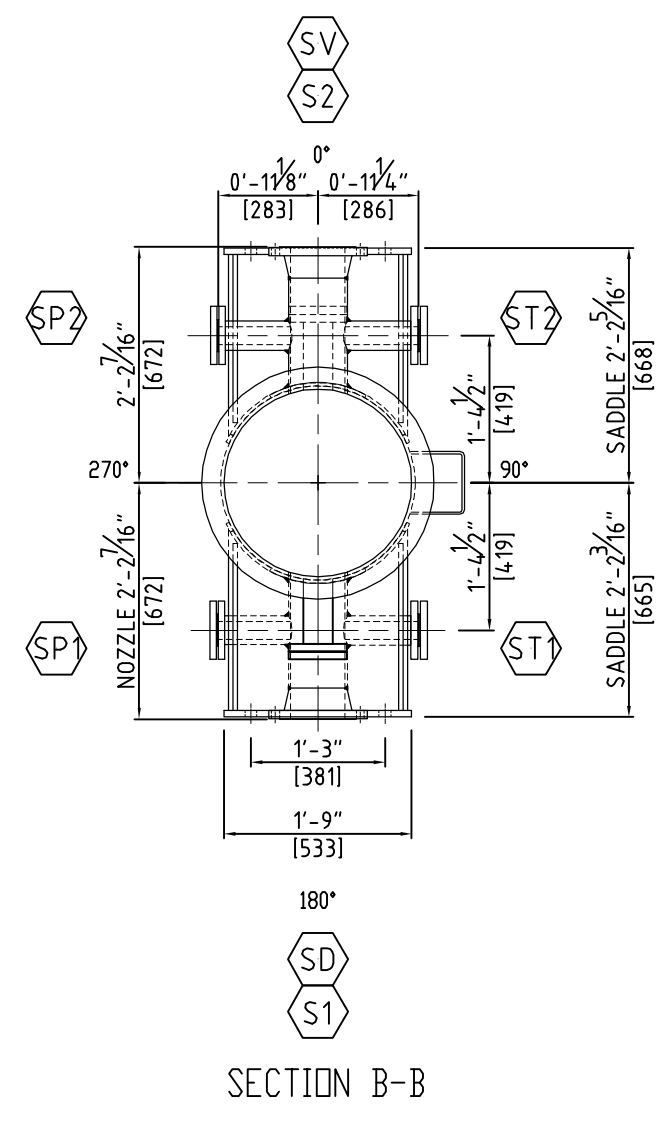
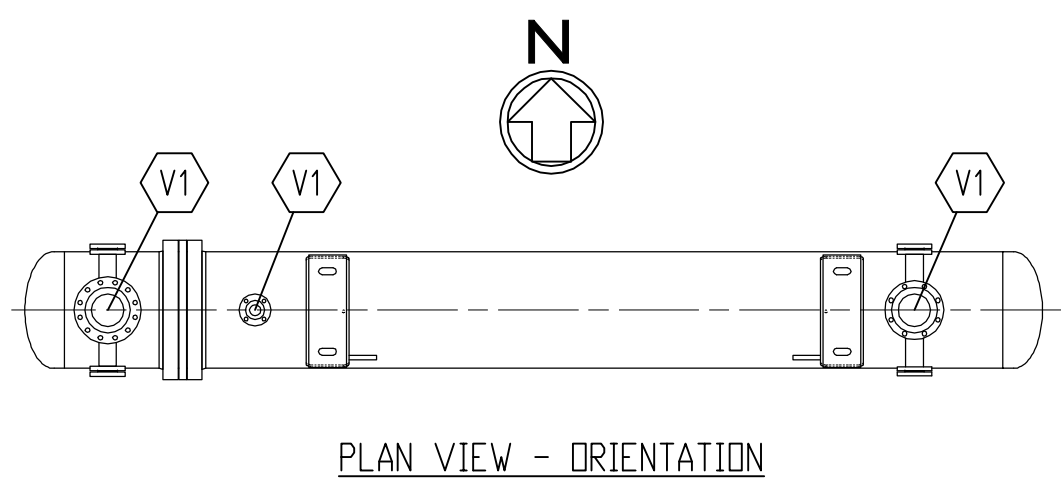
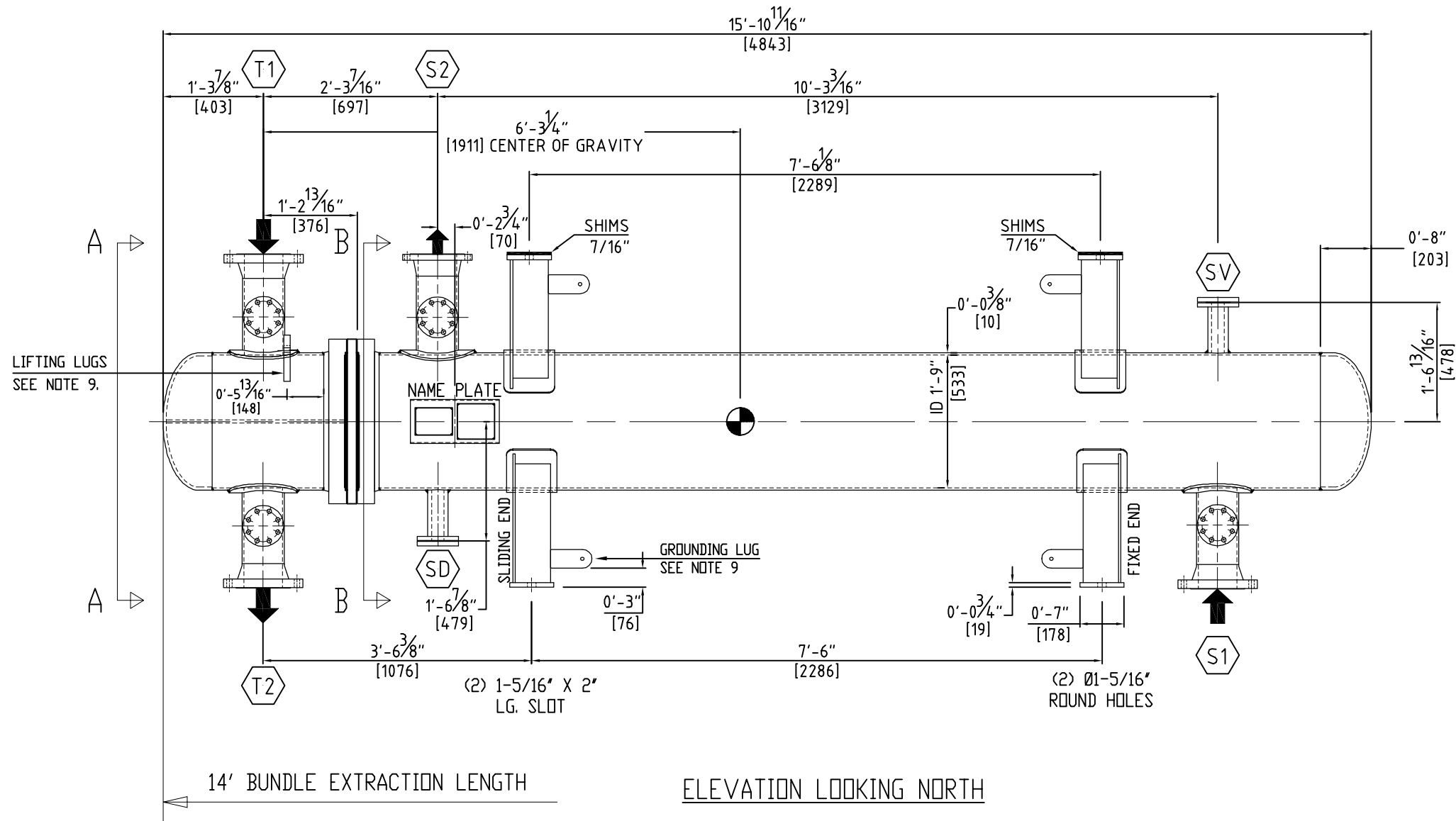
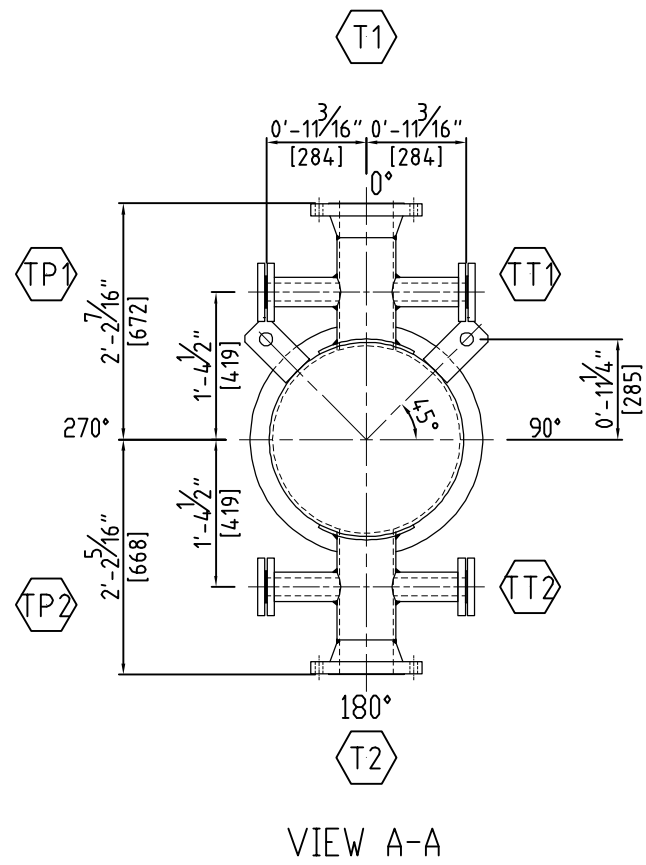




MARK	NOZZLE SIZE NPS	FORCES lbf			MOMENTS ft-lbf		
		P	V _L	V _C	M _L	M _V	M _C
T1	6	1800	1500	1500	3000	3150	2700
T2	6	1800	1500	1500	3000	3150	2700
S1	6	1800	1500	1500	3000	3150	2700
S2	6	1800	1500	1500	3000	3150	2700

NOZZLE SCHEDULE						
MK	QT	DESCRIPTION	FLANGE	NECK	PROCESS	
S1	1	6" 150# WNR	SA-105	SA-106B Sch40	SS INLET	
S2	1	6" 150# WNR	SA-105	SA-106B Sch40	SS OUTLET	
T1	1	6" 300# WNR	SA-105	SA-106B Sch40	TS INLET	
T2	1	6" 300# WNR	SA-105	SA-106B Sch40	TS OUTLET	
SP1	1	2" 150# LWN	SA-105		PRESSURE GAUGE	W/BLIND
SP2	1	2" 150# LWN	SA-105		PRESSURE GAUGE	W/BLIND
ST1	1	2" 300# LWN	SA-105		THERMOWELL	W/BLIND
ST2	1	2" 300# LWN	SA-105		THERMOWELL	W/BLIND
TP1	1	2" 300# LWN	SA-105		PRESSURE GAUGE	W/BLIND
TP2	1	2" 300# LWN	SA-105		PRESSURE GAUGE	W/BLIND
TT1	1	2" 300# LWN	SA-105		THERMOWELL	W/BLIND
TT2	1	2" 300# LWN	SA-105		THERMOWELL	W/BLIND
SV	1	2" 150# LWN	SA-105		VENT	W/BLIND
SD	1	2" 150# LWN	SA-105		DRAIN	W/BLIND

GENERAL NOTES		
1. ALL BOLT HOLES TO STRADDLE NATURAL CENTER LINES.		
2. INSULATION THICKNESS: SHELL SIDE 2.5", TUBE SIDE 3.5". (BY OTHERS)		
3. FLANGE FACING ROUGHNESS: 125-250 AARH.		
4. THESE UNITS ARE STACKED ON BOTTOM AND UNITS 107-CNT-E-101B ARE TOP.		
5. PAINT SPECIFICATION: TUBE SIDE: PAINT SYSTEM 6 - ACC DOC. 000-SP-MU-10-0017 SURFACE PREPARATION: SSPC SP10 1.0-2.0 MILS PRIMER: IO ZINC 2.5-3.0 MILS INTERMEDIATE: NONE FINISH: NONE SHELL SIDE: PAINT SYSTEM 5 - ACC DOC. 000-SP-MU-10-0017 SURFACE PREPARATION: SSPC SP10 1.0-2.0 MILS PRIMER: NOVOLAC EPOXY 4.0-6.0 MILS INTERMEDIATE: NOVOLAC EPOXY 4.0-6.0 MILS FINISH: NONE SADDLES AND UN-INSULATED SURFACES PAINT SYSTEM 1 - ACC DOC. 000-SP-MU-10-0017 SURFACE PREPARATION: SSPC SP10 1.0-2.0 MILS PRIMER: IO ZINC 2.5-3.0 MILS INTERMEDIATE: HB EPOXY 4.0-6.0 MILS FINISH: URETHANE 1.5-2.5 MILS		
6. NON-DESTRUCTIVE EXAMINATION ACCORDING TO API 660, CLAUSE 10		
7. THESE UNITS DON'T NEED PWHT.		
8. STEAM-OUT CONDITIONS ARE 366 °F, 0 psig		
9. FOR GROUNDING LUGS AND LIFTING LUG SEE DWG: DG-MR-11210-01-107-CNT-E-101-A-05		
10. THESE UNITS ARE PROVIDE WITH N2 PURGE		
NO.	DATE	REVISIONS
28-06-11		DRAWING AS BUILT
11-12-10		INCLUDE CB&I COMMENTS AND INTERNAL REVISION
11-11-10		INCLUDE CB&I COMMENTS AND INTERNAL REVISION
13-09-10		INCLUDE CB&I COMMENTS AND INTERNAL REVISION
07-05-10		NOZZLE REINFORCEMENT AND CBI COMMENTARIES
26-03-10		ISSUE FOR REVISION

DESIGN DATA		
TYPE		
TEMA "BEU"		
ASME CODE SECT. VIII DIV.1, 2007 EDD. ADD. 09 (STAMP YES)		
TEMA CLASS R and API-660 APPLIES		
WIND AND SEISMIC CODE: UBC 1997		
CB&I SPECIFICATIONS		
SIDE	SHELL	TUBE
FLUID	LCN FEED	H2S STRIPPER BOTTOMS
INT DESIGN PRESSURE	216 PSI	170 PSI
MAX DESIGN TEMPERAT.	340 °F	630 °F
EXT. DESIGN PRESSURE	N/A (NOTE 8)	N/A (NOTE 8)
CORROSION ALLOWANCE	0.125"	0.125"
RADIOGRAPHY	RT3	RT3
LONGITUDINAL	SPOT	SPOT
CIRCUMFERENTIAL	SPOT	SPOT
JOINT EFFICIENCY	0.85	0.85
CHARPY IMPACT TEST	EXEMPT PER UG-20(F) & UCS-66(C)	
PWHT	NO	NO
MAWP	216 psi @ 340 °F	182 psi @ 630 °F
MDMT DESIGN (RATED)	0 °F @ 216 psi	0 °F @ 182 psi
HYDROSTATIC TEST PRESSURE	281 psi at 70 °F	238 psi at 70 °F
No OF PASSES	1	2
TUBES	(127 U) O.D. 3/4" x 0.083" (MW) x 144" L.G.	
TUBE PITCH	1" SQUARE (90°)	
SURFACE	598 ft²	

ESTIMATED WEIGHTS Lbs.		
DRY:	11,852 lb	BUNDLE: 2,285 lb
		WET: 13,985 lb
WEIGHT AT LEFT SADDLE: 8,466 lb (Oper), 9,239 lb (Test)		
WEIGHT AT RIGHT SADDLE: 4,024 lb (Oper), 4,507 lb (Test)		
WEIGHT OF SADDLE PAIR: 238 lb		

MATERIAL	
CHANNEL:	SA-516 70
SHELL:	SA-516 70
TUBESHEETS:	SA-516 70 N
BAFFLES:	SA-36
TUBES:	SA-214 WLD TUBE
TUBE SIDE FLANGE:	SA-266 2-N
SHELL SIDE FLANGE:	SA-266 2-N
BOLTING :	SA-193 B7

GASKETS	
SHELLSIDE :	METAL DOUBLE JACKETED 304 S.S. GRAPHITE FILLED
TUBESIDE :	METAL DOUBLE JACKETED 304 S.S. GRAPHITE FILLED
BLINDED NOZZLES :	FLEXITALLIC SPIRAL WOUND 304 S.S. TYPE CGI

REFERENCE DOCUMENTS		
DESCRIPTION	DOCUMENTS No.	REV.
MECHANICAL CALCULATIONS	MC-MR-11210-01-107-CNT-E-101-A	4
GENERAL ARRANGEMENT AND ORIENTATION	DG-MR-11210-01-107-CNT-E-101-A-01	4
ASSEMBLE	DG-MR-11210-01-107-CNT-E-101-A-02	3
NO STANDARD FLANGE & GASKETS	DG-MR-11210-01-107-CNT-E-101-A-03	2
TUBE BUNDLE	DG-MR-11210-01-107-CNT-E-101-A-04	3
NAME PLATE & ATTACHMENT	DG-MR-11210-01-107-CNT-E-101-A-05	4
BILL OF MATERIALS	DG-MR-11210-01-107-CNT-E-101-A-06	4
STACKING	DG-MR-11210-01-107-CNT-E-101-AB-07	4
INSULATION CLIPS	DG-MR-11210-01-107-CNT-E-101-A-08	2
WELDING MAP	WM-MR-11210-01-107-CNT-E-101-A/B	1

INTERCAMBIADORES DE CALOR
CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO

Refinería de Cartagena S.A.

Cartagena Refinery Expansion Project
Cartagena, Colombia
JOB NO.: OTI-100202 (ITEM 36)
P.O. NO.: 42166001-PO-0001121001

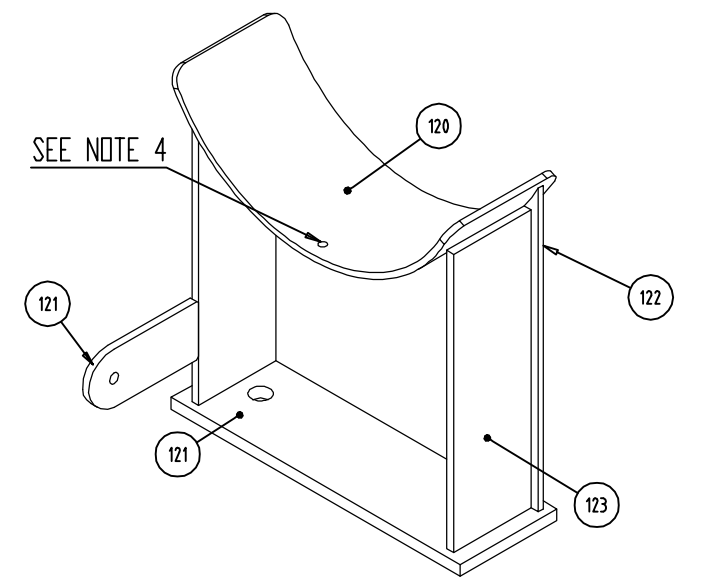
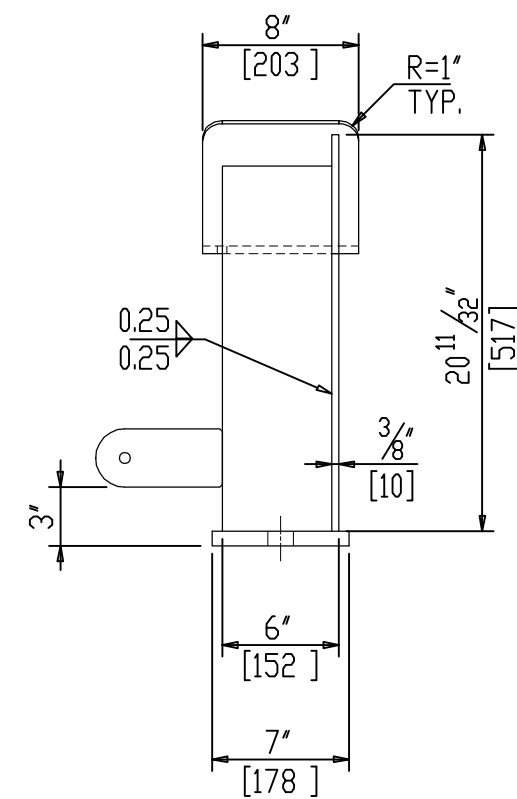
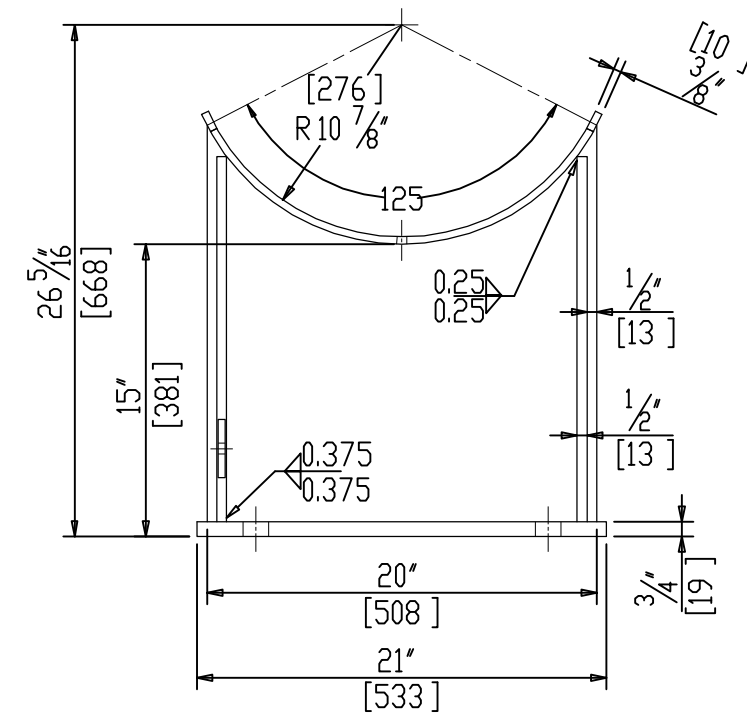
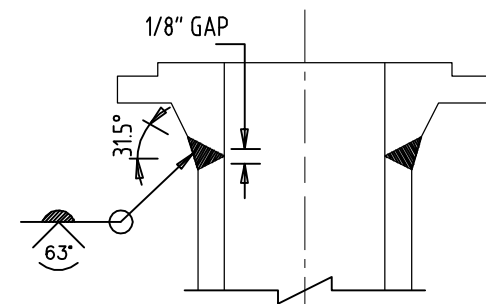
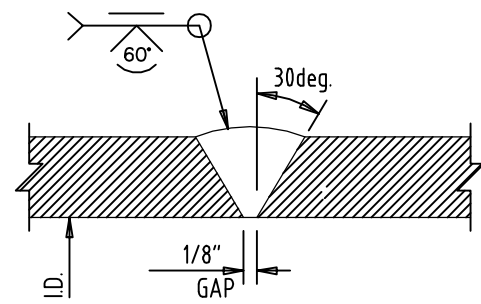
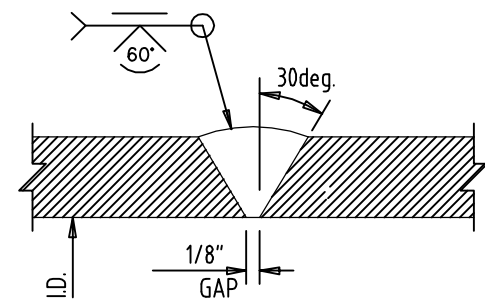
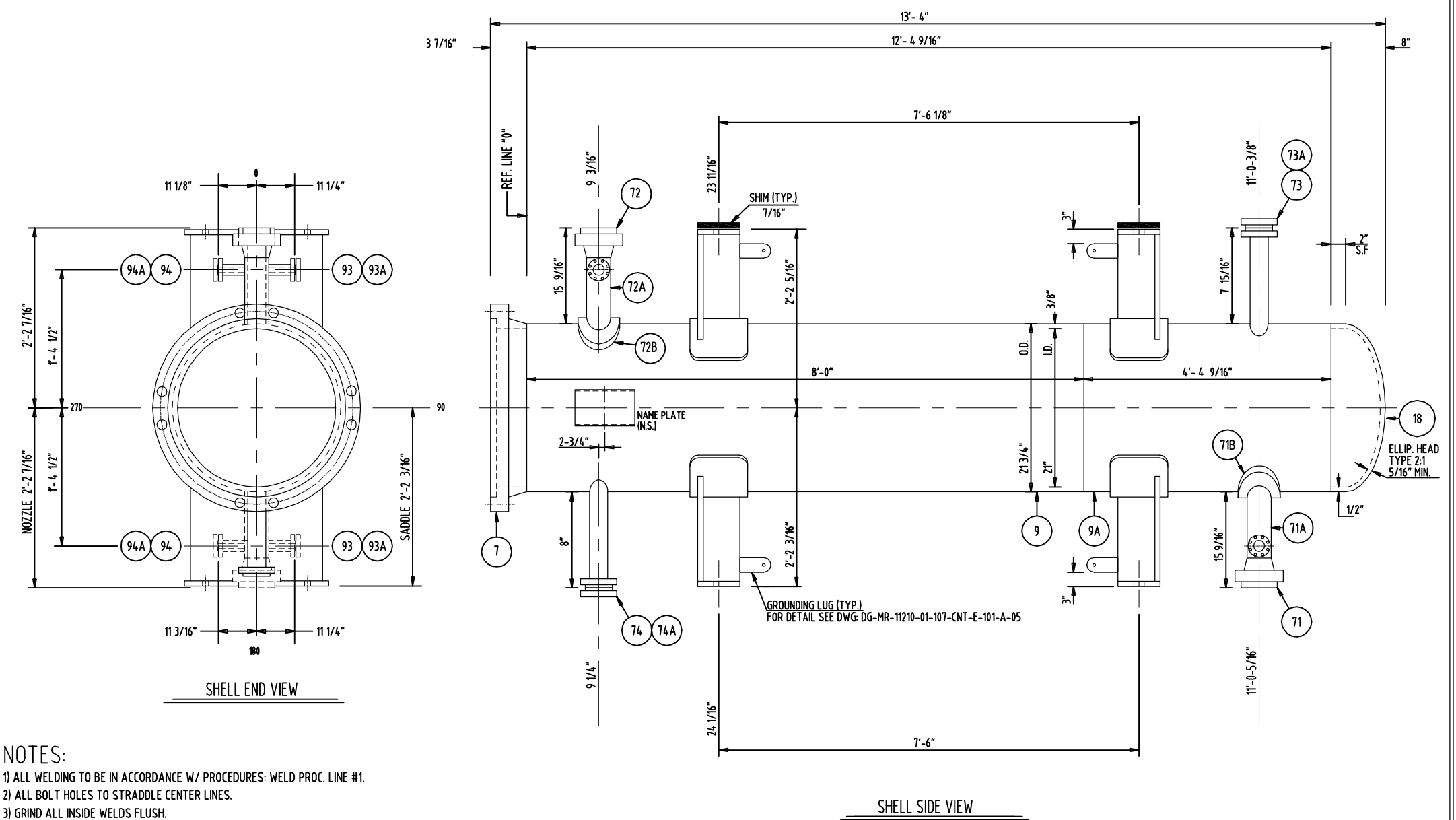
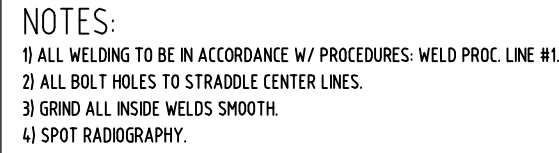
SERVICE: CDHYDRO FEED PREHEATERS
TAG.: 107-CNT-E-101A
QTY. / SIZE: 1 / 21"-14.4"

TEMA TYPE: BEU

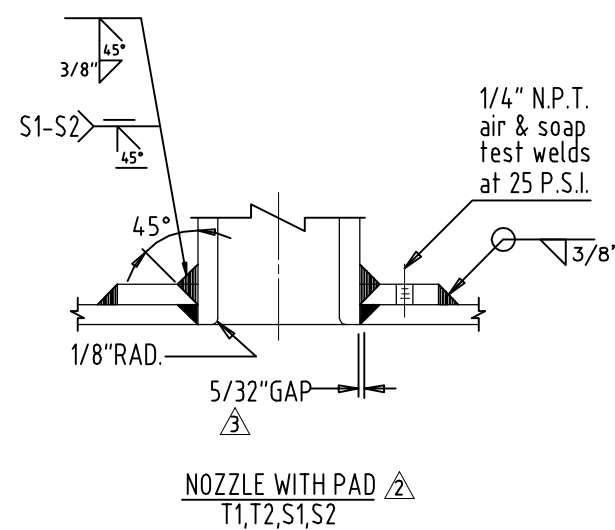
DWN. BY: F. ECHEVERRY
CHKD. BY: C. NARIÑO
APPVD. BY: A. VARELA

SCALE: .
DWG: 1 OF 8
DWG. NO.: DG-MR-11210-01-107-CNT-E-101-A-01

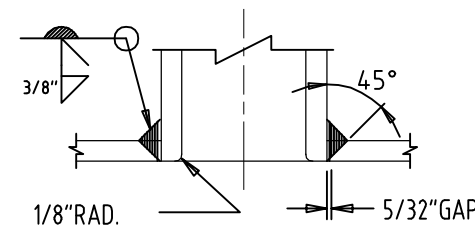
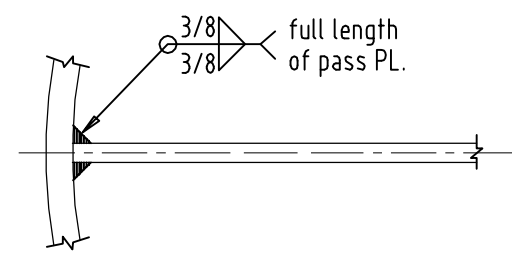
REV. 4



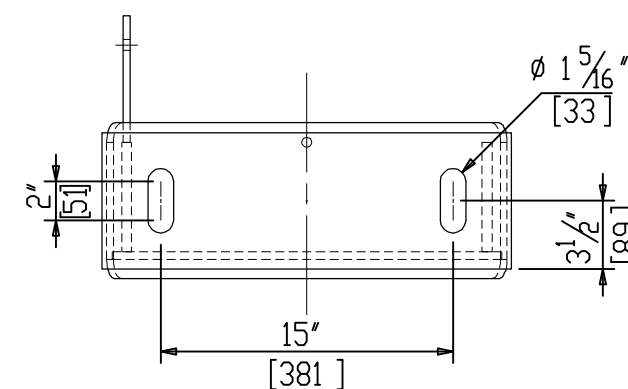
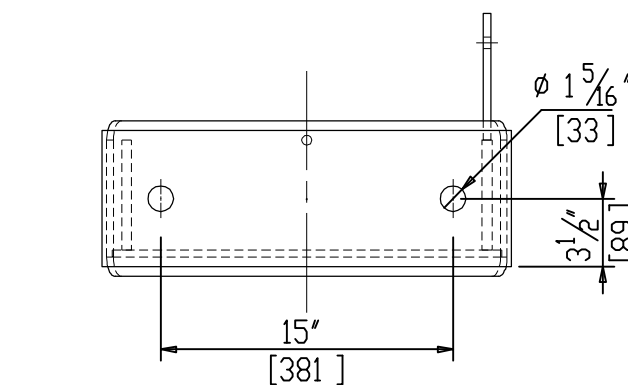
QTY: 4
- 2 WITH HOLES
- 2 WITH SLOTS



NOZZLE WITH PAD $\triangle_2$
T1,T2,S1,S2



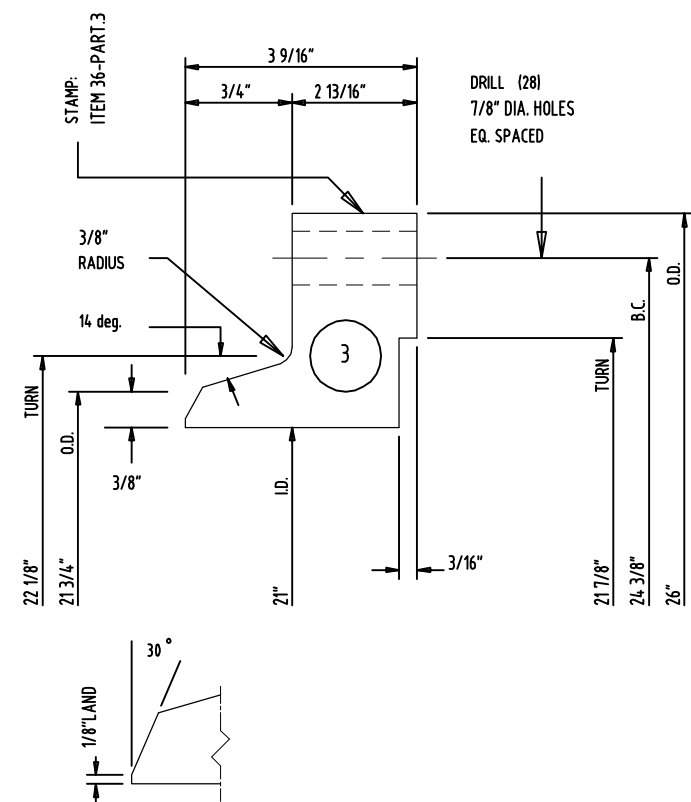
NOZZLE W/OUT PAD
TT1,TT2,TP1,TP2,ST1,ST2,SP1,SP2,SV,SD



	28-06-11	DRAWING AS BUILT
	11-11-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION
	13-09-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION
	30-05-10	ISSUE FOR REVISION
NO.	DATE	REVISIONS

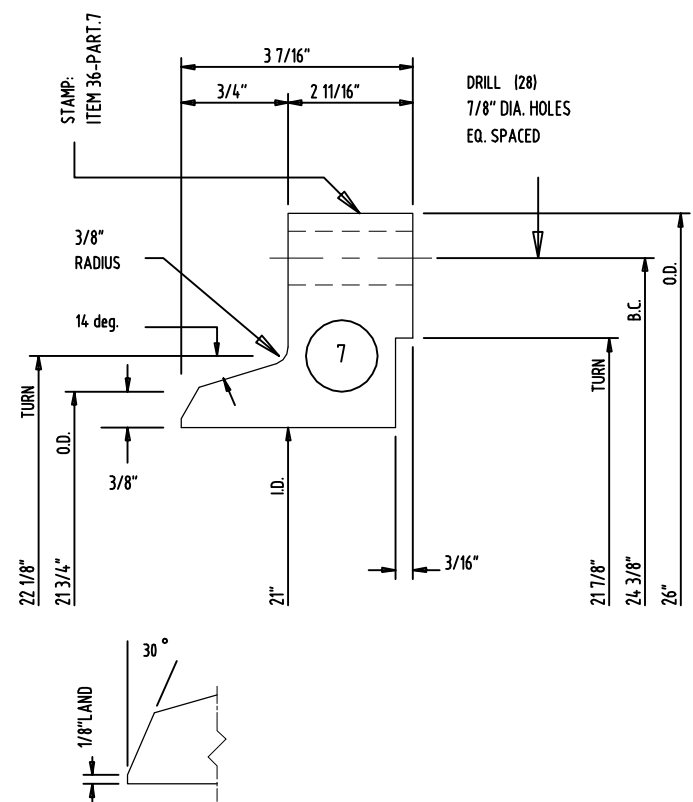
1. ---
2. ALL WELDING SHALL BE OF CONTINUOUS FILLET TYPE WITH DIMENSION 1/4" - UNLESS OTHERWISE SHOWN
3. SADDLE BEARING PLATE IS THE SAME TYPE MATERIAL AS SHELL
4. ϕ 1/4" NPT WEEP HOLE PASS (MK No. 120) AT VERTICAL CENTER LINE FOR VENTING, PLUG WITH HEAVY GREASE

	
INTERCAMBIADORES DE CALOR CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO	
 Refinería de Cartagena S.A.	Cartagena Refinery Expansion Project Cartagena, Colombia JOB NO.: OTI-100202 (ITEM 36) P.O. NO.: 42166001-PO-0001120001
SERVICE: CDHYDRO FEED PREHEATERS TAG: 107-CNT-E-101 A QTY. / SIZE: 1 / 21"-144"	TEMA TYPE: BEU
DWN. BY A. MONCADA	SCALE
CHKD. BY C. NARIÑO	DWG 2 / 8
APPRVD. BY A. VARELA	DWG NO. DG-MR-11210-01-107-CNT-E-101-A-02
REV. 	



TUBE SIDE FLANGE (FRONT)

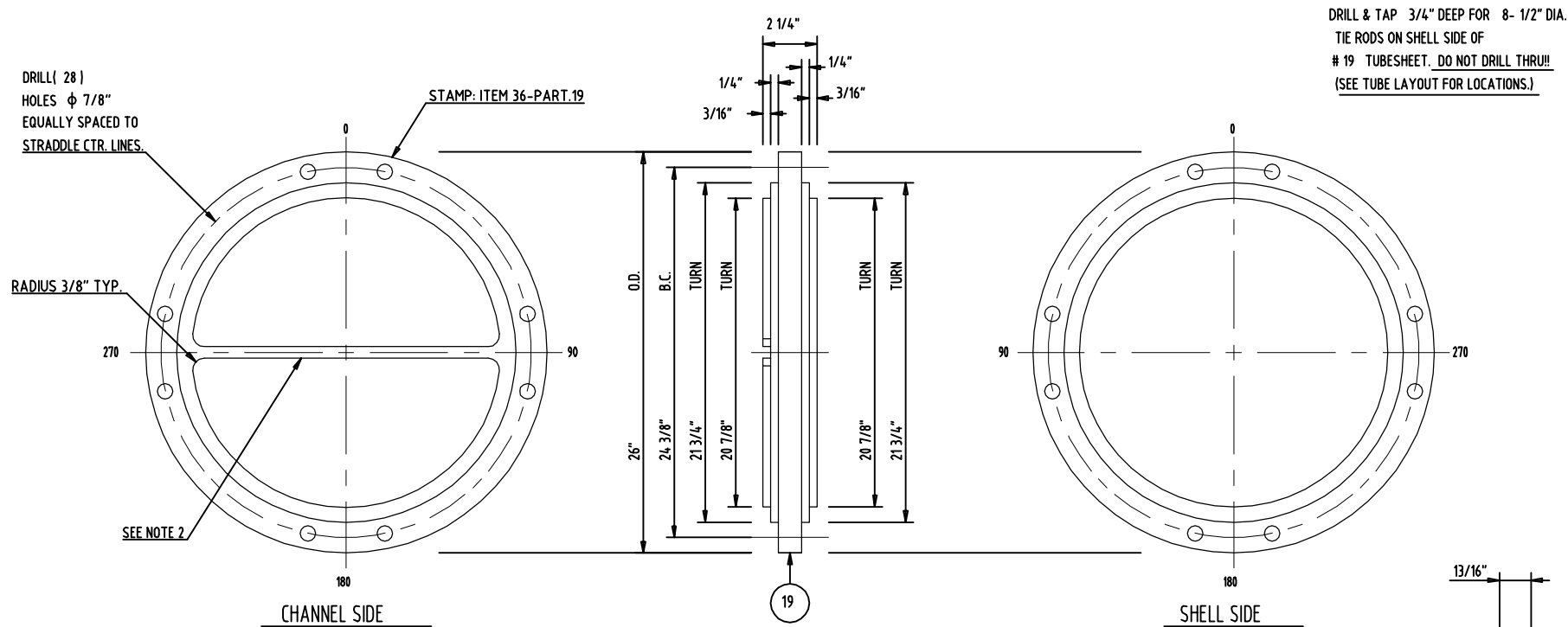
- NOTES:
- 1) MACHINE GASKET FACES TO BE 125 - 250 AARH
 - 2) ALL BOLT HOLES TO STRADDLE NATURAL CENTER LINES.
 - 3) ----
 - 4) USE ANTI-SEIZE COMPOUND IN EXTERNAL STUDS AND NUTS TO PREVENT GALLING



SHELL SIDE FLANGE (FRONT)

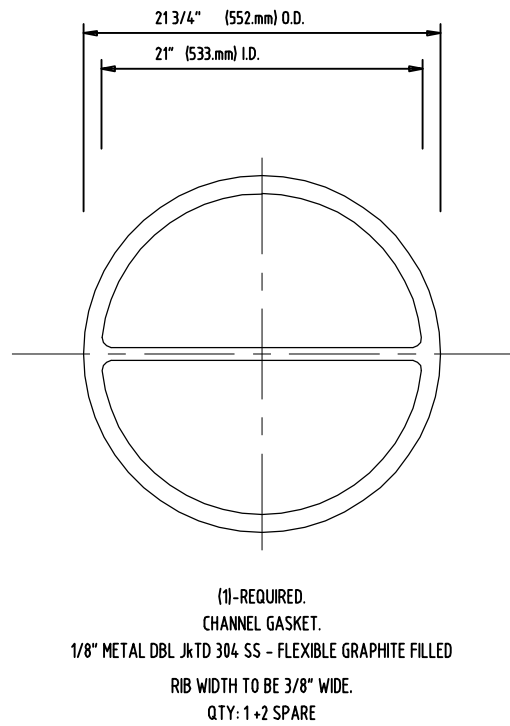
INTERCOL S.A.

AS BUILT

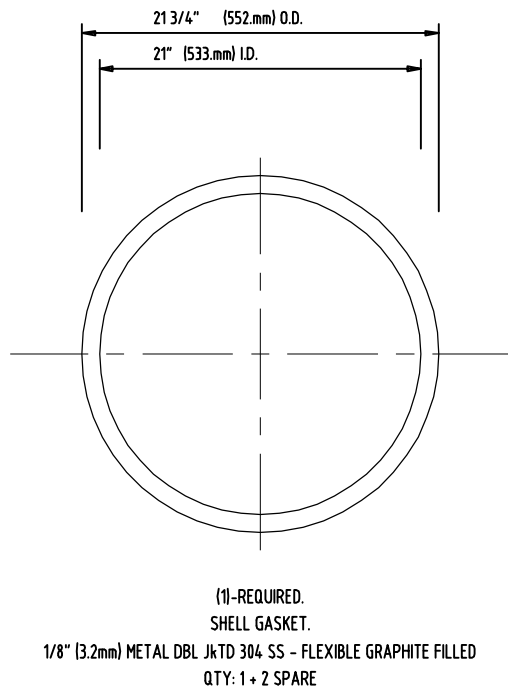


STATIONARY TUBESHEET DETAIL

- NOTES:
- 1) MACHINE GASKET FACES TO BE 125 AARH
 - 2) ALL PASS PLATE GROOVE WIDTHS TO BE 1/2" WIDE.
 - 3) ----
 - 4) USE ANTI-SEIZE COMPOUND IN EXTERNAL STUDS AND NUTS TO PREVENT GALLING



- 1) SET TO BE BOXED, MARKED WITH 0.T.I. 100202 & ITEM NO. 107-CNT-E-101 A & SHIPPED WITH EXCHANGER.
- 2) ALL RADIUS TO BE 1/4"
- 3) ALL JACKETED GASKETS TO HAVE LAP OF GASKET NEAR SIDE.



GASKET DETAILS

Δ	28-06-11	DRAWING AS BUILT
Δ	13-09-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION
Δ	30-05-10	ISSUE FOR REVISION
NO.	DATE	REVISIONS

INTERCOL S.A.

INTERCAMBIADORES DE CALOR

CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO

reficar

Refinería de Cartagena S.A.

Cartagena Refinery Expansion Project

Cartagena, Colombia

JOB NO.: 071-100202 ITEM 36)

P.O. NO.: 42166001-PO-0001121001

SERVICE: CDHYDRO FEED PREHEATERS

TAG: 107-CNT-E-101 A

QTY. / SIZE: 1 / 21"-14.4"

TEMA TYPE: BEU

DWN. BY: A. MONCADA

SCALE: .

CHKD. BY: C. NARIÑO

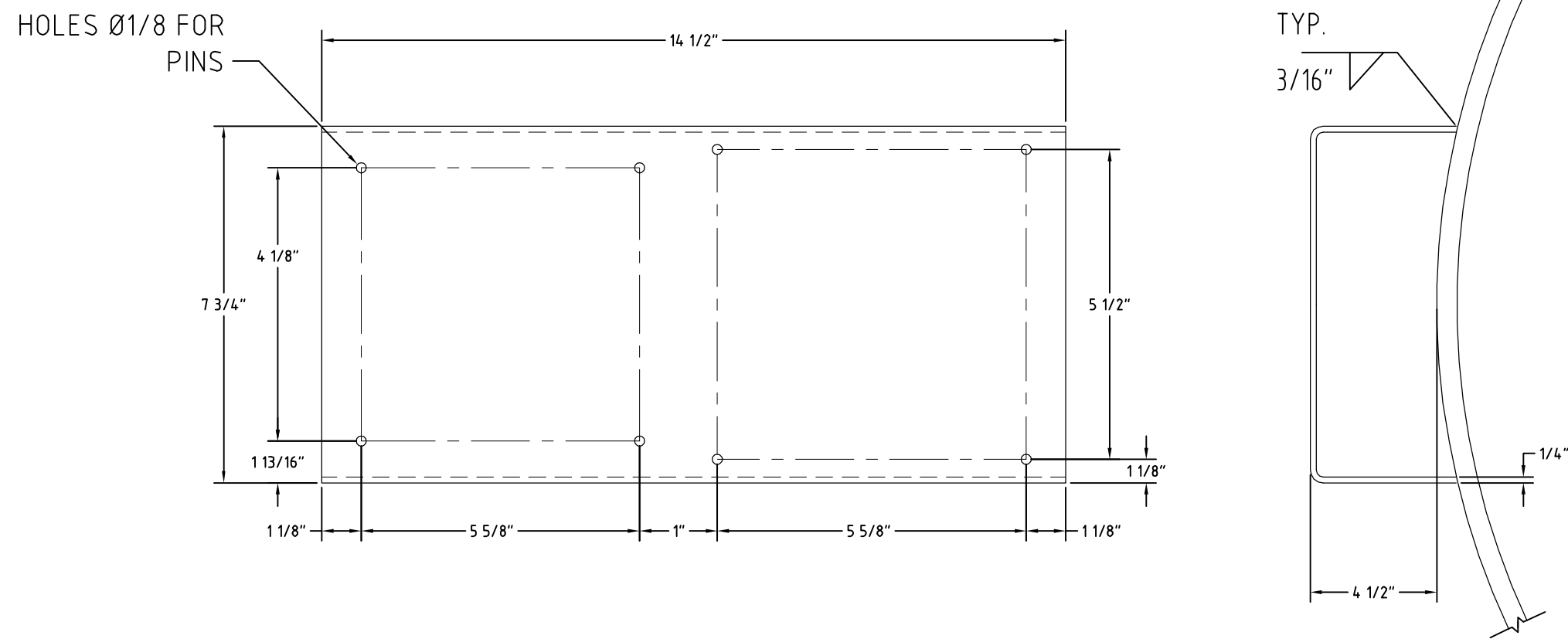
DWG: 3 / 8

APPVD. BY: A. VARELA

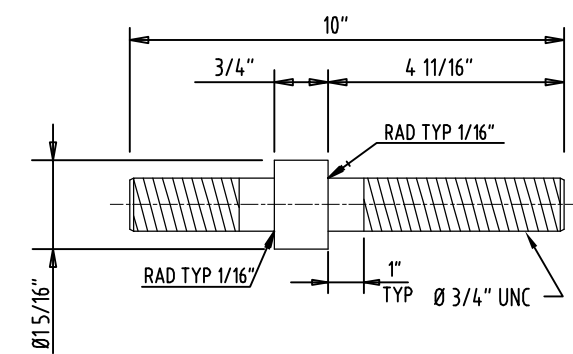
DWG. NO. DG-MR-11210-01-107-CNT-E-101-A-03

CB&I

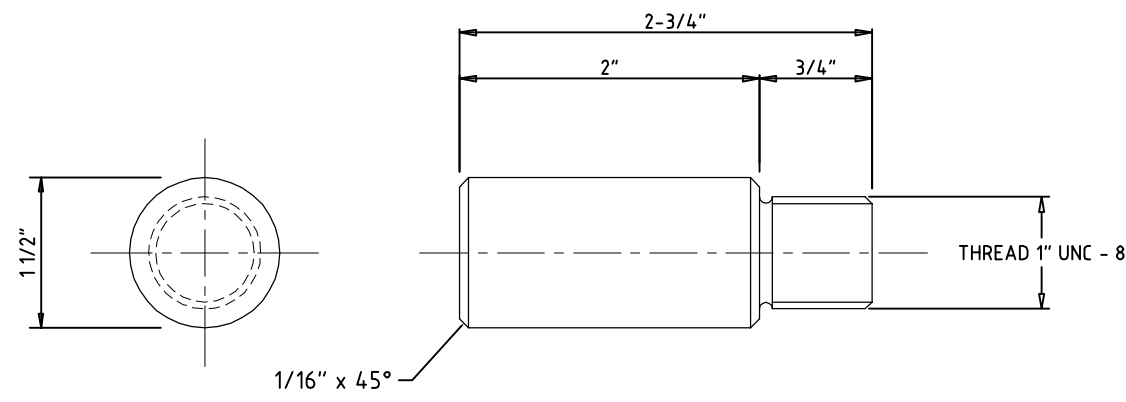
REV.



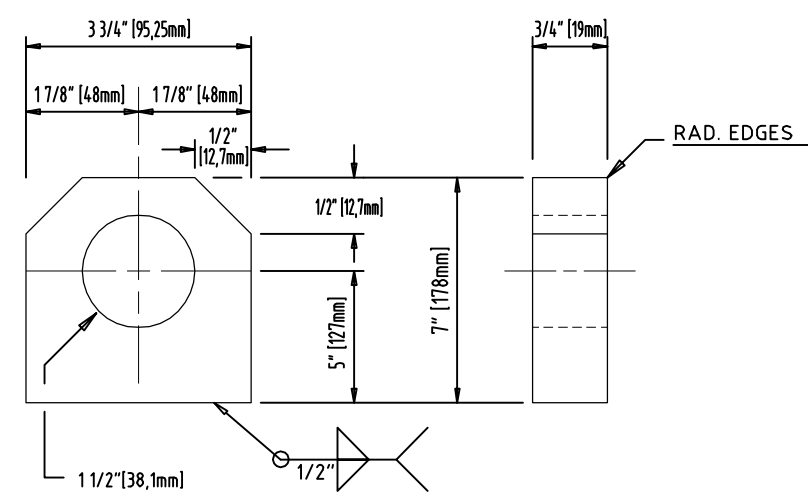
61 (ONE) REQ'D.
NAME PLATE AND DATA PLATE BRACKET DETAIL



41 BOLTS DETAIL

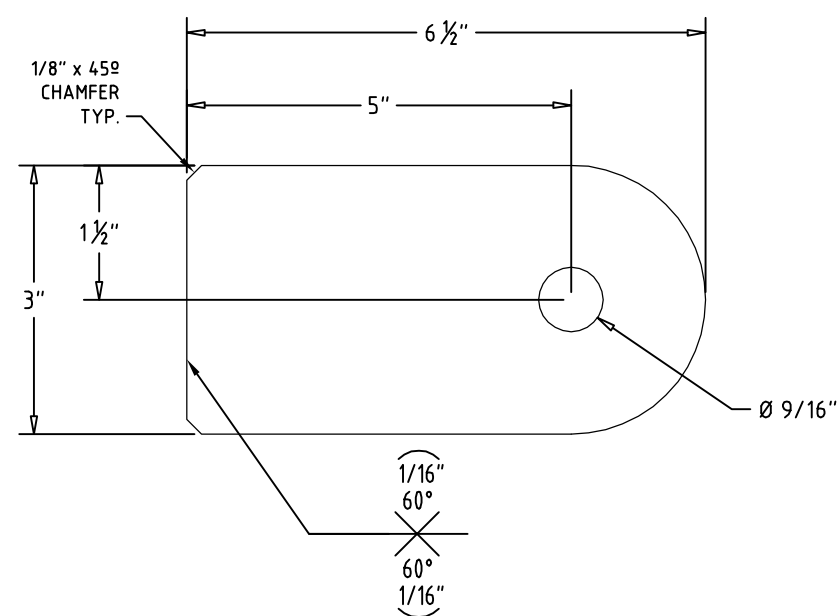


29 TUBESHEET PLUG
- MAT: AISI 1020

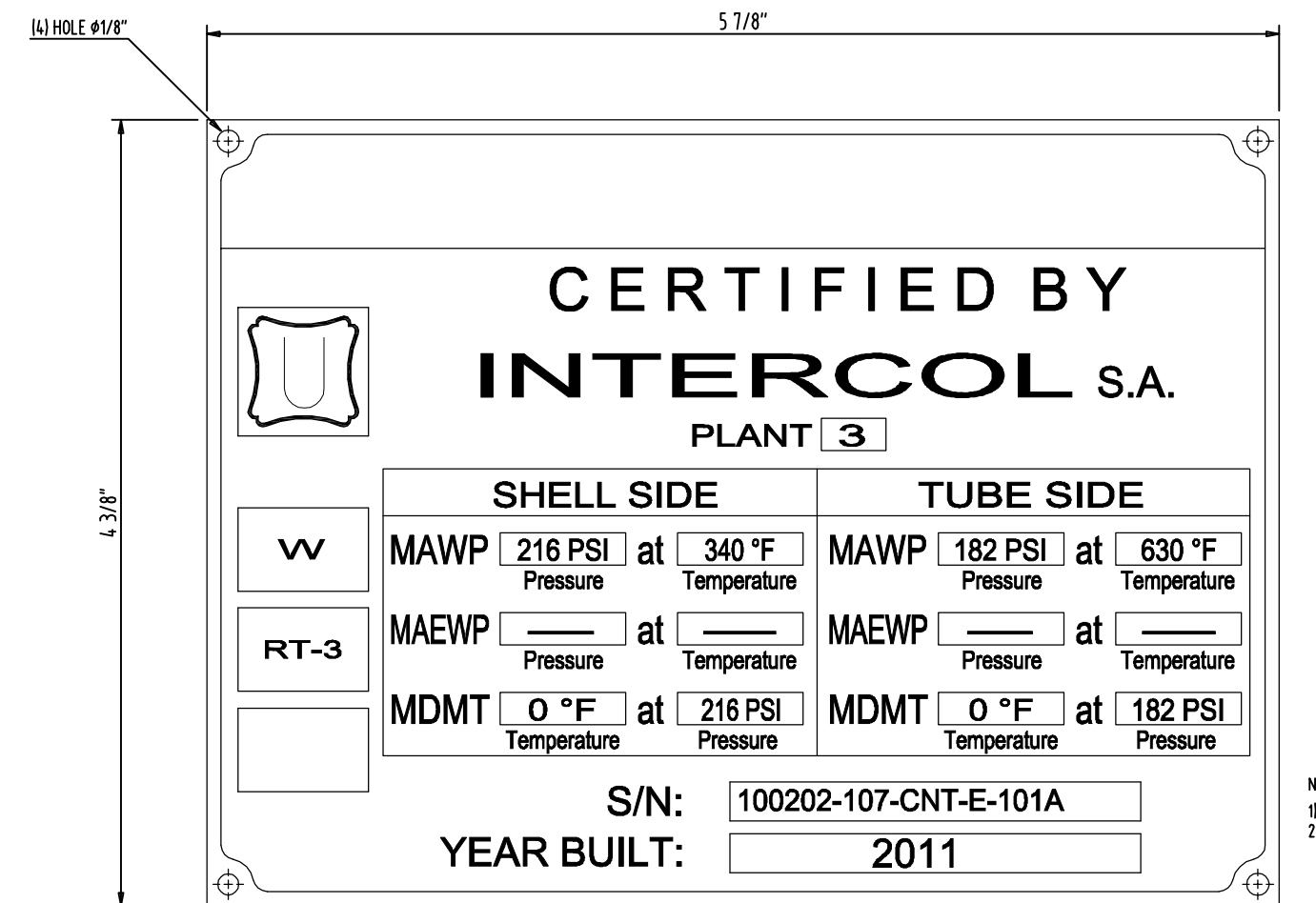


QTY: 2
LIFTING LUG DETAIL

62

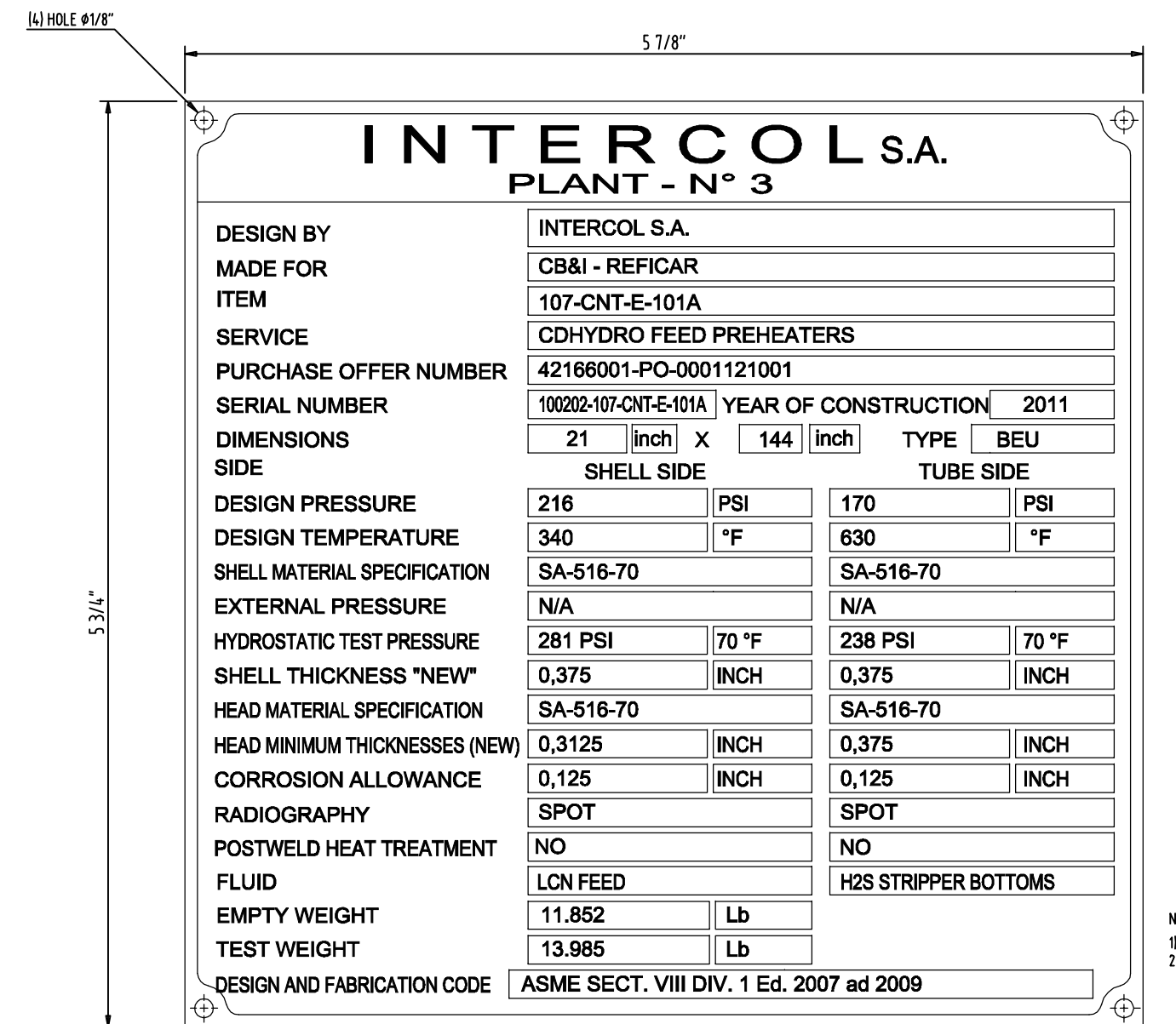


QTY: 4
63 GROUNDING LUGS
3/8" THK



QTY: 1
NAME PLATE
1/32" THK

NOTES:
1) LINE TYPE ARIAL
2) HEIGHT TEXT:
- 7/32"
- 1/8"
- 3/32"



QTY: 1
DATA PLATE
1/32" THK

NOTES:
1) LINE TYPE ARIAL
2) HEIGHT TEXT:
- 7/32"
- 1/8"
- 3/32"

INTERCOL S.A.
AS BUILT

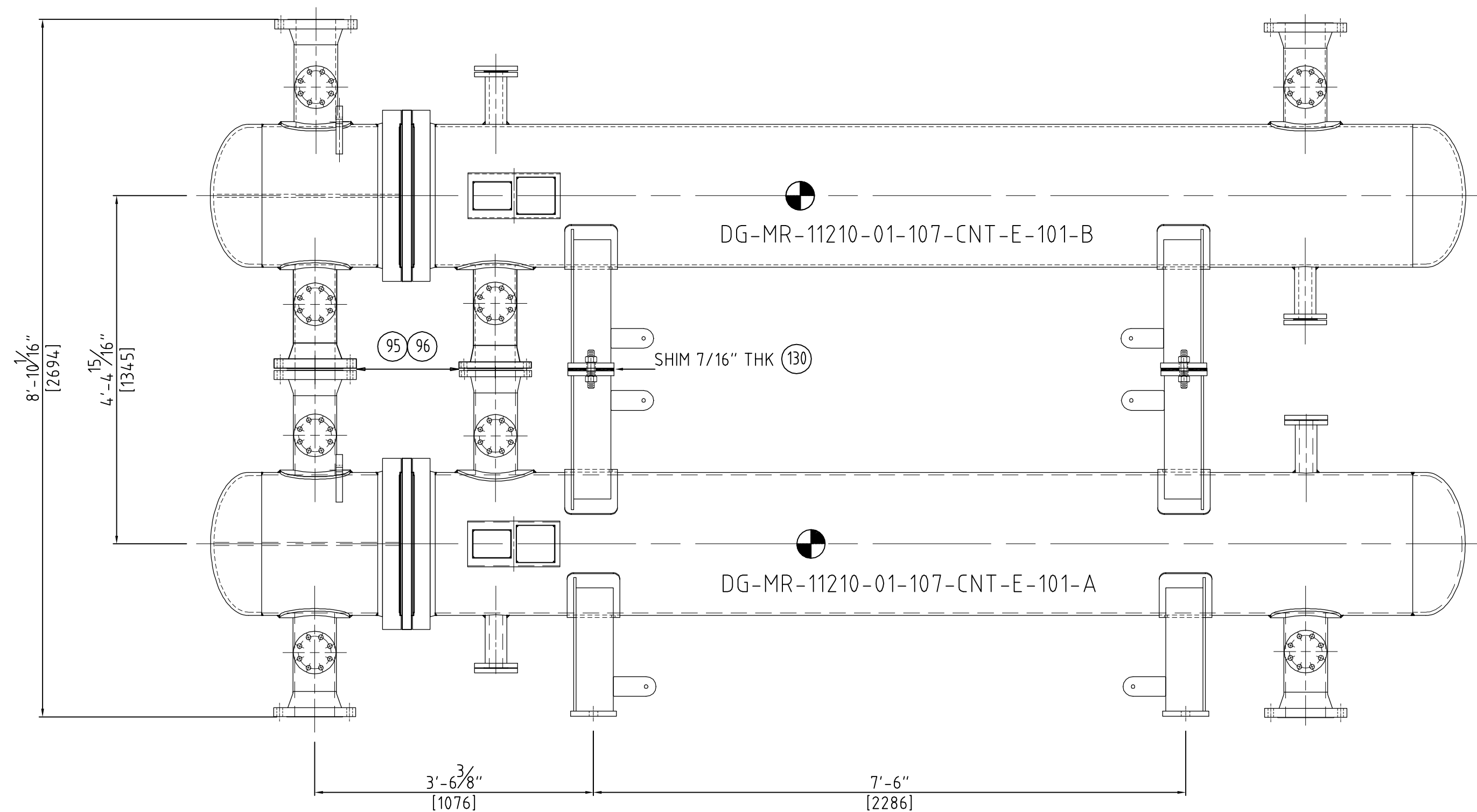
28-06-11	DRAWING AS BUILT	DWN. BY	F. ECHEVERRY	SCALE	-		REV.
11-12-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION	CHKD. BY	C. NARIÑO	DWG	5 / 8		
11-11-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION	APPVD. BY	A. VARELA	DWG. NO.	DG-MR-11210-01-107-CNT-E-101-A-05		
13-09-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION	NO.	DATE	REVISIONS			
30-05-10	ISSUE FOR REVISION						

INTERCAMBIADORES DE CALOR
CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO

Cartagena Refinery Expansion Project
Cartagena, Colombia
JOB NO.: 071-100202 ITEM 361
P.O. NO.: 42166001-PO-0001121001

SERVICE: CDHYDRO FEED PREHEATERS
TAG: 107-CNT-E-101 A
QTY. / SIZE: 1 / 21"-14.4"

TEMA TYPE: BEU



INTERCOL S.A.
AS BUILT

INTERCOL SA

INTERCAMBIADORES DE CALOR
CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO



Cartagena Refinery Expansion Project
Cartagena, Colombia

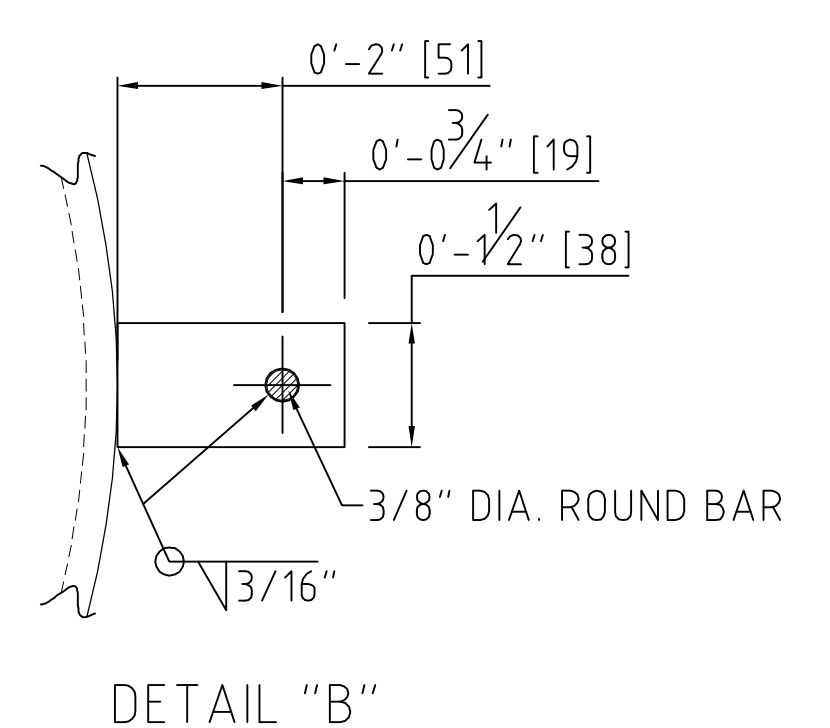
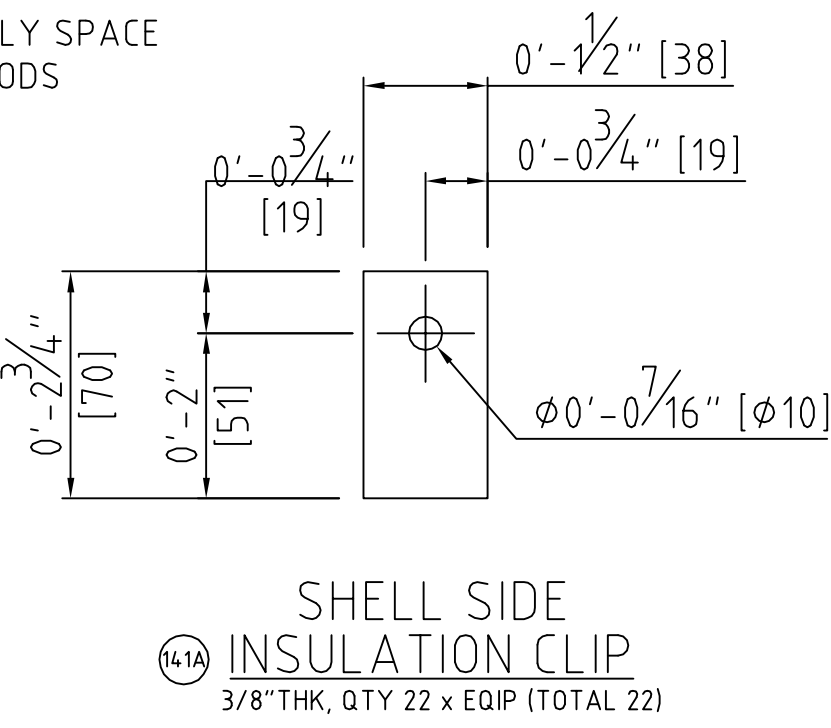
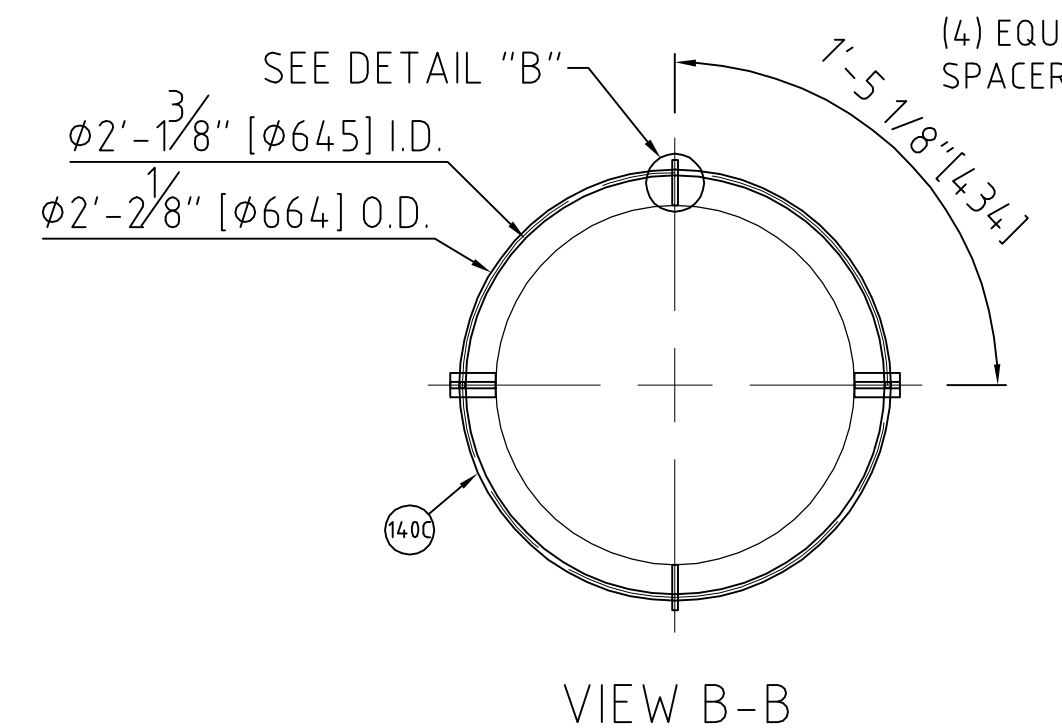
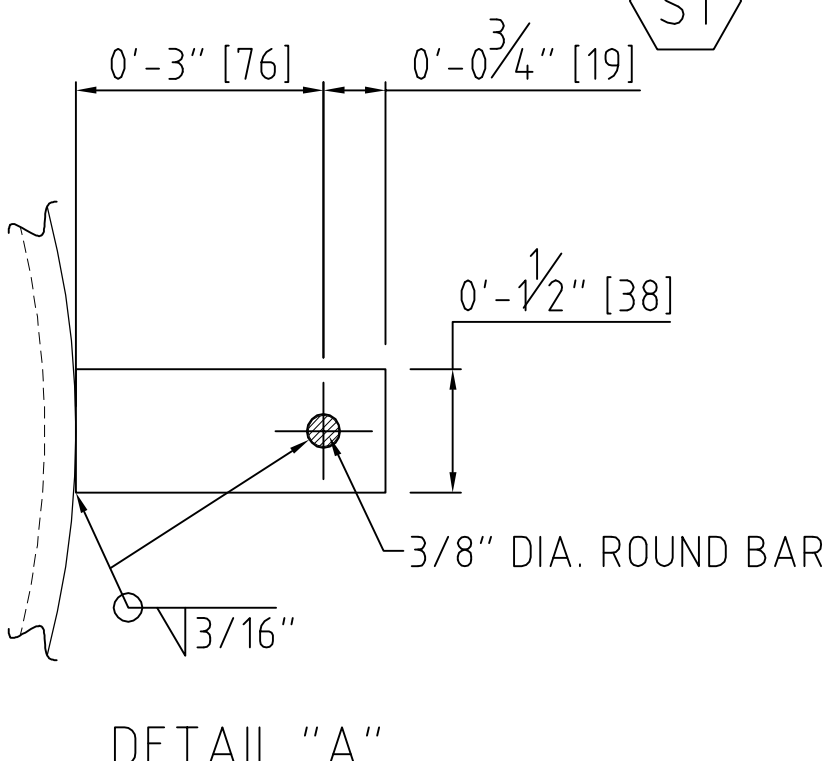
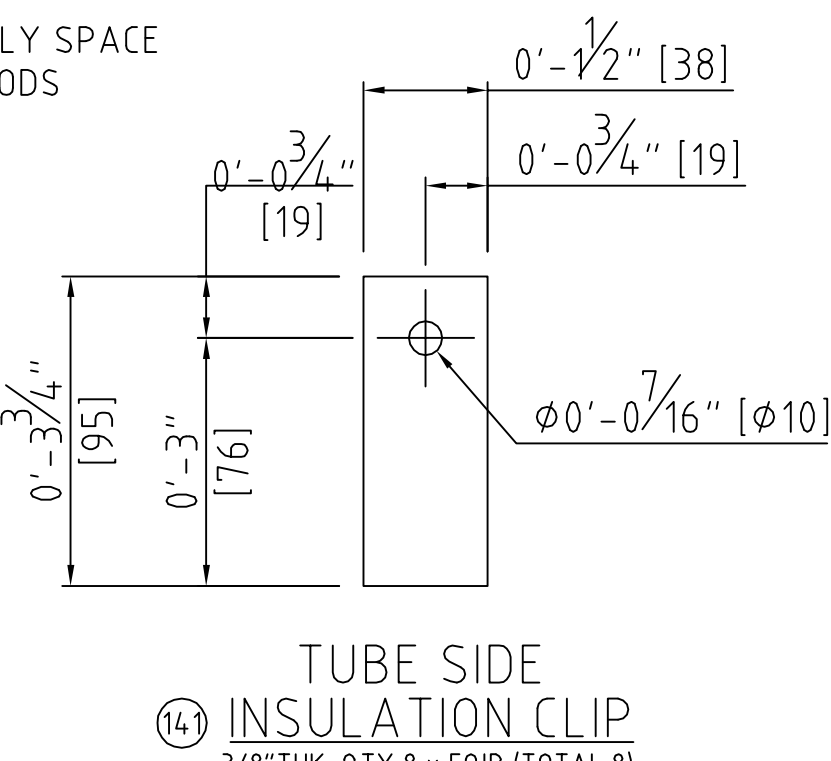
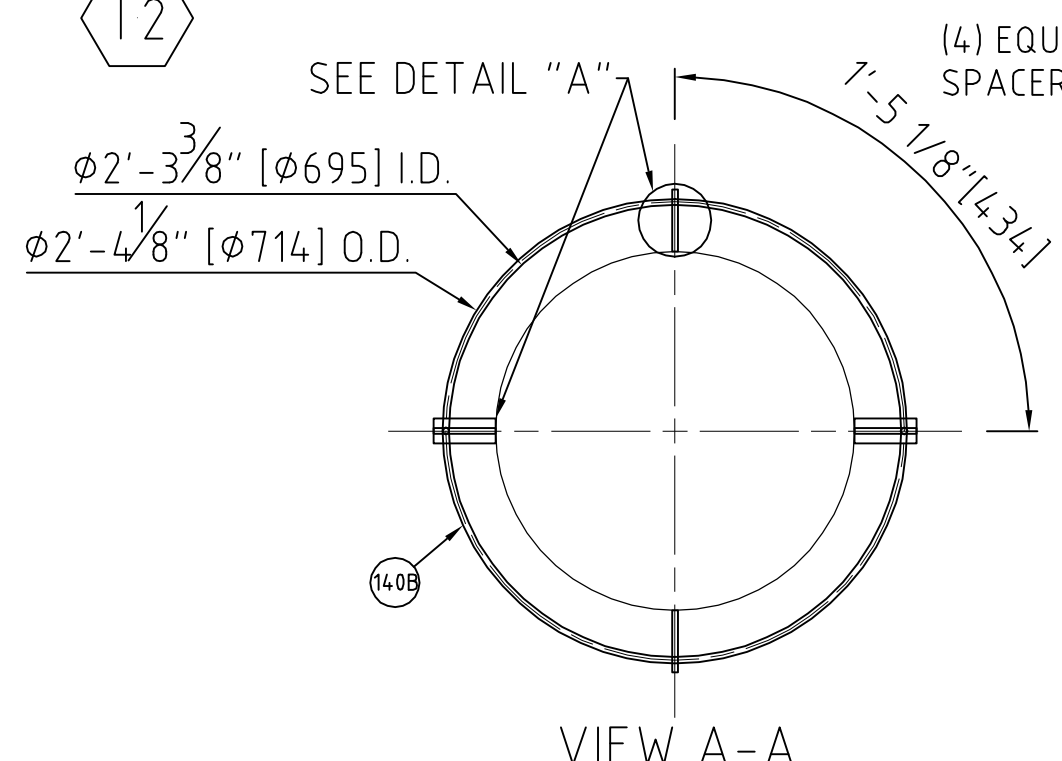
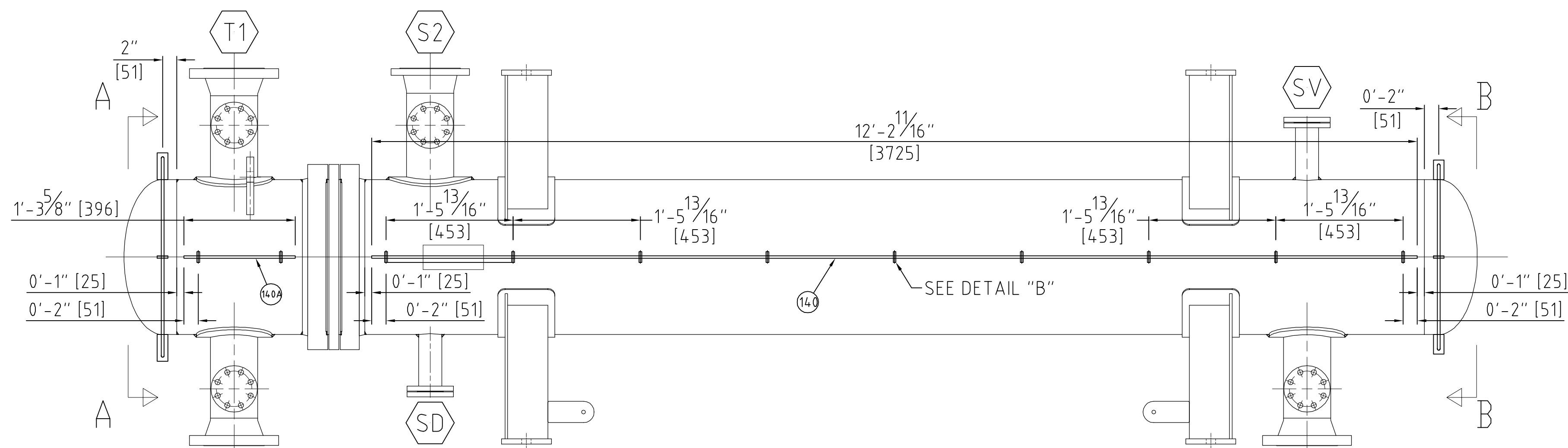
JOB NO.: OTI-100202/03 (ITEM 36)
P.O. NO.: 42166001-PO-0001121001

SERVICE: CDHYDRO FEED PREHEATERS
TAG: TAG 107-CNT-E-101 AB
QTY. / SIZE: 2 / 21"-144"

TEMA TYPE: BEU

△	28-06-11	DRAWING AS BUILT
△	13-12-10	INCLUDE CB&I COMMENTS
△	13-09-10	INTERNAL REVISION
△	25-08-10	INCLUDE CB&I COMMENTS AND INTERNAL REVISION
△	30-05-10	ISSUE FOR REVISION
NO.	DATE	REVISIONS

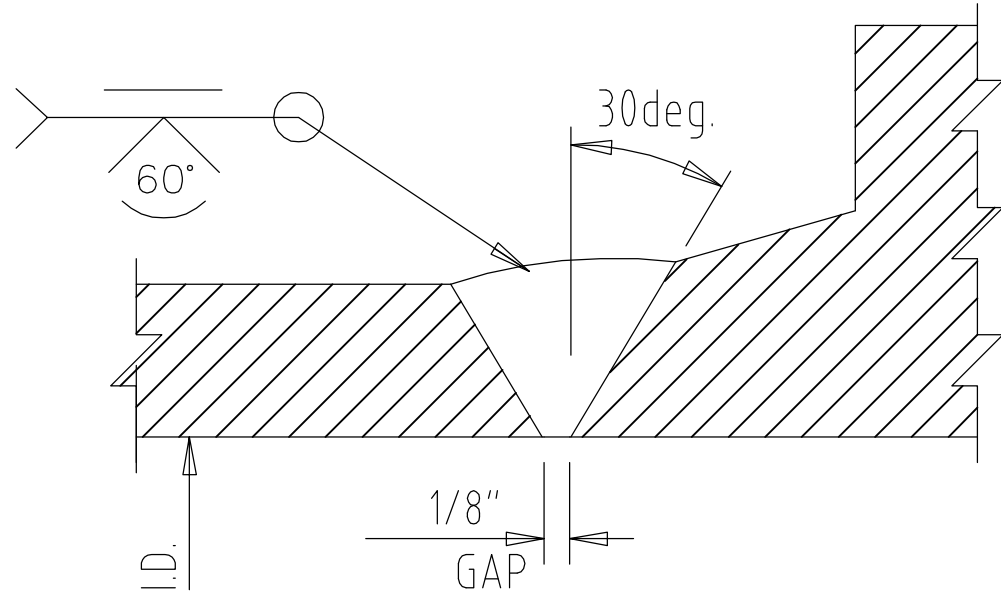
DWN. BY F. ECHEVERRY	SCALE -		REV. 4
CHKD. BY C. NARIÑO	DWG 7 OF 8		
APPVD. BY A. VARELA	DWG. NO. DG-MR-11210-01-107-CNT-E-101-AB-07		



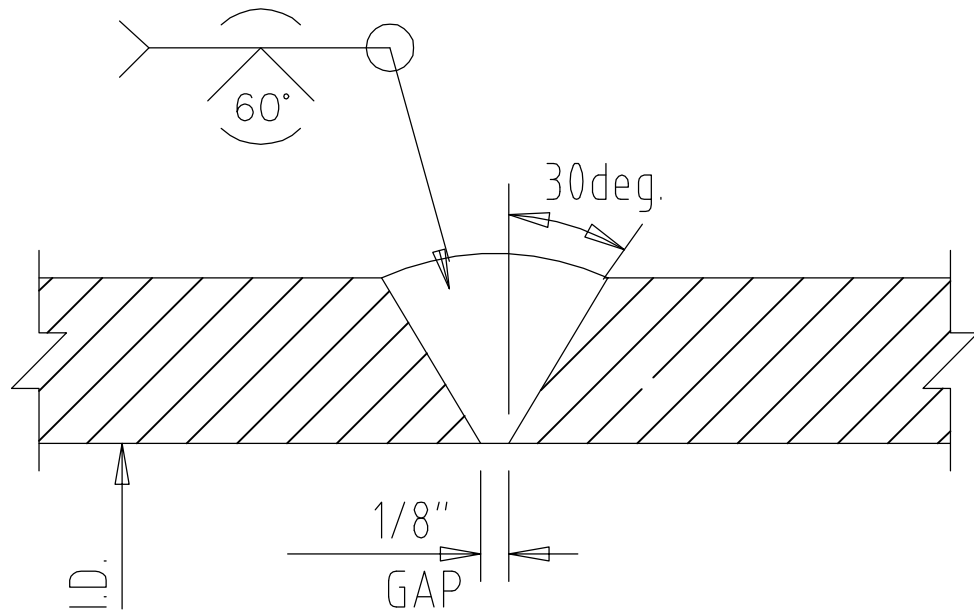
INTERCOL S.A.
AS BUILT

		INTERCOL S.A. INTERCAMBIADORES DE CALOR CALCULO, DISEÑO, FABRICACION, REPARACION Y MANTENIMIENTO	
Cartagena Refinery Expansion Project Cartagena, Colombia JOB NO.: 071-100202 ITEM 361 P.O. NO.: 42166001-PO-0001121001		TEMA TYPE: BEU	
SERVICE: CDHYDRO FEED PREHEATERS TAG: 107-CNT-E-101 A QTY. / SIZE: 1 / 21"-14.4"		SCALE: - DWG. NO. 8 / 8	
DWN. BY: E.S.RUIZ CHKD. BY: D.QUINAYAS APPVD. BY: A. VARELA			
NO. DATE 28-06-11 29-12-10 26-08-10		REVISIONS DRAWING AS BUILT INTERNAL REVISION ISSUE FOR REVISION	
NO. DATE 28-06-11 29-12-10 26-08-10		REVISIONS DRAWING AS BUILT INTERNAL REVISION ISSUE FOR REVISION	

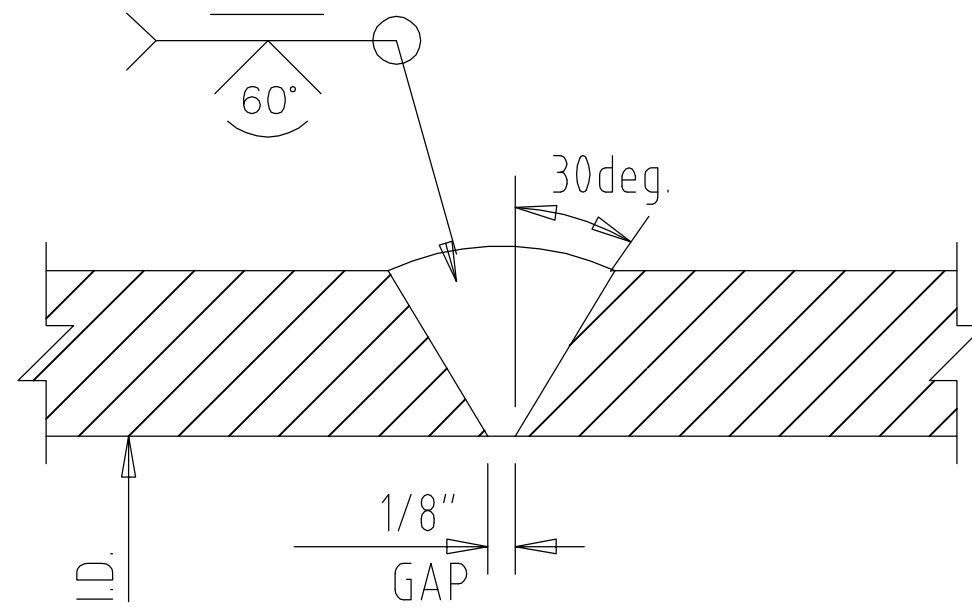
ITEM
36



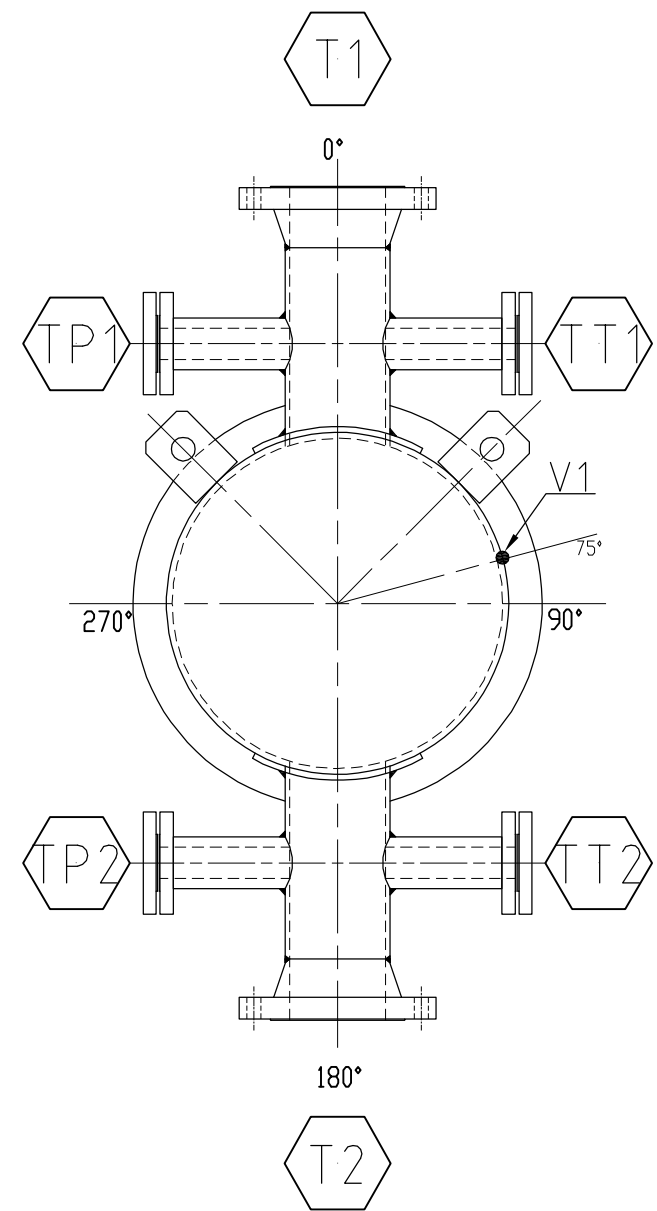
DETAIL A



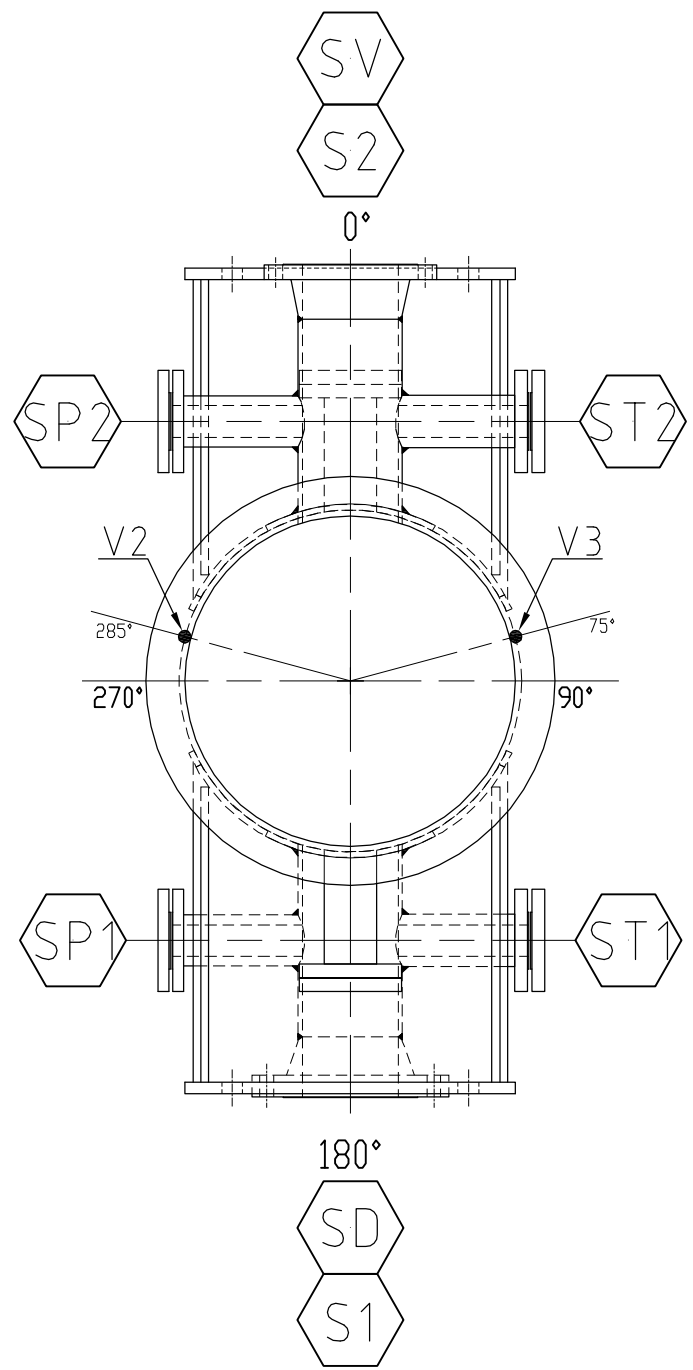
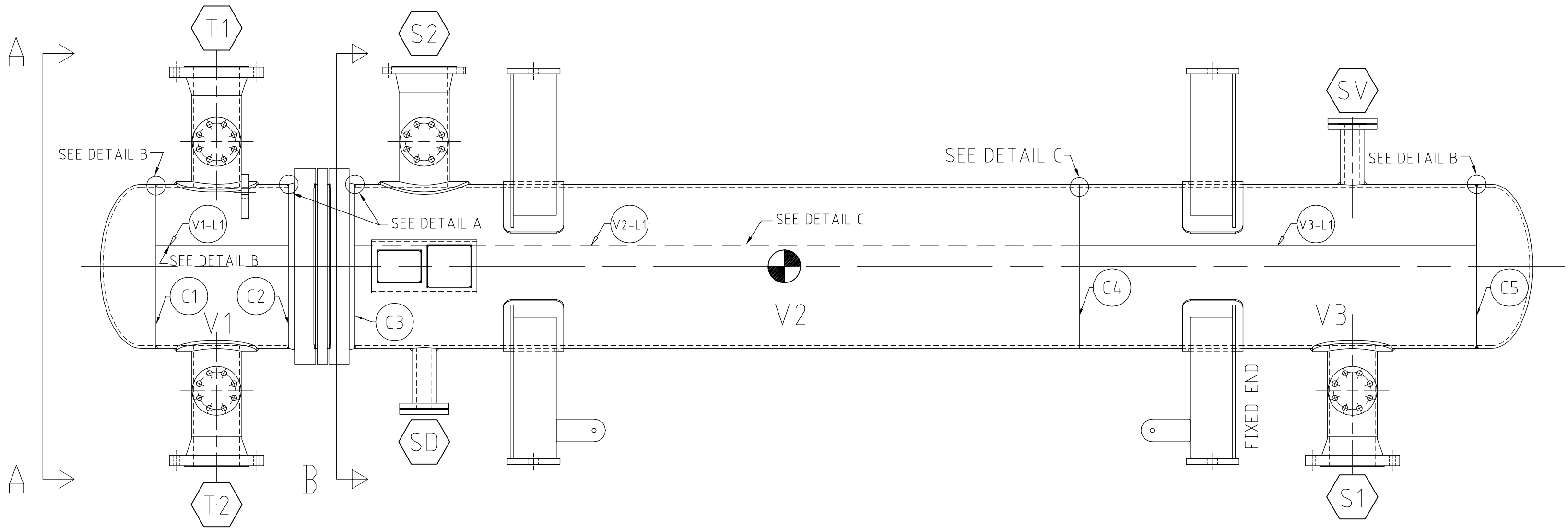
DETAIL B



DETAIL C



VIEW A-A



SECTION B-B