										
AWS Classification		E309L	T-1			-					
SFA# / AWS Specification		5.22	2			-					
		6				-					
A # or Chemical Composition		8				-					
Filler Metal Trade Name		-	E			-					
Maximum Weld Metal Thickness		2.5	5								
SHIELDING (OW-408)		2.0									
Electrode-Flux (Class)		-				-					
Flux Trade Name / Type		-				_					
Shielding Gas / CFH	1	00% CO2 -	- 35CF	Ή		-					
Gas Cup Size		1/2 - 3	3/4			_					
Trailing Gas / CFH		-				-					
Backing Gas / CFH		-				-					
ELECTRICAL (QW-410)		DOF	-								
		DCEI	Ρ			-					
GWAW, FCAW		SDDV	v								
GTAW		<u> </u>	11								
Electrode Type		_				_					
Electrode Size		-				_					
TECHNIQUE (QW-410)											
Beads		ER - Each b	bead ≤	5/8" wide		-					
Pass		MULTIF	PLE		_	_					
Number of Electrodes		1				-					
ELECTRODE SPACING											
Longitudinal		-									
Angle Contact Tube to Work Distance		- 2/4 1	1//			-					
			1/4 F								
Interpass Cleaning	MAN	JUAL / ME		CAL		- 🛆					
Pass or Eillor Eill	Current			Trovol	Mox	Maximum Heat Instituter					
Weld Metal Metal				Speed	Heat Input	Diameter = - 001	No				
Laver (s) Process Class Diam	eter Polarity	Amps	Volte	s (inm)	(.l/in)						
ANY FCAW E309LT-1 0.04	15 DCEP	125-220	24-2	9 8-16	-	JASUN J. HAN 02030171	· //				
		_		-		Accepted By PLANT 1-DEN	//				
	-	-	-	-			ý				
	-	-	-	-	-	<u> </u>					
	-	-	-	-	-	Accepted By PLANT 2 SLC					
Interpass cleaning not considered pe	ening.										
Refer to Appendix WPS for all other	variables.		1 - 1 - 1								
I his WPS is only used for material w	nich does not	require not	tch-tou	ghness testi	ng.	Accepted By PLANT 3 POC	;				
I incontrolod convit actual signature not sign	d by plant repres	ontativo									
	su by plant repres	ຣາແສແທບ.				<u> </u>					

APPENDIX WPS (ASME)
EATON METAL PRODUCTS COMPANY LLC
Date:6/3/2009 Revision:4
 * This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Welding Procedure Specification. ** Any information on actual WPS supercedes this document if a conflict exists.
QW-402 1 Approved joints shall be on detailed drawings for individual jobs. 2 Retainers prohibited.
QW-403 1 No pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QW-404 1 Consumable inserts prohibited. (GTAW) 2 Filler metal used with weld test. (GTAW) 3 Supplemental filler material not used in weld test. (FCAW, GMAW, SAW) 4 Recrushed slag not used in weld test. (SAW) 5 Flux not used in weld test. (FCAW, GMAW)
 QW-410 1 Backgouge performed with air carbon arc, plasma, and/or grinder. 2 Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) 3 Out of chamber welding only. (GTAW) 4 a FCAW - semiautomatic b SMAW - manual c SAW - machine d GTAW - manual
The brand specific filler and/or flux listed on the WPS shall not be substituted.
Applicable to WPS with Post Weld Heat Treatment (PWHT) A specific PWHT procedure shall be developed for each job.
All units referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.
ACCEPTED BY PLANT 1 DENVER CO

ACCEPTED BY		PLANT 1	DENVER, CO
ACCEPTED BY		PLANT 2	SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3	POCATELLO, ID
Uncontrolled copy if actual signature	not signed by plant representative		

Ur

 $\mathcal{C}^{\prime\prime}$

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC

PQR No			P1-	P8-FCA	W-AL				Date	1/12/2009 F	Revision _	1			
BASE MET	AL (QW-40)3)					JOINT (C	W-402. C	W-405)						
Material For	m	PLATE	Thick	(ness*	1.25		Туре	(GROOVE	G	iroove An	ale 60			
Material Spe	ec S	A240-304	– P#	8	Gr #	1	Root Ope	enina		Root Fac	се	1/16			
Material Spe	ec S	SA516-70	– P#	1	- Gr #	2	Backgoud	ne	YES	Back Welde	ed	YES			
* Weld thick	ness = to r	late thicknes	s			_	Test Posi	tion	1G V	ertical Progres	ssion	-			
PREHEAT (F) (QW-40	6)							<u> </u>	on loan in rogio.	-				
Minimum Te	emperature			50			POST W	ELD HEA	T TREAT	MENT (F) (QV	N-407)				
Maximum In	terpass Te	mperature		3	50		Temperat	ture Rang	e		-				
Preheat Mai	ntenance		PRIOR	/ DURI	NG		Time Rar	ige		-					
DDOCESS															
		404)			FUP	(V V									
	IAL (QVV- fication	404)			E2001	T 4									
AVVS Classif	ncation	t a sa			E309L	-1-1					•				
SFA# / AVVS	Specifica	uon			5.2	2									
Г # А # ст Сhair		opition			6						·				
A # or Chem	ncar Comp	osilion			<u>ح</u>	_					·				
Filler Metal I	liade Nam	е			-	15					·				
					0.04	15					·				
SHIELDING	(QVV-408)	1													
	ux (Class) Iomo / Tom	•									·				
Flux Trade N	vame / Typ	e			-				<u> </u>						
Shielding Ga					00% CO2	- 35									
Gas Cup Siz						ŀ					·				
Trailing Gas											·				
Backing Gas		0)									·				
ELEC I RICA	L (QVV-40	9)				-									
Current	0 A 1 M					:P					·				
GMAW, F	CAW				000	A \ /									
I ranster Mod	de				SPR/	4 Y									
GIAW Electrode Tu															
Electrode Ty	pe				-										
Electrode Siz															
	= (QVV-410)					`								
Beads						GER	<u>. </u>								
	lootrod					PLE									
					1										
ELECIRO	DE SPACI	NG													
Angle	o to Mark	Distance			-	1/4									
Contact Tube		Distance			3/4 - 1	1/4									
reening	oning			MAN											
Pass				Filler	Current				Travel	Max					
or Weld		Filler Met	al	Metal	Type &				Speed	Heat Input					
Layer (s)	Process	Class	Di	ameter	Polarity		Amps	Volts	(ipm)	(J/in)	Re	emarks			
ALL	FCAW	E309LT-	1	0.045	DCEP		150	27	12-20	20,250		-			
-	-	-		-	-		-	-	-	-		-			
-	-	-		-	-		-	-	-	-		-			
-	-	-		-	-		-	-	-	-		-			
-	-	-		-	-		-	-	-	-		-			
-	-	-		-	-		-	-	-	-		-			
		_							_						

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

20,250 J/in _= Amps x Volts x 60

Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No			P1-P8-F	CAW-A	L				Da	ate <u>11/12</u>	2/2009	_ Re	vision	1
TENSILE TEST (QW-150)														
SPECIMEN	WIDTH	THICK	K AF	REA	UL	TIMATE	ĒT	UĽ	TIMATE					-
NO.	(IN)	(IN)	(SC	QIN) TOTAL LOAD			ND S	STR	ESS (PSI)	LC	DCATI	ON C)F FAI	LURE
A	0.751	1.252	0.9	940		72,0	000		76,575	1	BA	SE N	/ETAL	
В	0.752	1.247	0.9	938		72,8	300		77,633		BA	SE N	/IETAL	
-	-	-		- (-			-			-		
-	-	-		_		-			-			-		
_	_	-		-					-			-		
-	-	-		-		-			-			-		
-	-	_		-		-			-			-		
GUIDED BEND TEST (QW-160)														
FIGU	RE NO AND	TYPE		RESUL	TS			FIGL	URE NO AN	ID TYPE	_		RE	SULTS
QW-	462.2 SIDE B	END		PASS	5			QW	/-462.2 SID	EBEND			P	ASS
QW-	462.2 SIDE B	END		PASS	5			QW	-462.2 SID	E BEND			P	ASS
				TOUG	HNE	SS TES	6 T (Q)	<u>W-1</u>	70)					0000
SPECIMEN	N	ЛОТСН			СН	TEST		Ъ		LAT		EXP	·	
NO.					PF		- 1 E IVII -)		(FT-LBS)	SHEAR	%	МШ	s	BREAK
-		-		-			-	`	-	-		-		-
-		-		-		.	-		-	-		~		-
-		-		[-		.	-		-	-		-		-
··. –		-		-		·	-	-		-		-		-
-		-		-		· ·	-		-	-		-		-
-		-		-		· ·	-		-	-		-		-
-		-		-			-		-	-		-		-
-		-		-		.	-	1	-	-		-		-
-		-		-		.	-		-	-		-		-
-		-		-		-		-		-		-		-
-		-		-		-	-		-	-		-		
			HA	ARDNES	SS TE	<u>S</u> T - B	rinell	Har	dness					
	E	BASE ME	TAL	-		0	HE	AT /	AFFECTE	ZONE		WE	<u>ELD M</u>	ETAL
			1	2	_	3	1		2	3	1		2	3
	-		-	_		-	-	-		-	-		-	-
	-		-	-		-	-	-	-	-	_		-	-
	-		-	-		-	-		-		-		-	-
N1: Interpa	ss cleaning no	ot conside	red peenir	ng.										
N2: Refer to	o Appendix P	QR for all	other varia	ables.										
N3:														
N4:														
N5: Origina	PQR - P1-P8	8-DS Rev	1 3/31/94											
Welder Name	:		R. CA	RTER					Stamp:	8	IC) Nun	nber:	699
Tests Conduc	ted By:		CMS	5			Labo	orato	ory Test Nu	nber:		<u>C-</u>	34-24	7
PQR was don	e and welding	of coupo	n was with	lessed b	y:	10186		EA	TON META	L PRODU	JCTS (СОМ	PANY	
We certify that	t the statemer	nts in this	record are	correct	and t	hat the	testy	velds	s were prep	ared, weld	ded, a	nd te	sted in	l
accordance w	ith the require	ements of	ASME Sec	ction IX.		INCON 1	HART	\mathscr{N}						
Dĭ		9			11	- 620301	71 /	1	-					
ACCEPTED B	3Y				2		1	-	PLANT 1	DENVER,	CO			
ACCEPTED B	BY					V	1		PLANT 2	SALT LAP	E CIT	'Y, U	Т	
ACCEPTED B	BY								PLANT 3	POCATE	LO, II	D		Page 2 of 2
Uncontroled copy	if actual signatur	re not signed	by plant rec	oresentativ	/e.									

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date: 6/3/2009	_Revision:3
 * This appendix addresses any E mentioned on the Procedure Qu ** Any information on actual PQR 	ssential, Supplementary Essential, and Nonessential variables not ualification Test Record. supercedes this document if a conflict exists.
QW-402	
1 Approved joints shall be on deta 2 Retainers not used for weld test	ailed drawings for individual jobs.
QW-403 1 No pass greater than 1/2" used	in weld test. (FCAW, GMAW, SAW, SMAW)
QW-404 1 Consumable inserts not used fo 2 Filler metal used with weld test. 3 Supplemental filler material not 4 Recrushed slag not used in weld 5 Flux not used in weld test. (FCA	r weld test. (GTAW) (GTAW) used in weld test. (FCAW, GMAW, SAW) d test. (SAW) W, GMAW)
QW-410 1 Backgouge performed with air c 2 Oscillation not used with automa 3 Out of chamber welding only. (G 4 a FCAW - semiautomatic b SMAW - manual c SAW - machine d GTAW - manual	arbon arc, plasma, and/or grinder. atic or machine welding. (FCAW, GMAW, GTAW, SAW) STAW)
Full size impact test specimins used	d. (10mm x 10mm)
All units referenced on PQR are in I	English (Standard, i.e. psi, inches, etc.) unless specifically noted.
ACCEPTED BY	PLANT 1 DENVER, CO
ACCEPTED BY	PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY	PLANT 3 POCATELLO, ID

Uncontroled copy if actual signature not signed by plant representative.

WELDING PROCEDURE SPECIFICATION (ASME)									
EATON METAL PRODUCTS COMPANY LLC									
WPS No			F	1-P8-GM	AWP-A		-	Date	.1/11/2017 Revision 2
Supportin	g PQR N	o(s)				P	1-P8-GMA	WP-A	-
BASE ME	ETAL (QV	V-403)				JOI	NT (QW-40	2, QW-405)	
P# .	P# 1 Gr# - to P# 8 Gr# - Groove ALL+3G≤60° Fillet ALL								
Thickness	s Range	3	<u>8/</u> 16	to	8	Pro	gression	UPHILL	Fillet Weld Size ANY
Backing YES Backing Material BASE/WELD METAL 60-Degree Inclination Angle MAX									
I ype: Semi-Automatic PREHEAT (F) (QW-406)									
POST WE	ELD HEA	T TREAT	MENT (F)	(QW-407)		Min	imum Temp	erature	50
Temperat	ure Rang	ė		-		Max	imum Inter	pass Tempera	ature 350
Time Ran	ge		-			Pre	neat mainte	nance	PRIOR / DURING .
PROCE	SS/TY	PE			GMA	WP			_
FILLER N	IETAL (Q	W-404)							
AWS Clas	sification				ER30)9L			-
SFA# / AV	VS Speci	fication			5.9	9			-
F #					6				-
A # or Che	emical Co	mposition			8				
Filler Meta	al Trade N	lame			-	<i>(</i> F			
Hiller Meta	al Diamete	er Iol Thiaka			0.04	15			
		(ал т піскл (69)			0				
Flectrode	Flux (Cla	ss)		•	_				
Flux Trade	Name /	Tvpe			-				
Shielding	Gas / CFI	4		98% A	vr - 2%CO2	2/35CF	H min		-
Gas Cup S	Size				1/2 - 3	3/4			-
Trailing Ga	as / CFH				-				
Backing G	as / CFH		_		-				-
ELECTRIC	CAL (QW	-410)							
Current					DCE	<u>P</u>			-
GMAW,	FCAW								
	lode		-+		PULSED	SPRAY		-	
GIAW Electrode	Tuno				_				
Flectrode	Size								
TECHNIQ		410)						-	
Beads		,		STRING	ER - Each I	bead ≤ 5	/8" wide		-
Pass					MULTI	PLE			·-
Number of	Electrode	es			1				<u> </u>
ELECT	RODE SP/	ACING	-						
Longitudin	al								
Angle									
Contact Tu	ibe to Wo	rk Distan	ce		1/2 -	1			-
Peening	Nooning						A1		· · · ·
merpass c				101741					
Pass or		Filler	Filler	Current			Travel	Max	Diameter =
	Draaaaa	Close	Metal	Type &	1000	Volta	Speed	Heat Input	
ANV/ALL	CAAAIA/D	EP300		DCED	170,210	24-28	(ipm)	(3/11)	by Aple Alast
		-	0.045			- 24-20	4-12		Accepted By PLANT 1 DEN
-	_	-		_	-	-	· _ ·	-	
-	-	-	-	-	-	-	-	-	
-	- Accepted By PLANT 2 SLO							Accepted By PLANT 2 SLC	
Interpass o	leaning n	ot conside	ered peening	ıg.					
Refer to Ap	pendix W	/PS for all	other vari	ables.				,	, .
Only w	Only weld joint details accepted by the Company Representative shall be used							ed	Accepted By PLANT 3 POC
This WPS i	is only us	ed for mal	erial which	n does not	require no	tch-toug	hness testii	ng.	1
Lincoln Invertec V-350Pro Pulsed MIG Stainless 0.045, 175WFS, 180SPD									
Uncontroled c	opy if actua	l signature r	nol signed by	plant repres	entative.				

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	6/3/2009	Revision:	4	
 * This a menti ** Any ir 	appendix addresses any oned on the Welding Pr nformation on actual WF	 Essential, Suppler ocedure Specificat S supercedes this 	mentary Essentia ion. document if a co	, and Nonessential variables not
QW-402 1 Appro 2 Retair	oved joints shall be on d ners prohibited.	etailed drawings for	r individual jobs.	· ·
QW-403 1 No pa	ss greater than 1/2" allo	wed. (FCAW, GMA	AW, SAW, SMAV	/)
QW-404 1 Consu 2 Filler r 3 Supple 4 Recru 5 Flux n	imable inserts prohibite netal used with weld tes emental filler material no shed slag not used in w ot used in weld test. (FC	d. (GTAW) st. (GTAW) ot used in weld test eld test. (SAW) CAW, GMAW)	. (FCAW, GMAW	, SAW)
QW-410 1 Backg 2 Oscilla 3 Out of 4 a FC b SM c SA d GT	ouge performed with air ation not used with autor chamber welding only. AW - semiautomatic IAW - manual W - machine AW - manual	carbon arc, plasm natic or machine w (GTAW)	a, and/or grinder. elding. (FCAW, C	SMAW, GTAW, SAW)
The brand	specific filler and/or flu	x listed on the WPS	5 shall not be sub	stituted.
Applicable A spec	to WPS with Post Weld ific PWHT procedure st	d Heat Treatment (l nall be developed fo	PWHT) or each job.	
All units re	ferenced on WPS are in	n English (Slandard	l, i.e. psi, inches,	etc.) unless specifically noted.
				- ·
ACCEDIE				
ACCEPTE	D BY			PLANT 2 SALT LAKE CITY, UT
ACCEPTEI	D BY	ned by plant represent	ative.	PLANT 3 POCATELLO, ID

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No	P1-P8-GM		Date1/13/2009 Revision1						
BASE METAL (QW-403)			JOINT	JOINT (OW-402, OW-405)					
Material Form PLATE	Thickness* 1.5 Type			(« ۱۰۵.) \	/-GROOV	E G	roove And	ale 50	
Material Spec SA516-70		Gr #	2 Root O	penina	0	Root Fac	ce	1/8	
Material Spec SA240-304L		 Gr #	1 Backgo	ude	YES	Back Welde	ed	YES	
* Weld thickness = to plate thickne	ss		Test Po	sition	3G V	erlical Progres	ssion	UPHILL	
PREHEAT (F) (OW-406)				4	5º INCLIN	ATION ANGLE	=	<u>.</u>	
Minimum Temperature	50		POST		TTREAT	MENT (F) (OV	– V-407)		
Maximum Internass Temperature		350	Temper	ature Rand	10. 10		-		
Preheat Maintenance	PRIOR / DURI	NG	Time R	Time Range					
		CMA							
		GINA							
AMS Classification		EDado							
SEA# / AM/S Specification		EN308	1.0						
SFA#1 Avv5 Specification		0.9		· · · ·		-			
IF #		. 0				-			
Filler Metal Trade Name			X 2001 Ci						
Cillor Motol Diamotor	L		K 309LOI			. •			
		. 0.04	0			-			
Electrode-Flux (Class)		-				-			
Flux Trade Name / Type		-				-			
Shielding Gas / CFH	98% A	r - 2%CO2	/ 35CFH m	in		-			
Gas Cup Size		5/8				-			
Trailing Gas / CFH		-			·	-			
Backing Gas / CFH	· · · ·	-				-			
ELECTRICAL (QW-409)	•								
Current		DCE	P			-		•	
GMAW, FCAW									
Transfer Mode		PULSED S	PRAY)		-			
GTAW									
Electrode Type		-			·				
Electrode Size		-			<u> </u>				
TECHNIQUE (QW-410)									
Beads		STRING	ER		-				
Pass		MULTIF	PLE						
Number of Electrodes		1				-			
ELECTRODE SPACING									
Longitudinal		-				-			
Angle		-	-			-			
Contact Tube to Work Distance		1/2 - 1	1			-			
Peening		NON	<u> </u>		;	-			
Interpass Cleaning	MAN	IUAL / MEC	CHANICAL			-			
Pass	Filler	Current			Travel	Max			
or Weld Filler Met	al Metal	Type &			Speed	Heat Input			
Layer (s) Process Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	Ren	narks	
ROOT GMAWP ER309L	0.045	DCEP	190	26	10	29,640		-	
MID GMAWP ER309L	0.045	DCEP	190	26	7	42,343		-	
CAP GMAWP ER309L	0.045	DCEP	190	26	5	59,280		-	
	-	-	-	-	-	-		-	
- i - i -	-	-	-	-	- 1	-		-	
	-	-	-	-	-	_		-	

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

59,280 J/in = Amps x Volts x 60 Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No			P1-P8-0	3MAWP	-A				D	ate 11/13/	2009	Revision	1				
TENSILE TEST (QW-150)																	
SPECIMEN	DIA		A	REA	UL	TIMAT	Έ	U	LTIMATE								
NO.	(IN)		(S	(SQIN) TOTAL LOAD ST			STR	RESS (PSI)	LO	CATIO	on of fa	ILURE					
Top 1	0.504	-	0.).200 17,118			85,803	B	ASEI	METAL 51	6-70						
Тор 2	0.507	-	0.	0.202 16,289			289		80,684	B	BASE METAL 516-70						
Bottom 1	0.506	-	0.	201		16,	388		81,496	96 BASE METAL 516-70							
Bottom 2	0.504	-	0.	200		16,0	818		84,299	BASE METAL 516-70							
-	-	-	[
	-	-				-	ľ		-			-					
-	-	-		-		-			-			-					
GUIDED BEND TEST (OW-160)																	
FIGU	RE NO AND 1	TYPE		RESUL	TS		<u></u>	FIG	URE NO A	ND TYPE		RE	SULTS				
(4) QW	-462.2 SIDE	BEND		PASS	;				-				-				
	••••••••••••••••••••••••••••••••••••••	11-11-11-11-11-11-11-11-11-11-11-11-11-		-					-				- .	•			
		· · ·		TOUG	HNE	SS TES	ST (C	₹W-1	70)								
					i				IMPACT	LATE	RAL E	EXP.	DROF	2			
SPECIMEN	1	NOTCH			CH	TEST	TEM	IP	VALUES		1		WEIGH	HT			
NO.	LU	CATION			'E	()	<u>F)</u>		(FT-LBS)	SHEAR %	·	MILS	BREAD	<u>ĸ</u>			
		-		l. [-		2			-	_				
		-				.	-		-			-	_	1			
-		-			-		-		-	-		-	-				
-		-		[-]		-			-	-		-	-	1			
-		'		- (-			-	-		- [-				
-		-	-	-		-		-	-		-	-					
-		-				-	-		-	-	1.	-	-	Í			
-		-	•				_		-	-	1	-	-				
-		-		_				-	_	· · _		-	-	•			
· · · · ·	,				EGG	TEST	Poo	lavo						=			
	E	ASE META		TRADA	200	1201-	HE	AT	AFFECTED	ZONE		WELD M	ETAL	_			
		<u> </u>	1	2		3		1	2	3	1	2	3				
• • •	SA516-70		48.0	48.5	1	19.0	71	.0	76.5	72.5	76.0	73.9	77.8	8			
S.	A240-304		61.0	56.5	5	56.5 J	73	3.5	72.5	72.1	-	-	-	- 1			
	-		-			-	-	•	-	-	-	-	-				
	-	× .	- .	-	_	-			-	-	-	-					
N1: Interpas	ss cleaning no	t considered	d peenir	ıg.													
N2: Refer to	Appendix PC	QR for all oth	ner varia	bles.								,					
N3:																	
N5: Test Pla	te: lindel Sta	inless Corn	oration k		-0086		о. <u>Но</u> г	at #A	1-165								
	ite, sinda ola	mess oorp		blaff	0000	or ipsec		al #/~		011	10.1		0005				
vvelder Name: Tosts Conduct	od Byr	NAC	Ciair L Tootin				Loh	orato	Stamp:		- 101		8005				
PQR was done	e and welding	of coupon w	as with	essed by	:	一杰		E	Eaton Metal	Products Ce	ompa	nv LLC					
We certify that	the statemen	ts in this rec	ord are	correct a	nd #	ALAWS	testy	velds	s were prep	ared, welde	d, and	tested in					
accordance wit	th the requirer	nents of AS	ME Sec	tion IX.		ųc I	<u> </u>			,							
BY				<u> </u>	<u> </u>	JASON J. H.	ART H	\mathbb{Z}				•					
ACCEPTED B	Y			1		C101	.//		PLANT 1	DENVER, C	0						
ACCEPTED BY	Y					\mathbf{V}	/		PLANT 2	SALT LAKE	CITY	, UT					
ACCEPTED BY	 ۲					v			PLANT 3	POCATELL	מו כ		Page 2 of	f 2			
Incontroled copy i	f actual signature	not signed by	plant rep	resentalive		•.			Controled copy if actual signature not signed by plant representative.								

•

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	6/3/2009	Revision:	3		
* This app	pendix addresses any ad on the Procedure	Essential, Supplem	entary Essential,	and Nonessential variables not	<u></u>
** Any info	rmation on actual PG	R supercedes this c	locument if a con	flict exists.	
QW-402					
1 Approve 2 Retainer	d joints shall be on d s not used for weld to	etailed drawings for est.	individual jobs.		
QW-403					
1 No pass	greater than 1/2" use	ed in weld test. (FCA	W, GMAW, SAW	/, SMAW)	
QW-404					
1 Consum	able inserts not used	for weld test. (GTA)	∧)		
2 Filler me	tal used with weld tes	st. (GTAW)		SA)4/)	
4 Recrushe	ed slag not used in w	eld test. (SAW)		3AW)	· .
5 Flux not	used in weld test. (FC	CAW, GMAW)			
QW-410	•				Í
1 Backgou	ge performed with alr	carbon arc, plasma	, and/or grinder.		[
2 Oscillatio	n not used with autor	matic or machine we	lding. (FCAW, G	MAW, GTAW, SAW)	
4 a FCAV	V - semiautomatic	(GIAW)			
b SMAV	V - manual		•		•
d GTAV	- machine V - manual		3		
0 01/11	·				
Full size imp	act test specimins us	ed. (10mm x 10mm) · ·		·]
All units refer	renced on PQR are ir	n English (Standard,	i.e. psi, inches, e	etc.) unless specifically noted.	
	·				
			-		
ACCEPTED	ВҮ			PLANT 1 DENVER. CO	
	·				

)

ACCEPTED BY ______ PLANT 2 SALT LAKE CITY, UT ACCEPTED BY ______ PLANT 3 POCATELLO, ID Uncontroled copy if actual signature not signed by plant representative.

•)

ł

		V							SME)	
WPS No								Date 1	2/17/2000 Revisio	on 1
Supportir	ng PQR No	o(s)		1-F0-01A		P1	-P8-GTAV	V-AL_		
BASE M	ETAL (OW	/-403)				JOIN	T (OW-40)	2 OW-405)		
P #		r = -	to P#	8	Gr #	- Groov	1 (Q11-402 /A		Fillet	A11
Thicknes	s Range	" <i>"</i>	/16	to	-0.436	Progr	ession		Fillet Weld Size	
Backing		Racking Mr	atorial		0.400	i i iogi		OFTILL		
Dacking		Jacking Ma						O(M-406)		
POST W				OW_{-407}		Minim		erature	50	
Tempera	ture Range			-		Maxir	num Intern			350
Time Rar	nde	·	-			Prehe	at Mainter	ance		RING
Thine Flai					_					
PROCE	SS / TY	PE			GTA	W			-	
FILLER N	METAL (Q	W-404)						_		
AWS Cla	ssification				ER30	9L			-	
SFA# / A	WS Specif	ication			5.9)			-	
F #					6				-	
A # or Ch	emical Co	mposition			8				-	_
Filler Met	al Trade N	lame			-				-	
Filler Met	al Diamete	er			3/32	2				
Maximum	n Weld Me	tal Thickne	ess —		0.43	6			-	
SHIELDI	NG (QW-4	.08)								
Electrode	-Flux (Cla	ss)			-				-	
Flux Trad	le Name / '	Туре			-				-	
Shielding	Gas / CFH	HÎ		100	0%Argon /	30-60CFH			-	
Gas Cup	Size				AN	Y			-	
Trailing G	Sas / CFH				-				-	
Backing (Gas / CFH			100)%Argon/	10-30CFF	1		-	
ELECTR	ICAL (QW	-410)								
Current		,			DCE	N			**	
GMAW	, FCAW									
Transfer I	Mode				-				-	
GTAW									_	
Electrode	Type			EWLa-1.	.5, 1.5% La	anthana (C	GOLD)		-	
Electrode	Size				3/32	2	/		-	
TECHNIC	QUE (QW-	410)				_				
Beads		,			WEA	VE			-	
Pass					MULTI	PLE			-	
Number o	of Electrod	es			1				-	
ELECT	RODE SP	ACING								
Longitudir	nal				-				-	
Angle					-				-	
Contact T	ube to Wo	ork Distan	ce —		-				-	
Peening					NON	E			-	
Interpass	Cleaning			MAN	NUAL / ME	CHANICA	L		-	las
Pass or		Filler	Filler	Current			Travel	May	Maximum Heat I	nution
Wald		Metal	Metal	Type 8			Sneed	Heat Input	Diameter =	
	Process	Class	Diameter	Polarity	Amne	Volte	(inm)	(.1/in)	By /	
$\Delta NY/\Delta II$	GTAW/	FR300I	3/32		150may	15may	1min	-	7/24	JASON J. HAKI
-					-	-			Accepted By PLA	
_	_	_		_		_				
_	_					_		_		
_		_				_			Accepted By DLA	
- Internase	cleaning n	nt conside	red neoni	-		-	-			
Refer to A	ueaning n Inpendiy M		othor yor	ny. ables						
Refer to Appendix WPS for all other variables. This WPS is only used for material which does not require notch-toughness testing Accepted By PLANT 3 PO							NT 3 POC			
Uncontroled	copy if actua	al signature r	not signed by	plant repres	entative.					

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Da	te: <u>6/3/2009</u> Revision: <u>4</u>
*	This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Welding Procedure Specification. Any information on actual WPS supercedes this document if a conflict exists.
Q٧	<u>V-402</u>
1 2	Approved joints shall be on detailed drawings for individual jobs. Retainers prohibited.
QV	/-403
1	No pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QV	/-404
1	Consumable inserts prohibited. (GTAW)
2	Filler metal used with weld test. (GTAW)
3	Supplemental filler material not used in weld test. (FCAW, GMAW, SAW)
4	Recrushed slag not used in weld test. (SAW)
5	Flux hot used in weld test. (FCAW, GMAW)
Q٧	/-410
1	Backgouge performed with air carbon arc, plasma, and/or grinder.
2	Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW)
3	Out of chamber welding only. (GTAW)
4	a FCAVV - semiautomatic
	c SAW - machine
	d GTAW - manual
The	e brand specific filler and/or flux listed on the WPS shall not be substituted.
1	Nicoble to M/PS with Post Weld Heat Treatment (DW/HT)
Aht	A specific PWHT procedure shall be developed for each job.
All ۱	units referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY		PLANT 1	DENVER, CO
ACCEPTED BY		PLANT 2	SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3	POCATELLO, ID
Uncontroled copy if actua	I signature not signed by plant representative	_	

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC										
PQR No		F	P1-P8-GTA	W-AL			_ Date _1	2/16/2009 F	Revision	1
BASE META	AL (QW-40)3)				QW-402, G	2W-405)			
Material Forr	m	PIPE T	nickness*	0.218	Type	SIN	GLE BÉVE	EL G	Groove Angl	e 60
Material Spe	sc SA	A312-304L F	⊃# 8	Gr #	1 Root Or	ening	3/32	Root Fa	ice	1/16
Material Spe	c SA5	3 Tp.E Gr.B	⊃# <u>1</u>	Gr #	1 Backgo	ige	NO	Back Welde	ed	NO
*Weld thickn	ess = to pi	pe thickness			Test Po	sition	5G Ve	- ertical Progre	ession	UPHILL
PREHEAT (F) (QW-40	6)						0		
Minimum Te	mperature	,	50		POST V	ELD HEA	AT TREATMENT (F) (QW-407)			
Maximum Int	terpass Te	mperature	3	50	Temper	emperature Range				
Preheat Mair	ntenance	PRIC	DR / DURI	١G	Time Ra	inge		-		
PROCESS	S / TYPE			GTA	w					
		404) —		•						
AWS Classif	ication	10-1)		ER30	91				-	
SFA# / AWS	Specificat	ion		5.9	02					
F#	opeenieen			6				-	-	
A # or Chem	ical Comp	osition		8				-	~	
Filler Metal T	rade Nam	e —						-	-	
Filler Metal D	Diameter			3/32	2			-	-	
SHIELDING	(QW-408)									
Electrode-Flu	Jx (Class)			-				-	-	
Flux Trade N	lame / Typ	е		-				-	-	
Shielding Ga	is / CFH		1	00%Argon	/ 45CFH			-	-	
Gas Cup Size	е			5					-	
Trailing Gas	/ CFH			**				-	-	
Backing Gas	/ CFH		1	00%Argon	/ 20CFH				-	
ELECTRICA	L (QW-40	9)								
Current				DCE	N			-	-	
GMAW, FO	CAW									
I ransfer Mod	je			-						
GIAW Electrode Tu	n 0		E)	NTh 2 20/	тиорил					
Electrode Ty	pe			2/20			-			
	 _ (\\/_/10	· —		5/52	•					
Reads	. (0.00-410)			/F					
Pass					기 F				-	
Number of E	lectrodes	·		1						
ELECTRO	DE SPACI	NG								
Longitudinal				_				-	-	
Angle				-				-	-	
Contact Tube	e to Work	Distance		-				-	-	
Peening				NON	E			~~	~	
Interpass Cle	eaning		MAN	IUAL / ME	CHANICAL			-	-	
Pass			Filler	Current			Travel	Max		
or Weld		Filler Metal	Metal	Type &			Speed	Heat Input	t	
Layer (s)	Process	Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	Ren	narks
ALL	GTAW	ER309L	3/32	DCEN	110-150	10-15	1-3	135,000)	-
-	-	_	-	-	-	-	-	-		-
-	-	-		-	-	-	-	-		-
_	_	_	_	_	_	_	_	_		

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

_

_

135,000J/in= Amps x Volts x 60Travel Speed

-

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC

PQR No P1-P8-GTAW-AL Date 12/16/2009 Revision 1 TENSILE TEST (QW-150) SPECIMEN WIDTH THICK AREA ULTIMATE ULTIMATE NO. TOTAL LOAD (IN) (IN) (SQIN) STRESS (PSI) LOCATION OF FAILURE 1-1 0.75 0.193 0.145 9,188 **BASE METAL - SA53** 63,475 1-2 0.748 0.195 0.146 9,357 64,151 **BASE METAL - SA53 GUIDED BEND TEST** (QW-160) FIGURE NO AND TYPE FIGURE NO AND TYPE RESULTS RESULTS (2) QW-462.3 FACE BENDS PASS (2) QW-462.3 ROOT BENDS PASS TOUGHNESS TEST (QW-170) LATERAL EXP. DROP IMPACT SPECIMEN NOTCH NOTCH TEST TEMP WEIGHT VALUES NO. LOCATION TYPE SHEAR % MILS BREAK (F) (FT-LBS) HARDNESS TEST - Rockwell B BASE METAL HEAT AFFECTED ZONE WELD METAL 2 3 3 1 2 3 1 2 1 ---N1: Interpass cleaning not considered peening. N2: Refer to Appendix PQR for all other variables. N3: N4: N5: Test Pipe: SA312-304L =TaChen Heat# 707585, SA53 Type E Grade B = lpsco Heat# 267234 STAN NEFF Welder Name: SN ID Number: 8002 Stamp: Tests Conducted By: MSI TESTING, INC. aboratory Test Number: 09-083 PQR was done and welding of coupon was witnessed by: EATON METAL PRODUCTS COMPANY LLC We certify that the statements in this record are correct and that the statements in this record are correct and that the statement with the statement of the s ds were prepared, welded, and tested in accordance with the requirements of ASME Section IX. JASON J. HART BΥ 02030171 PLANT 1 DENVER, CO ACCEPTED BY CWI ACCEPTED BY PLANT 2 SALT LAKE CITY, UT ACCEPTED BY PLANT 3 POCATELLO, ID Page 2 of 2 Uncontroled copy if actual signature not signed by plant representative.

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date: 6/3/2009 Revision: 3	
 * This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Procedure Qualification Test Record. ** Any information on actual PQR supercedes this document if a conflict exists. 	
QW-402 1 Approved joints shall be on detailed drawings for individual jobs. 2 Retainers not used for weld test.	
QW-403 1 No pass greater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)	
QW-404 1 Consumable inserts not used for weld test. (GTAW) 2 Filler metal used with weld test. (GTAW) 3 Supplemental filler material not used in weld test. (FCAW, GMAW, SAW) 4 Recrushed slag not used in weld test. (SAW) 5 Flux not used in weld test. (FCAW, GMAW)	
 QW-410 1 Backgouge performed with air carbon arc, plasma, and/or grinder. 2 Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) 3 Out of chamber welding only. (GTAW) 4 a FCAW - semiautomatic b SMAW - manual c SAW - machine d GTAW - manual 	
Full size impact test specimins used. (10mm x 10mm)	
All units referenced on PQR are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.	

ACCEPTED BY		PLANT 1	DENVER, CO
ACCEPTED BY		PLANT 2	SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3	POCATELLO, ID
Uncontroled copy if actua	I signature not signed by plant representative.		

W	ELDIN	g pro	CEDUR	E SP	PECIFIC	ATION (AS	SME)				
	EAT	ON ME	TAL PRC	DUC	TS COMP	PANY LLC					
WPS No	P8	-P8-GMA	NP-A	2 (28.64			0/16/2018 Revision <u>3</u>				
Supporting PQR NO(S)			P0-P0		\VVF-A, Fo-	Po-GIVIAVVP-A					
BASE METAL (QW-403)		_		JOI	INT (QW-40	2, QW-405)					
P# 8 Gr# <u>N/A</u> 1	ю Р# -	8	Gr # <u>N//</u>	A_Gro							
Inickness Range 3/1	o priol E			Pos			Fillet Weld Size				
Dacking TEO Dacking Mai				-PRE	EHEAT (F)	(QW-406)	~				
POST WELD HEAT TREATME	INT (F) (C	W-407)		Min	imum Temp	erature	100				
Temperature Range		NONE		Max	ximum Inter	pass Tempera	ture <u>400</u>				
Time Range	NON	E		Pre	heat Mainte	enance	PRIOR / DURING				
PROCESS / TYPE			GMAV	/P			GMAWP				
FILLER METAL (QW-404)							-				
AWS Classification			ER3X	X		·					
SFA# / AWS Specification			5.9	·			-				
F#			6				-				
A # or Chemical Composition			8				-				
Filler Metal Trade Name				<u> </u>							
Filler Metal Diameter			0.045	, i							
Maximum Weld Metal Thicknes	is —		8	·			-				
SHIELDING (QW-408)							-				
Electrode-Flux (Class)			<u>N/A</u>			_					
Flux Trade Name / Type		000/ 4-	N/A		l uniu au						
Shielding Gas / CFR		90% Ar	r - 2%0027	350FF	H min or						
Gas Cup Size		007070	1/2 - 3	/4							
Trailing Gas / CFH			N/A								
Backing Gas / CFH			N/A			_	-				
ELECTRICAL (QW-410)				_							
			DCE	,							
GMAW, FCAW Transfer Mode			PHI SED S	PRAY	,		_				
GTAW				11011							
Electrode Type			N/A				-				
Electrode Size			N/A			_					
TECHNIQUE (QW-410)		070000		1.4	E 101 1 1						
Beads		STRINGE	K - Each C		5/8" Wide		-				
Number of Electrodes			1								
ELECTRODE SPACING			·								
Longitudinal			N/A				-				
Angle			N/A								
Contact Tube to Work Distanc	e		1/2 -	1							
Peening Internass Cleaning		ΜΛΝ		= ^нами			-				
		Current					Maximum Host Input for any				
Weld Metal	riller Metal	Type &			Speed	Heat Input	Diameter = N/A				
Laver (s) Process Class	Diameter	Polarity	Amps	Volte	s (ipm)	(J/in)	By10/16/18				
ANY/ALL GMAWP ER3XX	0.045	DCEP	160-210	22-2	4 14-20	N/A					
- - -	-	-	-	-	-	-	Accepted By PLANT 1 DEN				
- - -	-	-	-	-	-	-					
Interness cleaning pet conside	-	-	-	-	-						
Refer to Appendix WPS for all	other veri	ng. ables					Accepted by FLANT 2 SLC				
Refer to Appendix SS for filler	metal sele	ection.									
This WPS is only used for ma	aterial wh	nich does	not requir	e noto	ch-toughne	ss testing.	Accepted By PLANT 3 POC				
Uncontroled copy if actual signature no	t signed by p	plant represe	ntative.								

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Date: <u>12/12/2011</u> Revision: <u>6</u>
 * This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Welding Procedure Specification. ** Any information on actual WPS supercedes this document if a conflict exists.
 QW-402 1 Approved joints shall be on detailed drawings for individual jobs. 2 Retainers prohibited. 3 Root spacing shall be sufficient to allow for complete joint penetration. 4 Bevel angle for groove welds that can only be accessed from one side (i.e. no backgouge/grind) shall be 30° or greater.
QW-403 1 No pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QW-404 1 Consumable inserts prohibited. (GTAW) 2 Filler metal used with weld test. (GTAW) 3 Supplemental filler material not used in weld test. (FCAW, GMAW, SAW) 4 Recrushed slag not used in weld test. (SAW) 5 Flux not used in weld test. (FCAW, GMAW)
 QW-407 PWHT When Required 1 For vessels that are exposed to enviornments that could cause stress corrosion cracking; a minimum hold time of 1 hour at a minimum temperature of 1150°F shall be applied.
 QW-410 1 Backgouge performed with air carbon arc, plasma, and/or grinder. 2 Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) 3 Out of chamber welding only. (GTAW) 4 a FCAW - semiautomatic b SMAW - manual c SAW - machine d GTAW - manual
UG-84 For weld procedures used when impact tests are requried, production material must: a Be of the same P-Number and Group Number with the exception allowed by QW-403.5(c) b Be in the same heat treated condition c Meet the minimum notch toughness requirements
The brand specific filler and/or flux listed on the WPS shall not be substituted.
Applicable to WPS with Post Weld Heat Treatment (PWHT) A specific PWHT procedure shall be developed for each job.
All units referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY		PLANT 1	DENVER, CO
ACCEPTED BY		PLANT 2	SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3	POCATELLO, ID
Uncontroled copy if actual sign	ature not signed by plant representative.		Page 2 of 6

APPENDIX SS

EATON METAL PRODUCTS COMPANY LLC

STAINLESS STEEL

BASE - FILLER METAL COMPATABILITY CHART

	1/13/2003	REVISION	U			
			BASE M	ATERIAL		
FILLER						
METAL	304	304 to 316	316	321	321 to 347	347
308	X –					
316	X	X	X			
317		X	X			
321				X	X	Х
347				X	X	X

When low Carbon content base material required use "L" grade filler metal.

1/12/2005 DEV/ISION

DATE

ER3XX, Si grade filler metal may be used for better wetting and bead contour.

Page 3 of 6

		PROCE									
		E	ATON ME	TAL PR	ODUCIS	COMPA	NYLLC		_		
PQR No			P8-P8-GMA	WP-A			Date	2/22/2012	Revision_	2	
BASE META	L (QW-40	3)			JOINT	QW-402,	QW-405)				
Material Form	n	PLATE T	hickness*	1.5	Туре	١	-GROOVE	-	Groove An	gle _	50
Material Spec	c SA	240-304L	P# 8	Gr #	1 Root Op	pening	0	Root F	ace	1/16	ı
Material Spec	c SA	240-304L	P# 8	Gr #	1 Backgo	uge	YES	Back Weld	ded	YES	
* Weld thickn	ness = to p	late thickness			Test Po	sition	1G V	ertical Progr	ression	N/.	A
PREHEAT (F) (QW-40	6)									
Minimum Ter	mperature		200			VELD HEA	T TREAT	MENT (F) (C	QW-407)		
Maximum Int	erpass Te	mperature	3	00	Temper	ature Rang	ge		NONE		
Preheat Main	itenance	PRI	OR / DURI	NG	Time Ra	ange		NON	E		
PROCESS				GMA	NP						
		104) —									
ANNS Classifi	ication			ER316	SI SI				_		
SEA# / AM/S	Specificat			5.0					-		
5FA#7A00	opecificat			<u>6</u>					_		
A # or Chemi	ical Comp			8				-			
Filler Motal T	rade Nam		l in		ax 316 Si				_		
Filler Metal P	roduct For			SOL					_		
Filler Metal D	liameter			0.04	5				-	_	
SHIFL DING	(OW-408)	_		0.01	•						
Electrode-Elu	(QVI 400) IX (Class)			N/A					-		
Elux Trade N	ame / Tvn	e —		N/A	·				-		
Shielding Gas	s/CFH	~	98% A	r - 2%CO2	2 / 35CFH m	in			-		
Gas Cup Size	<u> </u>	_	5/8	.,				-			
Trailing Gas /	CEH	_							-		
Backing Gas	/ CFH	_		N/A		·			-		
	(QW-40)	9) <u>-</u>									
Current	- (- /		DCE	Р				-		
GMAW, FC	WAC										
Transfer Mod	le			PULSED S	SPRAY				-		
GTAW	•										
Electrode Tvo	be			N/A			-				
Electrode Siz	e			N/A							
TECHNIQUE	(QW-410) —									
Beads		,		STRING	GER		-				
Pass		_		MULTI	PLE						
Number of El	ectrodes	_		1					-		
ELECTRO	DE SPACI	NG –									
Longitudinal				N/A					-		
Angle				N/A					-		
Contact Tube	to Work	Distance		1/2 -	1						
Peening	Contact Tube to work Distance								-		
Interpass Cle	terpass Cleaning MANUAL								-		
Pass			Filler	Current	1		Travel	Max			
or Weld		Filler Metal	Metal	Type &			Speed	Heat Inpu	ut		
Laver (s)	Process	Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	Re	emarks	3
ROOT	GMAWP	ER308I Si	0.045	DCEP	200-210	23-24	18	16.80	0	-	
MID	GMAWP	ER308LSi	0.045	DCEP	200-210	23-24	14-16	21.60	0	-	
CAP	GMAWP	ER308LSi	0.045	DCEP	200-210	23-24	14-16	21.60	0	-	
_	-		-	-		-	-	-		-	
-	-	-	-	-	-	-	-	-		-	
-	-		-	-	-	-	-			-	

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

21,600 J/in <u>= Amps x Volts x 60</u> Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME) EATON METAL PRODUCTS COMPANY LLC

PQR No			P8-P8-G	MAWP-	Α				D	ate2/22	2/2012	_ Rev	vision	2
SPECIMEN	WIDTH	THICKNE	SS AF	REA	UL.	TIMATI		ULT	ΓΙΜΑΤΕ					
NO.	(IN)	(IN)	(SC	QIN)	TOT	AL LOA	AD S	TRE	SS (PSI)	L	OCAT	ION C	F FAI	LURE
1	0.750	0.750	0.5	625		39,9	940		71,004		B/	ASE M	1ETAL	
2	0.750	0.750	0.5	625		40,0	250		71,200		BASE METAL			
3	0.750	0.750	0.5	625		40,1	165		/1,404					
4	0.750	0.750	0.5	625		39,1	(85		70,729		BASE METAL			
-	-	-		_		-			-			-		
_	-	-		-		_			-			_		
-		-		-		-						-		
				GUIDE	D BE	ND TE	ST (Q	W-1	60)					
FIGU	RE NO AND	TYPE		RESUL	rs		F	IGU	RÉ NO AI	ND TYPE			RES	SULTS
(8) QV	-462.2 SIDE	BEND		PASS					-					-
	-	_							-					-
				TOUG	HNE	SS TES	ST (QV	N-17	(0)					
									MPACT	LAT	ERAL	EXP.		DROP
SPECIMEN	I	NOTCH			СН	TEST		<u>ין</u> א	ALUES		~			WEIGHT
NO.	LC	DCATION			'E	(F)	(- I-LBS)	SHEAR	%		.5	BREAK
		_					-		-	_		_		_
_		-		-			-		-	-	1	-		-
-		-		-			-		-	-		-		-
-		-		-			-		-	-	-			-
-		-		-			-		-	-		-		-
-		-		-		·	-		-	-		-		-
-		-		-		· ·	-		-	-		-		-
-		-		-		· ·	-		-	-		-		-
-		-		-		-		-	-		-		-	
					500	TEAT	Deel		10	- 				
			· ^ i	HARUN	E22	IESI-			I B		1			
			1	2	<u> </u>	3	1		2	3	1		2	
				-	+	-	-		-	-	-		-	
	-		-	-		-	-		-	-	-		-	-
	-		-	-		-	-		-	-	-		-	-
	-					-	-		-	-	-		-	
N1: Interpa	ss cleaning n	ot conside	ed peenir	ng.										
N2: Refer t	o Appendix P	QR for all o	other varia	ables.										
N3:														
N4:														
N5: Test Pl	ate: ENCORI	E METALS	, HEAT #	5RE5										
Welder Name	:		Clair	Neff					Stamp:	CN	[) Num	nber:	8005
Tests Conduc	ted By:	<u> </u>	/ISI Testir	ng, Inc.			Labo	rator	y Test Nu	mber:	0	EATC	<u>N-12-</u>	001
PQR was don	e and welding	g of coupor	i was with	lessed b	y:			E	aton Meta	Products		pany L		
We certify tha	t the stateme	nts in this r	ecord are	correct	and t	nat the	test w 念	elds	were prep	bared, we	ded, a	nd tes	sted in	
accordance w			ASIVE SE	2000 IX. 7	122	אכו א	mð	Dan	iel Durtschi	Í				
	///	n jan	Mer -	~ ~/	<u>~</u> 3/	Inall	<u>and</u>	QC1	EXP. 3/1/2	2014				
ACCEPTED E	BY			_	_		V		PLANT 1	DENVER	, CO			
ACCEPTED E	BY								PLANT 2	SALT LA	KE CI	TY, UT	Г	
ACCEPTED E	BY								PLANT 3	POCATE	LLO, I	D		Page 5 of 6
	if actual signatu	ro not signed	by plant for	vocontativ	•									

Uncontroled copy if actual signature not signed by plant representative.

PROCEDURE QUALIFICATIOIN RECORD (ASME IX) EATON METAL PRODUCTS COMPANY LLC

PQR No.		P 8	-P8-GMAW	/P-A-1		Date o	f Welding	:	9/	/19/2018		
Weld Proc	ess(es)			GMAWP			Type(s)			Semiautom	atic	
JOINT DET	AILS (QW-4	402)					-					
Joint Design	• •	Butt Jo	int									
Groove Type	e	Single	V					18		19 /		
Root Spacin	g	0			\succ	1/		15		6		
Root Face		1/16	n			1	1	12	21	3		
Backing		Yes				T	9		<u> </u>	J		
Backing Typ	е —	Base M	etal			F	5		6	/		
Groove Ang	le	50°				,		4				
Back gouged		Yes					1-	2				
Retainers		None	2				×	1	$ \ge $			
POSITION	(QW-405)							20	\sim	~		
Test Positio	n	1G							23			
Progression												
BASE MET	ALS (QW-4	03)										
Material Spec	: (1)	SA-	240	to (2)	SA-240	P-N	o 8	Gr#	1 to	P-No 8	B Gr#	1
Type/Grade,	or UNS Numb	ber	304/304L	to 304	/304L Hea	t Treated Cor	ndition			None		
Material Thic	kness (T)			1.5"		Diamete	r of Test Co	upon		N/	/Α	
FILLER ME	TALS (QW-	404)	(A)		(B)		GAS (QW	/-408)				
SFA Specifica	tion		5.9				• •	Ga	ses	Mixture (%	6) Flo ^s	w Rate (cfh)
AWS Classific	ation		ER316LSi				Shielding	AR,	/02	98/2	<u> </u>	35
F-No			6				Trailing	No	ne	None		None
A-No			8				Backing	No	ne	None		None
Filler Metal T	rade Name	0	K Autrod 316	.Si			Gas Cup Siz	ze		5/8"		
Filler Metal P	roduct Form		Solid				PREHEAT	r (QW-40)6)		•	•
Supplementa	l Filler Metal		N/A				Minimum T	Temperatu	re		100	
Alloy Elemen	ts		N/A				Preheat Ma	aintenance		Prio	r/During	
Weld Metal T	hickness (t)		3/16"				TECHNIQ	UE (QW	-410)			
Maximum Pa	ss Thickness		3/16"				Multipass c	or Single Pa	iss (per side)		Multiple	-
ELECTROD	E						Single or M	lultiple Elec	ctrodes		Single	
Tungsten Typ	e		N/A				Initial and I	nterpass C	leaning	Mar	nua <mark>l /</mark> Mechar	nical
Tungsten 5ize	2		N/A				Peening Pe	rformed		1	None	
Consumable	Insert Used		No				Maximum	Pass Width	I		5/8"	
Electrode Spa	acing (2 Arcs)		N/A				Oscillation	(Machine)			N/A	
Angle			N/A				In Chambe	r Welding (GTAW)		N/A	
Contact Tube	to Work		1/2" to 1"				POST WE	ELD HEAT	TREATME	NT (QW-40)7)	
							Temperatu	re		None	3	
							Time			N/A		
	1 (0)11 400						Other			<u> </u>		
ELECTRICA	L (QW-405	2) 			1				[·	· · · · · · · · · · · · · · · · · · ·
Dorc(oc)	Drosace	Transfer Mode	Closer	Diamatar	Current &	Amno		Volte	Travel	Heat Input	String or	interpass
1	GMAW/P	Pulse-Snrav	FR316FSi	0.045"	DCEP	208		23	Speed (ipm)	17.900	String	Preheat
2	GMAWP	Pulse-Spray	ER316LSi	0.045"	DCEP	201		23	16	17,300	Weave	228°
3-6	GMAWP	Pulse-Spray	ER316LSi	0.045"	DCEP	202		23	15	1 8 ,600	Weave	290° Max
7-10	GMAWP	Puise-Spray	ER316LSi	0.045"	DCEP	209		23	14	20,600	Weave	280° Max
11-14	GMAWP	Pulse-5pray	ER316LSi	0.045"	DCEP	203		24	15	19,500	Weave	285° Max
15-19	GMAWP	Pulse-Spray	ER316LSI	0.045"	DCEP	205		23	15	18,900	Weave	275° Max
20-23	GMAWP	Pulse-Spray	ER316LSI	0.045"	DCEP	222		23	15	20,400	Weave	280° Max

Heat input calculated using QW-409.1 (c)1, Instantaneous energy readout.

PQR No.

P8-P8-GMAWP-A-1

Date of Welding

9/6/2012

TENSILE TESTS (QW-150)

Specimen No	Width	Thickness	Diameter	Area	Ultimate Total	Ultimate Stress	Location of Failure
Speemenne	(in)	(in)	(in)	(in)	Load (lbs)	(psi)	
Тор -1	0.749	0.796	N/A	0.5962	56,046	94,000	WM
Top -2	0.745	0.791	N/A	0.5893	55,196	93,500	WM
Bottom -1	0.750	0.796	N/A	0.5970	56,008	94,000	WM
Bottom -2	0.749	0.795	N/A	0.5955	55,758	93,500	WM

GUIDED-BEND TESTS (QW-160)

Type and Figure No	Result	Type and Figure No	Result
QW-462.2 Side Bend	Pass	QW-462.2 Side Bend	Pass
QW-462.2 Side Bend	Pass	QW-462.2 Side Bend	Pass

TOUGHNESS TESTS (QW-170)

Specimen No	Notch Location	Specimen Size (in)	Notch Size (in)	Test Temp (F)	Impact Values (Ft LBS)	Shear %	Mils	Drop Weight Break
								(#
Impact testing perfe	ormed to ASM	ie v ili		•				

Impact testing performed to

HARDNESS TEST - ROCKWELL B

Base Metal			Heat Affected Zone			Weld Metal		

DEPOSITED CHEMICAL ANALYSIS

С	Si	Mn	Р	S	AI	V	Cr	Ni	Fe	Ce	Мо

Chemical Analysis Conforms to A#

MATERIAL TRACABILITY

Item Description	Heat Number	M6N6		Manufacturer	Norti	North American Stainless			
Item Description	SA-240 304/304L	Heat Number	M6N6		Manufacturer	North American Stainless			
WELDING INFORMAT	ION								
Welding machine used			Lincoln 455M/ST	⊡ w /2 5m Fe	eder Box				
Welder Name	Richard	Carter	1D Number	-	Stamp RC				
TESTING INFORMATIO	ON								
Tests Conducted By	MSI	Laboratory	Test Number	18-408	Date of Tes t	ing	9/24/2018		
Preparation and welding	g of test coupon was wit	nessed by	Sean Dunn						
in accordance with the i This Procedure Qualifica	requirements of ASME D ation Record was prepar	(. ed and accepted by	4		<u>>></u>	0	n <u>10-15-18</u>		
Accepted By			Plant 1 Denver, C	0					
Accepted By			Plant 2 Salt Lake City, UT						
Accepted By Plant 3 Pocatello, 1D									
All units referenced on I	POR are in English (Stand	lard Le nsi inches	. etc.) unless specif	ically noted					

All units referenced on PQR are in English (Standard, I.e. psi, inches, etc.) unless specifically noted. Uncontrolled copy if not signed by plant representative

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	6/3/2009 Revision:	3
 This apperation mentione Any information 	ndix addresses any Essential, Suppon on the Procedure Qualification Te nation on actual PQR supercedes t	blementary Essential, and Nonessential variables not st Record. his document if a conflict exists.
QW-402 1 Approved 2 Retainers	oints shall be on detailed drawings not used for weld test.	for individual jobs.
QW-403 1 No pass (reater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)
QW-404 1 Consuma 2 Filler met 3 Suppleme 4 Recrushe 5 Flux not u	ele inserts not used for weld test. (G l used with weld test. (GTAW) ntal filler material not used in weld t l slag not used in weld test. (SAW) sed in weld test. (FCAW, GMAW)	GTAW) test. (FCAW, GMAW, SAW)
QW-410 1 Backgoug 2 Oscillation 3 Out of cha 4 a FCAW b SMAV c SAW d GTAW	 performed with air carbon arc, pla not used with automatic or machin mber welding only. (GTAW) semiautomatic manual manual manual 	asma, and/or grinder. e welding. (FCAW, GMAW, GTAW, SAW)
Full size impa	t test specimins used. (10mm x 10	0mm)
All units refer	nced on PQR are in English (Stand	dard, i.e. psi, inches, etc.) unless specifically noted.
ACCEPTED	Y	PLANT 1 DENVER, CO

ACCEPTED BY	PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY	PLANT 3 POCATELLO, ID
Uncontroled copy if actual signature not signed by plant representative.	Page 6 of 6

	ELDIN	G PRO	CEDUR	E SF	PECIFIC	CAT	ION (AS	SME)	
	EA	TON ME	TAL PRO	ODUC	TS CON	/IPA	NY LLC		
WPS No	P	8-P8-GTA	W-AL				Date 12	2/17/2009 Revi	sion <u> </u>
Supporting PQR No(s)	_			_	P8-P8-GT	AW-A	<u>L</u>		
BASE METAL (QW-403)				JO	INT (QW-	402, 0	QW-405)		
P# 8 Gr# -	to P#	8	Gr# -	Gro	oove	DOU	BLE BEVEL	- Fillet	ANY
Thickness Range 1/1	6	to	0.56	Pro	ogression	ι	JPHILL	Fillet Weld Size	ANY
Backing NO Backing Mat	erial		-						
				PR	EHEAT (F	;) (QV	V-406)		
	ENT (F) ((QW-407)		Mir	nimum Ter	npera	iture	50	250
Time Bange		-		Ma	ximum Int	erpas	s Temperat		350
	-					lienar	ice		
PROCESS / TYPE			GTA	W				-	
FILLER METAL (QW-404)									
AWS Classification			*ER3X	(X				-	
SFA# / AWS Specification			5.9						
F#			6				-		
A # or Chemical Composition			8					-	
Filler Metal Diameter			1/16 3/32	2 1/8					
Maximum Weld Metal Thicknes			0.56	<u>, 170</u>					
SHIELDING (QW-408)	~ <u> </u>		0.00						
Electrode-Flux (Class)			-					-	
Flux Trade Name / Type			-						
Shielding Gas / CFH		10	0% Ar, 500	CFH M	ax			-	
Gas Cup Size			<u> </u>	/		-			
Trailing Gas / CFH			-	0005					
			00% Ar, 15	-30CF	-				
Current		DCEN						_	[
GMAW. FCAW									
Transfer Mode			-					-	
GTAW									
Electrode Type		EWLa-1.5, 1.5% Lanthana (GOLD)							
Electrode Size		3/32							
TECHNIQUE (QW-410)									
Beads									
Pass Number of Electrodes				<u>'LE</u>					
			1						
Longitudinal			-					-	
Angle			-					-	
Contact Tube to Work Distance	e		-					-	11
Peening			NON	E				<u> </u>	~
Interpass Cleaning		MAN	IUAL / MEG	CHANI				/-	
Pass or Filler	Filler	Current			Trave	el	Max	Maximum Hea	t logu Wor any
Weld Metal	Metal	Type &			Spee	d H	Heat Input	Diameter =	. ULI MR
Layer (s) Process Class [Diameter	Polarity	Amps	Volts	s (ipm)	(J/in)	BY	JASON J. HART
ANY/ALL GTAW *ER3XX	1/16	DCEN	150max	15ma	ax 1mir	ר	- (2	02030171
ANY/ALL GTAW *ER3XX	3/32	DCEN	150max	15ma	ax 1mir	ן ו ו	-	Accepted By Pl	
ANY/ALL GIAW ARR3XX	8/1	DCEN	ISUMAX	isma		'	-		\vee
	_	_		-			_	Accepted By PI	ANT 2 SLC
Interpass cleaning not consider	ed peenir		-	_					
Refer to Appendix WPS for all c	other varia	ables.							
Refer to Appendix SS for filler n	netal sele	ction.						Accepted By Pl	ANT 3 POC
This WPS is only used for mate	rial which	does not	require not	tch-tou	ghness te	sting.			
Uncontroled copy if actual signature no	t signed by	plant represe	entative.			-			

ER3XX, Si grade filler metal may be used for better wetting and bead contour. 5

•

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Date	e:6/3/2009Revision:4
* T n ** A	his appendix addresses any Essential, Supplementary Essential, and Nonessential variables not nentioned on the Welding Procedure Specification. Any information on actual WPS supercedes this document if a conflict exists.
QW-	402
1 A 2 R	approved joints shall be on detailed drawings for individual jobs. Retainers prohibited.
QW- 1 N	403 Io pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QW- 1 C 2 F 3 S 4 R 5 F	404 Consumable inserts prohibited. (GTAW) iller metal used with weld test. (GTAW) upplemental filler material not used in weld test. (FCAW, GMAW, SAW) decrushed slag not used in weld test. (SAW) lux not used in weld test. (FCAW, GMAW)
QW 1 B 2 O 3 O 4 a b c d	410 ackgouge performed with air carbon arc, plasma, and/or grinder. Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) but of chamber welding only. (GTAW) FCAW - semiautomatic SMAW - manual SAW - machine GTAW - manual
The b	prand specific filler and/or flux listed on the WPS shall not be substituted.
Appli A	cable to WPS with Post Weld Heat Treatment (PWHT) specific PWHT procedure shall be developed for each job.
All ur	nits referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.

ACCEPTED BY	PLANT 1 DENVER, CO
ACCEPTED BY	PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY	PLANT 3 POCATELLO, ID
Uncontroled copy if actual signature not signed by plant representative.	

PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC											
PQR No			P8-P8-GTA	W-AL			_ Date _1	2/16/2009 R	evision <u>3</u>		
BASE META Material Forn Material Spe *Weld thickn PREHEAT (I Minimum Te Maximum In Preheat Main	AL (QW-40 m c SA- c SA- ess = to pi F) (QW-40 mperature terpass Te ntenance	03) <u>PIPE</u> <u>312-TP304L</u> <u>312-TP304L</u> ipe thickness 6) mperature <u>PRI</u>	hickness* P # <u>8</u> P # <u>8</u> 50 3: OR / DURIN	0.28 Gr # Gr # 50 IG	JOINT (0 Type Root Ope Backgou Test Pos POST W Tempera Time Rai	QW-402, 0 SIN ge ition ELD HEA ture Rang nge	QW-405) NGLE BEVI 1/8 YES 5G Ve T TREATM	ELGr Root Fac Back Welded ertical Progres MENT (F) (QW	roove Angle 60 e 1/16 d YES sion UPHILL /-407)		
PROCESS	S / TYPE			GTA							
FILLER MET AWS Classif SFA# / AWS F # A # or Chem Filler Metal T Filler Metal D	TAL (QW- ication Specificat ical Comp rade Nam Diameter	404)		ER30 5.9 6 8 - 3/32	BL	-					
SHIELDING Electrode-Flu Flux Trade N	(QW-408) ux (Class) lame / Typ	e _		- - -	15CEH						
Gas Cup Siz Trailing Gas	e / CFH	-		<u>3 - 5</u>		-					
ELECTRICA Current	/ CFH L (QW-40	9) —		DCE							
GMAW, Fo Transfer Moo GTAW	CAW le	_									
Electrode Ty Electrode Siz		,	EV	V <u>Th-2, 2%</u> 3/32	THORIA						
Beads Pass Number of E ELECTRO	ectrodes) — — NG —	WEAVE MULTIPLE 1								
Longitudinal Angle Contact Tube	e to Work	Distance									
Peening Interpass Cle	aning		MAN	NONI IUAL / MEC							
Pass or Weld Layer (s) ALL	Process GTAW	Filler Metal Class ER308L	Filler Metal Diameter 3/32	Current Type & Polarity DCEN	Amps 110-150	Volts 10-15	Travel Speed (ipm) 1-3	Max Heat Input (J/in) 135.000	Remarks		

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

-

-

_

_

_

_

-

_

_

_

_

_

-

-

_

_

_

_

_

_

_

-

_

-

_

_

-

_

_

_

J/in = Amps x Volts x 60 Travel Speed 135,000

-

_

-

_

_

_

_

-

_

_

-

-

-

_

_

_

_

_

ί.

PROCEDURE QUALIFICATION RECORD (ASME)

PQR No			P8-P8-C	STAW-A			,150		ate <u>12/16</u>	6/2009	Revision	3	
TENSILE TEST (QW-150)													
SPECIMEN	WIDTH	THICK	AF	REA	ŲĽ	TIMATE		ULTIMATE					
NO.	(IN)	(IN)	(SC	2IN)	тот	AL LOA	LOAD STRESS (PSI) LOCATION OF FAILU						
1	0.744	0.296	0.2	220		19,1	38	86,902		WE	LD META	L	
2	0.746	0.297	0.2	222		18,7	75	84,739		L			
-	-	-		-		-		-					
-	-	-		-		-		-			-		
-	-	-		-		-		-		-			
-	-	-		-		-		-			-		
-	-	-		-		-		-			-		
		-		-									
GUIDED BEND TEST (QW-160)													
(2) QW-4	462 3(a) FAC			PASS	3		(2)	W-462.3(a) F	ROOT BEN	D		PASS	
(2)	-			-			(_) G					-	
				TOUG	HNF	SS TES	T (Q)//	/-170)					
							- (0.00	IMPACT	LAT	ERAL	EXP.	DROP	
SPECIMEN	١	лотсн		NOT	СН	TEST	ТЕМР	VALUES				WEIGHT	
NO.	LC	CATION		TYF	ЭΕ	(F	;)	(FT-LBS)	SHEAR	%	MILS	BREAK	
-		-		-		-		-	-		-	-	
-		-		-		-		-	-		-	-	
-		-		-		-		-	-		-	-	
~		-		-				-	-		-		
- (-		-		-		-	-		-	-	
-		-		-		-		-	-		-	-	
-		-		-		-		-	-		-	-	
-		-						-	-		-	-	
-		-						-	-		-	-	
-		-						-	_		-	-	
		_		-		-			-		-	-	
			H		SS TF	ST - Br	rinell F	lardness	•			·	
	E	BASE ME	TAL			.01 - 01	HEA	AT AFFECTE	D ZONE		WELD	IETAL	
			1	2		3	1	2	3	1	2	3	
	-		-	*		-	-	-	-	-	-		
	-		-	-		-	-	-	-	-	-	-	
	-		-	-		-	-	-	-	-	-	-	
	-		-	-		-	-	-	-	-	-	-	
N1: Interpa N2: Refer to N3: N4: N5:	N1: Interpass cleaning not considered peening. N2: Refer to Appendix PQR for all other variables. N3: N4: N5:												
Welder Name	:		ROBERT	BLEVIN	IS			Stamp:	В	ID	Number:	774	
Tests Conduc	ted By:	M	SI TESTIN	NG, INC			Labor	atory Test Nu	mber:		03-318	3	
PQR was don	e and welding	g of coupo	n was witn	lessed b	by:	$ \rightarrow $		EATON MET	AL PRODU	JCTS (COMPAN	/	
We certify tha accordance w BY	t the statemen ith the require	nts in this	record are ASME Sec	correct	and t	QC 1 JASON J. HA	heist we	elds were pre	pared, weld	ded, ar	nd tested in	า	
ACCEPTED E	3Y					02030171		PLANT 1	DENVER,	co			
ACCEPTED E	3Y							PLANT 2	SALT LAP	KE CIT	Y, UT		
ACCEPTED E	3Y					V		PLANT 3	POCATE	LO, ID)	Page 2 of 2	

Uncontroled copy if actual signature not signed by plant representative.

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Da	e: <u>6/3/2009</u> Revision: <u>3</u>
*	his appendix addresses any Essential, Supplementary Essential, and Nonessential variables not nentioned on the Procedure Qualification Test Record. My information on actual PQR supercedes this document if a conflict exists.
Q٧	402
1 2	pproved joints shall be on detailed drawings for individual jobs. Retainers not used for weld test.
QV 1	403 Io pass greater than 1/2" used in weld test. (FCAW, GMAW, SAW, SMAW)
QW	404
1	Consumable inserts not used for weld test. (GTAW)
2	iller metal used with weld test. (GTAW)
3	upplemental filler material not used in weld test. (FCAW, GMAW, SAW)
5	lux not used in weld test. (FCAW, GMAW)
	410 ackgouge performed with air carbon arc. plasma, and/or grinder.
2	oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW)
3	Dut of chamber welding only. (GTAW)
4	SMAW - manual
	SAW - machine
	GTAW - manual
Full	size impact test specimins used. (10mm x 10mm)
All (nits referenced on PQR are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.
	·

....

ACCEPTED BY		_PLANT 1 DENVER, CO
ACCEPTED BY		 _PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY		PLANT 3 POCATELLO, ID
Uncontroled copy if actua	I signature not signed by plant representative.	

WELDING PROCEDURE SPECIFICATION (ASME)												
			E	EATON ME	TAL PR	ODUC	CTS CON	PANY	LLC			
WPS No				P8-P8-SM	AW-A	_			Date 1	2/15/2009 Rev	vision 4	
Supportin	Ig PQR No	o(s)				P8	G <u>1-P8G1-</u>	SMAW-	<u>A</u>		_	
BASE ME	ETAL (QW	/-403)				JO	INT (QW-4	02, QV	V-405)			
P #	8 G	ir# -	to P	# 8	Gr #	- Gro	oove	A	NY	Fillet	ANY	
Thicknes	s Range	.1	875	to	8 —	Pro	ogression	UP	HILL	Fillet Weld Siz	e ALL	
Backing	YES E	Backing M	aterial	BASE/WE	LD META	L	-			_		
			•			PR	EHEAT (F	(QW-4	106)			
POST W	ELD HEAT		/IENT (F) (QW-407)		Mir	nimum Terr	peratu	re	50		
Temperat	ture Range	e		-		Ma	iximum Inte	erpass 7	Fempera	iture	350	
Time Ran	ige					Pre	eheat Maint	enance		PRIOR / D	URING	
PROCE	SS / TY	PF		_	SMA	W				-		
		• – \\\/_404\	-									
AWS Cla	ssification	••-+0-+)			E3X	X				-		
SFA# / A	NS Specif	ication	-		5.4	<u> </u>						
F#			-		5	_						
A # or Ch	emical Co	mposition	-		8					-		
Filler Meta	al Trade N	lame	-		-					_		
Filler Meta	al Diamete	er			AN`	Y						
Maximum	Weld Me	tal Thickn	ess		8	_				-		
SHIELDI	NG (QW-4	.08)										
Electrode	-Flux (Cla	ss)	-		-							
Flux Trad	e Name /	Туре	-									
Shielding	Gas / CFF	4	-							-		
Gas Cup			-		-	_				-		
Backing G			-									
		-410)	-									
Current				DCEP						-		
GMAW	. FCAW		-									
Transfer I	Mode				-					-		
GTAW			-			-						
Electrode	Туре								-			
Electrode	Size		_									
TECHNIC	QUE (QW-	410)										
Beads			-	STRING	ER - Each	bead ≤	5/8" wide					
Pass			-			PLE				-		
Number o	t Electrod	es	-		1_							
ELECI	RODE SPA	ACING										
	lai		-									
Contact T	ube to Wo	ork Distan	-									
Peenina			-		NON	F						
Interpass	Cleaning		-	MAN	JUAL / ME	CHANI	CAL			-		
Pass or	<u> </u>	Fillor	- Fillor	Current			Trave		Max	Maximum Hea	at Innot the any	
Weld		Metal	Meta				Speer		at Innut	Diameter =		
Laver (s)	Process	Class	Diamet	er Polarity	Amns	Volts	(inm)		(.l/in)	By		
ANY/ALI	SMAW	E3XXI	5/3	2 DCFP	90-140	26-3	2 7-12		-	The l	🛛 JASON J. HART 🛛 🚿	
ANY/ALL	SMAW	E3XXL	1/8	DCEP	60-120	20-2	5 4-8		-	Accepted By P	AN 12030171	
ANY/ALL	SMAW	E3XXL	3/32	2 DCEP	40-100	19-24	4 3-8		- /	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
-	-	-	-	-	-	-	-		-			
-	-	-	-	-	-	-	-		-	Accepted By P	LANT 2 SLC	
Interpass	cleaning n	not conside	ered pee	ening.								
Refer to a	ppendix W	VPS for all	other va	ariables.								
Refer to A	ppendix S	S for filler	metal s	election.						Accepted By P	LANT 3 POC	
This WPS	is only us	ed for ma	terial wh	ich does not	require no	tch-tou	ghness tes	ting.				
Uncontroled	copy if actua	al signature i	not signed	by plant repres	entative.							

APPENDIX SS EATON METAL PRODUCTS COMPANY LLC

STAINLESS STEEL

BASE - FILLER METAL COMPATABILITY CHART

DATE	1/13/05	REVISION	0			
	BASE MATERIAL					
FILLER						
METAL	304	304 to 316	316	321	321 to 347	347
308	X					
316	X	X	X			
317		X	X			
321				X	X	X
347				X	X	X

When low Carbon content base material required use "L" grade filler metal.

ER3XX, Si grade filler metal may be used for better wetting and bead contour.

APPENDIX WPS (ASME) EATON METAL PRODUCTS COMPANY LLC

Da	te:6/3/2009Revision:4
*	This appendix addresses any Essential, Supplementary Essential, and Nonessential variables not mentioned on the Welding Procedure Specification.
**	Any information on actual WPS supercedes this document if a conflict exists.
Q٧	V-402
12	Approved joints shall be on detailed drawings for individual jobs. Retainers prohibited.
QV	V-403
1	No pass greater than 1/2" allowed. (FCAW, GMAW, SAW, SMAW)
QV	V-404
1	Consumable inserts prohibited. (GTAW)
$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	Supplemental filler material not used in weld test. (FCAW, GMAW, SAW)
4	Recrushed slag not used in weld test. (SAW)
5	Flux not used in weld test. (FCAW, GMAW)
QV	V-410
1	Backgouge performed with air carbon arc, plasma, and/or grinder.
2	Oscillation not used with automatic or machine welding. (FCAW, GMAW, GTAW, SAW) Out of chamber welding only. (GTAW)
4	a FCAW - semiautomatic
	b SMAW - manual
	c SAW - machine d GTAW - manual
Ĺ	
The	e brand specific filler and/or flux listed on the WPS shall not be substituted.
Ар	plicable to WPS with Post Weld Heat Treatment (PWHT) A specific PWHT procedure shall be developed for each job.
All	units referenced on WPS are in English (Standard, i.e. psi, inches, etc.) unless specifically noted.
1	
1	
AC	CEPTED BY PLANT 1 DENVER, CO

ACCEPTED BY PLANT 2 SALT LAKE CITY, UT
ACCEPTED BY PLANT 3 POCATELLO, ID

Uncontroled copy if actual signature not signed by plant representative.

J.
PROCEDURE QUALIFICATION RECORD (ASME)

EATON METAL PRODUCTS COMPANY LLC										
PQR No		P80	<u> 31-P8G1-S</u>	SMAW-A			Date2	2/15/2009 Re	evision <u>3</u>	
BASE META	L (QW-40)3)			JOINT (G	W-402. Q	W-405)			
Material Forr	n	PLATE T	nickness*	1 1/2 & 1	/2 Type	SIN(SINGLE BEVEL Groove Angle 50			
Material Spe	c SA-24	40. 304 & 316 F	P# 8	Gr #	1 Root Ope	nina	1/16	Root Face	e 1/16	
Material Spe	c SA-24	40, 304 & 316 F	$p_{\#} = \frac{1}{8}$	Gr #	1 Backgoud	ne	YES	Back Welder	YFS	
*Weld thickness = to plate thickness				Test Posi	tion	1G Ve	rticle Progres	sion -		
PREHEAT (F) ($OW-406$)				,			i tiolo i regioo			
Minimum Temperature 50					POST W			IENT (E) (OW	-407)	
Maximum Internass Temperature 350					Temperat	ure Range	<i></i>	<u> </u>	-	
Preheat Mair	ntenance	PRIC	DR / DURIN	VG	Time Rar	are rung.				
PROCESS	5/TYPE		SM	<u>AW 3048</u>	SS BASE			SMAW 316	SS BASE	
FILLER MET	「 AL (Q₩-4	404)								
AWS Classif	ication			E308	<u>BL</u>			E308	3L	
SFA# / AWS	Specificat	tion		5.4				5.4	-	
F #				5				5		
A # or Chem	ical Comp	osition		8				8		
Filler Metal T	rade Nam	e		-				-		
Filler Metal D	Diameter			5/32	2			3/32,	1/8	
SHIELDING	(QW-408)	ł								
Electrode-Flu	ux (Class)			-				-		
Flux Trade N	lame / Typ	e	-							
Shielding Ga	s / CFH		-							
Gas Cup Size	е			-				-		
Trailing Gas	/ CFH			-						
Backing Gas	/ CFH			-				-		
ELECTRICA	L (QW-40	9)								
Current				D <u>CE</u>	P	DCEP				
GMAW, FO	CAW									
Transfer Mod	de									
GTAW										
Electrode Typ	ре						-			
Electrode Siz	e		-							
TECHNIQUE	E (QW-410)								
Beads			STRINGER / WEAVE				STRINGER / WEAVE			
Pass				MUL <u>TI</u>	PLE		MULTIPLE			
Number of El	lectrodes			1				1		
ELECTRO	DE SPACI	NG								
Longitudinal				~	_					
Angle				-						
Contact Tube	e to Work	Distance		-						
Peening				NON	<u>E</u>			NON	IE	
Interpass Cle	eaning		MAN	IUAL / ME	CHANICAL		N	MANUAL / ME	CHANICAL	
Pass			Filler	Current			Travel	Max		
or Weld		Filler Metal	Metal	Type &			Speed	Heat Input		
Layer (s)	Process	Class	Diameter	Polarity	Amps	Volts	(ipm)	(J/in)	Remarks	
ANY	SMAW	E308L	5/32	DCEP	130	30	7-12	-	-	
ANY	SMAW	E316L	1/8	DCEP	120	22	4-8	-	-	
ANY	SMAW	E316L	3/32	DCEP	90	22	3-8	-	-	
-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	
_	-	-	-	-	-	-	-	-	-	

MAXIMUM HEAT INPUT FOR ANY DIAMETER =

J/in _ = Amps x Volts x 60 Travel Speed

PROCEDURE QUALIFICATION RECORD (ASME)

PQR No	PQR No P8G1-P8G1-SMAW-A Date 12/15/2009 Revision 3												
				TE	NSILE	TEST	(QW-1	50)					
SPECIMEN	WIDTH	THICK	AF	REA	UL	ΓΙΜΑΤΕ	Ξ	ULT	IMATE				
NO.	(IN)	(IN)	(SC	QIN)	TOT	AL LOA	AD ST	RE	SS (PSI)	LO	CATIC	ON OF FA	LURE
1	0.754	1.508	1.1	137		103,0	000		90,587		WE		_
2	0.753	1.508	1.1	136		102,9	900		90,619		WE		_
T-1	1.014	0.506	0.5	513		46,4	46,400 90,434			BASE METAL			-
T-2	0.995	0.507	0.8	504		45,0	000		89,203		BAS	SE METAL	-
-	-	-		-					-			-	
	GUIDED BEND TEST (QW-160)												
FIGU	RE NO AND	TYPE		RESUL	 .TS		F	IGU	RE NO AN	ID TYPE		RE	SULTS
4 @ QV	N-462.2 SIDE	BEND		PAS	S		2@	QW.	-462.3(a) F	ACE BEN	D	F	PASS
0	-			-			2@0	วพ-	-462.3(a) F	ROOT BEN	D	F	PASS
	-								-				-
				TOUC	SHNES	SS TES	ST (QV	/-17	(0)				
									MPACT	LATE	RAL E	EXP.	DROP
SPECIMEN	1	NOTCH		NOT	СН	TEST	TEMP	ν	ALUES				WEIGHT
NO.	LC	CATION		TY	PE	(F)	(F	FT-LBS)	SHEAR %	6	MILS	BREAK
		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		-	-		-	-
-		-		-			-		~	-		-	-
-		-		-	- -		-		-	-		-	-
								<u> </u>	<u> </u>				
	,		<u>H/</u>	ARDNE	SSTE	ST - B			dness			WELDM	
			1	2		3	1	$\frac{1}{1}$	2	3	1	2	3
	-		-	-		-	-		-	-	-	-	-
	-		-	-		-	-		-	-	-	-	-
	-		~	-		-	-		-	-	-	-	-
N1: Interpass cleaning not considered peening. N2: Refer to Appendix PQR for all other variables. N3: N4: N5: N6:													
N7: Origina	a PQRS. 33-	115 1994,	33-100 I	902					0	0.0		Number	000 000
vvelder Name	et ad Pure	R.					X obc		Stamp:	δ, D			099,230
POP was dor	cied By:				NG LA		Labor					20MPAN	/
FQR was dor			11 Was with	lesseu	0y.		s /						<u> </u>
we certify the accordance w BY	vith the require	ements of	ASME Se	ction IX	·	JASON J. 02030	HART 171		s were prep	bared, weld	ieu, ar	ia lestea l	
ACCEPTED	BY					CW	//		PLANT 1	DENVER,	со		
ACCEPTED I	3Y					V			PLANT 2	SALT LAK	E CIT	Y, U T	
ACCEPTED I	3Y								PLANT 3	POCATEL	LO, IE	D	Page 2 of 2

Uncontroled copy if actual signature not signed by plant representative.

APPENDIX PQR (ASME) EATON METAL PRODUCTS COMPANY LLC

Date:	6/3/2009	Revision:	3
* This men ** Any	appendix addresses any l tioned on the Procedure C information on actual PQF	Essential, Supplem Qualification Test R & supercedes this o	nentary Essential, and Nonessential variables not Record. document if a conflict exists.
QW-402)		
1 Appr 2 Reta	oved joints shall be on de iners not used for weld tes	tailed drawings for st.	r individual jobs.
QW-403 1 No p	ass greater than 1/2" used	d in weld test. (FCA	AW, GMAW, SAW, SMAW)
QW-404 1 Cons 2 Filler 3 Supp 4 Recr 5 Flux	sumable inserts not used f metal used with weld test plemental filler material no ushed slag not used in we not used in weld test. (FC	or weld test. (GTA . (GTAW) t used in weld test. ld test. (SAW) AW, GMAW)	ϞW) t. (FCAW, GMAW, SAW)
QW-410 1 Back 2 Oscii 3 Out o 4 a F b S c S d G	gouge performed with air lation not used with autom of chamber welding only. (CAW - semiautomatic MAW - manual AW - machine TAW - manual	carbon arc, plasm natic or machine w GTAW)	าa, and/or grinder. velding. (FCAW, GMAW, GTAW, SAW)
Full size	impact test specimins use	ed. (10mm x 10mn	m)
All units	referenced on PQR are in	English (Standard	d, i.e. psi, inches, etc.) unless specifically noted.
			· · · · · · · · · · · · · · · · · · ·
			·
ACCEPT	ED BY		PLANT 1 DENVER, CO
ACCEPT	ED BY		PLANT 2 SALT LAKE CITY, UT

PLANT 3 POCATELLO, ID

ACCEPTED BY

Uncontroled copy if actual signature not signed by plant representative.



Eaton Metal Products Company LLCC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4800 TAX: (303) 296-5736

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1



Eaton Metal Products Company LLC ENGINEERS DESIGNERS FABRICATORS PETROLEUM EQUIPMENT (303) 296-4000 TAX: (303) 296-5736

Inspection Records

EATON METAL PRODUCTS CO LLC MANUFACTURER DATA REPORT 5361-1

·	INSPECTION TEST PLAN									
Job No.	Customer	PO No.	Serial No.	Tag No.	National Board No.	Rev No. / Date				
5361-1	Anadarko	4500100246	TBD	V-1000	TBD	Rev 0 11/27/18				

INSPECTION ITEM		SIGN / DATE	DEMADKS		
	EMP QC	*AI	CUSTOMER		
PRE-FABRICATION				ne en en en en en en en en en en en en e	
AI HOLD POINT	H-SLC 3-15-19	H-SLC 3/1.5/19	3/15/19	*EITHER HEAD/SHELL FITUR.	
APPROVED ITP	H-SLC //-27-(8	in/28/18	315/14 1A	ITP shall be completed for inspection points prior to opening job with the AI	
APPROVED DKA WINGS	IP-SLC [1-27-18	W-SLC 11/28/19	H-SLC 2/13/19	job with the AI. The drawings shall be identified on the Drawing Summary Sheet. $R_{\rm ext}$	
	Dess'		Run		
APPROVED CALCULATIONS	H - SLC	W - SLC	H – SLC	Calculations shall be approved by the customer prior to	
	11-27-18	11/28/18	By NK	Hydro Summary Sheet shall accompany the calcs for the AI review.	
	25	Ľ		accompany the calcs for the AI review.	
APPROVED WELDING PROCEDURES	W-SLC 11-27-18	W-SLC 1/28/18	IP-SLC By AVX ME 315/19	Weld Procedures used shall be listed on approved drawings.	
WELDER QUALIFICATIONS	W-SLC 11-27-10		IP – SLC	Available for review in each shop of fabrication.	
			By MOM 2/11/19		
NDE PROCEDURES	IP-SLC 1-2>18		IP - SLC	NDE Procedures shall be reviewed and accepted by EMP	
	232		NOT 3/11/69	QC TEAM	
PREPLANNING MEETING	H-SLC11-2>-15	H - SLC	not	Meeting with EMP QC and AI to start job and establish hold points during fabrication. Job summary at the end	
~		1/28/12	3/15/19	of this ITP shall describe the approximate fabrication scope for each vessel in each plant	

INSPECTION TEST PLAN

,

INSPECTION ITEM		SIGN / DATE	REMARKS	
	EMP QC	*AI	CUSTOMER	
		l 1919 - Andrew Martin, Aline and Antonio Antonio (Martino)		
INPROCESS FABRICATION				
VISUAL INSPECTION (INTERNAL	H – POC	H – POC	H – POC	All surfaces and welds shall be visually examined during
COMPLETED VESSEL)		e de des	3/20/2019	All surfaces and welds shall be visually examined during
	5.1.19	Contraction of Contraction		fabrication by the AI after all welding is completed.
	4. Moust	antitie Engel		Inspection shall take place prior to Hydro test.
VISUAL INSPECTION (EXTERNAL)	Н́ – РОС	H – POC	H – POC	All surfaces and welds shall be visually examined during
COMPLETED VESSEL	5.15.19	5/15/19	Mail	All surfaces and welds shall be visually examined during
	1111		5/15/19	fabrication by the AI after all welding is completed.
COMPONENT EITLIP	C Mauret		ID SIC	All fit-up shall be within the tolerances specified in EMP
	AP-SLC 3-27-19		M 7129-19	Vessel Fabrication Tolerance specification
	He-D			
NONDESTRUCTIVE EXAMINATION				Acceptance per ASME Section VIII, Division I code.
RT/PAUT	H - SLC	W-SLC	IP - SLC	100% All Long Seams
	1 A THIN	24/19/19	NM 6/12/19	Spot An Onthi Stanis
	Kase-	C		
, RT/PAUT	H-POC 5.1.19	W - POC 5/1/9	IP - POC	Spot Closing Seam
	d. Mont	- Careta and a second	10/26/17	[-] 01 i
FINAL DIMENSIONAL	H – POC		IP - POC	All dimensions of finished vessel shall conform to the
	CIC IO		5-15-17	Fabrication Tolerance specification
	5.12.14		MON	r
	fillauct			
HYDRO IESI	H-POC Ulzzlig	H - POC 4/23/19	W - POC	Temperature shall be 40°F min
	110-111	******		Hold time shall be 1 hour
Water Boot	1. Mourt			Test shall be recorded with a chart recorder The chart shall be signed by the operator and the serial
	5.15.19	5/15/19	5/15/19	number of the chart recorder and/or gauge used shall be
Main Vessel	1.Movet	4C	- man	noted on chart.

INSPECTION TEST PLAN

INSDECTION ITEM		SIGN / DATE	DFMADKS	
	EMP QC	*AI	CUSTOMER	
PAINT	H-POC 5.17.19		MOT 7/24/2019	Surface preparation and paint shall be verified AND DOCUMENTED in accordance with P-Sheet from Engineering
FINAL CLEAN	H-POC 5-17-19 21/1101122		MOT 7/24/2019	The ID of the vessel shall be swept out and free of blast media
SHIPPING PREPARATION	H-POC 5.17.19 7.11.10 de		MA 7/24/2019	Vessel prepared to ship with the following items All flange faces protected with covers Extra studs, nuts, and gaskets supplied with vessel All manway covers with davits secured All cribbing and supports ready for loading
DOCUMENTATION 7				
MATERIAL TEST REPORTS (MTR)	H-SLC 4-19-19	W - SLC 	4/12/17 MCV	All pressure boundary and attachments to pressure boundary shall have an MTR or C of C.
WELD MAP DESCRIPTION (SLC SCOPE)	H-SLC 4-19-19	H-SLC L-1/19/19	Y	All pressure boundary and attachments to pressure boundary welds shall have welder ID and WPS used documented
WELD MAP DESCRIPTION (POC SCOPE)	H-POC 5.19.19 1.11 met	H-POC S/15/19	5/19/29 Mt	All pressure boundary and attachments to pressure boundary welds shall have welder ID and WPS used documented
DOCUMENT INDEX LOG	H-POC 5.15.19 1. Markt	H – POC 5/5/19	1	Document Index Log Initialed by QAM and AI
NDE REPORTS	H-SLC/POC 547-19 Alour + 5.15.19		5/19/17 MM	All NDE performed on the vessel shall have a report documenting acceptance.
NONCONFORMANCE REPORTS (NCR)	H-SLC/POC 5-15-17 Minuct	H – SLC/POC5/5/	NA	All NCRs cleared for vessel
NAME PLATE	H-POC 51519 Allower	H-POC \$15/	\$/19/19 NO	Stamped and a picture taken for records

INSPECTION TEST PLAN

INSDECTIONITEM		SIGN / DATE	DEMADKS	
INSPECTION ITEM	EMP QC	*AI	CUSTOMER	
ASME CODE DATA SHEET	H-POC SUSIS	H – POÇ <i>5/15/19</i>	SUSIN	Completed and signed by AI
	I'Mourt'	V. Carrieron	MON	UIA
FINAL DOCUMENT PACKAGE	H-POC		7/24/5019	Final document package to include:
			N	Manufacturers Data Report (U-1A)
	G.Monsal		1 MAN	Nameplate Picture
				Manufacturers Drawings
				Design Calculations
				MTRs
				WPS/PQK
				Completed ITP
				Weld Map Description
				Hydro Test Record
				NCRs M/2
COMPLETED ITP	H - POC		7/24/2019	All items requiring above shall be initialed by EMP QC and any items noted shall be initialed by the AI and
	71112.5-2		MA	Customer.
RELEASE FOR SHIPMENT	H – POC		7/24/2019	Documentation for the customer allowing the vessel to
	5.17.19		MA	ship to job site. To be stoved, recommend pre ship inspectivi
~~~	7. Marsol			w active Contract
/				
L				

#### EATON METAL PRODUCTS COMPANY LLC INSPECTION TEST PLAN

3 A.

.

#### SUMMARY

PLANT 2 (SLC) SCOPE: (SLC, UT) Fabricate 2 Halves	PLANT 3 (POC) SCOPE: (Pocatello, ID) Closing Seam Hydro Vessel Paint Vessel	Inspection Legend: H = Hold Point IP = In Process Inspection W = Witness Point * = AI to set Hold points at beginning of job



				N	1077L	ESCHEDILE	
Nozzle	Qty	Size	Rating	race Fla	nge	Service	Remarks
N1	1	24″	150#	RF	WN	INLET	w/ OIFFUSER
N2	1	24″	150#	RF	WN	OUTLET	
N3	1	2″	150#	RF	LWN	VRU RECYCLE	
N4	1	2″	150#	RF	LWN	PUMP RECYCLE	
N6	1	3″	150#	RF	LWN	DRAIN	w/ BLIND
N7	1	6″	150#	RF	LWN	DRAIN	w/ BLIND
N8	1	6″	150#	RF	LWN	PSV	
N9A/B	2	3″	150#	RF	LWN	BRIDLE	w/ STINGER (N9B)
N10	1	6″	150#	RF	LWN	LIQUID OUTLET (OIL)	w/ V.B.
N11	1	2″	6000#	FNPT	CPLG	SPARE	
N12	1	4″	150#	RF	LWN	LAHH	
N13	1	36″	150#	RF	WN	BOOT	SERIES "B"
N14	1	2″	150#	RF	LWN	HP DRAIN RECYCLE	
N15A	1	3"	150#	RF	ŴN	LEVEL (BOOT INTERFACE)	
N15B/C	2	3″	150#	RF	LWN	LEVEL GAUGE (IN BOOT)	
N16	1	4″	150#	RF	WN	WATER OUTLET (IN BOOT)	w/ INT PIPE
N17A/B	2	3″	150#	RF	LWN	SPARE LEVEL (IN BOOT)	
N18	1	3″	150#	RF	LWN	DRAIN (IN BOOT)	
M1	1	20"	150#	RF	WN	MANW AY	w∕ HINGE
M2	1	20"	150#	RF	WN	MANW AY	w/ HINGE
M3	1	20″	150#	RF	WN	MANW AY	w∕ HINGE

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

		WELDER ID &					
DESCRIPTION	FIT-UP	PROCE	OURE KEY	VISUAL ACCEPT	NDE	E ACCEPT/TYPE	
Weld GS HD /32U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Girth Seam	RS	LK II	LK II		Spot		
MK 1-1 to 1-3				Lead RK			
Head to Shell	DG			QC DG	SD		
Weld LS 32U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Long Seam	BS	RC II	RC II		100%		
MK 1-3				Lead RK			
Shell	DG			QC DG	SD		
Weld GS 32U/37U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Girth Seam	RS	LK II	LK II		Spot		
MK 1-3 to 1-2				Lead RK			
Shell to Shell	DG			QC DG	SD		
Weld LS 37U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Long Seam	BS	RC II	RC II		100%		
MK 1-2				Lead RK			
Shell	DG			QC DG	SD		
Weld GS 37U/35U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Girth Seam	RS	CC II	LK II		Spot		
MK 1-2 to 1-2				Lead RK			
Shell to Shell	DG			QC DG	SD		
Weld LS 35U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Long Seam	BS	RC II	RC II		100%		
MK 1-2				Lead RK			
Shell	DG			QC DG	SD		
Weld GS 35U/31U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Girth Seam	RS	CC II	CC II		Spot		
MK 1-2 to 1-3				Lead RK			
Shell to Shell	DG			QC DG	SD		
Weld LS 31U	SLC #2	INSIDE	OUTSIDE	SLC #2	RT		
Long Seam	BS	RC II	RC II		100%		
MK 1-3				Lead RK			
Shell	DG			QC DG	SD		
Weld GS 31U/33U	POC #3	INSIDE	OUTSIDE	POC #3	RT		
Girth Seam	JS	JS I	FZ I		Spot		
MK 1-3 to 1-3	BA	NS I	GG I	Lead SA	JM		
Shell to Shell CS	AD			QC AD	AD		
Weld LS 330	SLC #2	INSIDE	OUTSIDE	SLC #2	RI		
Long Seam	BS	RC II	RC II		100%		
MK 1-3	50			Lead RK			
Shell	DG	NODE		QC DG	SD		
Weld GS 330/380	SLC #2			POC #3	RI		
Girth Seam	RS	FZ III	FZ III		Spot		
MK 1-3 to 1-2	DC			Lead SA	JIM		
	DG				AD		
				SLC #2	KI 1000/		
Long Seam	BS	RC II	RC II	Lood DK	100%		
WIK 1-2 Shall	DC			Lead RK	6D		
					3D DT		
Cirth Soom	SLC #2			FOC #3	Spot		
MK 1-2 to 1-2	ко	JF 111		Lood SA	Spor		
Sholl to Sholl	DC	FZ 111	Γ <u>ζ</u> ΙΙΙ				
	SIC #2	INSIDE			RT		
	BC			5LC #2	100%		
MK 1-2	00			Lead RK	100 /8		
Shell	DG				.sn		
Weld GS 3611/3411	SI C #2	INSIDE	OUTSIDE	POC #3	RT		
Girth Seam	RS	JF III	JF III	1 00 #0	Spot		
MK 1-2 to 1-3		<b>.</b>		Lead SA	.IM		
Shell to Shell	DG						
Weld LS 34U	SI C #2	INSIDE	OUTSIDE	SI C #2	RT		
Long Seam	BS	RC II	RC II		100%		
MK 1-3	-•			Lead RK			
Shell	DG			QC DG	SD		

#### Page 2 of 6

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

		WELD		I				
DESCRIPTION		DROCE		VIE				VDE
DESCRIPTION	FII-UP	PROCEL		VI50			ACCEPT/I	TPE
Weld GS 34U/HD	SLC #2	INSIDE	OUTSIDE		POC #3	RI		
Girth Seam	CC	FZ III	J⊢ III			Spot		
MK 1-3 to 1-1			FZ III	Lead	SA	JM		
Shell to Head	DG			QC	AD	AD		
Nozzle N1	SLC #2	INSIDE	OUTSIDE		SLC #2			
RFWN to Pipe	JW	JW IV	JW IV					
1D-9 to 1D-2				Lead	RK			
	DG			00	DG			
Nozzle N1	POC #3	INSIDE		<u></u>	POC #3			
Pine to Shell	100 10	NS I			100 110			
	10	110 1	JS 1	Lood	54			
10-9101-2	40			Leau	JA AD			
	AD			QC	AD			
Nozzie N1	POC #3		OUTSIDE		POC #3			
Pipe to Repad	JS		NF I					
1D-9 to 1D-14				Lead	SA			
	AD			QC	AD			
Nozzle N1	POC #3	INSIDE	OUTSIDE		POC #3		POC #3	
Repad to Shell	JS	CD I	JS I				Air Test	
1D-14 to 1-2		NS I		l ead	SA			
				00				
Nozzlo N1	POC #2			Q0			AD	
					FUC #3			
		CD IX		I	<b>.</b>			
1G-4 to 1D-9	BA			Lead	SA			
	AD			QC	AD			
Nozzle N2	SLC #2	INSIDE	OUTSIDE		SLC #2			
RFWN to Pipe	JW	JW IV	JW IV					
1D-9 to 1D-2				Lead	RK			
	DG			QC	DG			
Nozzle N2	SI C #2	INSIDE	OUTSIDE		SI C #2			
Pine to Shell	RS	SW/	SW I		010 1			
	PK		000	Lood	РИ			
10-9101-3		JE I		Leau				
	DG			QC	DG			
Nozzie N2	SLC #2		OUTSIDE		SLC #2			
Pipe to Repad	RS		SW I					
1D-9 to 1D-14	RK			Lead	RK			
	DG			QC	DG			
Nozzle N2	SLC #2		OUTSIDE		SLC #2		SLC #2	
Repad to Shell	RS		JE I				Air Test	
1D-14 to 1-3				Lead	RK			
	DG			20	DG		DG	
Nozzle N3	POC #3	INSIDE	OUTSIDE	~~	POC #3		20	
RELWN to Shell	100 10				100 110			
	55		35 1	Lood	54			
10-7 10 1-3	40			Leau	SA			
	AD			QC	AD			
Nozzle N4	POC #3	INSIDE	OUTSIDE		POC #3			
RFLWN to Shell	JS	CD I	JS I					
1D-7 to 1-3				Lead	SA			
	AD			QC	AD			
Nozzle N6	POC #3	INSIDE	OUTSIDE		POC #3			
RFLWN to Shell	BA	JF I	JS I					
1D-5 to 1-3		-	NF I	l ead	SA			
	AD			00	AD			
Nozzle NZ	POC #3	INSIDE		<b>Q</b> O	POC #3			
	100 #3				100 #3			
RFLWIN to Shell	ВА	JF I	JS 1	I	<b>.</b>			
10-3 to 1-3				Lead	SA			
	AD			QC	AD			
Nozzle N8	SLC #2	INSIDE	OUTSIDE	1	SLC #2			
RFLWN to Shell	CC	JE I	RS I	1				
1D-3 to 1-2	SW			Lead	RK			
	DG			QC	DG			
Nozzle N9A	SI C #2	INSIDE	OUTSIDE	1	SI C #2			
RELWN to Shell	CC	SW I	RS I	1	520 //2			
	00 01M				PK			
10-5101-3	500			Lead	KK DC			
	DG	I	I	QC	DG		I	

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

		WELD		1							
DESCRIPTION				VICI							
DESCRIPTION	FII-UP	PROCEL		150		NDE	ACCEP1/1	TPE			
Nozzie N9B	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFLWN to Shell	CC	JE I	RS I								
1D-5 to 1-3	SW			Lead	RK						
	DG			QC	DG						
Nozzle N9B	SLC #2		OUTSIDE		SLC #2						
Pipe to RFI WN	RK		JW I								
			000	Lood	РK						
10-11 10 10-5	50			Leau							
	DG			QC	DG						
Nozzle N10	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFLWN to Shell	RK	JE I	SW I								
1D-3 to 1-3				Lead	RK						
	DG			QC	DG						
Nozzle N10	SI C #2		OUTSIDE		SI C #2						
Plate to RFI W/N	SW/		SW/		010 #2						
	500		500 1		DIZ						
ID-16 to 1D-3				Lead	RK						
	DG			QC	DG						
Nozzle N10	SLC #2		OUTSIDE		SLC #2						
Plate to RFLWN	SW		SW I								
1D-17 to 1D-3				Lead	RK						
	DG			00	DG						
Nozzlo NI11				QO							
	SLC #2		DOTSIDE		SLC #2						
Coupling to Head	RS	RS I	RS I								
1D-8 to 1-1				Lead	RK						
	DG			QC	DG						
Nozzle N12	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFI WN to Head	RS	RS I	RS I								
1D-4 to 1-1	ne -	1.0		Lood	PK						
10-4 10 1-1	DC										
	DG	NIGIPE		QC	DG						
Nozzle N13	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFWN to Pipe	JW	JW IV	JW IV								
1D-1 to 1D-12				Lead	RK						
	DG			QC	DG						
Nozzle N13	SI C #2	INSIDE	OUTSIDE		SI C #2						
Pine to Shell	RS	IF	RS I		010 1						
				Lood	DИ						
10-12 10 1-2	RK	5VV I		Leau	RN						
	DG		SW I	QC	DG						
Nozzle N13	SLC #2		OUTSIDE		SLC #2						
Pipe to Repad	RS		RS I								
1D-12 to 1D-13	RK		CC I	Lead	RK						
	DG		SW I	QC	DG						
Nozzle N13	SI C #2		OUTSIDE		SI C #2		SI C #2				
Repad to Shell	RS RS		RS I		010 #2		Air Test				
				Lood	DИ		All Test				
10-13 10 1-2	300			Leau	RN						
	DG		SVV I	QC	DG		DG				
Boot	SLC #2	INSIDE	OUTSIDE		SLC #2						
Long Seam	BS	JW IV	JW IV								
MK# 1H-2				Lead	RK						
	DG			QC	DG						
Boot	SI C #2	INSIDE	OUTSIDE		SI C #2						
					010 #2						
	500	JVV III	300 11		DI						
1H-1 to 1H-2				Lead	RK Do						
	DG			QC	DG						
Boot	SLC #2	INSIDE	OUTSIDE		SLC #2						
Plate to Head	JW	JW IV	JW III								
1H-2 to 1H-3				Lead	RK						
	DG			QC	DG						
	POC #3	INSIDE		~~	POC #3						
	100 #3		Ne		100#3						
KELWIN to Shell	12		II GN	I	<u> </u>						
1D-7 to 1-2				Lead	SA						
	AD			QC	AD						
Nozzle N15A	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFWN to Pipe	RK	JW VI	JW VI								
1D-6 to 1D-10				lead	RK						
	DC				DC						
	DG				DG						

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

		WELD						
DESCRIPTION	FIT-LID			VISUAI	ACCEPT			VDE
	SLC #2			SIC	2 #2	NDL		
Dino to Sholl				SEC	5 #2			
	NO NO	500 1	JL I	Lood	ΡV			
10-10 10 1-2	DC			Leau				
Norris N45D					DG			
	SLC #2			SLC	, #∠			
	ĸĸ	JVV IV	JVV IV		DI/			
1H-5 to 1H-2	50			Lead	RK			
N 1 N450	DG	NODE		QC	DG			
NOZZIE N15C	SLC #2	INSIDE	OUTSIDE	SLC	, #Z			
RFLWN to Boot	RK	JVV IV	JVV IV		DI/			
1H-5 to 1H-2				Lead	RK			
	DG			QC	DG			
Nozzle N16	SLC #2	INSIDE	OUTSIDE	SLC	5 #2			
RFWN to Pipe	JW	JVV III	JW III					
1H-4 to 1H-6				Lead	RK			
	DG			QC	DG			
Nozzle N16	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
Pipe to Pipe	JW	JW III	JW III					
1H-6 to 1H-7				Lead	RK			
	DG			QC	DG			
Nozzle N16	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
Pipe to Boot	JW	KE IV	KE IV					
1H-6 to 1H-2				Lead	RK			
	DG			QC	DG			
Nozzle N17A	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
RFLWN to Boot	RK	KE IV	KE IV					
1H-5 to 1H-2				Lead	RK			
	DG			QC	DG			
Nozzle N17B	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
RFLWN to Boot	RK	KE IV	JW IV					
1H-5 to 1H-2				Lead	RK			
	DG			QC	DG			
Nozzle N18	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
RFLWN to Head	RK	JW IV	JW IV					
1H-5 to 1H-3	KE			Lead	RK			
	DG			QC	DG			
Nozzle M1	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
RFWN to Pipe	JW	JW III	JW III					
1C-1 to 1C-13				Lead	RK			
	DG			QC	DG			
Nozzle M1	SLC #2	INSIDE	OUTSIDE	SLC	C #2			
Pipe to Head	JW	JE I	JE I					
1C-13 to 1-1	JE			Lead	RK			
	DG			QC	DG			
Nozzle M1	SLC #2		OUTSIDE	SLC	C #2			
Pipe to Repad	JE		JE I					
1C-13 to 1C-14	JE			Lead	RK			
	DG			QC	DG		01.0.40	
Nozzie M1	SLC #2		OUTSIDE	SLC	5#2		SLC #2	
Repad to Head	JE		JE I		DI/		Air Test	
10-14 to 1-1	JE			Lead	RK DO		50	
Na la M4	DG				DG		DG	
	PUC #3			POU	J #3			
Plate to REVVIN	JB		JB I	11	<b>.</b>			
10-01010-1								
					AD 7 #2			
				P00	J #J			
	JD			Lood	<b>6</b> 1			
10-01010-1								
Nozzlo M1					~ #2			
Plate to Blind	F UC #3			FU	5 #5			
$1C_{-1}$ to $1C_{-2}$ v2	50			beal	S۵			
10-41010-2 XZ								
		I .	1	30				

#### Page 5 of 6

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

WELDER ID &												
DESCRIPTI			PROCE		VIEI							
			FRUCEL		130		NDE	ACCEPT/T	IFE			
Rod to Plind		FOC #3				F 00 #3						
		JD		JD I	Lood	54						
10-01010-2												
Nozzlo	MO				QU							
DEW/N to Dino	VIZ					SLC #2						
		377	Jvv III	300 111	Lood	DИ						
13-1 10 13-13		DC			Leau							
Nozzlo	MO				QU							
Dipo to Sholl	VIZ	FUC #3		NS I		FUC #3						
1   12 to 1 2		13		113 1	Lood	54						
13-13 10 1-3												
Nozzlo	MO				QU							
Dipo to Dopod	VIZ	FUC #3				FUC #3						
		13			Lood	64						
13-13 10 13-14												
Nozzlo	MO				QU			DOC #2				
NOZZIE I Depend to Chall	IVIZ	PUC #3		OUTSIDE		PUC #3						
		12		JS I	اممط	C 4		Air rest				
1J-14 to 1-3					Lead	SA						
Norria	MO	AD			QC	AD		AD				
	IVIZ	PUC #3		OUTSIDE		POC #3						
Plate to REWIN		JB		JB I	1	0.4						
1J-5 to 1J-1					Lead	SA						
	10	AD			QC	AD						
Nozzie	W2	POC #3		OUTSIDE		POC #3						
Plate to RFWN		JB		JB I								
1J-6 to 1J-1					Lead	SA						
		AD			QC	AD						
Nozzle I	M2	POC #3		OUTSIDE		POC #3						
Plate to Blind		JB		JB								
1J-4 to 1J-2					Lead	SA						
		AD			QC	AD						
Nozzle	M2	POC #3		OUTSIDE		POC #3						
Rod to Blind		JB		JB I								
1J-8 to 1J-3					Lead	SA						
		AD			QC	AD						
Nozzle I	M3	SLC #2	INSIDE	OUTSIDE		SLC #2						
RFWN to Pipe		JW	JVV III	JVV III								
1J-1 to 1J-13					Lead	RK						
		DG			QC	DG						
Nozzle I	M3	SLC #2	INSIDE	OUTSIDE		SLC #2						
Pipe to Shell		RS	SW I	RS I								
1J-13 to 1-3		50		SW I	Lead	RK						
		DG			QC	DG						
Nozzle I	M3	SLC #2		OUTSIDE		SLC #2						
Pipe to Repad		RS		SW I		DI/						
1J-13 to 1J-14		50			Lead	RK						
		DG			QC	DG						
Nozzle I	M3	SLC #2		OUTSIDE		SLC #2		SLC #2				
Repad to Shell		RS		SW I				Air Test				
1J-14 to 1-3				RS I	Lead	RK						
		DG			QC	DG		DG				
Nozzle	МЗ	POC #3		OUTSIDE		POC #3						
Plate to RFWN		JB		JB I								
1J-5 to 1J-1		45			Lead	SA						
		AD			QC	AD						
Nozzie	M3	POC #3		OUTSIDE	1	POC #3						
Plate to RFWN		JB		JB I	l.	<b>.</b>						
1J-6 to 1J-1					Lead	SA						
		AD			QC	AD						
Nozzle I	M3	POC #3		OUTSIDE	1	POC #3						
Plate to Blind		JB		JB I								
1J-4 to 1J-2					Lead	SA						
		AD			QC	AD						

#### Page 6 of 6

#### EATON METAL PRODUCTS COMPANY LLC IN-PROCESS INSPECTION RECORD AND WELD MAP DESCRIPTION

JOB NUMBER 5361-1 VESSEL SERIAL NUMBER

WELDER ID &													
DESCRIPTION	FIT-UP	PROCEDURE KEY V		VISUAL ACCEPT	NDE ACCEPT/TYPE								
Nozzle M3	POC #3		OUTSIDE	POC #3									
Rod to Blind	JB		JB I										
1.J-8 to 1.J-2			•	Lead SA									
	AD			OC AD									
Internals Weir Plate	SI C #2		OUTSIDE	SI C #2									
Plate to Shell	JW		CC I	010									
1F-3 to 1-2	••••		RS I	Lead RK									
	DG		110										
Internals Vane Pack	SI C #2		OUTSIDE	SIC #2									
Plate to Shell	.IW			010									
1F-1 to 1-2	011		RP I	Lead RK									
	DG												
Internals Plate	POC #3		OUTSIDE	POC #3									
Plate to Shell	BA			100 #0									
1F-1 to 1-2	2,1		NS IX	Lead SA									
11 1 10 1 2	AD												
Internals Plate	POC #3		OUTSIDE	POC #3									
Plate to Shell	RA RA			100 //0									
1F-3 to 1-2	Bitt		NS IX	Lead SA									
11 0 10 1 2	AD												
Internals Plate	POC #3			POC #3									
Plate to Shell	RΔ			100#3									
1F-4 to 1-2	DA			Lead SA									
11 4 10 1 2	AD												
Internals Plate	POC #3			POC #3									
Plate to Shell	RA RA			100 //0									
$1G_{-7}$ to $1_{-2}G_{-3}$ v2	DA			A2 beal									
10-7 10 1-2-3 12	AD												
Internals Plate	POC #3			POC #3									
Plate to Shell	RA RA			100 //0									
1G-8 to 1-3 x2	DA			Lead SA									
10-0101-5 2	AD												
Internals Plate	POC #3			POC #3									
Plate to Shell	RA RA			100 //0									
1G-9 to 1-3 x2	Bitt			Lead SA									
	AD												
Internals Plate	POC #3		OUTSIDE	POC #3									
Plate to Shell	RA RA		GG IX	100 //0									
1G-10 to 1-3	2,1		00 //	Lead SA									
	AD												
Name Plate	POC #3		OUTSIDE	POC #3									
Plate to Head	.15			100 //0									
1-4 to 1-1	00		00 1	Lead SA									
	AD												
Saddle Pad	POC #3		OUTSIDE	POC #3									
Plate to Shell	.IS			1 00 #0									
1B-8 to 1-2				Lead SA									
Left	AD												
Saddle Pad	POC #3	INSIDE	OUTSIDE	POC #3									
Plate to Shell				1 00 #0									
1B-8 to 1-2				Lead SA									
Right	AD												
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1		~~ //									

I = P1-P1-GMAWP-AL

II = P1-P1-EM14KT-A

III = P1-P1-EM14K1-A

IV = P1-P1-EM14K2-A V= P1-P1-FCAW-AL WELD PROCEDURE KEY:

VI = P1-P1-GTAW-AL

VII = P1-P1-GMAWP-STT-A VIII = P1-P8-FCAW-AL

IX= P1-P8-GMAWP-A

X= P1-P8-GTAW-AL

XI = P8-P8-GMAWP-A XII = P8-P8-GTAW-AL XIII= P8-P8-SMAW-A XIV= XV=





Eaton Metal Prod	ucts CC	), LLC	Date:	5-213-19	M T W (îh	}FSSu	Page / of 4						
Daily Coating Insp	ection R	eport	Job #:	5361-1		Attachments							
Customer:		()	mopeotor				The presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence of the presence o						
Location:	Pocatello.	ID		2000									
Description:	132" ID In	let Slug Ca.											
Requirements:	See paint	sheet	·	Summary and a state of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second sec	1								
Contractor:	Airless		Spec. #	5361-PS1									
	Notes			Hold P	oint Inspect	ions Perfor	med						
SSPC-SP5 White Meta	Blast(Gree	en Diamond	Media)	☐ 1. Pre Surface Prep/Condition & Cleanliness									
	and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se		¹ 2. Surface Preparation Monitoring									
Finish Coat: 15:0-30.0	mils (INTE	RIOR COA	TING)	3. Post surface Preparation/Cleanliness & Profile									
Sherwin-Williams Nova-	Plate UHS	Epoxy Novo	olac Tank	<b>1</b> 4 Pre Application F	heo/Surface(	leanliness							
Lining			Carlow. Second Malaning	5 Application Moni	toring A A A A Bin	n Thickness (	<b>\</b> ለ <b>F</b> T)						
- Light-Grav			<u>9-82-</u>	f O Deet Andiantian	(Annelise time D								
	7.1 LA.			JX 6. Post Application	Application L	aeas	Í						
40 mil MAX DET in area	s that have	been stripe	coated	7. Post Cure/Dry Fi	lm Thickness	(DFT)							
57PC 10 10	MARTELS	1 West		🛛 🎵 8. Nonconformano	e/corrective Ac	tions Follow4	up						
Dr. N.A.	ID MILC			🗍 🎵 9. Holiday Testing I	Per 1.5.5 of AF	C Spec.							
S Here in wi	LINA	MAGRANA	VIO EDY	10. Final Inspection									
CAr's had c	A1400 .		<u> </u>	Approved By:	2 Marine	4							
		NA STATE	Ambie	ont Conditions			a state a state						
Time (am or pm)		5130	An										
Dry Bulb Temp [°] (C/F) or Ar	nbient	109.8	-										
Wet Bulb Temp [°] (C/F)		53)											
% Relative Humidity		21-9	7										
Surface Temp ^e (C/F) Mi	n/Max												
Dew Point Temp [°] (C/F)		368											
Wind Direction / Speed	(mph)	W-15	mph	mph		mph	mph						
Weather Conditions	<u> </u>	210	444										
La Creative de State de Tr	estex Tape		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Start Time Finish	Time	Est. Sq/ft.							
7				∏ Primer ∏ Intermed	iate _Г То	pooat _	Г Tauch-up						
Vestex PRI	ESS-O-FILM	ν™ HT	1	Generic Type:		ty Mixed:	3050la						
Contra -	1.	X-Coarse		Manuf .: Sffred we	lla_ A	lix Ratio:	101						
20 C 33 (C+XC)/	2, XC	38 to 115 µm		Prod. Name: Mauro	wyy wyk N	lix Method:	Drill						
08 15	25	115 µm		Prod. #: 358 04	00 5	Strain/Screer	n: 60 most.						
		4.5 ma		Color: Carlsbad	mon The N	Aaterial Tem	p: 741 °F						
	SS-O-FILN	/ ^w lur		Kit Sz/Cond.: 10 60	ι 5	Sweat-in Tim	e 3.o. M/in/Hrs						
X X		X-Coarse		Shelf Life 24 me.	F	Pot Life:	Y∠ Min/HDs						
20 C (C+XC)/		1.5 to 4.5 mil 38 to 115 µm		Batch #'s	CORE R	Reducer #:	NH						
08 13	25 XC	Made In USA 115 µm		(A) XM 0729CM	C	ty Added:	M-Pt/Qt/Gal						
		45 m3		(B) VM 27280834	7826 9	6 by Vol:	N %						
Vestex Pl	RESS-O-FI	LM™ ⊌r	1	(C)	S	pecific WFT	Avg: 10 14Mils						
5 22	i í	X-Coarse		Reducer:	A	chieved WF	TAvg: 1014Mils						
1 20 C 31 (C+X	3/2	1.5 to 4.5 mil 38 to 115 µm		Airless/Conv. Spray	🗂 Brus	h j	- Roller						
08 15	2.5	C Made In USA 115 µm	1	T. Other	·								
-		45 mā	1										
Average Pro	ofile in mils	: <u> </u>	mils	Air Cleanliness Che	dk l⊼C	il Seperator (	Check						
Surface Cleanline	ss & Profil	e Measurer	nent	,									
SSPO/NACE-SP-	6			🞼 Filter Check / Repla	се ГА	gitator Check	k						
				1									
F SSPC/NACE Spec/M	s Stds:			PSI (A) 3700									
•	_			PSI (B)									
「 Specified	_ mils avo./A	chieved	mils			×	1316						
				((	¥		1017						
	· · · · · ·		· · ·	Painter's S	ignature		Date						
					On -								
				J. 11 Jourson 5:13.19									
Customer's Inspecto	or / Represe	entative	Date	Inspector's	s Signature		Date						

·····	PARTY									*******		1			1	the second second second second second second second second second second second second second second second s		
Eaton	Eaton Metal Products CO, LLC								Date: 5 · 17	Ì.	1	M)r v	V Th F	S Su	Page	201	<u> </u>	
DET MO	as	ure	ment	Work	sheet	•			Job #:		536	51-1	man and a cost		777. XXX			
		ui v	ment		JIICOL		****		Description	):	132	" ID Inle	et Slug	Ca.		Contraction of the second second second second second second second second second second second second second s		
Customer	:	AN	ADARK	0					Inspector: Jake Mowat									
Location:		Poo	catello,	ID														
Contracto	r:	Airl	ess						Spec.#		536	1-PS1						
Item:									Item:								0	
		$\overline{\}$			Spot F	eading	s							Spot R	eading	S	L. COMPACTION AND AND AND AND AND AND AND AND AND AN	
Location:		Area	1	2	3	Total	% Min	Avg.	Location:		Area	1	2	3	Total	% Min	Avg.	
		A	7.7	84	93	25.4	4.0	8.4	1	0	A	8.4	10.1	83	26.8	4.0	8.9	
	0	в	8.0	5.7	TO	2.5.7	4.0	2.5		0	В	59	9.2	8.7	26.8	4.0	89	
	0	С	6.1	58	F>	17.6	4.0	5.8	1	0	С	8.6	9.9	84	27.8	4.0	9.2	
	0	D	5-5	64	5.6	20.3	4.0	67		0	D	8.1	\$ 7	5.4	76.2	4.0	8.7	
	0	E	53	8.4	52	15.9	4.0	86		0	E	83	10.2	8.8	273	4.0	9.1	
Approx.			in trayers		3600	114.9	1.9 20	126	Approx.				Sec.	3600	1249		89	
Sa/Ft		Spec	ified DF1	5-10	mils/um	Total DF	T 5-10	mils/um	Sa/Ft		Spec	ified DFT	5-10	mils/um	Total DF	T 5-10	mils/um	
Reference	Ins	spec	tion Rei	port Pa	ae#	l otar of		into pro	Reference	Ins	nec	tion Rer	ort Pa	1e#	Tiotal Bi	1 0 10	inite/pin	
Item:		1			901			$\wedge$	Item:								$\cap$	
	_		Т		Spot P	oodinaa	· · · · · · · · · · · · · · · · · · ·			-				Spot P	oodinaa	·		
Location		Ą			Spor A	T	<b>,</b>	I	Location		Ą			Sporn	l	, 		
		ea	1	2	3	Total	% Min	Avg.		_	ea	1	2	3	Total	% Min	Avg.	
	0	A	10.0	7.9	78	24.3	4.0	8.1		0	A	64	8.0	8.4	22.4	4.0	<u>d.&lt;</u>	
	0	В	10.2	9.3	9.1	286	4.0	9.5		0	B	8.2	76	8.1	23.9	4.0	79	
	0	<u>C</u>	8:0	9.4	9.4	24.8	4.0	8.9		0	С	7.0	7.3	8.0	22.3	4.0	7.4	
	0	D	8.3	27	8.0	21	4.0	80		0	D	10.6	8.7	7.3	28.6	4.0	9.5	
	0	Е	7.4	53	6.1	21.8	4.0	7:2		0	E	9-1	9.4	59	27.4	4.0	8.1	
Approx.		लेख <u></u>			3600	1275		8.5	Approx.					3600	121.6		8-1	
Sq/Ft	1	Spec	ified DFT	5-10	mils/µm	Total DF	T 5-10	mils/µm	Sq/Ft	ſ	Spec	ified DFT	5-10 r	nils/µm	Total DF	T 5-10	mils/µm	
Reference	Ins	pect	tion Rep	ort Pa	ge#				Reference I	ns	pect	ion Rep	ort Pag	je#				
Item:								0	Item:						ann a fhainn an an ann an Annaichean		0	
					Spot R	eadings		-			Spot Readings							
Location:		Are		-					Location:									
	0	ŭ ^	1	2	3	Total	% Min	Avg.		_	۵ŭ ۸	1	2	3	Total	% Min	Avg.	
			67	60	/ 7	207	4.0	0.0		2	<u>-</u>	5.4	70	0.1	200	4.0	0.0	
		2	8.0	81	7.2	26.7	4.0	<u>××</u>		치		3.0	3.0	8.1	6.6.5	4.0	2.5	
	~	Š-	101	20	52	011	4.0	82		허	<u> </u>		3.7	1 e	15.1	4.0	(a. (	
	쉬		6.0	6.7 5.1		14	4.0	12.10		싉		64	6.7	6/	20.0	4.0	0.6	
Anneal	-0		8.0	5-1	3.7	245	4.0	8.0			n de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de la compañía de l	¥-1	5.9	2000	23.T	4.U	3.7	
Approx.	Ŀ		n Be Jung Kalang		3000	11514		1.1	Approx.	H				3000	1(2,8		1.5	
Sq/Ft	-	Speci	ified DFT	5-10 I	nils/µm	Total DF	I 5-10	mils/µm	Sq/Ft		Speci	fied DFT	<u>5-10 n</u>	niis/µm [	Total DF	<u> </u>	mils/µm	
Reference	Ins	pect	ion Rep	οπ Ρα	je#				Reference II	ns	pecti	on Rep	on Pag	e#				
	j. gerst	ðs þó	DFT G	AGE C	ALIBR/	ATION I	RECOR	(D 100 100 100 100 100 100 100 100 100 10		2	Com	ments:						
Gage Type Model		Gaę	ge S/N	Plate Shim mils	BMR	Adjust +/-	Spec. Avg DFT	DFT Last Coat	DFT This Coat	+								
Positete Geous		635019 80 017					5.17.17											
												Qontr	actor's	Signate	ure	Date		
										/	N	V.	J	<u>,</u>	5.17.1	9		
Cus	tom	ier's	Inspect	tor / Re	presen	tative	Date			Îr	ISDe	ctor's S	ignatur	<u>е</u>	Date	f		
0.00									/				0.000		- 4.14			

Eaton Metal Prod	lucts CC	). LLC	Date:	5-6-11	M T W (Th)F	S Su	Page 3 of 4						
Daily Coating Insp	ection R	enort	Job #:	5361-1	Attachments								
Customer			Inspector:	Jake Mowat		🕅 DFT Sheet							
	ANADARI						Í TNOR						
Description:	122" ID In	ID lot Shia Co					۲ <u> </u>						
Pequiremente:	Soo point	choot				- 1017							
Contractor:	Airloss	Sileet	Spec #	5361-PS1									
Contractor.	Notes		opec. #	Hold Point Inspections Performed									
SSPC-SP6 Commercial	Riast Clea	ning	5. 	1 Pre Surface Pren/Conclition & Clearliness									
		ging		2 Surface Prenara	tion Monitoring								
Primer Coat: 5.0 - 10.0	mils			S 3. Post surface Preparation/Cleanliness & Profile									
Sherwin-Williams Macro	poxy 646	Fast Cure Er	DOXV	1 P 4 Pre Application Pren/9 rface Cleanlinese									
Carlsbad Canyon Tan	Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and Cardina and	2-00000000000000		5 Application Monitoring Add Ellen Thickness AAET									
53PC 5 white	mertal	Black	2000/07/W.	1 6 Post Andication	(Application Data								
Nova date	uHS.	TPUYY NO	unlate										
lining		,		7. Post Cure/DryH	im Ihideness (D	FI)							
light GrAy				☐ 8. Nonconformance	e/corrective Adia	ns Follow4	a,						
• / • /			-	反 9. Holiday Testing I	Per 1.5.5 of APC	Spec.							
40 mil MAY	DFt M	arons th	s.t.	🕅 10. Final Inspection	-10	0							
have be	en. 5	trip con	tel	Approved By:	L'Manso	S. A.							
	in the second second second second second second second second second second second second second second second	1. 1. E. 1. K. N. H	Ambie	nt Conditions		Next of a co	한 이 가지 않는 것을						
Time (am or pm)		4:20		,	· · · · · · · · · · · · · · · · · · ·								
Dry Bulb Temp ^e (C/F) or An	nbient	75.3											
Vvet Bulb Temp* (C/F)		55.2	-	Denomena									
% Relative Humidity		26.5											
Dow Point Tomp [®] (C/F)	Wiax	300											
Wind Direction / Speed /	(mph)	38.2	mph	he mph		nh	mph						
Weather Conditions		110.00	Inpie or 1	-orcan Inpri		ipii	прп						
	stex Tape			Start Time Finish	Time Es	st Sa/ft							
Tester PBF	55.0.FILM			Primer Intermedi	iate <b>F</b> Topoo	oat	T Touch-up						
www.testextape.com		X-Coarse		Generic Type:	Qtv	Mixed:	45 sal						
2.10.	•	1.5 to 4.5 m³ 38 to 115 μm		Manuf .: Streepin willing: Mix Ratio: 4701									
20 j C 33 (C+XC)/2	et XC	Mada in USA 115 µm	ľ	Prod. Name: Novae	plante with Mix	Method:	Drill						
08, 13	25	.4.5 m∄ j		Prod. #: Bb 219220 Strain/Screen: (00 Mesh									
				Color: Ist frag Material Temp: 75.4 °F									
Testex PRE	SS-O-FILM			Kit Sz/Cond.: 555	, Swe	eat-in Time	30 100/Hrs						
www.testextape.com		1.5 to 4.5 mil	Ŀ	Shelf Life 24 mo	Pot	Life:	/ Min/Ars						
c (c+xc)/3	2 à XC	Made In USA 115 µm	F	Batch #'s	Rec	lucer #: 🔨	- A						
	2.5	45 mil		(A) XM0589 1 A Qty Added: NM PUQUGal									
estex PRESS	5-0-FII М »	( 1) m		(B) XM 0749 ZM	™%b	y Vol:	<u>~v+ %</u>						
× [™]		X-Coarse			Spe		AVG: Mils						
20 C 12 (C+XC)/2		1.5 to 4.5 mi 38 to 115 um	H			leved vvr	TAVG. A PERMIS						
1 _{0.6} 1.5 25		Made in USA 115 µm		[X::Airless/Conv. Spray	, F Brush	Г	Roller						
	<u> </u>	4.5 mil		T Other:									
Average Pro	file in mils:		mils										
Surface Cleanlines	s & Profil	e Measuren	nent	C Air Cleanliness Chec	* pools	Seperator (	Jheck						
	- Les	h to mes		77 Filter Check / Reda	∽e l⊽ Adita	ator Check	·						
1	<b>)</b> 67.	11- 11-	<u>- p</u>		<i>y y</i>		-						
T SSPO/NACE Spec/Ms	s Stats:		Ĩ	PSI (A) 13,800									
			[F	PSI (B)									
Specified:	_ mils avg./A	chieved	mils										
_				767									
	18 L.S. 19		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 19	Painter's Signature Date									
					14.	Λ							
Quality	10				f Mour		5/-19						
Customer's Inspecto	r / Represe	entative	Date	Inspector's	Signature		Date						
				$\mathcal{V}$									
							· · · · · · · · · · · · · · · · · · ·						

<b></b>												1	and an international states of the second				
Eaton	Eaton Metal Products CO, LLC										11	M T V	<u>V Th F</u>	S Su	Page	4 01	64
DET MAN	 6.6.1.1.		 6 \A/a	المعاد	فممط				Job #: 5361-1								
	asur	emen	τννο	rksi	neet				Description	<b>n</b> :	132	" ID Inl	et Slug	Ca,			
Customer:	A	NADAF	RO		eraanteener or aandered efter Too				Inspector: Jake Mowat								
Location:	P	ocatello	, ID														
Contractor	: A	irless	-						Spec.#		536	1-PS1					
Item:				8000.000	5 . 10 . 10 . 10 . 10 . 10 . 10 . 10 . 1		an an an an an an an an an an an an an a		Item:	*****	I		na na ann an Saidheadh				0
	<u> </u>			S	Spot R	eading	s							Spot R	eading	s	
Location:				2	3	Total	% Mir	Avg.	Location:		Area	1	2	3	Total	% Min	Avg.
	Ā	17.	7 15	5	KA. D	48.9	12 0	163		0	A	110.7	17.9	215	66.4	12.0	18.8
	08	110.	2 14	8	10-7	46.8	12.0	1.56		<u> </u>	B	144	17.0	18.9	ta.5	12.0	14.6
		15	4 10	N I	16 8	49.3	12.0	11.4		ň	c	20.1	11.10	11.5-	537	12.0	177
		10	2 15	7	151	15.4	12.0	15.1		0	ň	154	14.2	15.5	45.6	12.0	11.7
		10.	7 15	-	15-1	<u>4) (</u>	12.0	147		<u>_</u>	F	17:0	146	15-5-	17	12.0	10:0
Approx			/ /->	· · ·	3400	71/	12.0	15-10	Approx		<b>–</b> 75.23		119.2	3400	4/1	12.0	1317
Sa/Et		onified F	ET 46 2	<u> </u>	ile/um	727 /	T 16 26	$\frac{1}{1} \frac{1}{2} \frac{\varphi}{\varphi}$	So/Et		Crock		16.96		Tatal DE	T 45 25	1 (O, S
Reference	Inene	ection F	enort	Dane Dane	ութ,իսս ∞#	TOTALDI	1 10-00	mis/µn	Reference	Inc	spec	tion Rei	ort Da	nnis/µnn ro#	Total Dr	1 10-35	mis/µm
Itom	liispe	souon r	epon	ay				0	litom		speci	uonine	υπτα	30#		H	0
					not D	oodinad		0	item.					Creek D.	oodinge		
Location	≥	?			pol R	eaungs	5 		Locations		≥			Spotri	eadings	; [	
	ea	1	2		3	Total	% Min	Avg.	Location.		ea	1	2	3	Total	% Min	Avg.
	<u>0 A</u>	17.1	17.	2 /	8.4	53.4	12.0	17.8		0	Α	140	15.6	14.4	44.5	12.0	14.8
	0 B	18.	7 16	61	15.3	50.2	12.0	16.7		0	B	15:3	15.5	16.0	47.2	12.0	15.7
	0 C	15-1	14	1_2	15.6	43.4	12.0	14.6		0	С	16 5	16:1	17.0	50. L	12.0	147
	0 D	15.	7 110	7 /	17.7	503	12.0	14.7		0	D	16.3	15.4	15.9	47.6	12.0	15.8
	0 E	15	115	7 1	15.6	44.9	12.0	15:6		0	E	14.7	147	14.9	44.3	12.0	177
Approx.	`-		일은 박	글리는	3400	2446		163	Approx.		2,73		집중이	3400	133.8		15.5
Sq/Ft	Sp	ecified D	FT 15-3	5 mi	ils/µm	Total DF	T 15-35	mils/µm	Sq/Ft		Spec	ified DFT	15-35 r	nils/µm	Total DF	T 15-35	mils/µm
Reference	Inspe	ction R	eport l	Page	e#				Reference Inspection Report Page#								
Item:			1999 Barry State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of S			<u></u>		0	Item: 0								
		Spot Readings									Spot Readings						
Location:	Area	1	2		3	Total	% Min	Avg.	Location:		Area	1	2	3	Total	% Min	Avg.
	0 A	15.0	15	40	179	48.5	12.0	16)		0	A	26.1	20.4	19.4	105.9	12.0	219
	0 B	71. 4	17.	نہ ما	24.1	1031	12.0	21		0	В	12.7	15-9	163	499	12.0	16.60
	0 C	15:6	16	11	19.8	51.5	12.0	17.1		0	С	15.5	15.0	169	47.8	12.0	159
	0 D	17.7	20.	4 2	21.6	59.7	12.0	19.9		0	D	17.9	18.4	17.3	5-3.4	12.0	17.8
	0 E	19.6	14	0 1	7.3	15.9	12.0	مز کار		0	ε	19.00	19.9	20.5	59.8	12.0	199
Approx.	1				3400	378:7		18.5	Approx.		1			3400	277	L STAT	18.4
Sa/Ft	Spe	cified D	T 15-3	mil	ls/um	Total DF	T 15-35	mils/um	Sa/Ft		Speci	fied DFT	15-35 n	nils/um	Total DF	T 15-35	mils/um
Reference I	nspe	ction R	eport F	ade	#				Reference I	ns	pecti	on Rep	ort Pag	e#	,		
	in in	DFT	GAGE	CAL	IBRA		RECOR	SD See		6	Com	ments:					
0			Plat	ə			Spec.	DFT		() I	2011					-	
Gage Type Model	G	age S/N	Shin	1 E	BMR	Adjust +/-	Avg DFT	Last Coat	Coat	┢							
Positern	6	35619	14.0	0	1.79						(	Contr	actor's	Signatu	5 - 2 ure	5-1° Date	<u>)</u>
									X. Mourt								
Custo	omer	's Inspe	ctor /	Repr	resent	ative_	Date			Ir	ispe	ctor's §	ignature	9	Date		