MISSISSIPPI POWER COMPANY

KEMPER COUNTY IGCC PROJECT

CONTRACT NO.: 17352

TAG NO.: CLCW HX, SPARE UNIT

SPX MATERIAL NO.: G2010000818

APV PLATE HEAT EXCHANGERS

SPX/APV MODEL: S280 M-14

SPX FLOW TECHNOLOGY SYSTEMS, INC.
1200 W. ASH STREET
GOLDSBORO, NC 27530
UNITED STATES
TEL 888 . 278 . 4321
www.spxft.com

AN SPX BRAND

Southern Company Generation **Kemper County**
MM218132 0 Unit 1

APV NORTH AMERICA PO: MPC17352-0001
1000818 DATABOOK Rev: NA
IGCC - MULTIPAGE - DOCUMENTATION PACKAGE FOR G2010000818 - TAG NO

TABLE OF CONTENTS

MANUFACTURING RECORD BOOK

SECTION

SPX FLOW TECHNOLOGY SYSTEMS, INC.

1200 W. ASH STREET

GOLDSBORO, NC 27530

UNITED STATES

TEL 888 . 278 . 4321

www.spxft.com

Quality Record

APV AN SPX BRAND

Approved

MATERIALS OF CONSTRUCTION

ITEM NO.	DESCRIPTION	MATERIAL
1	HEAD	SA516 GR70
2	FOLLOWER	SA516 GR70
3	END SUPPORT	A36
4	TOP BAR	A36 W/ 304 S.S. COVER
5	BOTTOM BAR	A36 W/ 304 S.S. COVER
6	M48 DIA. TIE BAR	SA193 GRB7
7	TIE BAR HEX NUTS	SA194 GR2H
8	HEAT TRANSFER PLATES	SB265 GR.1
9	STUDS	SA193 GRB7 ZINC PLATED
10	LINERS	SB265 GR. 2
11	GROUNDING LUG – HEAD	SA36
12	GROUNDING LUG – E.S.	SA36

APV
AN SPX BRAND
PARAFLOW ™

CERTIFIED BY
APV PRODUCTS, HEAT TRANSFER-GOLDSBORO
1200 W ASH ST., GOLDSBORO, NC 27533, USA
TEL. (919) 735-4570 FAX. (919) 581-1167

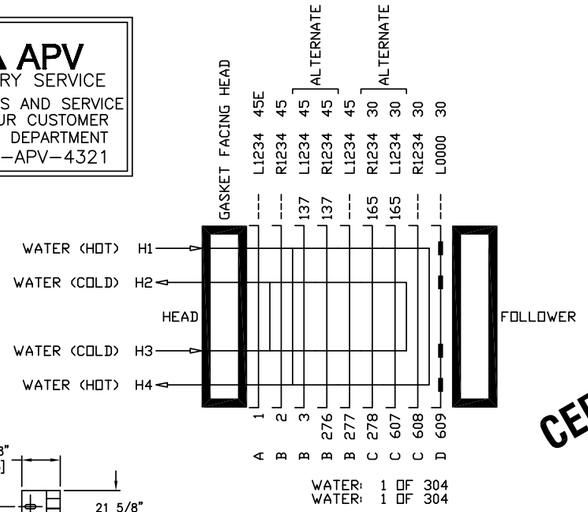
MODEL & YEAR	S280 M-14	2012	
SERIAL No.	G2010000818		
DRAWING No.	1000818		
MAX. ALLOWABLE WORKING PRESSURE			
CHAMBER 1	H1&H4	175 PSIG	AT 150°F
CHAMBER 2	H2&H3	175 PSIG	AT 150°F
MIN. DESIGN METAL TEMPERATURE			
CHAMBER 1	H1&H4	-20°F	AT 175 PSIG
CHAMBER 2	H2&H3	-20°F	AT 175 PSIG
TEST PRESSURE	263 PSIG	263 PSIG	
OPERATING TEMP: MAX/MIN	150 / 5°F		
PLATAGE DIM (L): MAX/MIN	107 7/8 / 105 1/2 IN		
PLATAGE DIM BASED ON: QTY/THK	609 / 0.6MM		

IMPORTANT:
APV Instruction Manual must be strictly observed during installation and operation of the equipment.

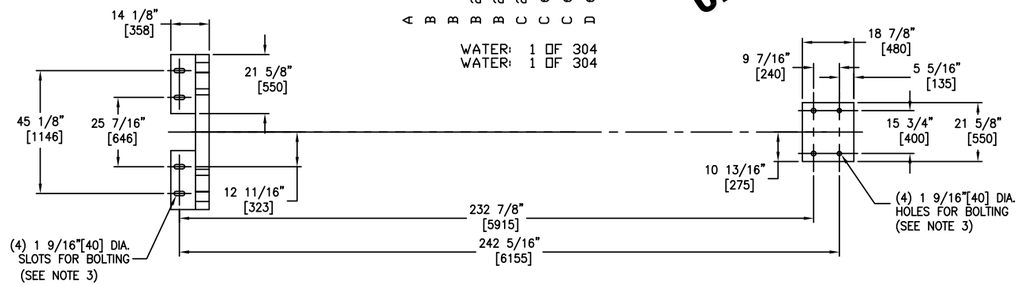
ASME Section VIII, Div. 1, 2007 Edition, 2009 Add.
Contract No.: 17352
Purchaser Equipment No.: TBA
Empty Weight: 37697 LBS.

FOR PARTS, SERVICE AND AFTER MARKET ASSISTANCE
CALL 1-888-APV-4321

APV
FACTORY SERVICE
FOR PARTS AND SERVICE
CALL OUR CUSTOMER
SERVICE DEPARTMENT
1–888–APV–4321



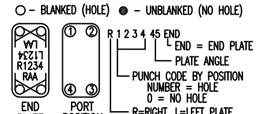
CERTIFIED FINAL



PLATES MUST BE ARRANGED ALTERNATELY LEFT AND RIGHT. FOR CONVENIENCE ON THIS DRAWING, WHERE BLOCKS OF R1234 AND L1234 PLATES OCCUR, THE TOTAL NUMBER OF EACH IS GIVEN.

PLATE IDENTIFICATION
VIEWED FROM GASKETED SIDE OF PLATE

○ – BLANKED (HOLE) ● – UNBLANKED (NO HOLE)



NOTES

1. THE INSTALLATION, OPERATION AND MAINTENANCE OF THIS HEAT EXCHANGER SHALL BE IN ACCORDANCE WITH THE APV PARAFLOW PLATE HEAT EXCHANGER INSTRUCTION MANUAL.
2. THIS MODEL HEAT EXCHANGER IS TIGHTENED USING A WRENCH ON THE TIE BAR HEX NUTS AT THE HEAD AND FOLLOWER ENDS. CLEAN AND LUBRICATE THE THREADS BEFORE OPENING OR CLOSING USING A LUBRICANT COMPATIBLE WITH CARBON STEEL. **APV RECOMMENDS NEVER-SEEZ REGULAR GRADE.** **DO NOT USE COMMON GREASE.** THE PLATE PACK IS TO BE TIGHTENED IN ACCORDANCE WITH THE INSTRUCTION MANUAL SUPPLIED. DO NOT TIGHTEN BELOW THE MINIMUM DIMENSION SHOWN.
3. THE CUSTOMER IS RESPONSIBLE FOR PROVIDING:
   – ANCHOR BOLTS PER ASTM A36 MINIMUM WITH A RECOMMENDED DIAMETER OF 1 3/8".
   – PROTECTION AGAINST START UP OR OPERATING PRESSURES EXCEEDING THE MAXIMUM ALLOWABLE WORKING PRESSURE.
   – PIPING TO THE FOLLOWER OR CONNECTOR GRIDS THAT ALLOWS FOR FREE MOVEMENT WHEN THE UNIT IS OPENED FOR SERVICE AND PROVIDES FLEXIBILITY FOR THE VARIATION OF THE COMPRESSED PLATAGE DIMENSIONS.
4. LINED STUDDED PORTS ARE PROVIDED WITH A SMOOTH RAISED FACE FINISH, DESIGNED TO MATE WITH ANSI B16.5 CL150 FLANGES.
5. BOLT HOLES STRADDLE CENTERLINES SHOWN.
6. DIMENSIONS ARE SHOWN IN INCHES. DIMENSIONS IN BRACKETS [ ] ARE IN MILLIMETERS.
7. STANDARD TOLERANCES:
   FRAME AND FOUNDATION BOLT LOCATIONS: ±1/4 INCH [±6mm]
   NOZZLE CENTERLINE AND FACE DIMENSIONS: ±1/8 INCH [±3mm]

DESIGN SPECIFICATIONS

DESIGN CODE REF. CALC: 1000816–821 ASME	ASME SECTION VIII DIV 1 2007 EDITION, 2009 ADDENDA API 662
MAX. ALLOWABLE WORKING PRESSURE	175 PSIG.
MINIMUM DESIGN METAL TEMPERATURE	–20 °F. @ 175 PSIG.
HYDROTEST PRESSURE	263 PSIG.
MINIMUM OPERATING TEMPERATURE	5°F.
MAXIMUM OPERATING TEMPERATURE	150°F.
SERIAL NUMBER	G2010000818
HEAT TRANSFER AREA	18294.4 SQ.FT.
FRAME SIZE	No. 5
MAXIMUM FRAME CAPACITY	808 PLATES MAX.
DRY WEIGHT	37697 LBS.
FLOODED (OPERATING) WEIGHT	55190 LBS.
TOTAL LIQUID VOLUME	2089.8 GALS.
FINISH	SPECIAL PAINT
ACCESSORIES SUPPLIED	GROUNDING LUGS, TIE BAR SLEEVES
	SS SHROUD

OPERATING CONDITIONS

LIQUID	FLOW RATE	TEMP. °F.	ΔP(PSIG)
WATER (COLD)	8972733 lb/hr	86.0° → 110.3°	20.0
WATER (HOT)	8732706 lb/hr	119.0° → 94.0°	18.9

Plates (Total: 609)

Qty	Part Number	ID	Description
1	GSS24K4XTX6AMMXA	A	S280S (45) END 0.6 NIT PX HS (2 YEL)
276	GSS24F4XTX6AMMXA	B	S280S (45) FLOW 0.6 NIT PX HS (2 YEL)
331	GSS23F4XTX6AMMXA	C	S280S (30) FLOW 0.6 NIT PX HS (2 YEL)
1	GSS23F0XTX6AMMXA	D	S280S (30) FLOW 0.6 NIT PX HS (2 YEL)

Frame (Maximum: 813)

Qty	Part Number	Description
1	GB510393G1G1G1G1	Head
1	GB510394AXAXAXAX	Follower – punch code 0000
1	GB510391	S280 M–14/5 SPECIAL

Fitting

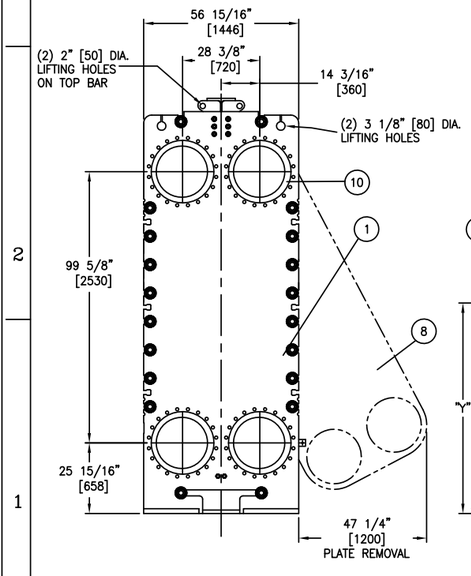
Qty	Part Number	Pos	Description
4	GB510395	H1,H2, H3,H4	NPS 20 Flange (Studded) Titanium Class 150 (Mates With) ANSI B16.5

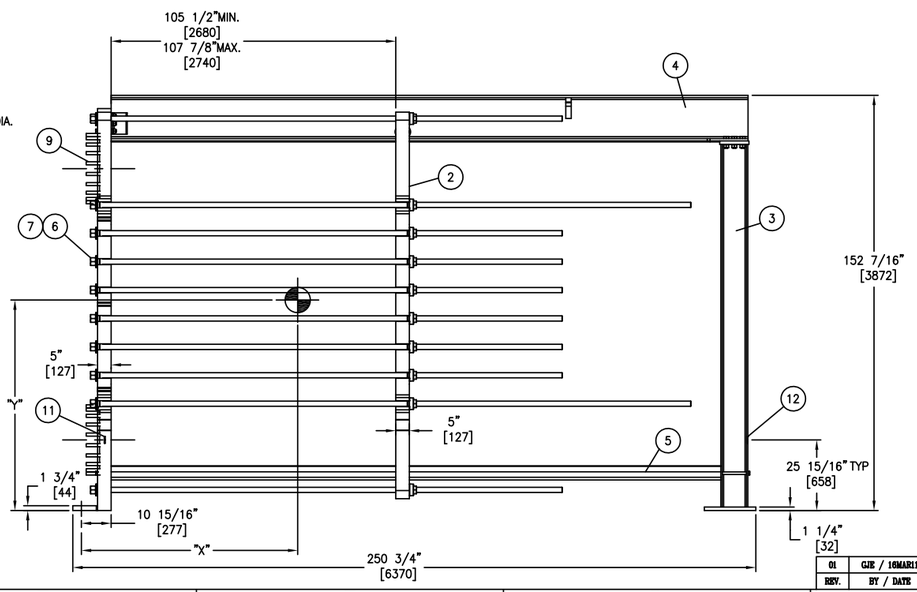
Accessories

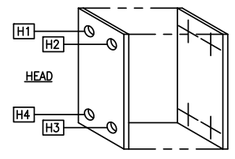
Qty	Part Number	Description
1	GASME U STAMP	ASME Inspection and U Stamp
2	GB510560	Grounding Lugs
1	GB510413	Shroud, S280 FS5 304SS
20	GB500636–M48	Tie Bars Sleeves
1	GSPEC–PAINT–3	3–Coat Paint procedure

CENTER OF GRAVITY

WEIGHT	X	Y
DRY	80.64	77.13
FLOODED	77.11	76.69







Mississippi Power Company – Kemper
County IGCC Project
Dekalb, MS
Tag: CLCW HX, Spare Unit
G2010000818

Contract No.: 17352

APV
AN SPX BRAND

SPX Flow Technology Systems,Inc.
1200 W. Ash Street
Goldsboro, NC 27530
Tel: (919) 735-4570
Fax: (919) 581-1134

Description: S280 M–14 SPECIAL PLATE HEAT EXCHANGER

Checked: Date:	Supersedes:	Scale:	Sheet:
		N.T.S.	1 OF 1

Approved: Date:	Drawn: Date:	Drawing No.:	Rev.
	GJE 1FEB11	1000818	01

CAD File: 1000818 A AUTOCAD

REV.	BY / DATE	CK. BY / DATE	DESCRIPTION AND LOCATION
01	GJE / 16MAR11	CK. BY / DATE	ADDED DIMS. ON H.S. FOOT & NOTE 3 REFERENCE PER CUST. COMMENTS

Quality Record

Approved

Kemper County MM218132

SPX	Document Title: Certificate of Conformance APV Order Number: G2010000816-821 Customer: Mississippi Power Company Customer Contract No.: 17352	ISSUE: 00 DATE: 25Oct12 BY: GJE Page 1 of1

SPX Flow Technology Systems, Inc.
PH: (919) 735-4570 FX: (919) 581-1134

Certificate Of Conformance

Customer: Mississippi Power Company
Customer Contract No: 17352
Location: Dekalb, MS
Project: Kemper County IGCC Project

Material #	Model #	Tag #
G2010000816	S280 M-14	CLCW HX, Operating Unit 1
G2010000817	S280 M-14	CLCW HX, Operating Unit 2
G2010000818	S280 M-14	CLCW HX, Spare Unit
G2010000819	S280 M-14	CLCW HX, Operating Unit 3
G2010000820	S280 M-14	CLCW HX, Operating Unit 5
G2010000821	S280 M-14	CLCW HX, Operating Unit 4

This is to certify that the following Plate Heat Exchangers comply with the purchase order and were built to ASME Section VIII, Division 1 2007 Edition, 2009 Addenda using approved designs and materials.

Signed & Approved: Gregory Eckard Project Manager / Mechanical Engineer

Approved

PRESSURE VESSEL CALCULATIONS

FOR AN

APV PLATE HEAT EXCHANGER

IN ACCORDANCE WITH THE

ASME BOILER AND PRESSURE VESSEL CODE

SECTION VIII, DIVISION 1

2010 EDITION

HEAT EXCHANGER MODEL:	S280 MGS-14	
REFERENCE DRAWING NUMBER:	1000816-821	
DESIGN PRESSURE:	175.00	psi
TEST PRESSURE:	263.00	psi
MAXIMUM DESIGN TEMPERATURE:	150.00	F
MINIMUM DESIGN METAL TEMPERATURE:	-20.00	F

P.O. NO: 17352

TAG NO.:

CUSTOMER: Mississippi Power Company

LOCATION: Dekalb, MS

D Eckard

THE FOLLOWING PARAMETERS APPLY TO THIS HEAT EXCHANGER DESIGN:

P =	175.000	psi	DESIGN PRESSURE (UG-21, Appendix 3)
A =	5104.755	sq in	PRESSURE AREA
d =	47.677	inches	SHORT SPAN (fig. UG-34 sketch j)
D =	107.070	inches	LONG SPAN (UG-34b)
G =	473.543	inches	GASKET PERIMETER (Appendix 2-3)
Hg =	2.264	inches	GASKET MOMENT ARM (Appendix 2-3, table 2.5.2)
L =	339.536	inches	TIE BAR PERIMETER (UG-34b, Appendix 2-10)
C =	0.300		UG-34 d sketch j
b =	0.188	inches	Appendix 2-3, Table 2-5.2, figure (1a) or (1b)
m =	1.000		ELASTOMER 75A SHORE (Table 2-5.1, Appendix 2-3)
y =	200.000	psi	ELASTOMER 75A SHORE (Table 2-5.1, Appendix 2-3)

BOLT (TIE BAR) DESIGN

REFERENCE: APPENDIX 2 - MANDATORY

MATERIAL:	SA-193 GR B7		
Sa =	25000	psi	@ ATMOSPHERIC TEMPERATURE
Sb =	25000	psi	@ DESIGN TEMPERATURE

BOLT LOAD:

DESIGN CONDITIONS:	Wm1 = A*P+2b*G*m*P	Appendix 2-5, formula 1
GASKET SEATING:	Wm2 = b*G*y	Appendix 2-3 & 2-5 (formula 2)

NOTE: THE FORMULAS HAVE BEEN MODIFIED FOR NONCIRCULAR GASKETS

Wm1 =	924408.38	lbf
Wm2 =	17757.86	lbf

TOTAL BOLT AREA REQUIRED IS THE GREATER OF THE FOLLOWING (Appendix 2-3 & 2-5d):

DESIGN CONDITIONS:	Am1 = Wm1/Sb =	36.976	sq in
GASKET SEATING:	Am2 = Wm2/Sa =	0.710	sq in

TOTAL BOLT AREA SUPPLIED:

SIZE 1	M48 x 5	QTY (n1)	20
SIZE 2		QTY (n2)	0

BOLT TENSILE AREA (As) = 0.7854 * (D - 0.9382 * P) ^ 2
Note: D is the bolt diameter, P is the bolt pitch

TOTAL AREA (Ab) = As1 * n1 + As2 * n2 45.668 sq in

TOTAL BOLT AREA SUPPLIED (45.668 sq in) IS GREATER THAN REQUIRED (36.976 sq in)

UNPORTED SLAB THICKNESS

The head and follower covers are designed as noncircular flat plates attached with bolts causing an edge moment. The thickness of the covers without openings is determined in accordance with UG-34 - UNSTAYED FLAT HEADS AND COVERS.

SLAB MATERIAL: SA-516 GR 70

Sop =	20000	psi	@	150	F
CA =	0.000	inches	Corrosion Allowance		
E =	1		Joint Efficiency (no welded joints)		

THICKNESS "T1" REQUIRED AT OPERATING CONDITIONS

T1 = d*SQR[((Z*C*P/(Sop*E))+((6*W*Hg)/(Sop*E*L*d*d))] UG-34 Formula 5
Z = MINIMUM OF: 3.4-(2.4*d/D) OR 2.5 UG-34 Formula 4
W = Wm1 = A*P+2*b*G*m*P Appendix 2-5 Formula 3

Z =	2.331	
W =	924408.384	lbf

MINIMUM REQUIRED UNPORTED THICKNESS, INCLUDING CA T1 = 3.970 inches

THICKNESS "T2" REQUIRED DUE TO GASKET SEATING

T2 = d*SQR[((Z*C*P/(Sgs*E))+((6*Wgs*Hg)/(Sgs*E*L*d*d))]
P = 0 psig at gasket seating conditions
Wgs = ((Am+Ab)*Sa)/2 Appendix 2 - 5 Formula 4
Am = GREATER OF: Am1 = Wm1/Sb OR Am2 = Wm2/Sa (From page 2)

Am =	36.976	sq in
Sgs =	20000	psi
Wgs =	1033051.250	lbf

MINIMUM REQUIRED UNPORTED THICKNESS, INCLUDING CA T2 = 1.438 inches

MINIMUM REQUIRED UNPORTED THICKNESS, INCLUDING CA, @ OPERATING OR GASKET SEATING CONDITIONS

T = GREATER OF: T1 OR T2

T = 3.970 inches

REINFORCEMENT REQUIRED FOR PORTED SLABS

A finite element analysis calculation (using ALGOR's Linear Stress Analysis package, version 9.20) in accordance with U-2(g) has been performed to calculate the required port reinforcement thickness. This analysis is summarized in APV Publication 3392. The following equation has been derived from the results of this analysis.

TBPA =	6398.097	sq in	AREA ENCLOSED BY ALL TIE BARS
ATMIN =	3812.589	sq in	MAXIMUM AREA ENCLOSED BY SIDE TIE BARS LOCATED INSIDE VERTICAL PORT CENTERS
VTC =	10.433	inches	MAXIMUM VERTICAL SPAN OF SIDE TIE BARS LOCATED INSIDE VERTICAL PORT CENTERS
TBMD =	31.646	inches	MAXIMUM VERTICAL SPAN FROM TOP / BOTTOM END TIE BARS TO TOP / BOTTOM SIDE TIE BAR LOCATED INSIDE VERTICAL PORT CENTERS
A =	0.9348		CONSTANT VALUE FOR US UNITS

THICKNESS "T3" REQUIRED FOR PORT REINFORCEMENT

T3 = A*(P/Sop)^0.5*d^1.0066*[(TBPA/ATMIN)*(VTC/TBMD)]^0.0201

MINIMUM REQUIRED REINFORCED THICKNESS, INCLUDING CA T3 = 4.226 inches

MINIMUM THICKNESS "Tport" REQUIRED FOR PORTED SLABS

Tport = GREATER OF: T OR T3

Tport = 4.226 inches

LOADINGS

The slab thickness for this heat exchanger is based on the loadings is section UG-22(a), taking into consideration both the internal and external (full vacuum) pressures. UG-21 states that the pressure vessel shall be designed for at least the most severe condition of coincident pressure and temperature expected in normal operation. The internal pressure is used in this calculation since it creates the maximum differential pressure between the inside and outside of the vessel. Loadings in sections UG-22 (b) through (i) have been considered with no additional thickness required.

HYDROSTATIC TEST PRESSURE

REFERENCE: UG-99 STANDARD HYDROSTATIC TEST

LOWEST STRESS RATIO (LSR):	1		UG-99(b)
MINIMUM TEST PRESSURE = 1.5*MAWP*LSR =	263.00	psi	

(PER NOTE 33, MAWP MAY BE ASSUMED TO BE THE SAME AS THE DESIGN PRESSURE)

IMPACT TESTING

The slab material, at 5.0 inches nominal thickness, is supplied in the normalized condition. The slab material is thus classified by curve D in section UCS-66. The governing thickness for determining whether impact testing is required is 5.0 / 4 = 1.25 inches [UCS-66(a)(3)]. Using 1.25 inches as the minimum thickness, table UCS-66 indicates that impact testing is required for minimum temperatures less than -21.0 F. The tie bar material impact test exemption temperature is -55.0 F. Therefore, no impact testing is required for this frame since the minimum temperature is -20.0 F. (reference: UG-20, UG-84 & UCS-66)

DESIGN SUMMARY

DESIGN TEMPERATURE:	150.00	F
MINIMUM METAL DESIGN TEMPERATURE:	-20.00	F
MAXIMUM DESIGN PRESSURE:	175.00	psi
MINIMUM TEST PRESSURE:	263.00	psi
HEAD AND PORTED FOLLOWER:		
MINIMUM REQUIRED THICKNESS:	4.226	inches
UNPORTED FOLLOWER:		
MINIMUM REQUIRED THICKNESS:	3.970	inches
TIE BARS:		
REQUIRED TOTAL ROOT AREA:	36.976	sq in
SUPPLIED TOTAL ROOT AREA:	45.668	sq in

Material Test Report

AGI

Cert Number 11093
Test Reference
9/13/2012

SPX Flow Technology Systems Inc
1200 West Ash Street
Goldsboro, NC 27530

Issued from
AGI Inc. Steel Processing Div.
42720 State Route 7
Hannibal, OH 43931

Sold To: SPX Flow Technology Systems Inc, 1200 West Ash Street, Goldsboro, NC 27530
Ship To: SPX Flow Technology Systems Inc, 1200 West Ash Street, Goldsboro, NC 27530

Product Information

	Heat	Tag
HR Steel Plate A515 Gr70	456090-3-0401	405866ACCAA

Normalized
5.5" x Custom Shape

Conform To ASME-SA516 Gr70 r05 12/1/2005
ASTM-A516GR70N; >4 r10 10/1/2010
ASTM-A20 r10 10/1/2010

Chemical Composition

C	Mn	P	S	Si	Al	Cr	Ni
0.23	1.1	0.016	0.009	0.22	0.037	0.02	0.006
Cu	**Mo**	**Nb**	**Ti**	**V**			
0.018	<0.005	<0.002	0.002	<0.002			

Physical Tests

Tensile (T)	Yield (T)	Elongation in 2 (T)
76,000 PSI	48,000 PSI	29.9 %

Heat Treatment				Impact Tests						
Heat Trmt	Temp	Time	Cool Mthd	Impc	UM	Temp	D	Rslt 1	Rslt 2	Rslt 3
Normalize	1675 F	1:00 HRS	Air 70 F							

SC 2016748 / PO 4501217000 / PN GB510392 Rev 0

AGI by: Paul E Hommer
Paul Hommer, Quality Manager

Reviewed and Accepted to
ASME Sect. II
Edition: 2011a
By & Date: 9.14.12

VENDOR	AGI
PART #	GB5110393G1
P.O./DATE	4501217000
HEAT #	456090-3-0401
THICKNESS	5.5N / 5.0
INSPECTOR APP:	9.14.12
A.I. APPROVAL:	09.14.12
DESCRIPTION	S285 Head

G1 G1 G1

4.98 / 5.15

Quality Record

Approved

Material Test Report

AGI

Cert Number 9/12/2012
Test Reference 11722

SPX Flow Technology Systems Inc
1200 West Ash Street
Goldsboro, NC 27530

Issued from
AGI, Inc. - Steel Processing Divisi
12122 State Route 7
Hanneibal, OH 43931

Sold To: SPX Flow Technology Systems Inc, 1200 West Ash Street, Goldsboro, NC 27530
Ship To: SPX Flow Technology Systems Inc, 1200 West Ash Street, Goldsboro, NC 27530

Product Information

HR Steel Plate AS16 Gr70
Normalized
5.5" x Custom Shape

Heat 457734-4-0201

Tag 406323AAA

Conform To ASME-SA516 Gr70 r05 12/1/2005
ASTM-A516GR70N >4 r10 10/1/2010
ASTM-A20 r10 10/1/2010

Chemical Composition

C	Mn	P	S	Si	Al	Cr	Ni
0.21	1.1	0.013	0.014	0.19	0.035	0.021	<0.005

Cu	Mo	Nb	Ti	V
0.019	<0.005	<0.002	<0.002	<0.002

Physical Tests

Tensile (T)	Yield (T)	Elongation in 2 (T)
75,400 PSI	47,300 PSI	30.2 %

Heat Treatment				Impact Tests						
Heat Trmt	Temp	Time	Cool Mthd	Impc	UM	Temp	D	Rslt 1	Rslt 2	Rslt 3
Normalize	1675 F	1.15 HRS	Air 70 F							

SO 2016748 / PO 4501217000 / PN GB510394 REV 0

AGI by: Paul E. Hommer
Paul Hommer, Quality Manager

VENDOR	Calco Steel
PART #	GB510394
P.O./DATE	4501217000
HEAT #	457734-4-0201
THICKNESS	5.5" N/ 5.139"
INSPECTOR APP	9.17.12
A.I. APPROVAL:	9.17.12
DESCRIPTION	SA516 Follow

Reviewed and Accepted to
ASME Sect. II
Edition: 2011a
By & Date: 9.17.12

9/12/2012 04:05 PM 1

4.98 / 5.15

Quality Record

Approved

KEYSTONE * * * MATERIAL CERTIFICATION * * *

7621 Old Rockside Rd.
Cleveland, Ohio 44131

Threaded Products Division

Sold To: SPX FLOW TECHNOLOGY SYSTEMS
SPX SHARED SERVICES
2200 EAST DEVON AVE
DES PLAINES, ILLINOIS 60018

Order Date 9/12/12
Order No. 4501259940
Shipped Date 10/10/12
Invoice No. 68364-04

METRIC A 193 - B-7 ALLOY FULL THREAD STUDS - PLAIN

24 Pcs. M48 X 5.0 X 4400 MM

PART NO. GB510543 ID# 2I24ZM = HEAT# 8170224

MATERIAL DESCRIPTION

Weight	Size	Length	Shape	Grade	Type
19,254 LBS.	1.7560 / 1.7560	294.00	RND	B7	TGP

Heat No.	Order No.	Rec. Date	Code
8170224	020525	9/26/12	

SPECIFICATIONS

ASTM A193 GRADE B7 ASME SA193, GRADE B7 ASTM A434, CLASS BC

CHEMICALS

ELEMENTS:	C	MN	P	S	SI	CU	NI
AMOUNTS	0.4000	0.9200	0.0110	0.0340	0.2300	0.0900	0.0400

ELEMENTS:	CR	V	MO	SN	AL	CA	N
AMOUNTS	1.0100	0.0020	0.2100	0.0050	0.0230	0.0001	0.0102

MECHANICAL PROPERTIES

Tensile P.S.I.	Yield P.S.I.	Elong. %	Red. of Area %	Hard. BHN	Grain Size	Grain
139,100	123,700	20.0	64.0		6	

MELT SOURCE: REPUBLIC TECH
CASTING METHOD: BLOOM

MACRO TEST RESULT: OK
REDUCTION RATIO: 50.4:1

State of Ohio
County of Cuyahoga

Sworn to and subscribed before me
This____Day of_____20___

We certify the foregoing a true and accurate report as represented by our suppliers.

Lisa Jarosz
Sales & Q.A. Coordinator

KEYSTONE * * * MATERIAL CERTIFICATION * * *

Threaded Products Division

7621 Old Rockside Rd.
Cleveland, Ohio 44131

08/31/12

Sold To: SPX FLOW TECHNOLOGY SYSTEMS
SPX SHARED SERVICES
2200 EAST DEVON AVE
DES PLAINES, ILLINOIS 60018

Order Date 4/19/12
Order No. 4501213107
Shipped Date 8/31/12
Invoice No. 67990-02

METRIC A 193 - B-7 ALLOY FULL THREAD STUDS - PLAIN

11 Pcs. M48 X 5.0 X 5600 MM

PART NO. GB510549 ID# 2B20ZM = HEAT# 11922820

MATERIAL DESCRIPTION

Weight	Size	Length	Shape	Grade	Type
13,874 LBS.	1.7550 / 1.7550	240.00	RND	B7	

Heat No.	Order No.	Rec. Date	Code
11922820	0018698	2/24/12	

SPECIFICATIONS

ASTM A193, GRADE B7 ASME SA193, GRADE B7

CHEMICALS

Elements:	C	MN	P	S	SI	CR	MO	NI
Amounts	0.400	0.810	0.014	0.031	0.250	0.870	0.167	0.070

Elements:	V	CU	AL	NB	SN
Amounts	0.027	0.220	0.003	0.220	0.013

MECHANICAL PROPERTIES

Tensile P.S.I.	Yield P.S.I.	Elong. %	Red. of Area %	Hard. BHN	Grain Size	Grain
133,100	119,400	19.0	59.0	279	6	

MACRO TEST RESULT OK MELT SOURCE: GERDAU AMERISTEEL
COUNTRY OF ORIGIN: UNITED STATES OF AMERICA

Reviewed and Accepted to
ASME Sect. II
Edition: 2010/2011
By & Date: 9/7/12
09.17.12

State of Ohio
County of Cuyahoga

Sworn to and subscribed before me
This____Day of_____20___

We certify the foregoing a true and accurate report as represented by our suppliers.

Lisa Jarosz
Sales & Q.A. Coordinator

Quality Record

Approved

INSPECTION CERTIFICATE

KPF

FACTORY : 601 YONGTAN-DONG, CHUNGJU-CITY,
CHUNGCHEONGBUK-DO, KOREA 380-250
TEL : (043) 849 - 1114
FAX : (043) 849 - 1234

FIELD OF TESTING : MECHANICAL, CHEMICAL
LAB. ID. : 111983
CERT. NO. : 0982-01, 0882-02

STANDARD OF CERTIFIED : ISO 9001, ISO 14001, QS9000
CERT. NO. : AC-01899, EAC-03556, MC-01899

Certificate No. : J420060525059
P/O No. : NH065474
L/C No. : CAD-FASTENAL
Date Issued : 2006/05/25
Date Shipped : 2006/05/25
Date Tested : 2006/04/11
Date Manufactured : 2006/04/21
Specifications : ASTM A194/A194M - 04a

Customer : FASTENAL COMPANY PURCHASING
Description : GR.2H HEX 1D NUTS, ZP
Grade : GR.2H
Size : M48x5.0P
Marking : 2H,M48,KPF LOGO
Surface Condition : ZINC PLATING (WHITE)
Lot No. : F2H0597400
Q'ty Shipped : 839 PCS

1. Chemical Composition (%)

Heat No.		C x100	Si x100	Mn x100	P x1000	S x1000	Cr x100	Mo x100	Ni x100	B x10000	Cu x100	Ti x100	V x100	Al x1000	
Spec.	Min.	40													
	Max.		40	100	40	50									
603040090		46	23	62	13	2	1		1		1				

2. Macroetch Meet

Division	Surface Condition	Random Condition	Center Segregation	Spec. of Test Method
Spec.	S2	R2	C2	ASTM E381 -
Results	S2	R2	C2	
Tested By	K.R. LEE			

3. Mechanical Properties

Division		Hardness Surface	Hardness Core	Specimen Tensile: Yield Strength	Specimen Tensile: Tensile Strength	Specimen Tensile: Elongation	Specimen Tensile: Reduction of Area	Proof Load: Load	Proof Load: Elongation	Tensile Load	Sample Nut Hardness 540℃/24hr	Impact Test: Individual	Impact Test: Average	Bending Test	Bolt Retempering Hardness	Tap Wrench Fit Test	Decarburization Test By Hardness
		n = 2									n = 1						
Unit	Min.	HRB									HRB						
	Max.	HRC															
Spec.	Min.	95									79						
	Max.	35															
Results	1	HRC 29									HRC 26						
	2	28									26						
	3	28															
	4																
	5																
	6																
	7																
	8																
	9																
	10																
	Avg.																
Tested By		G.Y. HWANG									G.Y. HWANG						
Spec.of Test Method		ASTM A370 -									ASTM A370 -						

Reference : PART NO. : 0110451
ALL FASTENERS MEET THE REQUIREMENTS OF THE (FQA) AND RECORDS OF COMPLIANCE ARE ON FILE

This is to certify that the above results are true and correct in every details

IN-SUB CHOE
Chief of Quality Management Dept.

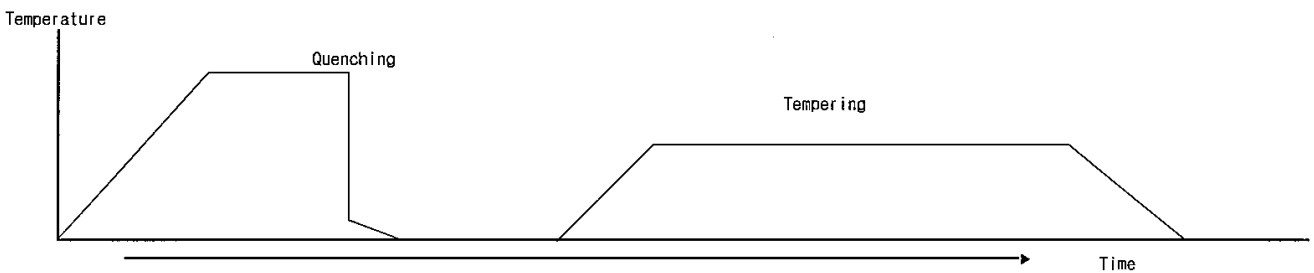
Certificate No. : J420060525059

4. Others

Division		Plate Thickness	Salt Spray Test	Decarburization Test By Microscope		Torque Tension Test		Prevailing Torque Test						Remark
				Partial Decarb. (Base Metal Height)	Gross Decarb. Depth.	Clamp Load	Tightening Torque	1st Install Prevailing Torque	Clamp Load	1st Rem.High't Prevailing Torque	1st Rem.Low't Prevailing Torque	5th Rem.High't Prevailing Torque	5th Rem.Low't Prevailing Torque	
Unit	Min.													
	Max.													
Spec.	Min.													
	Max.													
Results	1													
	2													
	3													
	4													
	5													
	6													
	7													
	8													
	9													
	10													
	Avg.													
Tested By														
Spec.of Test Method														

5. Heat Treatment

Quenching	Min. Temp.	
	Max. Temp.	
	Working Temp.	870 ℃
	Holding Time	30 min.
Tempering	Min. Temp.	455 ℃
	Working Temp.	480 ℃
	Holding Time	90 min.



This is to certify that the above results are true and correct in every details

NUCOR
NUCOR CORPORATION
NUCOR STEEL SOUTH CAROLINA

Mill Certification
5/15/2012

300 Steel Mill Road
DARLINGTON, SC 29540
(843) 393-5841
Fax: (843) 395-8701

Sold To: RYERSON PROCUREMENT CORP
PO BOX 91602
LUBBOCK, TX 79490-1602
(770) 368-4349
Fax: (770) 368-4228

Ship To: RYERSON TULL 09
300 GALLIMORE DAIRY RD
PO BOX 18448
GREENSBORO, NC 27419-0000
(336) 668-0031
Fax: (770) 368-4228

P/C 23707 9

Customer P.O.	M0900978	Sales Order	158018.1
Product Group	Merchant Bar Quality	Part Number	533752502403730
Grade	ASTM A36-08, A529-05, A709-09a GR36, ASME SA36-07 Ed 11 Ad	Lot #	DL1210255901
Size	3/8x2-1/2" Flat	Heat #	DL12102559
Product	3/8x2-1/2" Flat 20 A36/A529GR50	B.L. Number	C1-579435
Description	A36/A529GR50	Load Number	C1 262293
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.

C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Cb
0.20%	0.83%	0.016%	0.022%	0.14%	0.38%	0.10%	0.13%	0.030%	0.0050%	0.004%

Yield 1: 52,000psi (359MPa) Tensile 1: 77000psi (531MPa) Elongation: 27% in 8"(% in 203.3mm)
Yield 2: 52,000psi (359MPa) Tensile 2: 77000psi (531MPa) Elongation 26% in 8"(% in 203.3mm)

1. WELDING OR WELD REPAIR WAS NOT PERFORMED ON THIS MATERIAL
2. MELTED AND MANUFACTURED IN THE USA
3. MERCURY, RADIUM, OR ALPHA SOURCE MATERIALS IN ANY FORM HAVE NOT BEEN USED IN THE PRODUCTION OF THIS MATERIAL

VENDOR Ryerson
PART # GB510555
P.O. / DATE 4501240681 7/31/12
HEAT # DL12102559
DESCRIPTION Flat Bar

James H. Blew
Division Metallurgist

T2475 YXNC0796

Certificate No. 11-AGNS-1244 S

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464 Date APR. 3, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	11	A	0.600X 1254.0 X COIL.	1	1,360	12CS545	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe	Ti
	Min						BAL.
	Max	0.050	0.0050	0.06	0.030	0.10	
	1	0.002	0.0020	0.04	0.002	0.03	BAL.

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV	Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)				4.5	
Max							130		7.0	0.72
1	T	T	199	298	37		106		6.0	0.67
	T	L	166	314	52		106			0.53
	B	T	199	300	37		107		6.0	0.66
	B	L	172	309	51		107			0.56

Reviewed and Accepted to

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

T. Ikeda
Manager of Quality System Section

Heat Treatment ※7: ASME Sect. II
Edition: 2011
By & Date: SM 10/5/12
JS 10.09.12

We hereby certify that the above results are true and correct in every details.

Quality Record

Kemper County MM218132

Approved

T2475 YXNC0796

Certificate No. 11-AGNS-1244 Z

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' ㎜ ; space U ; up)	Quantity	Mass Kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	11	A 0.600X 1254.0 X COIL.	1	1,360	12CS545	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L. C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y: 1.0%offset Yield Strength
2 Y: 0.02%offset Yield Strength
3 Y: 0.1%offset Yield Strength
4 Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti				
Min													
Max		0.050	0.0050	0.06	0.030	0.10			BAL.				
1		0.002	0.0020	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	199	298	37		106			6.0	0.67
	T	L	166	314	52		106				0.53
	B	T	199	300	37		107			6.0	0.66
	B	L	172	309	51		107				0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

Quality Record

Approved

T2475 YXNC0796

Certificate No. 11-AGNS-1244 R

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	10	A	0.600X 1254.0 X COIL.	1	2,660	12CS545	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L. C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.002	0.0020	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	199	298	37		106			6.0	0.67
	T	L	166	314	52		106				0.53
	B	T	199	300	37		107			6.0	0.66
	B	L	172	309	51		107				0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2475 YXNC0796

Certificate No. 11-AGNS-1244 Y

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY, NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass Kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	10	A	0.600X 1254.0 X COIL.	1	2,660	12CS545	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.c	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.002	0.0020	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness Test HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	199	298	37		106			6.0	0.67
	T	L	166	314	52		106				0.53
	B	T	199	300	37		107			6.0	0.66
	B	L	172	309	51		107				0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2475

YXNC0796

Certificate No. 11-AGNS-1244 U

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type: ASTM B265 GRADE 1

Condition & Finish: 2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ ㎜ ; space U ; up)	Quantity	Mass Kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	13	A 0.600X 1254.0 X COIL.	1	1,695	12CS551	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti
Min									BAL.
Max		0.050	0.0050	0.06	0.030	0.10			
1		0.002	0.0020	0.04	0.002	0.03			BAL.

Tensile Test

	※4	※5	Yield Strength 0.2 %offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV		ASTM NO.	
Min			(1)	(1)	(1)				4.5	
Max							130		7.0	0.72
1	T	T	199	298	37		106		6.0	0.67
		L	166	314	52		106			0.53
	B	T	199	300	37		107		6.0	0.66
		L	172	309	51		107			0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2475

YXNC0796

Certificate No. 11-AGNS-1244 AB

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012.

34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass Kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	13	A 0.600X 1254.0 X COIL.	1	1,695	12CS551	D185115	GOOD

Notes ※1 Shape
A ; Coil

※2 L. C
L : Ladle
C : Check

※3 Element
CC : Cb+Ta+Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.002	0.0020	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test / ※6 GS / ※6 YT

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness Test HV		Bend Test		※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)						4.5	
Max							130				7.0	0.72
1	T	T	199	298	37		106				6.0	0.67
	T	L	166	314	52		106					0.53
	B	T	199	300	37		107				6.0	0.66
	B	L	172	309	51		107					0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.7 ,B:11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2474 YXNC0796

Certificate No. 11-AGNS-1244 W

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY, NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	15	A	0.600X 1254.0 X COIL.	1	3,415	12CS552	D185114	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb + Ta + Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min													
Max		0.050	0.0050	0.06	0.030	0.10			BAL.				
1		0.004	0.0021	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV		ASTM NO.	
Min			(1)	(1)	(1)				4.5	
Max							130		7.0	0.72
1	T	T	196	298	37		107		5.5	0.66
	T	L	169	307	54		107			0.55
	B	T	203	296	35		107		5.5	0.69
	B	L	176	304	52		107			0.58

Heat Treatment ※7

Reviewed and Accepted to
ASME Sect. II
Edition: 2011
By & Date: 10/5/12
10.09.12

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.4 ,B:11.3

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

Quality Record

T2474 YXNC0796

Certificate No. 11-AGNS-1244 AD

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	15	A 0.600X 1254.0 X COIL.	1	3,415	12CS552	D185114	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0021	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test			※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	196	298	37		107			5.5	0.66
	T	L	169	307	54		107				0.55
	B	T	203	296	35		107			5.5	0.69
	B	L	176	304	52		107				0.58

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.4 ,B:11.3

Witnessed by

Inspection Agency

Heat Treatment ※7

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2474 YXNC0796

Certificate No. 11-AGNS-1244 V

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	14	A	0.600X 1254.0 X COIL.	1	3,395	12CS552	D185114	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0021	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

		※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
				MPa	MPa	%	%	HV			ASTM NO.	
Min				(1)	(1)	(1)					4.5	
Max								130			7.0	0.72
1		T	T	196	298	37		107			5.5	0.66
		T	L	169	307	54		107				0.55
		B	T	203	296	35		107			5.5	0.69
		B	L	176	304	52		107				0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.4 ,B:11.3

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2474 YXNC0796
Certificate No. 11-AGNS-1244 AC

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	14	A 0.600X 1254.0 X COIL.	1	3,395	12CS552	D185114	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+Ta+Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti					
Min														
Max		0.050	0.0050	0.06	0.030	0.10			BAL.					
1		0.004	0.0021	0.04	0.002	0.03			BAL.					

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test		※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)						4.5	
Max							130				7.0	0.72
1	T	T	196	298	37		107				5.5	0.66
	T	L	169	307	54		107					0.55
	B	T	203	296	35		107				5.5	0.69
	B	L	176	304	52		107					0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.4 ,B:11.3

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

T2473

YXNC0796

Certificate No. 11-AGNS-1244 T

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464

Date APR. 3, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	12	A 0.600X 1254.0 X COIL.	1	3,000	12CS550	V155018	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
B : Bottom
H : Hard
M : Middle
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y: 1.0%offset Yield Strength
2 Y: 0.02%offset Yield Strength
3 Y: 0.1%offset Yield Strength
4 Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.002	0.0018	0.04	0.002	0.04			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test		※6 GS	※6 YT
			MPa	MPa	%	%	HV				ASTM NO.	
Min			(1)	(1)	(1)						4.5	
Max							130				7.0	0.72
1	T	T	201	296	35		106				5.5	0.68
	T	L	169	301	51		106					0.56
	B	T	204	299	34		108				5.5	0.68
	B	L	169	300	51		108					0.56

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.0 ,B:10.9

Witnessed by

Inspection Agency

T. Ikeda.
Manager of Quality System Section

Heat Treatment ※7

Reviewed and Accepted to
ASME Sect. II
Edition: 2011
By & Date: SW 10/5/12
JS 10.09.12

We hereby certify that the above results are true and correct in every details.

T2473

YXNC0796

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY
NIIGATA PREF.JAPAN

Certificate No. 11-AGNS-1244 AA

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	12	A 0.600X 1254.0 X COIL.	1	3,000	12CS550	V155018	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.002	0.0018	0.04	0.002	0.04			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	201	296	35		106			5.5	0.68
	T	L	169	301	51		106				0.56
	B	T	204	299	34		108			5.5	0.68
	B	L	169	300	51		108				0.56

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:11.0 ,B:10.9

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda

Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

T2472 YXNC0796
Certificate No. 11-AGNS-1244 X

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501154454

NAR STAINLESS STEEL
ST TITANIUM

Date AUG. 2, 2012

Specification & Type: ASME SB-265 2010ED. GRADE 1

Condition & Finish: 2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	9	A 0.500X 1254.0 X COIL.	1	2,165	1208504	V155017	GOOD

Chemical Composition in % ※3

※2 L.C		C	H	O	N	Fe			Ti			
	Min								BAL.			
	Max	0.050	0.0050	0.06	0.030	0.10						
	1	0.002	0.0021	0.04	0.002	0.03			BAL.			

Reviewed and Accepted to
ASME Sect. II
Edition: 2011
By & Date: SPX 10.17.12

※4 ※5	Tensile Test: Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6	※6
	MPa	MPa	%	%	HV		ASTM NO.	
Min	111	111	111				4.5	
Max					130		7.0	0.72
1 TT	214	296	45		104		5.0	0.72
TL	179	296	51		104			0.60
BT	213	298	35		106		5.5	0.71
BL	179	258	49		106			0.60

Notes ※1 Shape
A : Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
B : Bottom
H : Hard
M : Middle
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y: 1.0%offset Yield Strength
2 Y: 0.02%offset Yield Strength
3 Y: 0.1%offset Yield Strength
4 Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Remarks
SPEC.NO.3041-1 REV.15, SURFACE ROUGHNESS:GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S-T.S
*S 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min 390Max, 45Min
Certified According to PED 97/23/EC Annex I, Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen:10.5mm Min); T:11.5 ,5-11.7

Witnessed by

Inspection Agency

Heat Treatment ※7

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

T2472 YXNC0796
Certificate No. 11-AGNS-1244 0

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date APR. 3. 2012. 34

Specification & Type	ASTM B265 GRADE 1							Condition & Finish	2B				
No.	Case No.	※1	Shape & Size Unit inch ; " feet ; ' mm ; space U ; up					Quantity	Mass Kg T;Total	Inspection No.	Heat No.	Dimensional& Visual Examination	
1	9	A	0.600X 1254.0 X COIL					1	2,165	12CS504	V155017	GOOD	

Chemical Composition in % ※3

※2 L・C	C	H	O	N	Fe			Ti				
Min								BAL.				
Max	0.050	0.0050	0.06	0.030	0.10							
1	0.002	0.0021	0.04	0.002	0.03			BAL.				

	※4 ※5	Tensile Test Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6 GS	※6 YT
		MPa	MPa	%	%	HV		ASTM No.	
Min		(1)	(1)	(1)				4.5	
Max						130		7.0	0.72
1	MT	214	296	35		104		5.0	0.72
	TL	179	296	51		104			0.60
	BT	213	298	35		106		5.5	0.71
	BL	179	298	49		106			0.60

Heat Treatment ※7

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS:GOOD
(1) MECHANICAL PROPERTIES, YT, Y.S/T.S
*S 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-348Max, 240Min-410Max, 34Min
L : 155Min-330Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen:10.5mm Min.; T:11.5 ,B:11.7

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

Notes ※1 Shape
A : Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Approved

T2462 YXNC0795

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Certificate No. 11-AGNS-1244 K

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464

Date MAR. 12, 2012.

34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A	0.600X 1254.0 X COIL.	1	3,365	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L, C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in %

	※2 L・C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness Test HV	Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)				4.5	
Max							130		7.0	0.72
1	T	T	210	311	35		113		5.5	0.68
	T	L	181	311	50		113			0.58
	B	T	208	298	34		107		5.5	0.70
	B	L	178	307	52		107			0.58

Reviewed and Accepted to

Heat Treatment ※7

ASME Sect. II

Edition: 2011

By & Date: SHV 10/5/12
GS 10.09.12

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T2462 YXNC0795

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Certificate No. 11-AGNS-1244 K

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464 Date MAR. 12, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A 0.600X 1254.0 X COIL.	1	3,365	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L, C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Heat Treatment ※7

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 0

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464

Date MAR. 12, 2012.

34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	Shape & Size ※1 Unit inch ; " feet ; ' mm ; space U ; up	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A ; 0.600X 1254.0 X COIL.	1	3,365	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L. C
L : Ladle
C : Check

※3 Element
CC : Cb+Ta+Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L・C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test			Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV				ASTM NO.	
Min			(1)	(1)	(1)						4.5	
Max							130				7.0	0.72
1	T	T	210	311	35		113				5.5	0.68
	T	L	181	311	50		113					0.58
	B	T	208	298	34		107				5.5	0.70
	B	L	178	307	52		107					0.58

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

T. Ikeda

Manager of Quality System Section

Heat Treatment ※7

We hereby certify that the above results are true and correct in every details.

T1462 YXNC0795

Certificate No. 11-AGNS-1244 K

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A	0.600X 1254.0 X COIL.	1	3,365	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta + Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti					
Min														
Max		0.050	0.0050	0.06	0.030	0.10			BAL.					
1		0.004	0.0026	0.04	0.002	0.03			BAL.					

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area
			MPa	MPa	%	%
Min			(1)	(1)	(1)	
Max						
1	TT		210	311	35	
	TL		181	311	50	
	BT		208	298	34	
	BL		178	307	52	

Hardness Test	Bend Test	※6 GS	※6 YT
HV		ASTM NO.	
		4.5	
130		7.0	0.72
113		5.5	0.68
113			0.58
107		5.5	0.70
107			0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS,GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1, Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.

Manager of Quality System Section

T-#2

Certificate No. YXNC0795
11-AGNS-1244 0

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY
NIIGATA PREF.JAPAN

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12. 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1			Condition & Finish	2B			
No.	Case No.	※1	Shape & Size Unit inch ; " feet ; ' mm ; space U ; up	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A	0.600X 1254.0 X COIL.	1	3,365	12B5503	D144940	GOOD

Chemical Composition in % ※3

※2 L・C	C	H	O	N	Fe			Ti				
Min												
Max	0.050	0.0050	0.06	0.030	0.10			BAL.				
1	0.004	0.0026	0.04	0.002	0.03			BAL.				

	※4	※5	Tensile Test Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)						
Max										4.5	
1	T	T	210	311	35		130			7.0	0.72
	T	L	181	311	50		113			5.5	0.68
	B	T	208	298	34		113				0.58
	B	L	178	307	52		107			5.5	0.70
							107				0.58

Heat Treatment ※7

Notes ※1 Shape
A : Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS:GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1,
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda

Manager of Quality System Section

Approved

T2962 YXNC0795

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY, NIIGATA PREF,JAPAN

Certificate No. 11-AGNS-1244 O

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL ST TITANIUM

Date MAR. 12, 2012.

34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; ″ feet ; ′ am ; space U ; up)	Quantity	Mass Kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	7	A 0.600X 1254.0 X COIL.	1	3,365	12BS503	D144940	GOOD

Notes ※1 Shape
A : Coil

※2 L. C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y : 1.0%offset Yield Strength
2 Y : 0.02%offset Yield Strength
3 Y : 0.1%offset Yield Strength
4 Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti
Min									
Max		0.050	0.0050	0.06	0.030	0.10			BAL.
1		0.004	0.0026	0.04	0.002	0.03			BAL.

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness Test HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1. Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

Quality Record

Kemper County MM218132

Approved

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 J

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	6	A	0.600X 1254.0 X COIL.	1	3,375	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Tl
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L・C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Heat Treatment ※7

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 J

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	6	A	0.600X 1254.0 X COIL.	1	3,375	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER :Erichsen
FC :Ferrite Content
MP:Magnetic Permeability
NM:Non-Metallic Inclusion Test
GS :Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti
Min									BAL.
Max		0.050	0.0050	0.06	0.030	0.10			
1		0.004	0.0026	0.04	0.002	0.03			BAL.

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Heat Treatment ※7

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 N

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012.

34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	6	A 0.600X 1254.0 X COIL.	1	3,375	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+Ta+Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

YXNC0795

Certificate No. 11-AGNS-1244 J

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional& Visual Examination
1	6	A	0.600X 1254.0 X COIL.	1	3,375	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y: 1.0%offset Yield Strength
2 Y: 0.02%offset Yield Strength
3 Y: 0.1%offset Yield Strength
4 Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti					
Min									BAL.					
Max		0.050	0.0050	0.06	0.030	0.10								
1		0.004	0.0026	0.04	0.002	0.03			BAL.					

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test		※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)							
Max							130				4.5	
1	T	T	210	311	35		113				7.0	0.72
	T	L	181	311	50		113				5.5	0.68
	B	T	208	298	34		107					0.58
	B	L	178	307	52		107				5.5	0.70
												0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1, Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda

Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF.JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 N

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date MAR. 12, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1 Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass KG / T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	6	A 0.600X 1254.0 X COIL.	1	3,375	12BG503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+Ta+Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti					
Min														
Max		0.050	0.0050	0.06	0.030	0.10			BAL.					
1		0.004	0.0026	0.04	0.002	0.03			BAL.					

Tensile Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
		L	181	311	50		113				0.58
	B	T	206	298	34		107			5.5	0.70
		L	178	307	52		107				0.58

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1. Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 N

Customer SPX FLOW TECHNOLOGY DANMARK A/S

NAR STAINLESS STEEL
ST TITANIUM

P.O.No. 4501134464 Date MAR. 12, 2012. 34

Specification & Type	ASME SB-265 2010ED. GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; ″ feet ; ′ mm ; space U ; up)	Quantity	Mass kg T:Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	6	A	0.600X 1254.0 X COIL.	1	3,375	12BS503	D144940	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1 Y: 1.0%offset Yield Strength
2 Y: 0.02%offset Yield Strength
3 Y: 0.1%offset Yield Strength
4 Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV		Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	210	311	35		113			5.5	0.68
	T	L	181	311	50		113				0.58
	B	T	208	298	34		107			5.5	0.70
	B	L	178	307	52		107				0.58

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.4 ,B:12.2

Witnessed by

Inspection Agency

Heat Treatment ※7

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No. 2-12-1, MINATOCHO, JOETSU CITY, NIIGATA PREF, JAPAN

NAR STAINLESS STEEL
ST TITANIUM

Certificate No. TXH[illegible] 11 AGNE-1244 E

Customer [illegible] FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4511134404

Date FEB. 29, 2012 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	[illegible]

No.	Case No.	※1	Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass (kg, T;Total)	Inspection No.	Heat No.	Dimensional & Visual Examination
1	1	A	0.600X 1254.0 X COIL	1	2,345	12R5501	D144939	GOOD

Chemical Composition in % ※3

※2 L.C	C	H	O	N	Fe			Ti
Min								BAL
Max	0.050	0.0050	0.06	0.030	0.10			
L	0.003	0.0025	0.04	0.002	0.02			BAL

Reviewed and Accepted to
ASME Sect. II
Edition: 2011
By & Date: Sm 10/11/12 B 10.17.12

※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6 GS	※6 YT
		MPa	MPa	%	%	HV		ASTM NO.	
Min		[illegible]	[illegible]	[illegible]				4.5	
Max						120		7.0	0.72
T	T	212	303	35		112		5.5	0.65
T	L	181	311	50		117			0.50
B	T	203	287	35		107		5.5	0.70
B	L	178	316	51		107			0.56

Heat Treatment ※7

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-245Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1, Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen;10.5mm Min.; T;11.9 ,B;11.6

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

Notes ※1 Shape
A : Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
B : Bottom
H : Hard
M : Middle
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD
NAOETSU WORKS
ADDRESS : No. 2-12-1,MINATOCHO, JOETSU CITY, NIIGATA PREF.,JAPAN

NAR STAINLESS STEEL
ST TITANIUM

7XHC0795

Certificate No. 1[illegible]-AGNS-1249 A

Customer SEA FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134664

Date FEB. [illegible] 20[illegible]

Specification & Type	ASTM B265 GRADE 1				Condition & Finish	2P			
No.	Case No.	※1	Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass (kg, T;Total)	Inspection No.	Heat No.	Dimensional & Visual Examination	
1	1	A	0.600X 1254.0 X COIL	1	[illegible]	1BB5[illegible]	[illegible]44909	GOOD	

Chemical Composition in % ※3

	※2 L·C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.0500	0.0050	0.06	0.030	0.10							
1		0.0030	0.0025	0.04	0.002	0.02			BAL.				

	※4	※5	Tensile Test: Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test	Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV		ASTM NO.	
Min			1[illegible]	[illegible]	[illegible]				4.5	
Max							120		7.0	0.72
1	T	T	212	308	35		112		5.5	0.69
	T	L	185	318	50		112			0.59
	B	T	208	297	36		107		5.5	0.70
	B	L	176	306	51		107			0.58

Heat Treatment ※7

Notes
※1 Shape
A : COIL

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y: 1.0%offset Yield Strength
2Y: 0.02%offset Yield Strength
3Y: 0.1%offset Yield Strength
4Y: 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP: Magnetic Permeability
NM: Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Remarks
SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
1. MECHANICAL PROPERTIES. YT, Y S/T.S
[illegible] 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 167Min-248Max, 240Min-410Max, 24Min
L : 165Min-250Max, 260Min-390Max, 35Min
Certified According to PED 97/23/EC Annex I,
Section 1.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(0.5mm Min) : T.[illegible] [illegible]

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

Kemper County MM218132

Approved

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY, NIIGATA PREF,JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 C

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date FEB. 29, 2012.

34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	3	A	0.600X 1254.0 X COIL.	1	2,055	12BS502	D144938	GOOD

Notes ※1 Shape
A ; Coil

※2 L, C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top
M : Middle
B : Bottom
H : Hard
S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing
Q : Quenching
T : Tempering
S : Solution Treatment

Chemical Composition in %

	※2 L.C	C	H	O	N	Fe			Ti				
Min									BAL.				
Max		0.050	0.0050	0.06	0.030	0.10							
1		0.004	0.0026	0.04	0.002	0.03			BAL.				

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset	Tensile Strength	Elongation	Reduction of Area	Hardness Test		Bend Test	※6 GS	※6 YT
			MPa	MPa	%	%	HV			ASTM NO.	
Min			(1)	(1)	(1)					4.5	
Max							130			7.0	0.72
1	T	T	220	308	34		112			5.5	0.71
	T	L	185	310	49		112				0.60
	B	T	217	301	34		109			5.5	0.72
	B	L	184	305	49		109				0.60

Reviewed and Accepted to ASME Sect. II

Heat Treatment ※7

Edition: 2011

By & Date: SW 10/5/12
BS 10.09.12

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.3 ,B:12.4

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda
Manager of Quality System Section

T2449

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES,LTD.
NAOETSU WORKS
ADDRESS : No.2-12-1,MINATOCHO, JOETSU CITY,
NIIGATA PREF,JAPAN

YXNC0795
Certificate No. 11-AGNS-1244 D

Customer SPX FLOW TECHNOLOGY DANMARK A/S

P.O.No. 4501134464

NAR STAINLESS STEEL
ST TITANIUM

Date FEB. 29, 2012. 34

Specification & Type	ASTM B265 GRADE 1	Condition & Finish	2B

No.	Case No.	※1	Shape & Size (Unit inch ; " feet ; ' mm ; space U ; up)	Quantity	Mass kg T;Total	Inspection No.	Heat No.	Dimensional & Visual Examination
1	4	A	0.600X 1254.0 X COIL.	1	2,055	12BS502	D144938	GOOD

Notes ※1 Shape
A ; Coil

※2 L.C
L : Ladle
C : Check

※3 Element
CC : Cb+ Ta+ Ti
GG : Other Element Each
HH : Other Element Total
Remain : Remainder
Bal : Balance

※4 Position
T : Top M : Middle
B : Bottom
H : Hard S : Soft

※5 Direction
T : Transverse
L : Longitudinal

※6 Test Item
1Y : 1.0%offset Yield Strength
2Y : 0.02%offset Yield Strength
3Y : 0.1%offset Yield Strength
4Y : 0.01%offset Yield Strength
ER : Erichsen
FC : Ferrite Content
MP : Magnetic Permeability
NM : Non-Metallic Inclusion Test
GS : Grain Size

※7 Heat Treatment
A : Annealing Q : Quenching
T : Tempering S : Solution Treatment

Chemical Composition in % ※3

	※2 L.C	C	H	O	N	Fe			Ti
Min									BAL.
Max		0.050	0.0050	0.06	0.030	0.10			
1		0.004	0.0026	0.04	0.002	0.03			BAL.

Tensile Test / Hardness Test / Bend Test

	※4	※5	Yield Strength 0.2 % offset MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness HV	Bend Test	※6 GS ASTM NO.	※6 YT
Min			(1)	(1)	(1)					
Max							130		4.5	
1	T	T	220	308	34		112		7.0	0.72
	T	L	185	310	49		112		5.5	0.71
	B	T	217	301	34		109			0.60
	B	L	184	305	49		109		5.5	0.72
										0.60

Heat Treatment ※7

Remarks

SPEC.NO.0041-1 REV.15, SURFACE ROUGHNESS;GOOD
(1) MECHANICAL PROPERTIES, YT; Y.S/T.S
*5 0.2%Y.S(MPa) T.S(MPa) EL(%)
T : 165Min-248Max, 240Min-410Max, 34Min
L : 165Min-230Max, 240Min-390Max, 45Min
Certified According to PED 97/23/EC Annex 1.
Section 4.3 by TUV ANLAGENTECHNIK GmbH
Erichsen(10.5mm Min); T:12.3 ,B:12.4

Witnessed by

Inspection Agency

We hereby certify that the above results are true and correct in every details.

T. Ikeda.
Manager of Quality System Section

T2449

SURFACE PREPARATION & PAINT REPORT

Customer:	Mississippi Power Company
PO #:	17352
Tag No.:	See Table
Project:	Kemper County IGCC Project
Project No.:	
APV Material number:	See Table
Paint System:	3 - Coat
Primer Coat:	Carbozinc 8071
Intermediate Coat:	Carboguard 8922
Finish Coat:	Carbothane 8815
Paint Procedure:	1000816-821 PAINT

Customer Tag No.	SPX Material No.
CLCW HX, Unit 1	G2010000816
CLCW HX, Unit 2	G2010000817
CLCW HX, Unit 3	G2010000819
CLCW HX, Unit 4	G2010000821
CLCW HX, Unit 5	G2010000820
CLCW HX, Spare Unit	G2010000818

Condition	Start of Blasting	Start of Primer	Start of Intermediate Coat	Start of Top Coat
Time	7 am	10 am	1:00 pm	5 pm
Ambient Temperature (°F)	75.0	75.8	76.3	76.8
Relative Humidity (%)	63.8	58.7	64.6	60.7
Dew point Temperature (°F)	62.7	62.5	64.0	65.9
Substrate Temperature (°F)	81.7	76.9	78.1	78.0

BLAST	HEAD		FOLLOWER	
	SIDE A	SIDE B	SIDE A	SIDE B
READING 1	2.8	2.7	2.8	3.0
SIDE A	Testex PRESS-O-FILM™ HT Coarse 0.8 to 2.5 mil 20 to 64 µm		PRESS-O-FILM Testex PRESS-O-FILM™ HT Coarse 0.8 to 2.5 mil 20 to 64 µm	
SIDE B	Testex PRESS-O-FILM™ HT Coarse 0.8 to 2.5 mil 20 to 64 µm		Testex PRESS-O-FILM™ HT Coarse 0.8 to 2.5 mil 20 to 64 µm	

PRIMER	HEAD	FOLLOWER
allowable: 3.0-4.0	SIDE A / SIDE B	SIDE A / SIDE B
READING 1	3.3 / 3.6	3.3 / 3.4
READING 2	3.2 / 3.4	3.2 / 3.3
READING 3	3.2 / 3.3	3.3 / 3.4

INTERMEDIATE COAT	HEAD	FOLLOWER
allowable: 5.0-6.0	SIDE A / SIDE B	SIDE A / SIDE B
READING 1	5.6 / 5.5	5.5 / 5.2
READING 2	5.5 / 5.3	5.3 / 5.3
READING 3	5.4 / 5.3	5.4 / 5.3

TOP COAT	HEAD	FOLLOWER
allowable: 2.0-3.0	SIDE A / SIDE B	SIDE A / SIDE B
READING 1	3.6 / 2.8	2.8 / 2.6
READING 2	2.7 / 2.9	2.9 / 3.0
READING 3	2.8 / 2.8	2.8 / 3.0

Greg Eckard
Mechanical Engineer / Contract Administrator

William Oden
APV Coatings Technician

ROLLED
SEP 14 2012
DATE AUTH

Quality Record

Approved

CERTIFICATE OF TEST

Liquid Penetrant Examination

APV Products Heat Transfer-Goldsboro

1200 W. Ash Street
P.O. Box 2046
Goldsboro, NC 27533-2046
Tel: 919-735-4570
Fax: 919-731-5443

Date: 9 / 26 / 2012

Customer Order Number (s) _____ **Router Number(s)** 616

_____ _____

_____ _____

_____ _____

Penetrant Method: Visible / Florescent **Penetrant Mfg. & Type:** P6R 9D1B

Light Meter ID : _____ **Calibration Due Date:** _____ **Foot Candles:** 120

Procedure Number: TDOC 4004 **Sensitivity Level:** _____

Dwell Time: 5/10 (mins.)

Plate Type: _____ **Visual Booth Inspector:** _____

Material: Ti. **Employee Number:** BE

Thickness: _____ **Production Order Qty:** _____

Cast No(s): _____ **Sample Size:** _____

Examination Results (sketch map defects if needed):

Number of Good ~~Plates~~: 12 **Number of Defective ~~Plates~~:** 0

Comments:

_____

_____

_____

_____

_____

Quality Manager or Designee

SP

SPX Flow Technology - APV Heat Transfer

INSPECTION and MATERIAL CERTIFICATION

CUSTOMER	Mississippi Power	Order Number	27278535	DRWG NO.:	1000818 Rev 01
NB No.:	13880	Serial Number	G2010000818	CRN No.:	
Model:	S280 M-14	Quality Plan	YES	CE Stamp	

MATERIAL SPECIFICATION AND HEAT CODES

Component	Specification	Heat Number	Assembler
Head	SA516 Gr70	456090 -3-0401	AP
Follower	SA516 Gr70	~~456090 -3-0401~~ 457734-4-0201	AP
Tie Bars	SA193 Gr B7	19337	AP
Tie Bar Nuts	SA194 Gr 2H	19424	AP
Flanges			
Stubends			
Pipe			
Liners			
Tri-Clamp			
Grid			
Grounding Lug	SA36	DL12102559	
Plates	SB265 Gr1	T2462 T2474 T2450	
~~Bosses~~	T2473 T2475	T2449 T2472	

Hydrostatic Test

Chamber	Pressure	Temp	Time (Min)	Gage #	Chart Rec #	APV	A.I.	3rd Party
H1 & H4	263	Ambient	~~3.5~~ 15	FA034	FH024	AP		
H3 & H2	263	Ambient	~~3.5~~ 15	FA010	↓	AP		
H1 & H4	263	Ambient	REMAINDER 60	FA034	↓	AP	10.16.12	
H3 & H2	263	Ambient	REMAINDER 60	FA010	FA024	AP	10.16.12	
		Ambient						
		Ambient						
		Ambient						
		Ambient						
		Ambient						
		Ambient						

APV

APV: TDOC 0902
ISSUE 06

Quality Record

Approved

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
As Required by the Provisions of the ASME Code Rules, Section VIII Division 1

1. Manufactured and certified by **SPX Flow Technology - APV Heat Transfer, 1200 W. Ash Street, Goldsboro, NC 27530**
(Name and address of Manufacturer)

2. Manufactured for **Mississippi Power Company, 2992 West Beach Boulevard, Gulfport, Ms. 39501**
(Name and address of Purchaser)

3. Location of Installation **Mississippi Power Company, 5835 Highway 493, Dekalb, Ms. 39328**
(Name and Address)

4. Type: **Vert.** (Horiz. or vert., or sphere) **Heat Exchanger** (Tank, separator, jkt. vessel, heat exh., etc.) **G2010000818** (Mfg.'s serial No.)

N/A (CRN) **1000818 REV 01** (Drawing No.) **13880** (Nat'l. Bd. No.) **2012** (Year built)

5. ASME Code, Section VIII, Div.1 **2007/2009** (Edition and Addenda (date)) **N/A** (Code Case No.) (Special Service per UG 120(d))

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell for heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) No. of course(s): **no shell** (b) Overall length (ft & in.):

Course(s)			Material	Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

7. Heads: (a) **SA516-70 Head, Fixed** (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) **SA516-70 Head, Moveable** (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp

	Location (Top Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	**END**	**4.226"**	**0.0"**						**57"X148"**					
(b)	**END**	**3.97"**	**0.0"**						**57"X142"**					

If removable, bolts used (describe other fastenings) **Bolts 20 SA 193-B7 M48, Nuts 40 SA 194-2H M48**
(Mat'l., Spec. No., Grade., size, No.)

8. Type of jacket _____ Jacket closure _____
(Describe as ogee & weld, bar, etc.)
If bar, give dimensions _____ If bolted, describe or sketch.

9. MAWP **175/175** (internal) _____ (external) psi at max. temp. **150** (internal) _____ (external) **°F** Min. design metal temp. **-20** °F at **175/175** psi

10. Impact test Bolting, Impact exempt per fig. UCS-66(e) at test temperature of _____ °F
(Indicate *yes* or *no* and the components(s) impact tested)

11. **Hydro.**, pneu., or comb. test press. **263 psi** Proof test _____

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: _____ (Stationary (Mat'l Spec. No.)) _____ (Dia., in. (subject to press.)) _____ (Nom. thk., in.) _____ (Corr. Allow., in.) _____ (Attachment (welded or bolted))
_____ (Floating (Mat'l Spec. No.)) _____ (Dia., in.) _____ (Nom. thk., in.) _____ (Corr. Allow., in.) _____ (Attachment)

13. Tubes: _____ (Mat'l Spec. No., Grade or Type) _____ (O.D., in.) _____ (Nom. thk., in. or gauge) _____ (Number) _____ (Type (Straight or U))

Items 14 - 18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s) _____ (b) Overall length (ft & in.):

Course(s)			Material	Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

15. Heads: (a) _____ (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) _____ (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp

	Location (Top Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)														
(b)														

If removable, bolts used (describe other fastenings) _____
(Mat'l Spec. No., Grade, size, No.)

FORM U-1 (Back)

16. MAWP _____ (internal) _____ (external) psi at max. temp. _____ (internal) _____ (external) °F Min. design metal temp. _____ °F at _____ psi

17. Impact test _____ at test temperature of _____ °F
(Indicate *yes* or *no* and the components(s) impact tested)

18. Hydro., pneu., or comb. test press. _____ Proof test _____

19. Nozzles, inspection, and safety valve openings:

Purpose (Inlet Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material		Nozzle Thickness		Reinforcement Material	How Attached		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
INLET	**2**	**20"**	**MACH'D**					**NONE**			**HEAD**
OUTLET	**2**	**20"**	**MACH'D**					**NONE**			**HEAD**

20. Supports: Skirt **no** (yes or no) Lugs **0** (No.) Legs **0** (No.) Others **Feet** (Describe) Attached **Head, Bolted** (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: (List the name of part, item number, mfg's. name and identifying number)

22. Remarks: **Heads, Impact exempt per UCS 66 (3)(a), Fixed Head to Movable head distance 107-7/8"**
Heat transfer plates, Mat'l SB265 Gr1, .024" thick, qty 609, Impact exempt per UNF 65

PRESSURE RELIEF DEVICES SUPPLIED BY OTHERS PER UG-125 (A)

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.

U Certificate Authorization No. **27,869** Expires **July 15, 2015.**

Date 10/17/12 Name **SPX Flow Technology - APV Heat Transfer** (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of **North Carolina** and employed by **HSB CT.** of **Hartford Connecticut** have inspected the pressure vessel described in this Manufacturer's Data Report on 10/16/12, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this Inspection.

Date 10/17/12 Signed _____ (Authorized Inspector) Commissions NB12662 NC1503 (Nat'l Board incl. endorsement, State, Province and No.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1.

U Certificate Authorization No. _____ Expires _____

Date ____/____/____ Name _____ (Assembler) Signed _____ (Representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of _____ and employed by _____ of _____ have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items _____, not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of _____ psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date ____/____/____ Signed _____ (Authorized Inspector) Commissions _____ (Nat'l Board, (incl. endorsements) State, Prov. and No.)

DESCRIPTION: **S280 M-14 Plate and Frame Heat Exchanger**
SUPPLIER: **SPX Flow Technology Systems, Inc.**
WORKS ORDER No: **SEE BELOW**
SUPPLIER CONTACT:
INSPECTION AUTHORITY: **Hartford Steamboiler**
Customer

CLIENT: **Mississippi Power Company**
P.O. No: **17352**
TAG No: **Below**
PROJECT: **Kemper County IGCC Project**
Project Location: **Dekalb, MS**

REVISION No: **01**
DATE: **8/22/2011**
BY: **GJE**

APV Products - Goldsboro
INSPECTION & TEST PLAN

TAG NO.	MATERIAL NO.
CLCW HX, OPERATING UNIT 1	G2010000816
CLCW HX, OPERATING UNIT 2	G2010000817
CLCW HX, SPARE UNIT	G2010000818
CLCW HX, OPERATING UNIT 3	G2010000819
CLCW HX, OPERATING UNIT 5	G2010000820
CLCW HX, OPERATING UNIT 4	G2010000821

Sales office: **SPX Flow Technology Systems, Inc.**

Customer: **Mississippi Power Company**

Specifications: **ASME VIII DIV. 1 2007 EDITION, 2009 ADDENDA**

INSPECTION & TEST PLAN DISTRIBUTION

Customer **Mississippi Power Company**

D. Overby _____

Quality Assurance _____

H- Hold Point, W - Witness Point, R - Review Documentation, N - Notification
V - Verification

Approved

DESCRIPTION: **S280 M-14 Plate and Frame Heat Exchanger**
SUPPLIER: **SPX Flow Technology Systems, Inc.**
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SUPPLIER CONTACT:
INSPECTION AUTHORITY: **Hartford Steamboiler**
Customer

CLIENT: **Mississippi Power Company**
P.O. No: **17352**
TAG No: **Below**
PROJECT: **Kemper County IGCC Project**
Project Location: **Dekalb, MS**

REVISION No: **01**
DATE: **8/22/2011**
BY: **GJE**

Quality Record

No	REQUIREMENT	CHARACTERISTICS TO BE VERIFIED	CONTROL PROCEDURES & ACCEPTANCE CRITERIA	VERIFICATION DOCUMENTATION	APV		CUSTOMER	
					CODE	SIGN	CODE	SIGN
1	Approved Inspection & Test Plan	Purchase Order Adherence	Inspection & Test Plan	Signed ITP	W		N/A	
2	Receive material & inspect against material test certificates	Visual & dimensional & Chemical Composition Against Specification	APV Documentation TDOC 0012 Issue 12	Test Certification	W		N/A	
3	Material dimensions & markings	Visual & dimensional	APV Drawings	ISO Manual	W		N/A	
4	Prefabrication meeting - 10 day notice	Purchase Order Adherence	Inspection & Test Plan	Signed ITP	W		H	
5	Cut coil to length	Visual & dimensional against specification	APV Documentation APV 3456	Quality control & Material Certification	W	N/A	N/A	
6	Press & dimensional check first off plate	Visual & dimensional against specification	APV Documentation TDOC 0018 Issue 06	Quality control log book & SAP transaction	W	N/A	N/A	
7	Press plates	Visual & dimensional & Chemical Composition Against Specification	Routing	SAP transaction	W	N/A	N/A	Kaiser Plates 10/23/12
8	Apply gaskets to plates	Visual & dimensional against specification	APV Documentation APV 3181	SAP transaction	W	N/A	N/A	
9	Fabricate frame components	Visual & dimensional against specification	APV Detail Drawings	Routings & SAP transaction	W		W	
10	Dye pen test liner welds	Visual against specification	Per specification 1000816-821 NDE	Routings & SAP transaction	W		W	

Doc. No.:100816-821 ITP

H- Hold Point, W - Witness Point, R - Review Documentation, N - Notification
V - Verification

Approved

DESCRIPTION: **S280 M-14 Plate and Frame Heat Exchanger**
SUPPLIER: **SPX Flow Technology Systems, Inc.**
WORKS ORDER No: **SEE BELOW**
SUPPLIER CONTACT:
INSPECTION AUTHORITY: **Hartford Steamboiler**
Customer

CLIENT: **Mississippi Power Company**
P.O. No: **17352**
TAG No: **Below**
PROJECT: **Kemper County IGCC Project**
Project Location: **Dekalb, MS**

REVISION No: **01**
DATE: **8/22/2011**
BY: **GJE**

No	REQUIREMENT	CHARACTERISTICS TO BE VERIFIED	CONTROL PROCEDURES & ACCEPTANCE CRITERIA	VERIFICATION DOCUMENTATION	APV		CUSTOMER	
					CODE	SIGN	CODE	SIGN
11	Blast frame fabricated parts	Visual against specification	Per specification 1000816-821 PAINT	SAP transaction	W	WO	W	
11	Paint frame paint thickness cert	Visual against specification	Per specification 1000816-821 PAINT	Paint report incl. paint thickness results	W	WO	W	
12	Assemble heat exchangers & dimensional checks	Visual & dimensional against specification	APV Documentation APV3181	SAP transaction	W		N/A	
13	Hydrostatic pressure test W/ Chart recorder	Integrity of assembled unit	ASME VIII Div 1, 2007 Edition, 2009 Addenda	Test certification ASME U-1 data report	W		W	
14	Dry unit with forced air after hydro test	Visual verification	Routing	shop traveler	W		N/A	
15	Final Inspection workmanship & Clean including nameplate review & code stamp	Visual & dimensional against specification	Inspection & Test Plan	Signed ITP	W		H	
16	Preparation for shipping	Visual inspection against specification	Customer Packing, Marking, & Shipping Instructions	SAP Transaction	N		N/A	
17	Review final documentation package: ASME U-1 data report, material test certificates, Shop traveler, nameplate facsimile	All documents complete	Purchase order required documentation	Final Documentation	W		H	
17	Release by Inspector required prior to shipment	Inspection Release	Inspection & Test Plan	Signed ITP	H		H	

Note: The Purchaser's quality representative shall have notification from the Supplier in sufficient time (minimum of 5 working days for domestic facilities, 10 working days for facilities outside North America) to ensure witness and hold points may be observed. The supplier shall notify the Purchaser via e-mail to, but not limited to, the following address: vendorqty@southernco.com

Doc. No.:100816-821 ITP

H- Hold Point, W - Witness Point, R - Review Documentation, N - Notification
V - Verification

Approved

APV
AN SPX BRAND

Instruction Manual
Paraflow Plate Heat Exchanger

Read and understand this manual prior to operating or servicing this product.

SPX®

Kemper County MM218132

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

The purpose of this manual is to provide you with the information necessary for the safe and proper installation, operation and maintenance of your APV Paraflow Plate Heat Exchanger. This will ensure many years of satisfactory performance. The manual is specific to the tie bar tightened frames. Separate publications deal with Paraflow Plate Heat Exchangers tightened by other means.

1.2 Safety

Safe installation, operation and maintenance of the APV Paraflow Plate Heat Exchanger requires proper procedures and training of all personnel. Section 2.0 Safety Instructions should be read and understood before proceeding. This section discusses general safety practices. In addition, specific hazards are indicated throughout this manual by the appropriate hazard label in bold type.

Warning:

Read and understand the entire manual before unpacking the equipment and installing it.

It is the objective of APV to clearly identify each area of potential hazard and guide workers in safe operation, service and maintenance procedures.

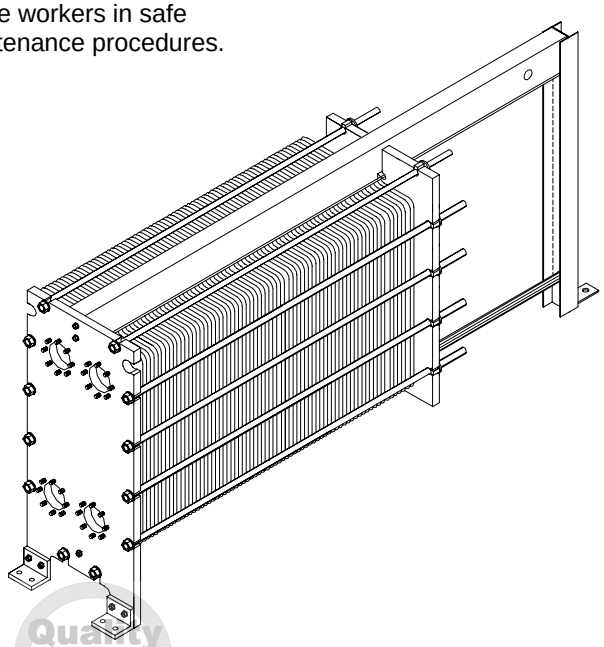
1.3 Design

The Paraflow is the original plate type heat exchanger designed by APV to provide maximum efficiency and cost effectiveness in handling heat transfer duties. The basic concept is two liquids flowing on either side of a thin corrugated metal plate so heat may be easily transferred between the two. The plate heat exchanger also minimizes maintenance downtime and requires little floor space compared to other types of heat transfer equipment. This equipment has many applications in a wide range of industries. Typical industries include:

Chemical	Dairy
Industrial	Beverage
Petroleum	Liquid Food
HVAC	Pharmaceutical
Refrigeration	Health Care

1.4 Receiving and Inspection

APV Paraflow Plate Heat Exchangers are assembled and inspected before shipment and properly prepared for transportation. APV cannot, however, guarantee safe arrival. Therefore, upon receipt of this equipment, check all received items against the packing list for damage or missing parts. Damage or loss should be reported immediately to the carrier.



2.0 SAFETY INSTRUCTIONS

2.1 General Statement

APV Paraflow Plate Heat Exchangers are designed and manufactured with due consideration and care for generally accepted safety standards. However, like any mechanical device, the proper and safe performance of this equipment depends upon using sound and prudent operating, maintenance and servicing procedures under properly trained supervision.

For your protection, and the protection of others, learn and always follow the safety rules outlined in this section. Observe warning signs on machines and act accordingly. Form safe working habits by reading the rules and abiding by them. Keep this booklet handy and review it from time to time to refresh your understanding of the rules.

2.2 Hazard Level Identification

Definitions for identifying the various hazard levels shown on warning labels or to indicate proper safety procedures in the instruction manual are provided in the following labels.

Danger:

The use of the word "Danger" always signifies an immediate hazard with a high likelihood of severe personal injury or death if instructions, including recommended precautions, are not followed.

Warning:

The use of the word "Warning" signifies the presence of hazards or unsafe practices that could result in severe personal injury or death if instructions, including recommended precautions, are not followed.

Caution:

The use of the word "Caution" always signifies possible hazards that could result in minor injury or damage to product or property if instructions, including recommended precautions, are not followed.

2.3 Operating Zone

An operating zone should be established around all heat exchangers. A brightly painted guard rail or warning stripe should define the zone. Only the operator or other authorized personnel should be within the operating zone when machine control circuits are energized or the heat exchanger is operating. No tools or other equipment should be kept within the operating zone.

2.4 Installation

Utilities, such as water, steam, electric, air and hydraulic, should be installed by trained and authorized personnel only. Installations must comply with all applicable codes and standards, including those established by OSHA.

2.5 Safety Instructions

Before Starting a Machine
Be absolutely positive all necessary guards and safety devices are installed and operating properly. This includes spray screen or pressure relief devices.

Be sure all personnel are clear of the machine.

Remove (from the operating zone) any materials, tools or other foreign objects that could cause injury to personnel or damage the machine.

Make certain all alarms, indicating lights, pressure gauges and other safety devices or indicators are in working order.

After Shutdown
Make certain all water, steam, air, hydraulic and electric utilities are turned off. Make certain all pressure in the heat exchanger is released.

2.6 General Operating Safety

Do not operate this heat exchanger until you read and understand the operating instructions and become thoroughly familiar with the heat exchanger and its operation.

Never operate a heat exchanger while a safety device or guard is removed or disconnected.

Always wear safety glasses, hats, shoes, ear protection or any other required safety equipment.

Never remove “Warning” tags that are displayed on the heat exchanger. Torn or worn labels should be replaced.

Do not start the heat exchanger until all other personnel in the area have been warned and have moved outside the operating zone.

Remove any tools or other foreign objects from the operating zone before starting.

Absolutely do not have loose clothing, neckties, necklaces or unrestrained long hair near an operating heat exchanger.

Do not wear gloves, rings, watches, bracelets or other jewelry near an operating heat exchanger.

Keep the operating zone free of obstacles that could cause a person to trip or fall towards an operating heat exchanger.

Never sit or stand on anything that might cause you to fall against the heat exchanger.

“Horseplay” around a heat exchanger at any time is dangerous and prohibited.

Know the EMERGENCY STOP procedure for the machine.

Never operate the machine above specified capacity, pressures or temperatures.

Keep alert and observe indicator lights and warnings that are displayed on the heat exchanger.

Do not operate faulty or damaged equipment. Make certain proper service and maintenance procedures have been performed.

A safe work surface should be provided around the heat exchanger, including proper guarding of elevated platforms and the design and use of ladders.

2.7 Service and Maintenance Safety

Do not service a heat exchanger until you are thoroughly qualified and familiar with the tasks to be performed.

Never operate any valves, pumps or controls while persons are performing maintenance on the heat exchanger.

Do not bypass a safety device.

Always use the proper tool for the job.

Do not enter a confined space without first checking for toxic fumes and providing standby personnel on the site.

2.8 Safe Cleaning Procedures

Manual Cleaning Procedures
Do not use toxic or flammable solvents to clean a heat exchanger.

Always clean up spills around heat exchanger as soon as possible.

Never attempt to clean a heat exchanger while it is operating.

Cleaning In Place Procedures

Make certain all connections in the cleaning circuit are tight to avoid contact with hot water or cleaning solutions.

When the cleaning cycle is controlled from a remote or automated control center, establish fail safe procedures to avoid automatic start up while servicing equipment in the circuit.

On equipment that includes heat shields, make certain the shields are properly installed prior to starting the cleaning cycle (see Paragraph 4.8 and 9.3).

3.0 CONSTRUCTION

3.1 Frame

A typical Paraflow Plate Heat Exchanger is shown in **Figure 1.** **Figure 2** is an exploded view showing the individual components. The main components include a stationary cover (head), Item 1, an end support, Item 2, connected by a top carrying bar, Item 3, and bottom guide rail, Item 4. These components are bolted together to form a rigid frame that supports the thin metal heat transfer plates, Item 5, and moveable cover (or follower), Item 6. Each plate is separated and sealed by a gasket. The plates are compressed between the head and follower by means of tie bars, Item 7 on either side of the exchanger. Liquids are introduced to the heat exchanger through connections located in the head, follower or intermediate connector grids, when supplied (as shown in Figure 3 on page 10).

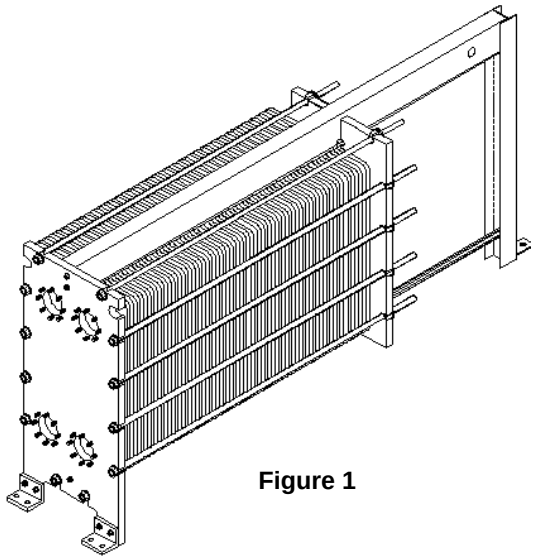


Figure 1

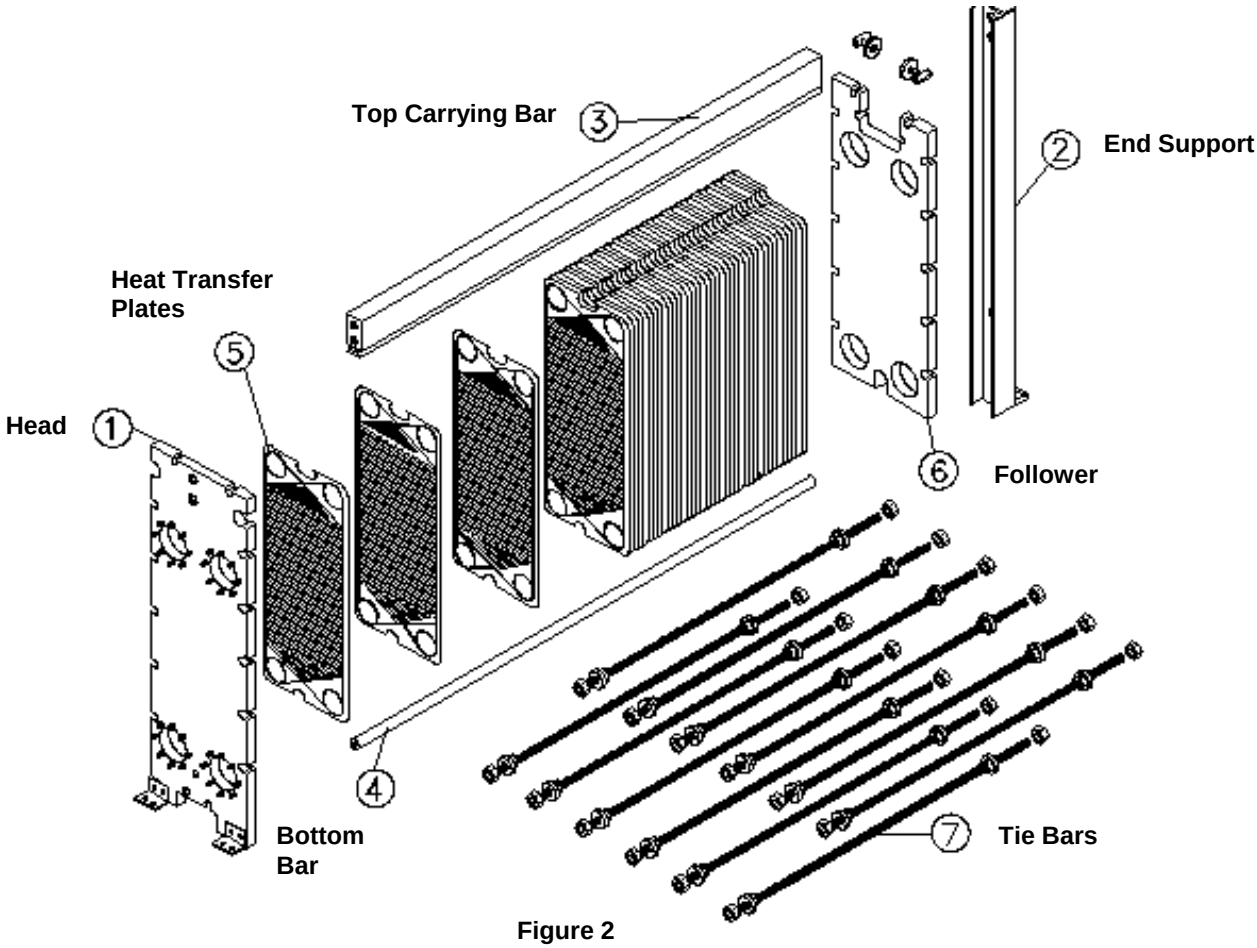


Figure 2

When Paraflow Plate Heat Exchangers are opened for service, the follower moves back along the top bar to allow full access to each individual plate. Divider plates and intermediate connector grids also move freely on the top carrying bar to provide easy access to individual plates.

Paraflow frames used in industrial duties are fabricated in carbon steel and are finished in a heavy duty chemical resistant paint. Industrial frame connections may be studded with various lining materials or nozzles. The nozzles are fabricated in carbon steel, stainless steel or alternate metals. Connection types may be lap-joint, weld neck or specialty flanges. Sanitary tube connections may also be supplied on carbon steel frames. The connection materials and types may be mixed on an individual frame.

Frames used for sanitary duties are usually fabricated in solid stainless steel or carbon steel that is entirely clad with stainless steel. The finish is either a #4 polish or glass bead blast depending on the model. Standard connections are sanitary tube fittings at all locations. Industrial fittings may be supplied when required.

Divider plates may be used to divide a heat exchanger into separate operating sections. Divider plates have no connections but may allow flow from one section to the next.

Intermediate connector grids as shown in **Figure 3** may be used to divide a heat exchanger into separate sections to accommodate multiple duties within a single frame. Connector grids may have up to two connections at any corner.

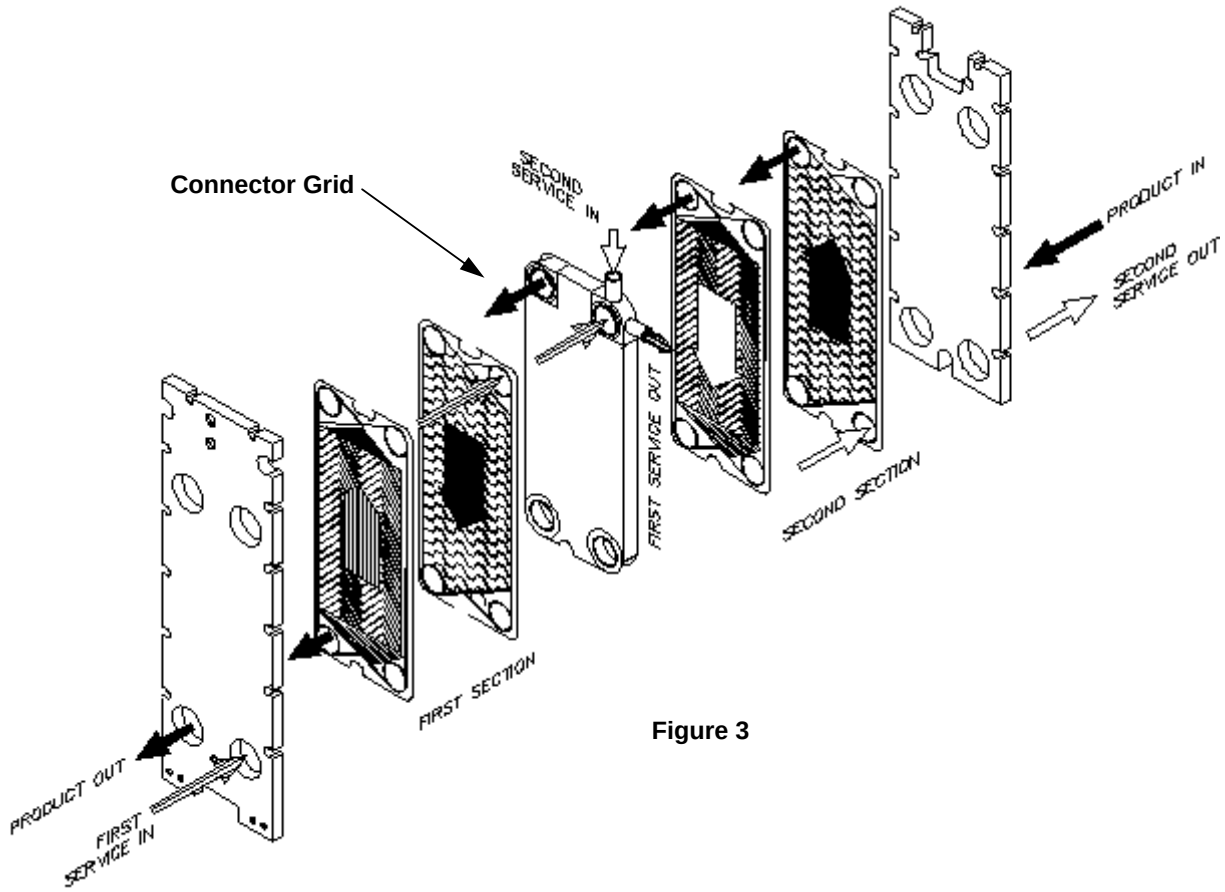


Figure 3

3.2 Plates

APV heat exchanger plates come in over 60 different sizes and 34 different corrugation patterns. This allows the heat exchanger to be matched closely to a specific duty. The corrugations cause turbulence in the liquids as they flow in a thin stream in the passage between each plate **(Figure 4).** The plates have ports in each corner that, when stacked in a plate pack, form a manifold for even fluid distribution to the individual plate passages **(Figure 5)**. The ports are gasketed so only two ports on each plate allow flow across the plate (flow ports). The other two ports are through ports and do not allow the liquid flowing in them across the plate. This flow pattern is alternated from plate to plate to form right hand plates and left hand plates.

Figure 4

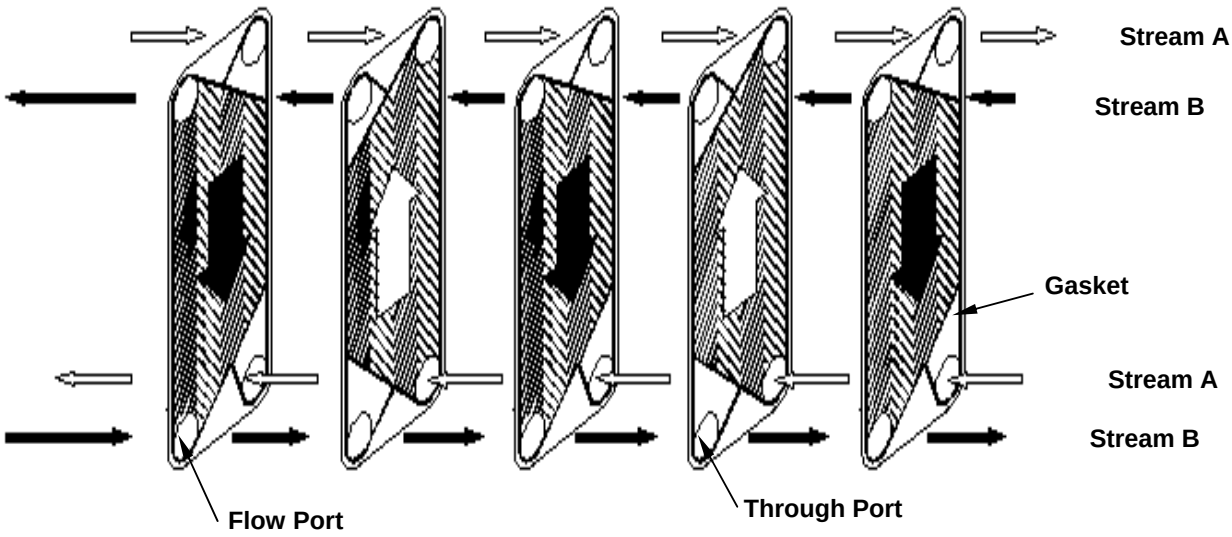
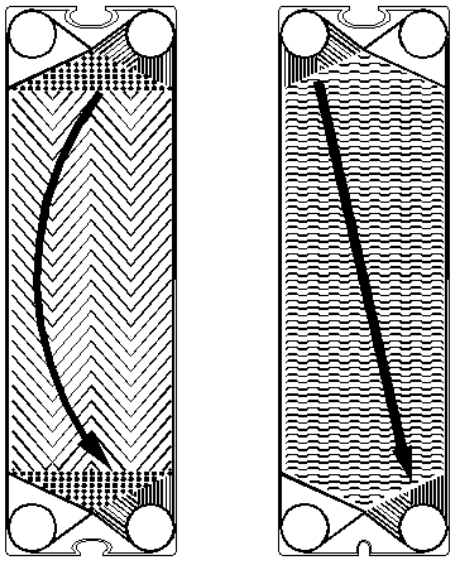


Figure 5

Plate Construction
All plates are designated as either diagonal flow or vertical flow **(Figure 6)** based on their flow pattern. Plates are pressed in thicknesses between 0.4 - 1.2 mm (0.016 and 0.047 inches) in a variety of materials (see Plate Materials below). The plate corrugation pattern alternates from plate to plate to provide support at the points of contact. One type of corrugation pattern looks like a washboard. It provides a wide gap between plates with contact points about every 1 to 3 square inch of heat transfer surface area.



Vertical Flow Diagonal Flow

Figure 6

Another design is the chevron pattern of relatively shallow corrugations with support provided at peak/peak contact. Alternate plates are arranged so that corrugations cross to provide contact points for every 0.2 to 1 square inch of surface. This greater density of contact points in the chevron pattern allows a higher differential operating pressure for a given plate thickness than the washboard pattern.

Mixing Plates
To obtain optimum thermal and pressure drop performance while using a minimum number of heat exchanger plates, plates of two or more corrugation angles may be mixed within the same frame. This is available for many APV Paraflow Plate Heat Exchanger models.

Mixing plate angles results in flow passages that differ significantly in their flow characteristics. This allows the Paraflow design to be fine tuned in a single or even multiple pass arrangement to closely match to the thermal and pressure drop requirements of the application.

Plate Material

Paraflow plates may be pressed from 304 or 316 stainless steel, Avesta 254SMO or 254SLX, Nickel 200, Hastelloy B-2, C-276 or G-3, Incoloy 825, Inconel 625, Monel 400, Titanium, Titanium-Palladium or other specialty alloys as required to provide suitable corrosion resistance to the liquids being handled.

Duo-Safety Plate
The APV Duo-Safety heat exchanger plate is a double wall plate manufactured from two loose plates pressed together at the same time to form a pair. Each APV Duo-Safety plate pair is equipped with a non-glue Paraclip gasket, which seals and holds the pair together.

The space between the two plates of the APV Duo-Safety plate pair serves as a safety zone in case of through-plate leaks from corrosion or wear. Should this occur, the liquids will not be mixed, but will be discharged between the two walls into the atmosphere. This provides a high level of certainty that liquids will not be cross contaminated. The APV Duo-Safety plate pair also can be dismantled for cleaning between the two plate walls.

Paraweld Plate
The APV Paraweld plate is a right and left hand plate laser welded together to form a plate pair. This welded plate is particularly suited for use with refrigerants such as ammonia and Freon, or aggressive liquids that would otherwise attack the gaskets in a conventional heat exchanger plate.

When the welded pairs are installed in a frame, each pair is separated by elastomeric seals.

3.3 Gaskets

The seal between the plates is achieved by a single gasket around the perimeter of the plate and a double gasket around the two through ports. This double gasket separates the port from the heat transfer area with a double barrier. The space between the double gasket is vented to atmosphere to prevent cross contamination. **(Figure 7).**

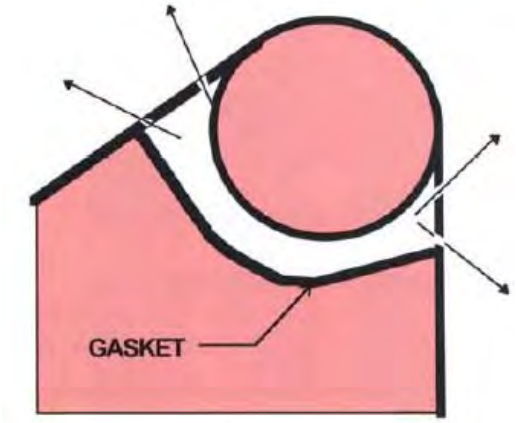


Figure 7

Interlocking Gaskets
APV Paraflow Plate Heat Exchanger plates have interlocking gaskets with upstanding lugs and scallops evenly spaced around the outside edges. These scallops ensure that there are no unsupported portions of the gaskets and, in combination with the patented form of the pressed groove, provide mechanical plate-to-plate support for the sealing systems. The upstanding lugs **(Figure 8)** maintain plate alignment in the Paraflow during plate pack closure and operation. The groove form provides 100% peripheral support of the gasket, leaving none of the material exposed to the outside. In addition, the gasket exposure to the process liquid is minimized by the full depth plate gasket groove.

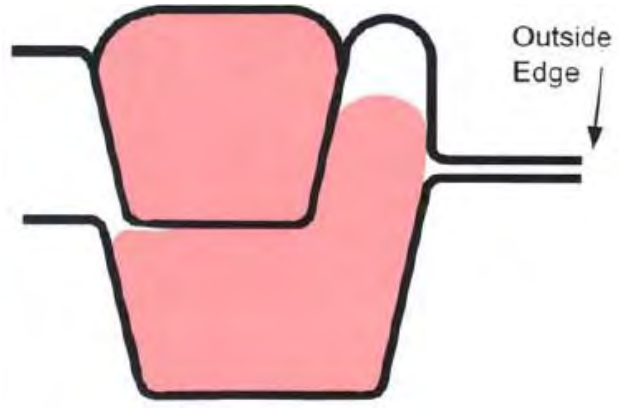


Figure 8

Gasket Materials
As detailed in **Figure 9**, various gasket materials are available as standard which provide chemical and temperature resistance coupled with excellent sealing properties. Other gasket materials are available for special applications. Gasket material selection must take into consideration the chemical composition of the fluids involved as well as the operating conditions.

Materials	Application
Paracil	General Purpose material for aqueous and fatty duties
EPDM	High temperature general purpose material for chemical and steam applications
Paraflor	Mineral oils, acids, steam and hot water at high temperatures
Paradur	Organic solvents, chemicals and sulfuric acid
Paraprene (Neoprene)	Refrigeration duties with ammonia and freon.

Figure 9

Gasket Attachment
APV Paraflow Plate Heat Exchanger gaskets are attached to individual plates by one of two methods, glued or clip in. The glued in gaskets are attached by a thermoplastic adhesive which is heat cured for maximum strength.

The clip in gaskets (Paraclip) are attached to the plates by small nubs around the perimeter of the gasket which snap into matching holes.

3.4 Intermediate Connector Grids

These intermediate connector grids divide the plate heat exchanger into separate sections that may operate independently. The connector grids are equipped with removable connector bosses (**Figure 10)** that provide connections for the liquids handled.

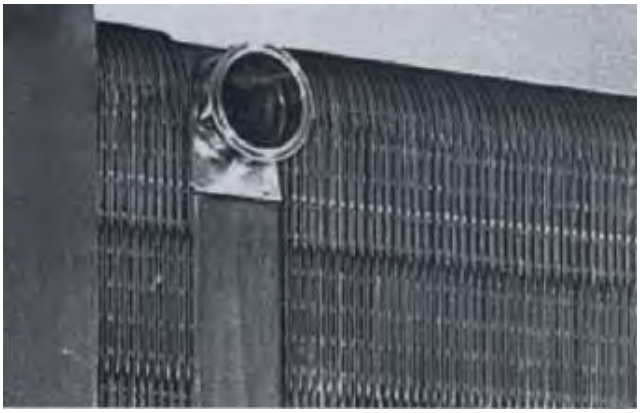


Figure 10

The connector grid bosses form the connecting link between sections of the plate heat exchanger and provide connections to and from these sections. On some models, two connections can be provided in the same connector grid boss with connections to the adjoining sections.

3.5 General Arrangement Drawing

A General Arrangement Drawing is supplied with each APV Paraflow Plate Heat Exchanger. This drawing provides detailed information concerning design specifications, operating conditions, dimensions, connections, plates and gaskets, plate arrangement diagram and key, bill of material and special notes.

Design Specifications
The data list on the design specifications provides the key mechanical information used to design the plate heat exchanger. This includes the design code, maximum allowable working pressure and temperature, maximum and minimum platage dimensions, heat transfer area, frame size, maximum plate capacity, weights and volume.

Operating Conditions
This table on the drawing contains the duty or operating conditions for which the heat exchanger was designed. It specifies each fluid, the flow rates, the temperatures and the pressure drops.

Connection Schedule
The connection schedule identifies the size, material and type of each connection supplied.

Plate and Gasket List
Each general arrangement drawing contains a summary of all the plates and gaskets used for the plate arrangement. This summary includes plate types, angles and material, and also gasket type, material and attachment (glued or clip in).

3.6 Plate Arrangement Diagram

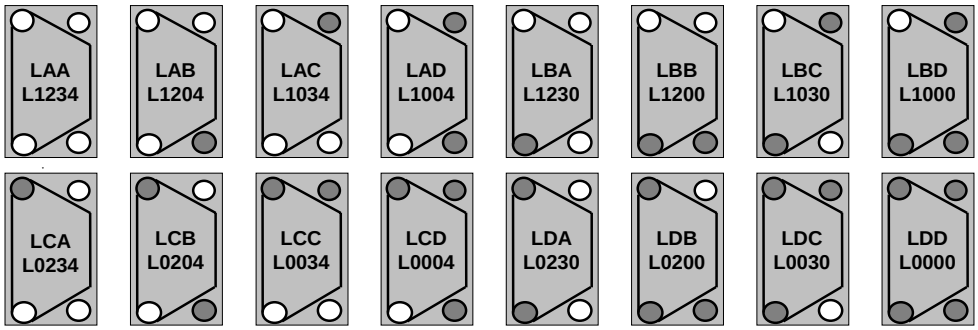
Configuration of the Diagram
The plate heat exchanger is designed to perform a duty (or duties) by arranging the number and type of plates required in a specific sequence. This arrangement is represented schematically by the plate diagram shown on the general arrangement drawing. The schematic represents the fluid flows by heavy lines with arrows and the plates by thin vertical lines. Plate ports that block flow (not open) are represented by small black rectangles.

Each connection on the plate diagram is identified and labeled. The connections are also identified on the dimensioned view or the isometric view of the plate heat exchanger and the Connection Schedule.

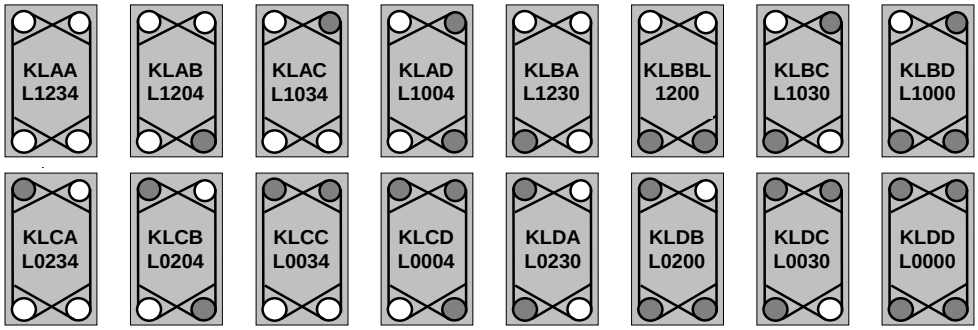
Along the top of this diagram is a listing of each plate required, showing the hand of each plate (Right or Left), the direction the gaskets face (Head or Follower) and the punch code (blanking designation). The punch code indicates which ports are open and allow flow. Additional codes may be listed indicating plates with drains (D) and vents (V) or plates with end gaskets (K). Other symbols may be used to indicate special support pads or gaskets. The general arrangement drawing includes a key which illustrates the punch codes. The punch codes are also illustrated on the following pages in **Figure 11** for vertical flow plates and **Figure 12** for diagonal flow plates.

VERTICAL PLATE PUNCH CODES

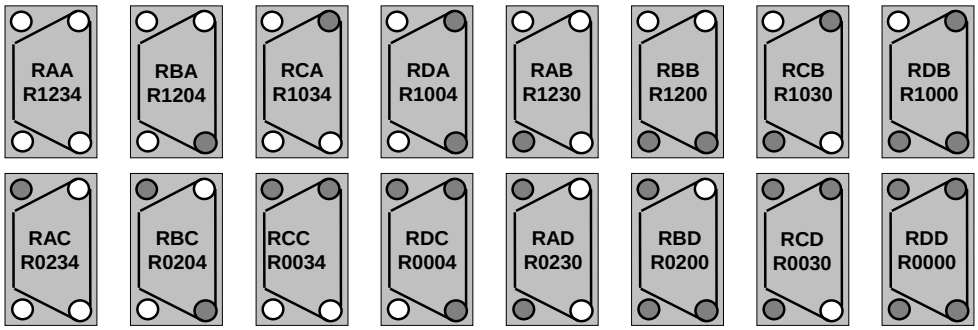
LEFT HAND FLOW PLATES:



LEFT HAND END PLATES:



RIGHT HAND FLOW PLATES:



RIGHT HAND END PLATES:

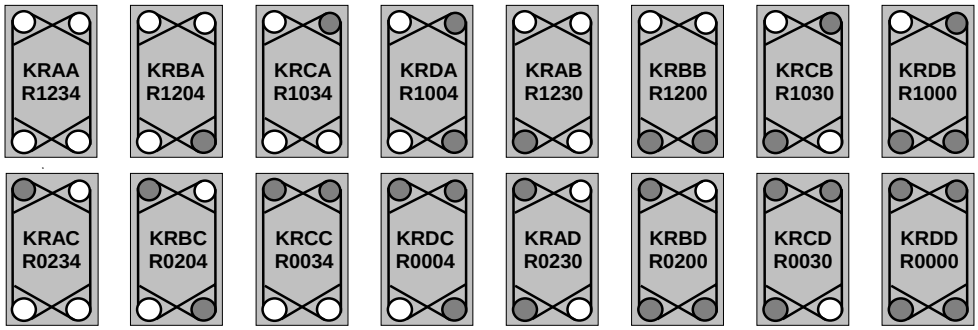


***PLATE VIEWED FROM GASKETED SIDE.**

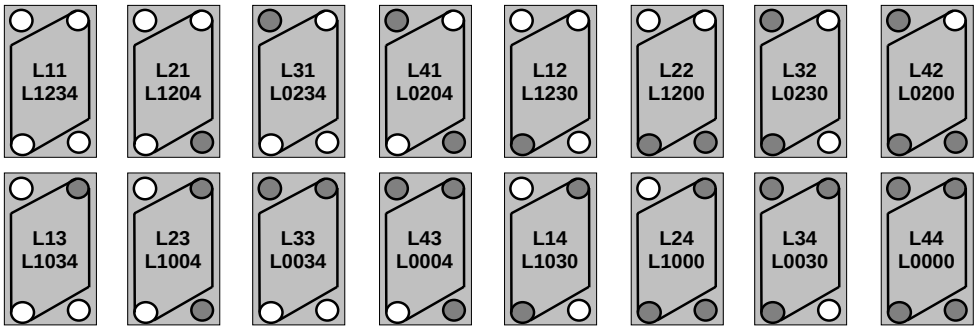
Blanked (Hole)

Unblanked (No Hole)

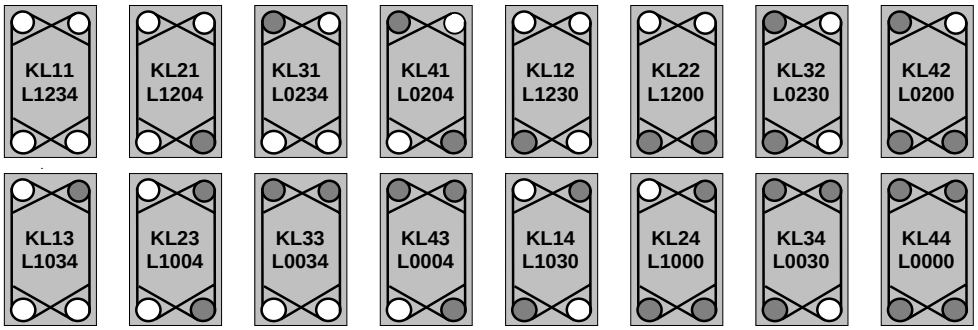
Figure 11

DIAGONAL PLATE PUNCH CODES

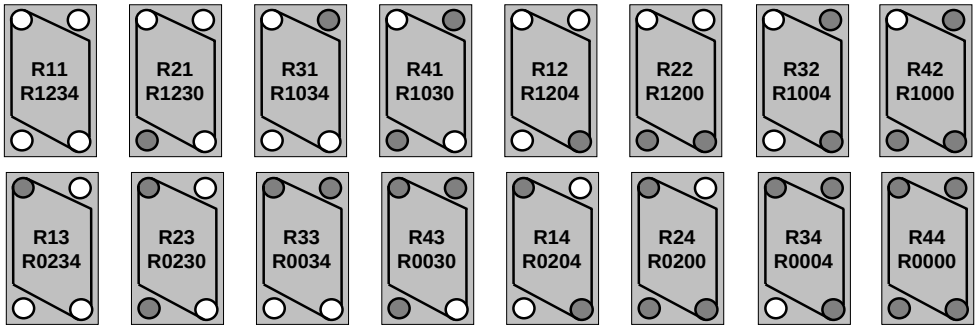
LEFT HAND FLOW PLATES:



LEFT HAND END PLATES:



RIGHT HAND FLOW PLATES:



RIGHT HAND END PLATES:

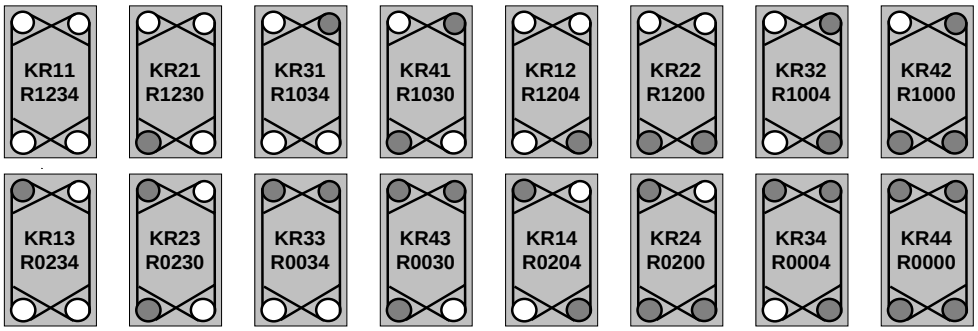


***PLATE VIEWED FROM GASKET SIDE.**

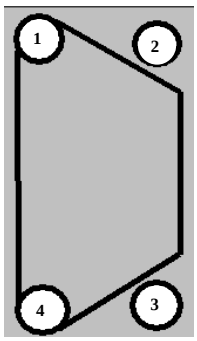
Blanked(Hole) Unblanked(No hole)

Figure 12

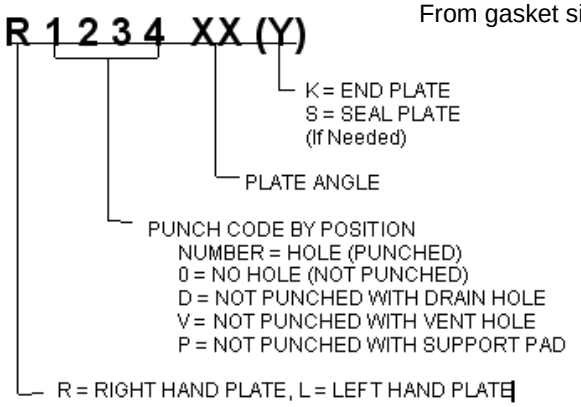
IMPORTANT NOTICE:

The standard conventions for identifying plates and showing the plate arrangement diagram have changed effective August 11, 1997.

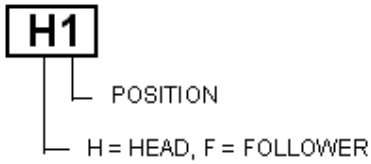
The plate punch code will use The five character code as shown In Figure 11 or 12. The equivalent three character code is shown for reference. The position are numbered as shown in the sketch on the right. The complete plate identification number is constructed as follows:



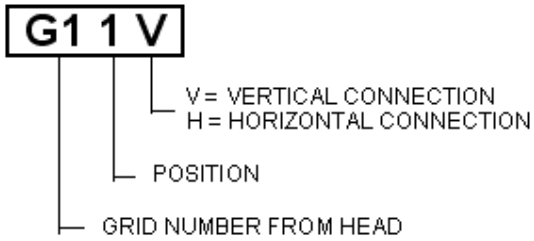
From gasket side



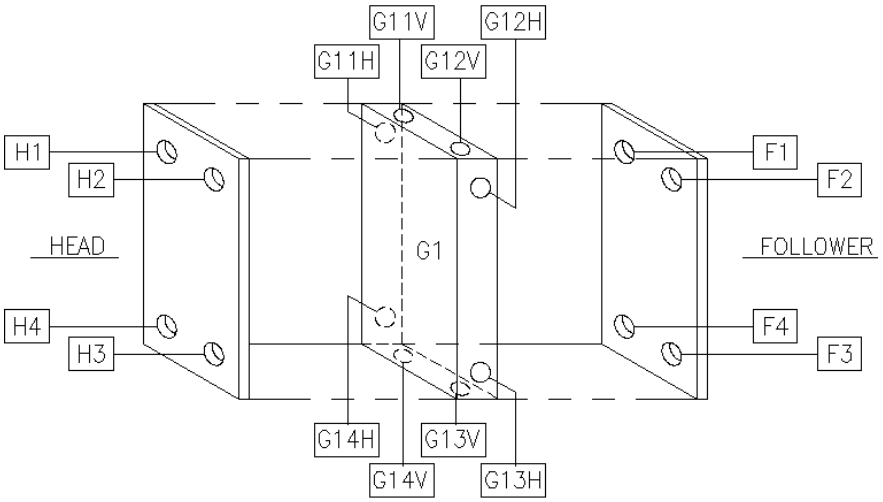
The plate arrangement and all general arrangement drawing will now show the head or fixed cover on the left. Frame connections are labeled with an H (head) of F (follower) and a number corresponding to the position.



Connection grids are labeled with a G plus a number with 1 being the first grid from the head. Grid connections are labeled as follows:



These labels are shown in the picture below and examples of the plate arrangements are shown on the following page.



Note:
All possible connection are shown here. Only the connection provided will be shown on the customer drawing

Examples

Figure 13 shows a typical single pass arrangement using diagonal flow plates with all the connections on the head.

Note:

PLATES MUST BE ARRANGED ALTERNATELY LEFT AND RIGHT. FOR CONVENIENCE ON THE DRAWING, WHERE BLOCKS OF R1234 AND L1234 PLATES OCCURS, THE TOTAL NUMBER OF EACH IS GIVEN

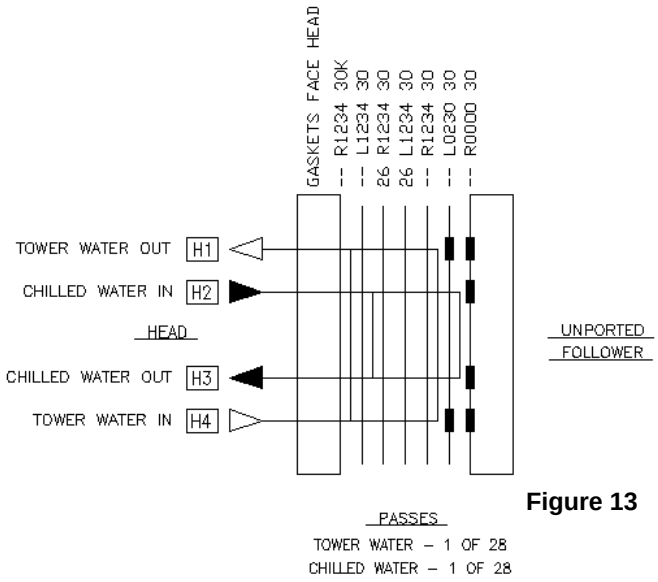


Figure 13

Figure 14 shows a two-section arrangement with connections on the head, follower and connector grid. It also shows the use of the special codes to indicate drain plates (D), support pads (P) and seal plates (S) typical for an SR6 plate.

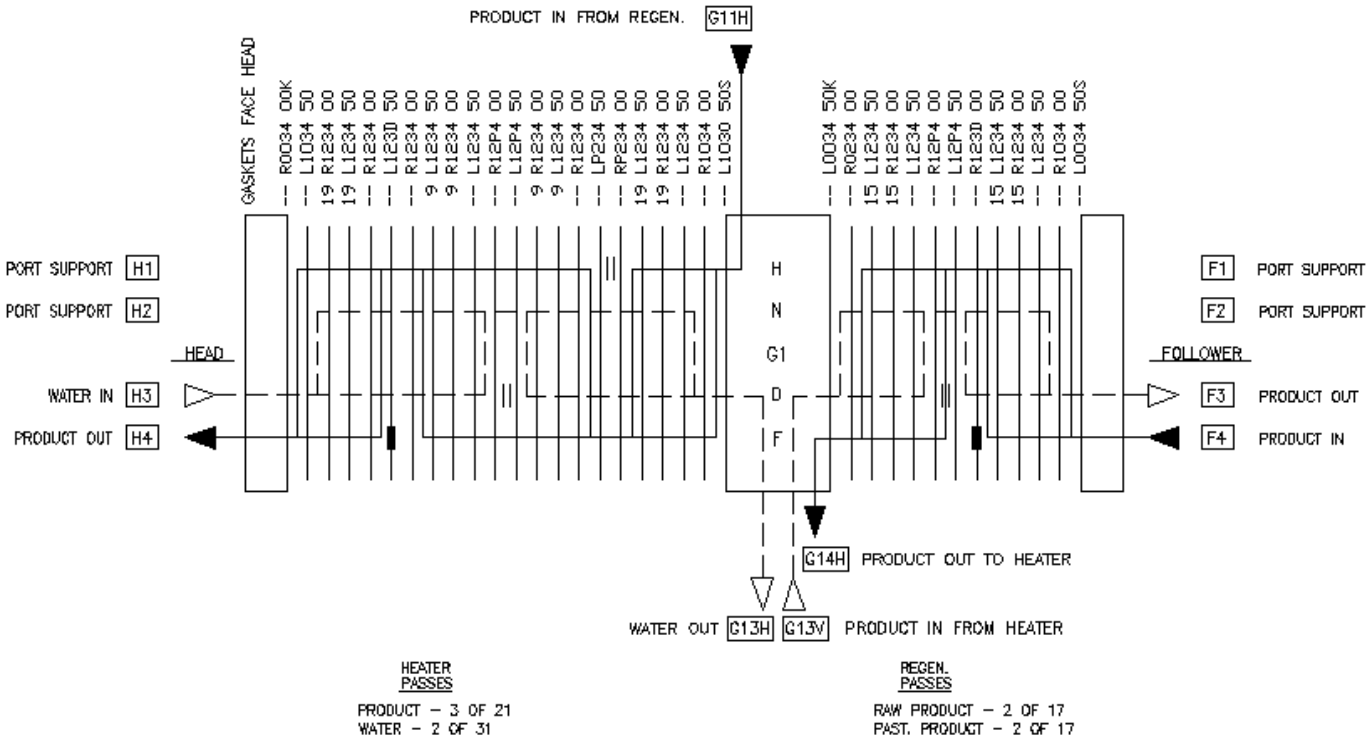


Figure 14

4.0 INSTALLATION

4.1 Location

The heat exchanger should be installed in an area with adequate clearance around the unit to install or remove plates and perform maintenance.

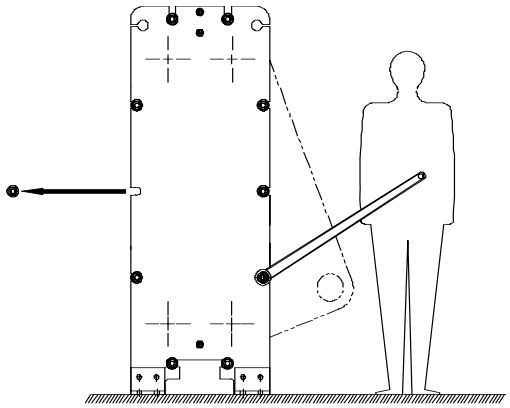
The unit should also be located with consideration for the required piping connections. Product and service lines should be designed to minimize pressure drops and be adequately supported to minimize the loads on the heat exchanger.

4.2 Foundations

The foundation pad for the heat exchanger should be level and sized properly for the outline of the frame. It must also be of adequate strength to support the full operating weight of the unit. The overall dimensions and operating weight are listed on the general arrangement drawing.

4.3 Space Requirements

On at least one side of the plate heat exchanger there must be sufficient clearance to remove a plate from the top bar. Also, there must be adequate room to tighten or remove the tie bars and inspect the plate heat exchanger **(Figure 15)**. The follower must be free to move along the full length of the top bar as shown in **(Figure 16)**. The general arrangement drawing provides overall dimensions and plate removal distance.



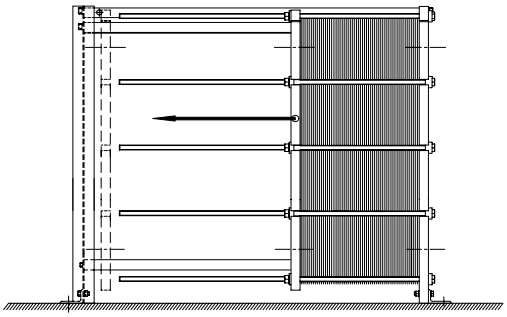


Figure 16

4.4 Connections and Piping

The plate heat exchanger must be connected in accordance with the arrangement shown on the general arrangement drawing provided with the heat exchanger.

Pipe lines to the follower and connector grid(s) must be located to allow the unit to be easily opened for inspection and maintenance. These lines must also be flexible to allow for small variations in the tightening dimensions and possible thermal expansion.

4.5 Pressure Pulsation and Vibration

Piston pumps, gear pumps, valves etc. must not be able to transfer pressure pulsations or vibrations to the plate heat exchanger as this may cause fatigue fracture in the plates. The use of pressure dampers in the pipeline is recommended to minimize this effect.

4.6 Pressure / Temperature Ratings

The pressure and temperature ratings for a specific heat exchanger are listed on the general arrangement drawing provided with the unit. These ratings must not be exceeded at any time during startup or operation.

Over pressure protection must be provided if it is possible the system may develop a higher pressure than the maximum allowable working pressure of the heat exchanger.

Warning:

Do not exceed the maximum operating pressure or temperature listed on the General Arrangement Drawing or damage to the heat exchanger will result.

4.7 Hydraulic Shock

The plate heat exchanger will be damaged by any hydraulic shock that occurs during start up or operating changes. To avoid damage, throttling valves and soft pump starts are recommended.

4.8 Spray Screen

A spray screen may be provided for new or existing heat exchangers. They are recommended whenever corrosive liquids or high temperatures are present. See Section 9.0 Accessories for more information.

4.9 Short Term Storage

All heat exchangers and components must be stored in a cool environment away from sunlight. They must also be covered loosely by a tarp or plastic sheet that allows air circulation and provides protection from water, debris and sunlight. This procedure is suitable when the storage period is less than six months.

4.10 Long Term Storage

Long term storage of APV Plate Heat Exchangers requires following Procedure SP5002 to avoid damage or deterioration. This procedure should be used when a heat exchanger will not be placed in service within six months after shipment from the factory. This procedure should also be used when an installed heat exchanger will be out of service for more than six months. Contact the Customer Service Department listed in Section 8.0 of this manual for copies of the procedure and assistance.

Caution:

A heat exchanger which has been in storage for more than five (5) years should be inspected by an APV representative prior to preparing it for operation.

5.0 ASSEMBLY

5.1 Handling

APV Paraflow Plate Heat Exchangers are shipped fully assembled and skid mounted, or when required, they are shipped unassembled in boxes. In either case, proper handling practices must be followed. The weight of an assembled heat exchanger is listed on the general arrangement drawing. Weights of components are listed on the shipping box. The skids and boxes are designed to be moved by standard lift trucks of proper capacity.

5.2 Lifting

All APV heat exchangers are provided with lifting holes, lugs or eyebolts to simplify lifting. The general arrangement drawing shows their size and location. When lifting an assembled heat exchanger frame, ensure that the lifting point is approximately above the center of the plate pack. A spreader beam is recommended for large or long frames.

Warning:

All lifting equipment must have the proper capacity and be in good condition. Personnel must follow safe rigging practices at all times.

5.3 Assembling the Frame

Caution:

All components must be properly supported during all phases of assembly.

The following steps are recommended to safely assemble an APV heat exchanger. These instructions refer to the components illustrated in Figure 2 in Section 3.0.

When assembling a heat exchanger frame, start by erecting and securing the head. Fasten the bottom guide bar to the head by the bolts supplied and block it up. Bolt the end support to the bottom guide bar with the bolts supplied. See **Figure 17**. Note that shorter bolts are used at the end support.

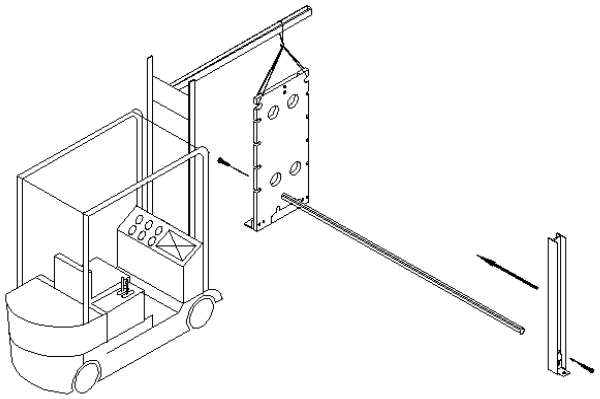


Figure 17

Position the follower in the frame next to the head and brace it securely. See **Figure 18**.

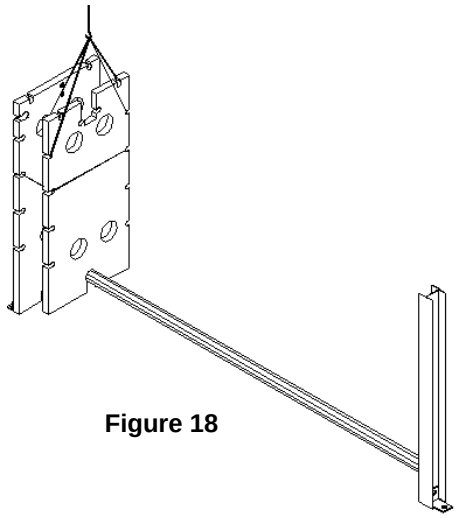


Figure 18

Position the top carrying bar between the head and end support and using the bolts provided, fasten it securely. See **Figure 19.**

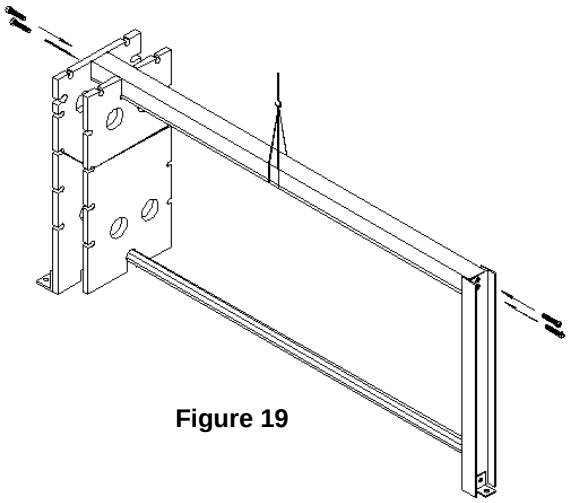


Figure 19

Lift the follower into place and install the roller and axle assembly. See **Figure 20**. Roll the follower back to the end support to allow plate installation.

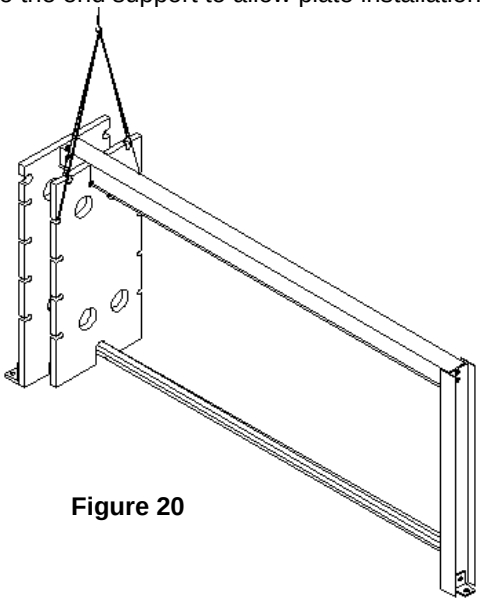


Figure 20

5.4 Installation of Plates

Wipe the top carrying strip clean between the head and the end support and apply a petroleum based rease to allow the plates to slide freely.

Install all the plates of the type and quantity specified on the plate arrangement drawing, starting at the head end of the frame. Check to make sure all plates are oriented properly, that gaskets are properly seated in their grooves, and there is no debris anywhere on the plates or gaskets. Clean the sealing surface with a lint free cloth. Push each plate firmly against the previous one. Use special care with plates having Paraclip gaskets (gaskets clipped to the plates) to avoid dislodging them. See **Figure 21.**

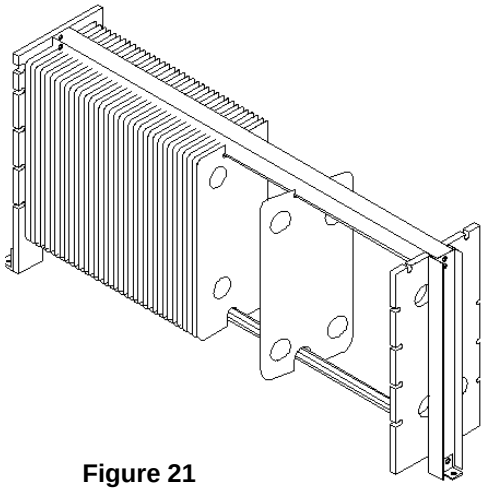


Figure 21

Note: The plate arrangement on the general arrangement drawing indicates if the gasket side of the plate faces the head or follower.

CAUTION:

During installation, always alternate left and right hand plates. For simplification only, whole blocks of identical left or right hand plates are shown on the plate arrangement drawing. The total number of each is given.

5.5 Installation of the Tie Bars

When all plates have been correctly installed, roll the follower up to the end of the plate pack. Install the tie bars into the frame holes or key hole slots as specified by the tightening instructions below.

Clean the tie bar threads and liberally apply an anti - seize compound along the area where the nuts will travel during tightening. Also apply the compound to both sides of the plain washer under the tie bar nut. APV recommends **Never-Seez® Regular Grade Lubricant** for carbon steel tie bars and **Never Seez® Black Moly Lubricant** for stainless steel tie bars**.** Do not use standard grease as it may result in galling. **Figure 22** shows an assembled frame with tie bars installed.

CAUTION:

Never-Seez® Regular Grade is not suitable for stainless steel tie bars.

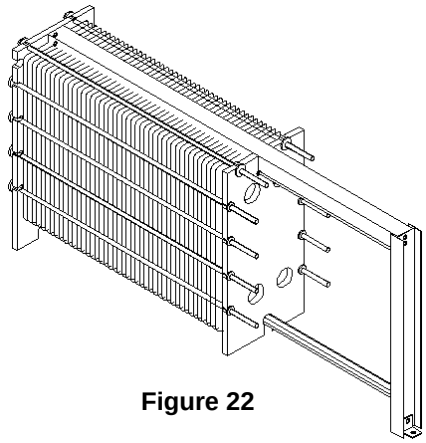


Figure 22

5.6 Closing Tie Bar Frames

The intent of these instructions is to provide a method to evenly and safely tighten a Paraflow Plate Heat Exchanger with tie bars. Proper tightening is essential for satisfactory operation and maximum gasket life. These instructions should be followed closely for both initial assembly and whenever the exchanger is closed after service.

1. Confirm that plates are all installed correctly to the general arrangement drawing. Check the quantity and orientation (alternating left and right). Move the follower toward the fixed head as far as it can go. Install four tie bars as shown in **Figure 23.**

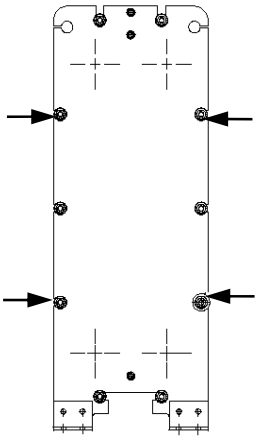


Figure 23

2. Starting with the top tie bar pair and alternating with the bottom, tighten the tie bars evenly about 1/2” to 1” at time until the platage dimension (thickness of the plate pack) measured at the installed tie bars is equal and the follower is parallel to the head. This measurement should be about 10% over the final plate dimension specified on the Paraflow plate arrangement drawing. Throughout this step, keep the dimension from one side to the other at each pair of tie bars within 1/4”. Also, always tighten the top pair of tie bars first to keep the plates from riding up.

WARNING:

Never tighten a Paraflow which is under pressure from any source.

Never tighten a Paraflow with piping connected to the follower or connector grids.

3. Install the rest of the tie bars on the sides of the heat exchanger between the ports (if applicable) and tighten them evenly until the plate dimension is the same at all installed tie bars.

4. Starting with the top pair of tie bars, continue tightening equally about 1/4" at time until the platage dimension measures about 5% above the final dimension.

5. Install the remaining tie bars (if applicable) above the top ports and below the bottom ports of the frame. Starting with the top pair and working down, tighten each pair 1/8" at a time. After each tightening cycle of 1/8", return to the top set of bars and repeat the procedure.

NOTE: On large heat exchangers using 2", 42 mm or 48 mm diameter tie bars, it may only be possible to achieve 1/16" movement during the final stages of tightening.

6. Tighten the exchanger to the maximum platage dimension specified on the plate arrangement drawing. The dimension must be the same at all tie bars. See **Figure 24**

WARNING:

Refer to your plate arrangement drawing for the proper tightening plate dimension.

NOTE: Due to o-ring type gasket seal, **the final closed dimension is determined by dimension**, not tie bar torque.

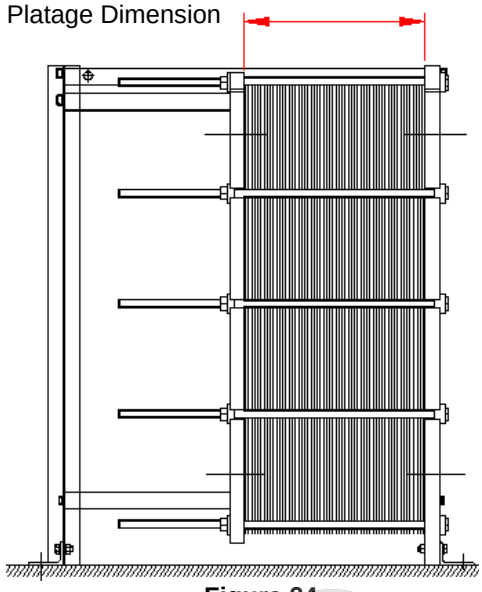


Figure 24

Manufacturing tolerances of the plate may result in the actual minimum platage dimension varying. Refer to your plate arrangement drawing for actual minimum and maximum dimensions.

7. Pressure test the heat exchanger for leaks by using **potable water** at the desired pressure but do not exceed the pressure specified on the drawing. The test may be done on each side separately or on both sides at once. Make sure all air is vented from the heat exchanger before performing the pressure test.

8. If leaks occur, the heat exchanger may be further tightened and retested. It is suggested that this be done in steps of approximately 0.001" per plate until the leak stops or the minimum dimension specified on your general arrangement drawing is reached.

9. If the leaks continue, mark them carefully and open the exchanger in accordance with Paragraph 5.7. Inspect the area of the leaks closely for damaged gaskets, plates, sealing surfaces or debris. Replace all suspect plates or gaskets, clean the sealing surface with a lint free cloth, and repeat steps 1 through 7.

5.7 Opening Tie Bar Frames

Tie bar frames may be opened safely by following steps 1 through 6 in Paragraph 5.6 in reverse order. The tie bars must be loosened in the same sequence and amount as described in each step.

WARNING:

Never open a Paraflow until the unit has been cooled below 100°F (38°C).

Never open a Paraflow which is under pressure from any source.

Never open a Paraflow with piping connected to the follower or connector grids.

6.0 STARTUP AND OPERATION

6.1 General

Prior to startup, make sure the unit is correctly assembled and the piping connected properly. Also, check that the plates have been compressed to the proper dimension specified on the general arrangement drawing. See **Figure 24** and refer to Section 5.0.

Warning:

Proper assembly and tightening are required for safe startup and operation.

6.2 Startup

Caution:

All pipe lines must be inspected and flushed clean prior to operation. Strainers are recommended to prevent debris from installation from entering the unit.

Sudden surges and rapid changes in pressure or temperature must be avoided, as these may damage the plates and gaskets. Throttling valves, flow diversion valves and shut off valves must be operated slowly. Control flows with throttling valves downstream of the heat exchanger.

Caution

Do not allow the pressure to change more than 150 psig (10 bar) per minute or the temperature more than 20°F (11°C) per minute.

Improper startup will cause damage to the heat exchanger frame, plates or gaskets. Follow instructions closely.

Valves located on the outlet side of any liquid stream must be opened prior to startup to prevent dead heading the heat exchanger.

If steam or another condensable vapor is used as a heating media, it must be turned on after liquid has been introduced on the product side.

During initial startup, the exchanger may develop minor leaks. If these leaks do not stop when the unit has reached operating temperatures, refer to Paragraph 6.5 Troubleshooting.

Air in the heat exchanger will normally be carried out by the liquid flow. However, it is good practice at startup to vent air from the system at a high point in the piping. This will ensure the system is filled with liquid.

6.3 Operation

During operation, the same precautions against rapid changes of pressure or temperature during start-up must be observed. Once normal operating conditions are reached, temperature and pressure drops must be regularly checked. Increasing pressure drops and/or falling temperature may indicate reduced performance of the heat exchanger. This must be investigated to determine the cause. See Paragraph 6.5 Troubleshooting.

Warning:

Do not exceed the maximum operating pressure or temperature listed on the general arrangement drawing or damage to the heat exchanger will result.

6.4 Shut Down

The heat exchanger must be shut down slowly and allowed to cool naturally to room temperature. Inlet valves, if used, should be closed before outlet valves. If steam is used as a heating media, it must be shut off first. In cooling duties, the cooling liquid must be shut down first to avoid freezing of the product.

All liquids must be drained from the heat exchanger after shut down to prevent precipitation of products or scale buildup.

If the heat exchanger will be out of service for six months or longer, it must be properly prepared for storage. See APV Standard Procedure SP5002 for instructions. Contact the Customer Service Department listed in Section 8.0 of this manual for copies of the procedure and assistance.

6.5 Troubleshooting

APV plate heat exchangers are designed to provide trouble free service over the life of the unit. However, conditions or processes may change, resulting in reduced performance or even leakage. The following table provides some guidelines for diagnosing common problems and suggested solutions.
This table is intended as a general guide only. Assistance in specific cases may be obtained by calling your nearest Service Center listed in the front of this manual or the Customer Service Department listed in Section 8.0.

Troubleshooting Plate Heat Exchangers

Problem	Possible Causes	Suggested Solutions
1. Reduced Heat Transfer	a. The inlet temperatures or flow rates do not correspond to the original design.	Correct temperatures or flow rates to design conditions.
	b. Plate surfaces have become fouled on either the product or service side.	Open the heat exchanger and clean the plates or clean the plates in place by circulating a suitable cleaning agent -- see Section 7.0.
	c. Freeze up.	Correct temperatures or flow rates to design conditions.
2. Increased Pressure Drop or Reduced Flow Rate	a. Plate surfaces have become fouled on either the product or service side.	See paragraph 1(b) above.
	b. Debris is blocking the flow channels.	Open the heat exchanger and clean the plates -- see Section 6.0. Screens or filters must be installed to prevent debris from entering the unit.
3. Visible leakage	a. Operating pressure exceeds the rating of the heat exchanger.	Reduce the operating pressure to the rating of the heat exchanger. If the unit continues to leak after the pressure is reduced, the plates or gaskets are damaged and must be replaced. See Section 7.0.

Troubleshooting Plate Heat Exchangers		
Problem	**Possible Causes**	**Suggested Solutions**
3. Visible leakage (continued)	b. The heat exchanger is not tightened adequately for the operating conditions.	Tighten the heat exchanger further in increments of .001 inch per plate, checking for leakage each time. Do not tighten below the minimum dimension shown on the general arrangement drawing -- See Paragraph 5.6. If leaks continue, see paragraph 3(c) below.
	c. Sealing surfaces of plates or gaskets may be damaged or dirty.	Open the heat exchanger and inspect the plates and gaskets. There must not be any cuts, cracks, debris or flat spots on the gaskets. Paraclip gaskets must not have any debris under the gasket. The plates must be clean and free of heavy scratches or dents on both sides. Replace the defective parts.
	d. Chemical attack of the gaskets.	Identify the source of chemical attack and correct either by eliminating the corrosive agent or changing the material of the gaskets.
4. Cross Contamination	a. Cracks in one or more plates. These may be caused by fatigue resulting from pressure fluctuations during operation. Dye penetrant testing may be required to identify cracks in the plates -- refer to Factory Service, Section 8.0 for assistance.	Open the heat exchanger and inspect the plates. Replace the defective parts. Identify the source of pressure fluctuations and correct.
	b. Holes in the plates caused by corrosion.	Identify the source of corrosion and correct either by eliminating the corrosive agent or changing the material of the plates.

7.0 MAINTENANCE

7.1 Opening the Frame

WARNING:

Never open a Paraflow until the unit has been cooled below 100°F (38°C).

Never open a Paraflow which is under pressure from any source.

Never open a Paraflow with piping connected to the follower or connector grids.

Opening Tie Bar Frames
Drain all fluids from the heat exchanger and allow it to cool. Loosen the tie bars evenly in reverse order of steps 1 through 6 in Paragraph 5.6. Remove the tie bars and push the follower towards the end support **(Figure 25)**. The plates may now be separated for cleaning and inspection.

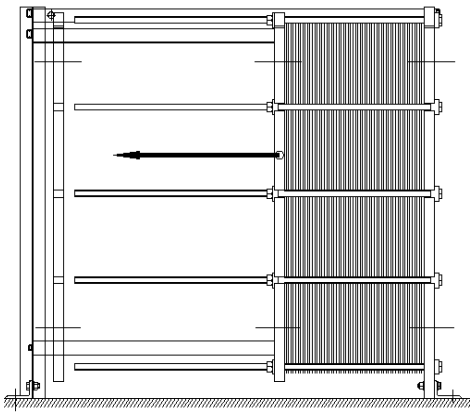


Figure 25

7.2 Inspection

Check the front and back of every plate for cleanliness and freedom from debris. Product build up and scale will reduce the performance of the heat exchanger and cleaning is required - See Paragraph 7.3.

Check each plate for cracks or holes. Some cracks may not be readily visible and will require dye penetrant inspection to locate them. Contact your nearest APV Service Center listed at the front of this manual.

Gaskets must be thoroughly checked for cuts, flattening, cracks, brittleness, breakage and proper fit of the gasket groove. The gasket groove in the plate must be free of distortion or kinks.

The entire gasket and sealing surfaces of the plates must be totally free of any debris since any foreign material will cause leakage and may damage the gasket. When installing clip in gaskets, careful inspection is required to be sure there is no debris or glue from previous gaskets under the installed gasket which will cause leakage.

7.3 Clean In Place (CIP)

Cleaning in place is accomplished by circulating a suitable cleaning solution through the heat exchanger instead of opening it. This removes deposits or trapped product on the plates. CIP works best in the reverse direction of normal flow. Good results are also possible with same direction flow and higher velocities. If the product to be flushed out has a high viscosity, the circulation flow rate must be large enough to reach a sufficient speed for flushing out the product.
If the product pump is volumetric, it may be necessary to insert a pump for the cleaning solution in parallel to the former. It is assumed that the fouling on the plates is soluble in a cleaning solution that does not attack plates and gaskets.

Great care must be taken to select proper cleaning solutions and cycles to avoid damaging the plates and gaskets. Due to the large variety of cleaning needs, each user is responsible for determining the best method for his situation. It is recommended that a

reputable supplier of cleaning materials be consulted for assistance. The capacities and resistance to corrosion of plate heat exchangers depend on the plate pack being kept clean.

Example of CIP-cleaning:

- Drain off product residues and cooling and heating media.
- Rinse with cold or lukewarm water.
- Circulate with warm cleaning fluid solution.
- Rinse with warm water. Rinse with warm water with softener added to it.
- Rinse with cold or lukewarm water.

Cleaning can also be effected without circulation by pouring a cleaning fluid solution into the system. After some time of standing, wash out the detergent with clean water.

7.3.1 Determination of correct CIP regime.

The plate heat exchanger must be opened for inspection at regular intervals. This is necessary especially during the running-in period, until experience has been gained on the effectiveness of the cleaning process.
With these inspections, it will gradually be possible to determine circulation times, temperatures, and chemical concentrations with great certainty!

Insufficient cleaning is most often due to:

- too small circulation quantity
- too short cleaning period.
- too small chemical consumption in relation
- to the fouling on the plates.
- too long periods of operation.

If the plate heat exchanger is out of operation for a long time, it is advisable to empty it, separate the plates, and clean the unit.
Clamp the plate heat exchanger lightly together, and leave it covered in order to protect the gaskets against dirt and the effect of light!

7.3.2 Acceptable CIP solutions.

The definition of an acceptable CIP solution is brief and to the point. Fouling on the plates must be removed without damaging plates and gaskets or reducing the inherent corrosion resistance. It is important not to decompose the passive (protective) film on stainless steel - the film contributes to preserving the resistance of the steel to corrosion.

Do not use chlorine-containing agents such as hydrochloric acid (HCl).

EXAMPLE OF AN ACCEPTABLE CIP SOLUTION:
(Basis Stainless 316 plates and Nitrile gaskets in Dairy applications.)

- OIL AND FATS are removed with a water emulsifying oil solvent, e.g. BP-SYSTEM CLEANER.
- ORGANIC AND GREASY COATINGS are removed with SODIUM HYDROXIDE (NaOH) – Typical concentration 1.5% w/w max. temperature 85°C (185-F). 1.5% w/w concentration corresponds to 3.75 litre 30% NaOH per 100 litre water.
- MINERAL SCALE DEPOSITS are removed with NITRIC ACID ($HN0_3$)-max. concentration 1.0% w/w - max. temperature 65°C (149°F).
  1.0 % w/w concentration corresponds to 1.17 litre 62% $HN0_3$ per 100 litres water.
- Excess Nitric acid can seriously damage Nitrile rubber gaskets.

Several alternative acids to Nitric can be used, Phosphoric acid can be used at up to 5% and 85°C. Consult APV to find all the alternative CIP regimes possible.

Caution

The heat exchanger must be thoroughly drained and rinsed immediately following CIP. Residue from CIP may cause corrosion if left in the heat exchanger.

7.3.3 Measurement of solution concentration.

SODIUM HYDROXIDE (NaOH) solution is titrated with 0.1 n HYDROCHLORIC ACID (HCl) with methyl orange or methyl red as indicator.
NITRIC ACID ($HN0_3$) solution is titrated with 0.1 n SODIUM HYDROXIDE (NaOH) with phenolphthalein as indicator.

The concentration of the cleaning fluid in % can be calculated from the titration result according to the following formula:

$$\text{CONCENTRATION} = \frac{b \times n \times m}{a \times 10} \ \%$$

a = ml volume of cleaning fluid in sample for titration
b = ml vol. titration fluid added to change of color
n = normality of titration fluid
m = molecular weight of cleaning fluid (NaOH) molecular weight 40 ($HN0_3$)molecular weight 63.

In order to use the correct quantity of chemicals for CIP cleaning, the cleaning fluid should be checked immediately before flushing. If the concentration is too low, <0.5%, the plate heat exchanger is probably not clean. If the concentration is too high, >1%, the chemical consumption can be reduced.

7.4 Replacement of plates

Before replacing a plate in a heat exchanger, the new plate must be checked against the plate it is replacing. The new plate must be identical in every way.

The general arrangement drawing provided with the heat exchanger provides information on the material, port punching, gaskets and location of each plate in the heat exchanger.

Note: During the installation, **always alternate left and right hand plates**. For simplification only, whole blocks of identical left or right hand plates are shown on the plate arrangement drawing. The total number of each is given. Vertical flow plates may be changed from left hand to right or vice versa by turning the plate over.

7.5 Regasketing

Plate heat exchanger gaskets are attached to individual plates by one of two methods, glued or clip in. Glued in gaskets are attached by a thermoplastic adhesive which is heat cured for maximum strength.

The clip in gaskets (Paraclip) are attached to the plates by small nubs around the perimeter of the gasket which snap into matching holes.

Removal of old gaskets
To remove Paraclip clip in gaskets, the gasket may be carefully pulled from the plate. If the gasket is to be reused, pull slowly to avoid tearing off the clips or stretching the gasket.

To remove glued in gaskets, the bond between the plate and gasket is softened by using a propane torch to heat the plate from the nongasketed side directly behind the gasket. As the adhesive softens, use pliers to pull the gasket from the groove. Continue this process until the entire gasket has been removed.

Caution

Avoid overheating the metal. This will discolor and damage the plate.

To remove remaining traces of old adhesive, grease or dirt from gasket grooves, use a solvent such as Acetone or a commercial gasket removal product. Do not use abrasives to clean the gasket grooves.

Attachment of Glued in Gaskets
To attach new replacement gaskets, apply a thin even film of 3M formula EC-1099 adhesive to the plate gasket groove. The adhesive may be spread evenly with a small acid brush dipped in acetone. Allow the adhesive to dry until tacky, about 30 seconds. Press the gasket firmly in place, starting at one corner of the plate and continuing across and along the length of the plate. The entire gasket must be firmly in place with no twists or bumps.

As each plate is gasketed, it should be stacked neatly on a clean, flat surface in the order it will be installed. Take special care not to move the gaskets out of position. After all the plates are regasketed, they may be placed in the frame. The frame is tightened per Paragraph 5.6 to a platage dimension about 10% above the maximum compressed platage specified on the general arrangement drawing.

Heat treatment is essential to cure the adhesive and obtain maximum bond strength. This is done using steam or hot water to heat the plate pack. Attach a low pressure desuperheated steam line to an upper port and slowly raise the temperature of the plate pack to at least 220°F (105°C). Maintain the temperature for a minimum of three hours.

If steam is not available, hot water may be used with the same temperature and time requirements as steam.

After the required time, allow the heat exchanger to cool naturally to room temperature and complete the tightening to the required dimension per paragraph 5.6.

Attachment of Paraclip Gaskets

Non-glued Paraclip gaskets are an alternative to glued in gaskets that greatly simplifies on site regasketing. The gaskets have a series of small nubs or projections molded into the underside of the gasket. These projections fit into corresponding slots located around the periphery of the plate and port areas, securing the gasket to the plate **(Figure 26)**. When the plate heat exchanger is tightened, a complete and secure seal is assured.

To attach an Paraclip gasket, the gasket is laid out on the plate in its correct position. The projections are firmly pressed into the corresponding slots in the plates. After installing the gasket, the plate may be immediately installed in the frame in preparation for tightening.

Figure 26.1

Figure 26.2

Figure 26.3

Attachment of EasyClip Gaskets
Non-glued Easyclip gaskets are an alternative to glued in gaskets that greatly simplifies on site regasketing. During fixing the gasket a pressure is applied, which expands 2 tongues into 2 slots in the plate. This barbed effect (fish hook) secures the gasket to the plate, in fact it now takes more force to remove the gasket than to apply it. These tongues fit into corresponding slots located around the periphery of the plate and port areas, securing the gasket to the plate **(Figure 27)**. When the plate heat exchanger is tightened, a complete and secure seal is assured.

To attach an EasyClip gasket, the gasket is laid out on the plate in its correct position. The projections are firmly pressed into the corresponding slots in the plates. After installing the gasket, the plate may be immediately installed in the frame in preparation for tightening.

Figure 27

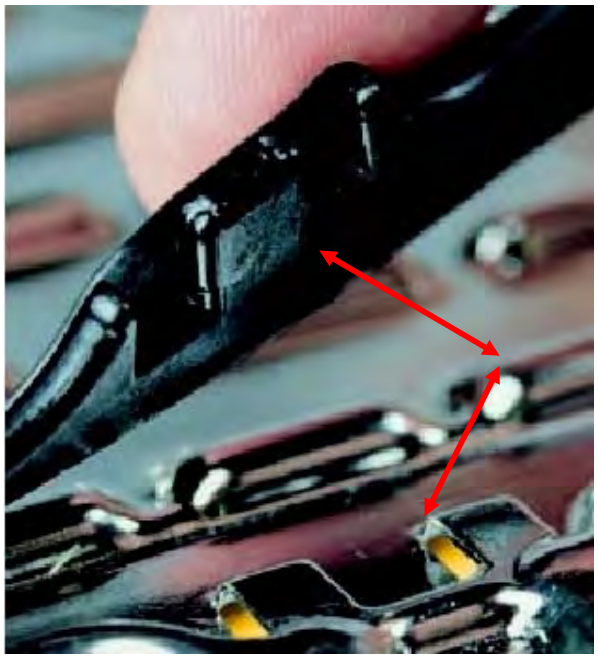


Figure 27.1

Figure 27.2

Figure 27.3

8.0 PARTS AND SERVICE

8.1 Ordering Parts

Parts, plates and gaskets may be ordered referencing the W. O. Number listed on the Heat Exchanger nameplate when ordering.

APV Parts Express
Tel: (888) APV 4321
(1-888-278-4321)

8.2 Service

APV maintains service facilities at several locations around the country. These sites are equipped to repair, rebuild or regasket your heat exchanger. Service personnel are also available to provide on-site assistance. Call the number listed below to inquire about or arrange for service.

APV Heat Transfer
Customer Service Center

Southwest
APV Service Center
1101A Pleasantville Drive
Houston, TX 77029

Phone: (888) 278-1030
Fax: (888) 278-1050

West Coast
APV Service Center
863 East Levin Avenue
Tulare, CA 77029

Phone: (559) 685-7400
Fax: (559) 685-5241

8.3 Documentation

Copies of this manual, the General Arrangement Drawing or other documents referenced by this manual may be ordered from the Customer Service Department listed in Paragraph 8.1.

9.0 ACCESSORIES

9.1 Manual Tightening Wrenches

Manual tightening wrenches are available for most APV Paraflow Plate Heat Exchangers to allow opening and closing a unit in the field. Ratchet type wrenches specifically designed for tie bars are available for medium to large exchangers. The T4, Junior, H17, SR1, TR1 and SR2 use box wrenches of the correct size. Power tightening equipment is required to tighten LR9, TR9, SR14, B Series and SR23 heat exchangers.

9.2 Power Tightening Equipment

Pneumatic Wrench
To facilitate the closing and tightening of large heat exchangers or units containing numerous plates, pneumatic tightening wrenches are available in two models, both as single or dual units.

Figure 28 shows the pneumatic power tighteners recommended for specific tie bar tightening heat exchangers. **Figure 29** gives a description of each tightener model.

Pneumatic Wrench Recommendations

MODEL	SINGLE PT-5	DUAL PT-5	SINGLE PT-7	DUAL PT-7
SR3	GOOD	BEST		
R4/LR4	GOOD	BEST		
R5	GOOD	BEST		
SR6 SERIES	GOOD	BEST		
R8	GOOD	BEST		
SR9	GOOD	BEST		
TR9/LR9 SERIES			GOOD	BEST
B SERIES			GOOD	BEST
SR14 SERIES			GOOD	BEST
SR23 SERIES			GOOD	BEST

Figure 28

The power tightener assemblies require clean lubricated air at a minimum of 90 psig at the filter-regulator inlet. Air consumption is 25 scfm full load or 40 scfm no load for each tightener.

Tightener Data

TIGHTENER MODEL	DRIVE	SPEEDS	WEIGHT EACH
PT-5	1”	1 FORWARD 1 REVERSE	60 LB. (27 Kg)
PT-7	1-1/2”	2 FORWARD 2 REVERSE	80 LB. (36 Kg)

Figure 29

9.3 Spray Screen

A spray screen may be supplied for new or existing plate heat exchangers. They are recommended whenever corrosive liquids or high temperatures present a safety hazard to personnel near the exchanger. These spray screens enclose the plate pack completely on the sides and top and are easily removed. The bottom is open to allow leak detection. **Figure 30**

Figure 30

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