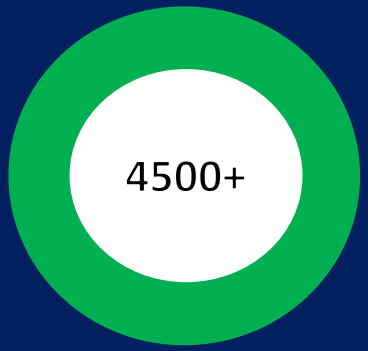
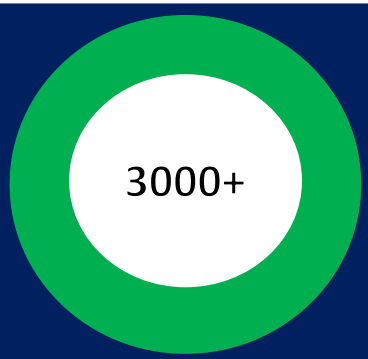
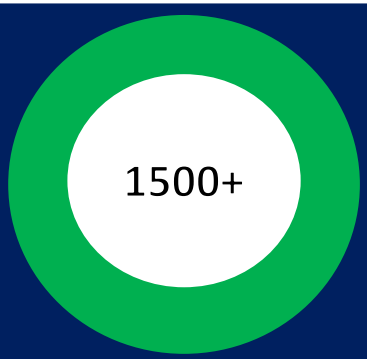
Projects Completed Successfully



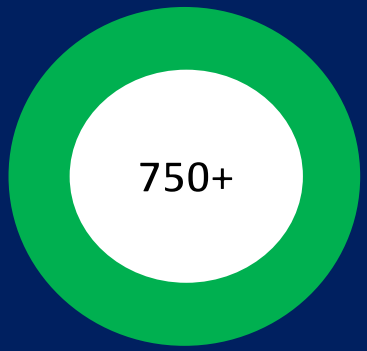
Pressure Vessels & Reactors



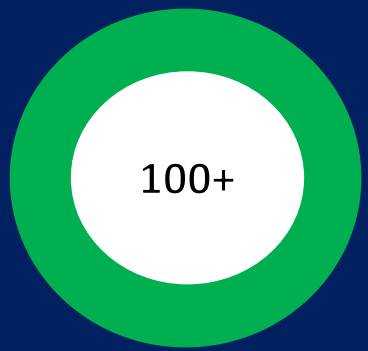
Heat Exchangers



Storage Tanks



Process Columns



ASME Audits Participated

U U2 S R CE

Engineering – Capability

Codes and Standards

- American Standards: ASME Sec. VIII Div I, II, III
- European Standards: EN 13445
- British Standards: BS PD 5500
- German Standards: AD Merkblätter
- Russian Standards: GOST
- Australian Standards: AS
- Indian Standards: IS
- DIN
- AD 2000
- API 650, API 620
- UL-142, UL-58

Software Capabilities

- PV Elite 2018
- Ansys R19
- CAESER-II
- SOLIDWORKS
- STAAD Pro V8i
- Nozzle Pro
- Auto CAD 2019

Design – Pressure Vessel

- **Scope:**
  - ✓ Static design as per ASME section VIII div-I
- **Application:** Pretreatment Vessel for Chemical Plant
- **Size**: ID 3000 mm
- **Pressure:** 3 bar at 350 deg C
- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** PV Elite

Input Data

OPERATING AND DESIGN DATA							
	UNITS						
Type	Vert. / Horiz.	Vertical					
Operating Fluid /Content		Vessel-Crude PA , Nozz. Jacket-SL /SM Steam, Limpet Coil- Terminol 66					
Fluid /Content Characteristics		Vessel-(Organic Acids), Nozz. Jacket- None, Limpet Coil- None					
Additional Requirements		No					
Statutory Requirements		NO					
Design Code "U" Stamp		ASME Sec VIII Div 1 2015 Edition with latest Errata				No	
Operating Temperature	°C	Vessel-280	Nozz. Jacket-165 / 204	Limpet Coil- 320			
Operating Pressure	bar(a)	Vessel-1.05	Nozz. Jacket-7 / 16	Limpet Coil- 5			
Max. Operating Static Head	m	5.4 from bottom tan line.					
Density of Operating Fluid	kg/m³	Vessel-1062	Nozz. Jacket- -	Limpet Coil- -			
Internal Design Pressure	barg	Vessel-3	Nozz. Jacket-10 / 22	Limpet Coil- 10			
External Design Pressure	barg	FV for Nozzle Jacket					
Design Temperature	°C	Vessel-350	Nozz. Jacket-200 / 230	Limpet Coil- 350			
Min. Design Metal Temperature	°C	10					
Max. Allowable Working Pressure	barg	-					
Is designed for "STEAM OUT" condition ?	Yes/ No	No					
If "YES" Steam Temperature	°C	-					
Steam pressure	barg	-					
Is NACE Code Applicable ?	Yes/ No	No					
Hydrostatic test pressure (Shop / Site)	barg	As per code					
Corrosion Allowance	mm	NIL					
Corrosion Allowance on internals	mm	0					
Post Weld Heat Treatment	Yes/ No	As per code					
Radiography Shell / Dished end / Cone		Shell-Spot / Head - 100%					
Joint Efficiency Shell /Dished end / Cone		0.85 / 1.0					
Wind Design Code		IS-875 Part 3 (Ed. 2015) Amd-1 Vb=44 m/s, k1=1.0, k2=Table-2 of IS:875(Part 3) for Terrain categ-3,k3=1.0,k4=1					
Seismic Design Code		IS-1893 Part 1 -6th Edition 2016, Part 4 2015, Importance Factor 1.5, Category 2, Zone III, Zone Factor Z = 0.16, R = 2.0, Soil Type = Type II (Medium Soil), I/R ratio shall be 1					

Output- PV Elite

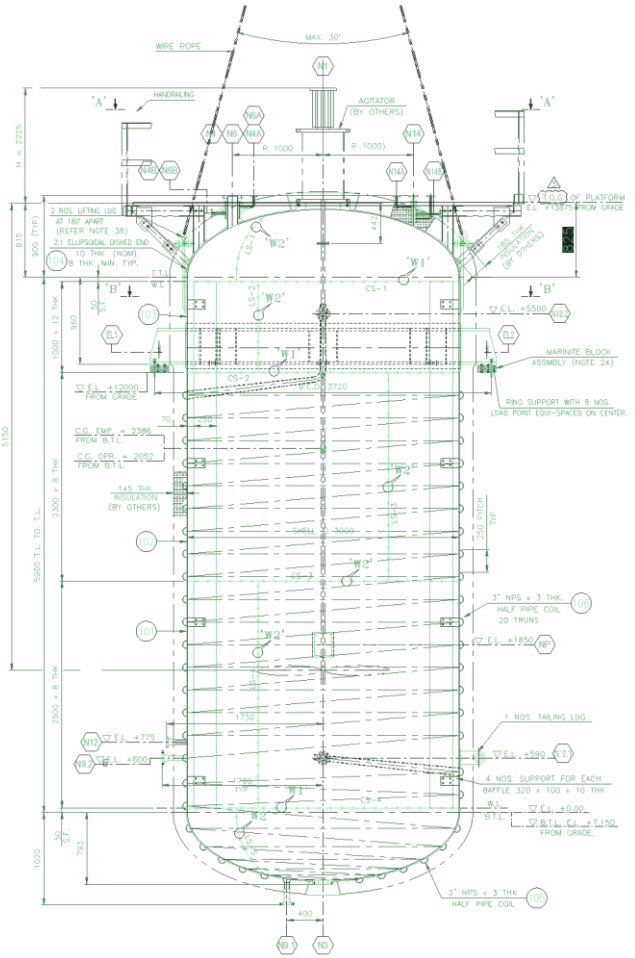
```
PROJECT - IGPL PA-IV/MA-4 PROJECT
DATA SHEET No. 1922-402-04-P441D-A4-101 REV. 1
4TH PRETREATMENT VESSEL (TAG No. F-441D)
PV Elite 2016 SP1     Licensee: P.E.D.CONSULTANTS
FileName : F-D441 REV
Input Echo :                          Step:    1   8:36pm  Dec 26,2018
```

PV Elite Vessel Analysis Program: Input Data

```
    PROJECT - IGPL PA-IV/MA-4 PROJECT
    DATA SHEET No. 1922-402-04-P441D-A4-101 REV. 1
    4TH PRETREATMENT VESSEL (TAG No. F-441D)

    Design Internal Pressure (for Hydrotest)          0.3000  MPa
    Design Internal Temperature                          350  °C
    Type of Hydrotest                        UG-99(b) Note [36]
    Hydrotest Position                             Vertical
    Projection of Nozzle from Vessel Top             550.00  mm
    Projection of Nozzle from Vessel Bottom          80.000  mm
    Minimum Design Metal Temperature                     10  °C
    Type of Construction                             Welded
    Special Service                                    None
    Degree of Radiography                              RT-4
    Use Higher Longitudinal Stresses (Flag)               Y
    Select t for Internal Pressure (Flag)                 N
    Select t for External Pressure (Flag)                 N
    Select t for Axial Stress (Flag)                      N
    Select Location for Stiff. Rings (Flag)               N
    Consider Vortex Shedding                              N
    Perform a Corroded Hydrotest                          Y
    Is this a Heat Exchanger                             No
    User Defined Hydro. Press. (Used if > 0)        0.0000  MPa
    User defined MAWP                               0.0000  MPa
```

Output- Drawing



Design – Shell & Tube Heat Exchanger

- **Scope:** Design Of Shell and Tube Heat Exchanger as per ASME section VIII div-2

- **Application:** Propane Chiller For Oil & Gas Industry
- **Size**: 967 Sq. Mtr
- **Pressure:** 120 bar at 110 deg C (Shell & tube side)
- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** PV - Elite

Input Data

Shell-and-tube heat exchanger: horizontal / ~~vertical~~ Case: Controlling case:

TEMA type : BKU ~~floating head / floating head with tube side bellows / hairpin / fixed tube sheet / fixed tube sheet with expansion joint in shell~~

PROCESS DATA			Shell side		Tube side	
Name of fluid			Propane		Wet Gas	
Fluid flow rate	- total	kg/s	30.729		121.84	
	- liquid in / out	kg/s	21.63	0.00	0.45	2.33
	- vapour in / out	kg/s	9.10	30.729	121.39	119.51
Temperature in/out		°C	28.13	29.4	55.0	34.48
Pressure at inlet		bar (abs)	9.9		96.9	
Pressure drop	calculated / allowed	bar	0.02	0.3	0.451	0.5
Velocity	calculated (17)/ allowed (18)	m/s	0.21	10.05/(9)	5.97	10.15/(9)
Film coefficient (1)	average	W / m²,K	710.23			
Fouling resistance (1)		m²,K / W	0.00018		0.00022	
Average wall temperature of shell / tubes		°C	29.21		33.75	

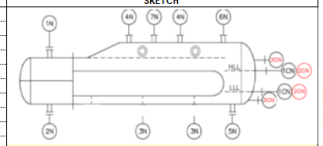
Total heat duty	:	7482	kW	Thermosiphon reboiler: Static head from column liquid level to bottom tube sheet/shell	: m
Effective temp. difference	:	13	K	Kettle: Minimum hold up capacity	: m³
Overall coefficient clean (2)	:	1045.85	W / m²,K		
Overall coefficient fouled (2)	:	644.72	W / m²,K	Condenser: Number of tubes submerged:	:
Total number of shells	:	1		Total required surface per unit	958.7 m²
Connected in series : 1	in parallel : 1			Total effective surface of unit	912.2 m²
				Effective surface per shell	912.2 m²

CONSTRUCTION DATA PER SHELL						
Shell inside diameter	:	2188.0	mm	Number of passes shell side	1	
Bundle dia.(outer tube limit)	:	1498.0	mm	Baffle type: ~~single / double segmental / NTIW / support only~~		
Number of passes tube side	:	2		Baffle orientation:	-	
Number of tube holes per tube sheet	:	2430		Outer baffle cut: - % Overlap -		tube rows
Type of tube	:	bare/~~finned~~		Baffle spacing central:	641	mm
Tube OD (plain end)	:	19	mm	Baffle spacing inlet/outlet:	640 -	mm
Tube wall thickness	:	2	mm	Baffle thickness:	14	mm
Tube length (straight)	:	6100	m	Number of cross passes:	1	
Tube pitch	:	25	mm	Number of pairs of sealing strips:	-	
Tube lay-out angle	:	30 / 45 / 60 / 90	deg.	Impingement protection/spider pipe below inlet nozzle:	yes/no	

Estimated mass per shell			
Dry	:	82300	kg
Wet	:	94350	kg
Bundle only	:	21100	kg

NOZZLE DATA		Shell side		Tube side	
		Inlet	Outlet	Inlet	Outlet
Nozzle DN	inch	12" (N3)	16" (N4 A/B)	20" (N1)	20" (N2)
Velocity	m/s	7.24	6.99	8.57	7.61
		Shell side		Tube side	

SKETCH



N1	Wet gas channel inlet	CN1 A/B	LIC
N2	Wet gas channel outlet	CN2 A/B	LSHH
N3	Propane mixed phase inlet	CN3 A/B	LEVEL GAUGE
N4A/B	Propane vapour outlet		
N5	Drainage		
N6	Depressurization connection		
N7	Vent (with ball valve and blind flange)		

Notes:
1) Film coefficients and fouling resistance are related to their own surface
2) Overall coefficients are related to the outer diameter of the tubes
3) Due to piping and safety requirements exchanger will be elevated 9 meter above ground level.
4) Design codes: ISO 16812 • DEP 31,21,01,30-Gen • TEMA-R • ASME Sec. VIII Div. 2 • DEP 31,22,00,31-Gen
5) Material selected as per DEP 31,21,01,30-Gen
6) Gasket selected as per DEP 31,21,01,30-Gen
7) All the wetted parts (tube side) shall be suitable for Sour Service application & shall be in compliance with "NACE MR 0175 / ISO-15156 /SP-2041".In addition, all pressure retaining carbon steel materials shall be supplied in normalized condition.
8) Earthing boss in accordance with STD-4-0304-001
9) Allowed velocities in accordance with TEMA and DEP 31210112 requirements

Data / requisition sheet (cont sheet) for SHELL AND TUBE HEAT EXCHANGERS

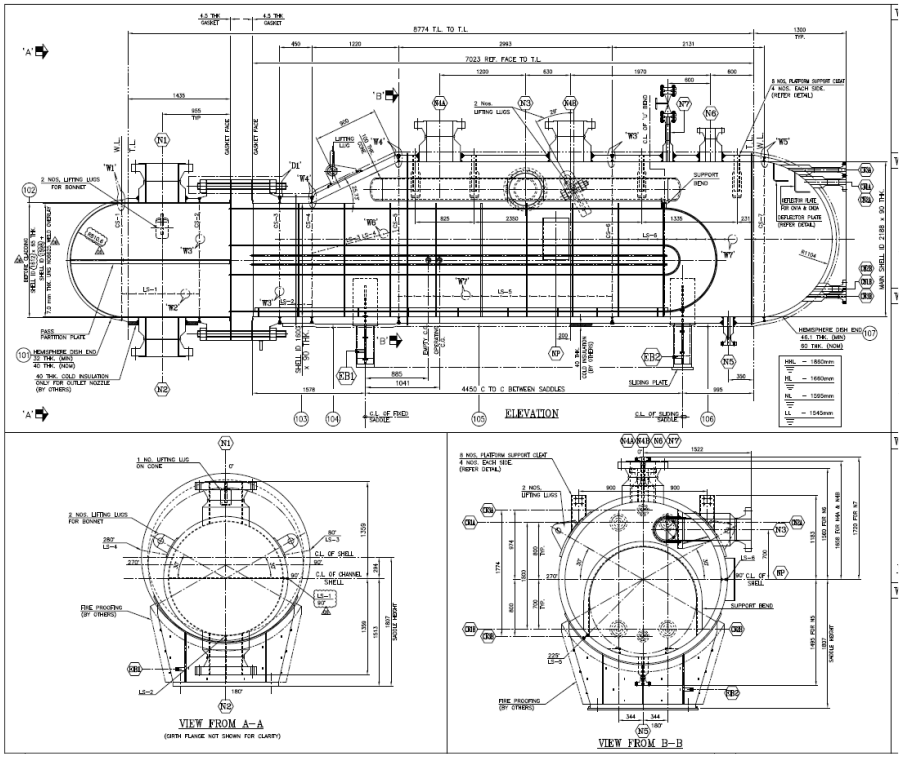
Design book No. : page

Contr. Job No. :

MESC No. :

EQUIPMENT Propane Chiller

Rev. letter



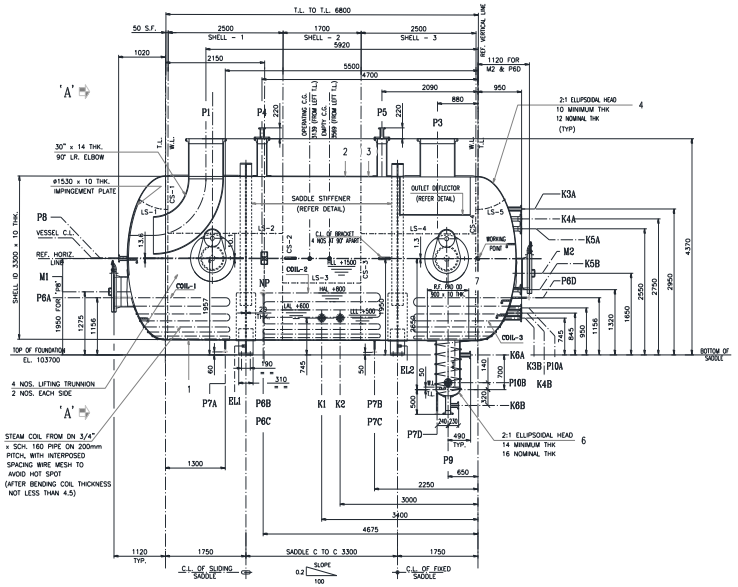
Output- Drawing

Design – Pressure Vessel

- **Scope:**
  - ✓ Static design as per ASME section VIII div-I

- **Application:** Flare KO Drum
- **Size**: ID 3300 mm
- **Pressure:** 3.5 bar at 350 deg C

- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** PV - Elite



Input Data

DESIGN DATA

INSTALLATION		OUTDOOR	CODES	ASME SECT. VIII DIV. 1, 2015 Ed. + PROJ. SPECIFICATIONS	
ASME STAMP			YES		
			VESSEL	JACKET	COIL (SEE NOTE "N")
QUANTITY			1		
CAPACITY		m^3	68		(H)
CONTAINED FLUID	NAME		NITROGEN+HYDROCARBONS		LLP STEAM
	PHYSICAL STATE		VAPOUR/LIQUID		VAPOUR/LIQUID
	DENSITY	kg/m^3	1.31/630.8		1000
	FLUID HAZARDOUSNESS		240		000
SERVICE	LETHAL/SOUR (NACE)/ WET H2S/CYCLIC/OTHERS		N/A		N/A
TEMPERATURE (SEE NOTE "M") °C	DESIGN	1st. cond.	350		270
		2nd. cond.	–		180
		3rd. cond.	–		–
	OPERATING		66		180
MINIMUM DESIGN METAL TEMPERATURE (SEE NOTE "E") °C			–29		–29
PRESSURE bar (g) (SEE NOTE "K, M")	DESIGN	1st. cond.	3.5		5.5
		2nd. cond.	–		FULL VACUUM
		3rd. cond.	–		–
	OPERATING		0.09+0.345		3.5
HYDROTEST PRESSURE		bar (g)	ACCORDING TO CODE		ACCORDING TO CODE
PNEUMATIC TEST PRESSURE		bar (g)	–		–
CORROSION ALLOWANCE (SEE NOTE "O")		mm	3		3
POSTWELD HEAT TREATMENT			NONE		NONE
RADIOGRAPHY			SPOT		SPOT
WELDING EFFICIENCY			0.85		0.85
INSULATION	TYPE/THK.	PP / 65 (SEE NOTE "L") mm	PREPROOFING	YES	(HOLD)

Output- PV Elite

PV Elite Vessel Analysis Program: Input Data

Low pressure pe flare ko drum
Tag No 9133

Design Internal Pressure (for Hydrotest)	0.3500	MPa
Design Internal Temperature	350	°C
Type of Hydrotest	UG-99(b)	
Hydrotest Position	Horizontal	
Projection of Nozzle from Vessel Top	0.0000	mm
Projection of Nozzle from Vessel Bottom	0.0000	mm
Minimum Design Metal Temperature	-29	°C
Type of Construction	Welded	
Special Service	Air/Water/Steam	
Degree of Radiography	RT-4	
Use Higher Longitudinal Stresses (Flag)	Y	
Select t for Internal Pressure (Flag)	N	
Select t for External Pressure (Flag)	N	
Select t for Axial Stress (Flag)	N	
Select Location for Stiff. Rings (Flag)	N	
Consider Vortex Shedding	N	
Perform a Corroded Hydrotest	Y	
Is this a Heat Exchanger	No	
User Defined Hydro. Press. (Used if > 0)	0.0000	MPa
User defined MAWP	0.0000	MPa
User defined MAPnc	0.0000	MPa

Output- Drawing

Design – Pressure Vessel

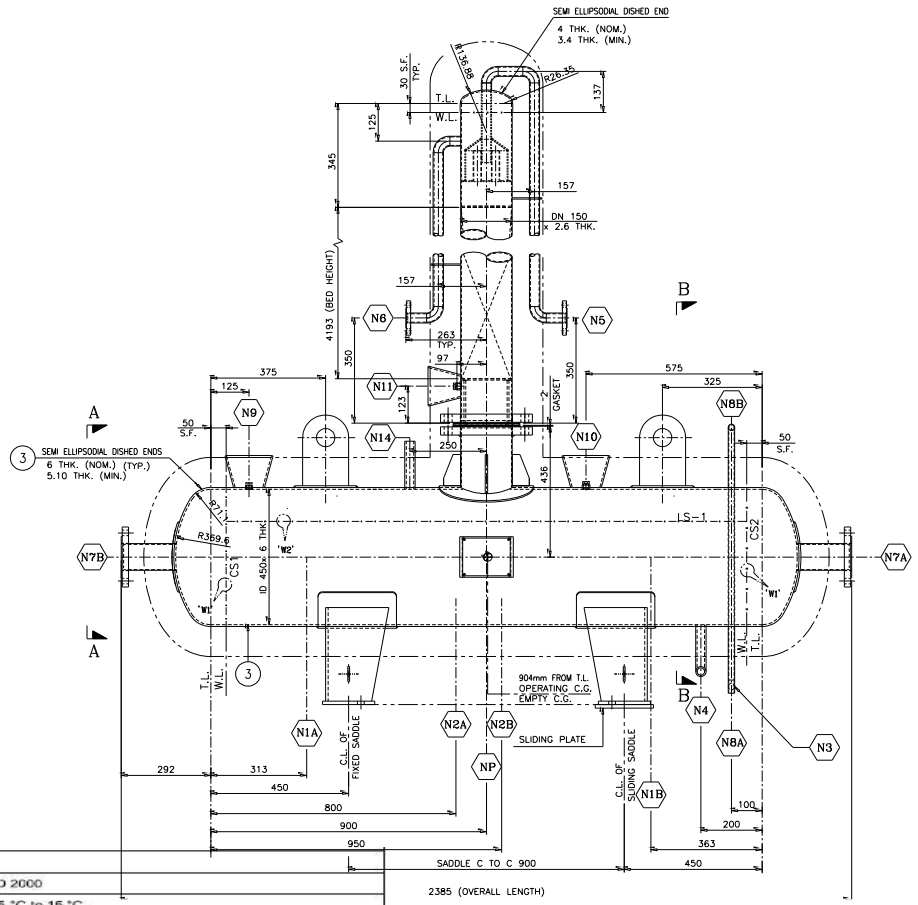
- **Scope:**
  - ✓ Static design as per AD 2000

- **Application:** CO2 Rectifier-Reboiler
- **Size**: ID 450 mm
- **Pressure:** 20 bar at 30 deg C

- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** NA

Output Calculation Data

Design Data				
Construction Code	AD 2000 MERKBLATT (ED. SEPTEMBER 2016)			Clause
PED categories	IV	SEP		
PED module	G	-		
Fluid type / Group	Gas / 2			
Pressure X Volume (Bar X L)	6660			
Stress category	I			Clause 3, W10
Test Group	8			Table 1a, HP0
Material sub group	8.1			Table 1a, HP0
Type of Vessel	Horizontal			
	Shell	Coil		
Internal Design Pressure	20	20	Bar(g)	
Design Temperature for Internal Pressure	30	30	°C	
External Design Pressure	NA	NA	Bar(g)	
Operating Pressure (Min / Max)	15 to 17	15 to 17	Bar(g)	
Operating Temperature (Min / Max)	-35 to 15	-35 to 15	°C	
Minimum Design Metal Temperature	-45	-45	°C	
MAWP (Same as design pressure)	20	20	Bar(g)	
Pnumatic Test Pressure at the top of Vessel	28.6	28.6	Bar(g)	Caluse 4.17, HP 0
Corrosion allowance	Nil			
Radiography Marking	Spot			Table 1b, HP 0
Joint Efficiency	0.85			Table 1b, HP 0
Specific Gravity of Content	Negligible			
Service	CO2 Gas			
Test Media	Air			
Empty / Operating Weight	505		Kg	
Test Weight	505		Kg	
Post Weld Heat Treatment	No			Table `1b', HP 0
Post Forming Heat treatment	No			Clause 2.2.3, HP 7/3
Impact Test	No			Table 1, W10
Shell Inside Diameter	450		mm	
Shell Length (WL- WL)	1800		mm	
Vessel Volume	312	6.2	liters	
Wind data	EN 1991-1-4:2005 (Design wind speed 31.5 m/s, Terrain Category-O)			
Siesmic data	G Loading, I = 1.25, Gx=Gy=Gz=0.07			
Inspection opening requirement	Yes			Table `1',A5 & Appe. A5



Output- Drawing

DESIGN DATA :-	
Design Code:	AD 2000
Operating Temperature	-35 °C to 15 °C
Operating Pressure	15 to 17 Bar g
Design Temperature	-45 °C to 30 °C
Design Pressure	20 Bar g
* Test Pressure	
Pneumatic (Vessel)	22 Bar g
Coil testing (Pneumatic)	22 Bar g
** Hydraulic	NA
* - Pressure shall be hold at test pressure for 1 hr and next 8 hrs at working pressure/ design pressure, ** - NA.	
Radiography	Spot 10%
Corrosion Allowance	Nil

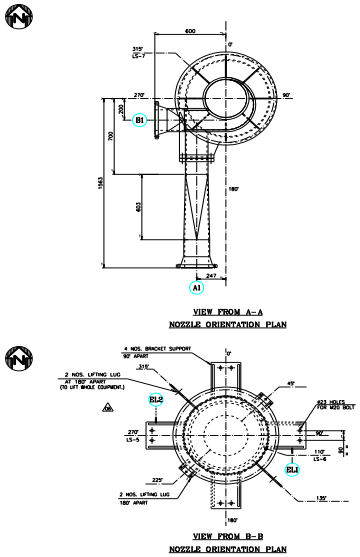
Design – Cyclone Separator

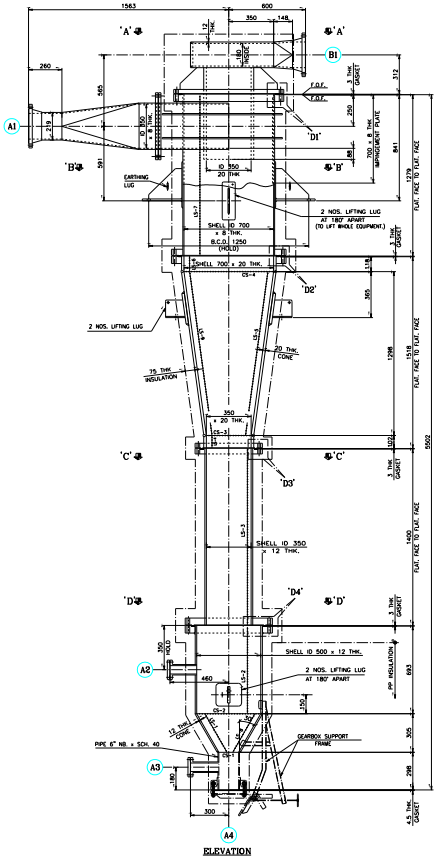
- **Scope:**
  - ✓ Static design as per ASME section VIII div-I
  - ✓ FE Analysis

- **Application:** Decoke Cyclone
- **Size**: ID 700 mm
- **Pressure:** 0.5 bar at 320 deg C

- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing

- **Software Used:** PV-Elite, Ansys





Output- Drawing

Input Data

DESIGN DATA		
DESIGN CODE	: ASME SECT. VIII DIV.1 (only design & calculation)	
INSPECTION BY	: RELIANCE / TPB AND/OR NOMINEE	
REGULATION	: –	
WIND CODE	: INDIAN STANDARD IS875 (PART 3) 1987	
EARTHQUAKE CODE	: IS1893 (PART 4)	
SERVICE		DECOKE CYCLONE
FLUID		STEAM / AIR / SOLIDS
OPERATING PRESSURE	kg/cm²g	(See Note 1. from PDS)
OPERATING TEMPERATURE	Deg C	(See Note 1. from PDS)
FLUID DENSITY		(See PDS)
DESIGN PRESSURE	kg/cm²g	0.5 + FULL OF WATER
AT DESIGN TEMPERATURE	Deg C	320
EXT. DESIGN PRESSURE	kg/cm²g	–
AT DESIGN TEMPERATURE	Deg C	–
M.D.M.T AT DESIGN PRES	Deg C	7.5
INTERNAL CORROSION	mm	(See Note 13. from PDS)
JOINT EFFICIENCY		0.85
STRESS RELIEVED		PER CODE
RADIOGRAPHIC EXAMINATION		SPOT
SHOP TEST PRESSURE	kg/cm²g	PER CODE & SPEC.
PAINTING / PAINTING AREA	– / m2	PER SPEC. / *
INSULATION THICKNESS	mm	PER SPEC. (Note 10. from PDS)
CAPACITY	m3	LATER
CODE STAMP		NO
NO. OF ITEMS		1

Output- PV Elite

PV Elite Vessel Analysis Program: Input Data

Design Internal Pressure (for Hydrotest)	0.1079	MPa
Design Internal Temperature	320	°C
Type of Hydrotest	UG-99(b) Note [36]	
Hydrotest Position	Vertical	
Projection of Nozzle from Vessel Top	0.0000	mm
Projection of Nozzle from Vessel Bottom	0.0000	mm
Minimum Design Metal Temperature	8	°C
Type of Construction	Press. Welded	
Special Service	Air/Water/Steam	
Degree of Radiography	RT-3	
Use Higher Longitudinal Stresses (Flag)	Y	
Select t for Internal Pressure (Flag)	N	
Select t for External Pressure (Flag)	N	
Select t for Axial Stress (Flag)	N	
Select Location for Stiff. Rings (Flag)	N	
Consider Vortex Shedding	Y	
Perform a Corroded Hydrotest	Y	
Is this a Heat Exchanger	No	
User Defined Hydro. Press. (Used if > 0)	0.0000	MPa
User defined MAWP	0.04903	MPa
User defined MAPnc	0.0000	MPa

Design – Pressure Vessel

- **Scope:**
  - ✓ Static design as per PD 5500

- **Application:** Surge Vessel
- **Size**: ID 3000 mm X Length 22000 mm
- **Pressure:** 20 bar at 50 deg C

- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** PV Elite

PV Elite Vessel Analysis Program: Input Data

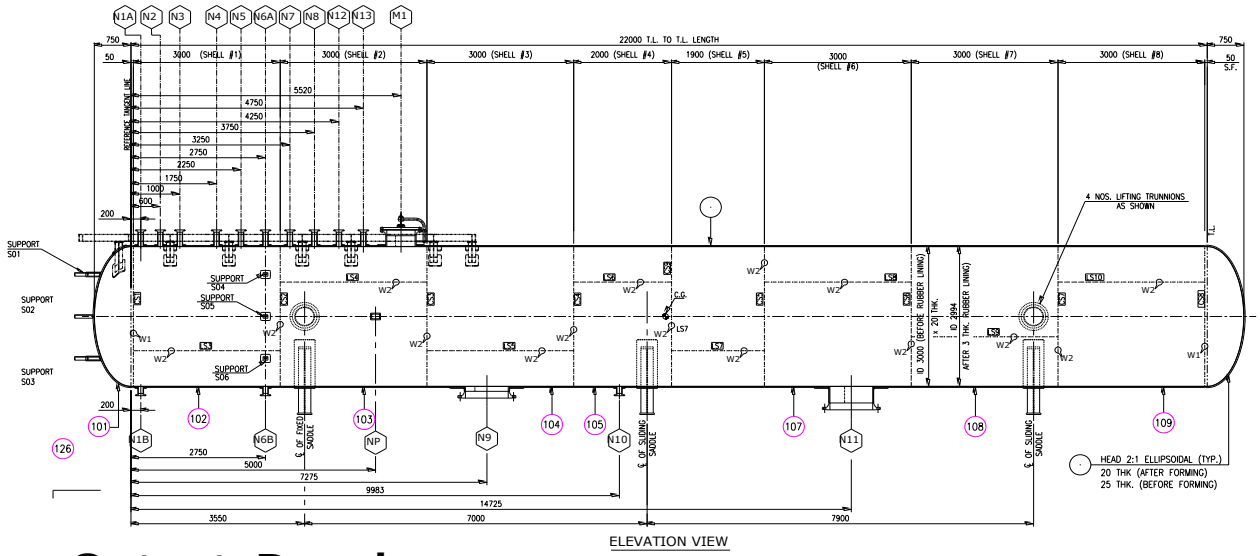
```
Project : WATER SECURITY MEGA RESERVOIRS PACKAGE B PRPS 2 - UMM
Project Code : GTC 626/2014
SURGE VESSEL DIA. 3000 x 22000 LG.

Design Internal Pressure (for Hydrotest)                2   MPa
Design Internal Temperature                            50   °C
Hydrotest Position                                Horizontal
Projection of Nozzle from Vessel Top                    0   mm
Projection of Nozzle from Vessel Bottom                 0   mm
Minimum Design Metal Temperature                        0   °C
Use Higher Longitudinal Stresses (Flag)                 Y
Select t for Internal Pressure (Flag)                   N
Select t for External Pressure (Flag)                   N
Select t for Axial Stress (Flag)                        N
Consider Vortex Shedding                                N
Perform a Corroded Hydrotest                            Y
Is this a Heat Exchanger                               No
User Defined Hydro. Press. (Used if > 0)                3   MPa
User defined MAWP                                       0   MPa
User defined MAPnc                                      0   MPa
```

Output –PV Elite

DESIGN DATA				
CONSTRUCTION CODE			PD 5500 : EDITION 2015	
ENQUIRY CASES			5500/82, 5500/91	
CERTIFICATION MARK			NOT APPLICABLE	
NATIONAL BOARD REGISTRATION			NOT REQUIRED	
MANUFACTURER SERIAL No.			REFER NOTE 7	
INSPECTION			N-KON / CLIENT	
EQUIPMENT No.			SS2A1-SV1, SS2A1-SV2, SS2A1-SV3, SS2A1-SV4 SS2A2-SV1, SS2A2-SV2, SS2A2-SV3, SS2A2-SV4	
JOB No.			X00061-CA-SE-1101	
PRESSURE	DESIGN (INT/EXT)	MPa	2.0 / 0.055	
	OPERATING (INT/EXT)	MPa	0.55 / N.A.	
	HYDROTEST AT TOP OF VESSEL	MPa	3.0 USER DEFINED TEST PRESSURE GREATER THAN PRESSURE AS PER 5.8.5-1	
	MAWP (INTERNAL) (HOT & CORRODED)	MPa	2.0 @ 50°C (SAME AS DESIGN PRESSURE)	
	MAWP (EXTERNAL)	MPa	0.055 @ 50°C (SAME AS DESIGN PRESSURE)	
TEMPERATURE	DESIGN (INT/EXT)	°C	50 / –	3.2.4
	OPERATING (MAX/MIN)	°C	TBA	
	NDMT	°C	0 °C @ 2.0 MPa	3.2.8
METAL TEMPERATURE DURING HYDROTEST		°C	NOT LESS THAN 17 & NOT BE MORE THAN 48	
OPERATING MEDIUM			WATER	
CAPACITY (FULL / WORKING)		Cu m	162.60 / 151	
MEDIUM DENSITY		Kg/Cu m	1000	
CORROSION ALLOWANCE (INT/EXT)		(mm)	3/NIL (INTERNALLY RUBBER LINED – 3 THK EPDM)	3.3.2 & 3.3.3
CONSTRUCTION CATAGORY			CATEGORY 2	3.4.1
RADIOGRAPHY	LONG SEAM		SPOT 10% + ALL 'T' JOINTS	TABLE:3.4-1
	CIRC. SEAM		SPOT 10% + ALL 'T' JOINTS	8.6.4.2
JOINT EFFICIENCY	LONG SEAM		NOT APPLICABLE	
	CIRC. SEAM		NOT APPLICABLE	
PWHT			EXEMPTED	4.4.3.1
IMPACT TESTING			EXEMPTED	ANNEX: D
SPECIAL SERVICE			NO	
INSPECTION OPENING REQUIREMENT			YES (PROVIDED NOZZLE NII)	
WIND LOAD			BS-6399 PART 2, 1997, DESIGN WIND SPEED 180 kM/Hr.	QCS 29.1.2.11
SEISMIC LOAD			ASCE 7-2010, Sa-0.08, S1-0.043, I-1.00, SITE CLASS : D	3.2.1
INSTALLATION			HORIZONTAL	
INSULATION	TYPE / THK		NA	
FIREPROOFING	TYPE / THK		NA	
HYDRO TEST POSITION			HORIZONTAL	

Input Data



Output- Drawing

Design – Shell & Tube Heat Exchanger

- **Scope:** Design Of Shell and Tube Heat Exchanger as per ASME section VIII div-1

- **Application:** Wash Water Heater
- **Size**: 42.9 KW
- **Pressure:** 19 bar at 150 deg C (Shell & tube side)
- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Manufacturing drawing
- **Software Used:** PV - Elite

Output –PV Elite

PV Elite Vessel Analysis Program: Input Data

Wash Water Heaters
02-01-E-1231/1241 A/B
Rev 2

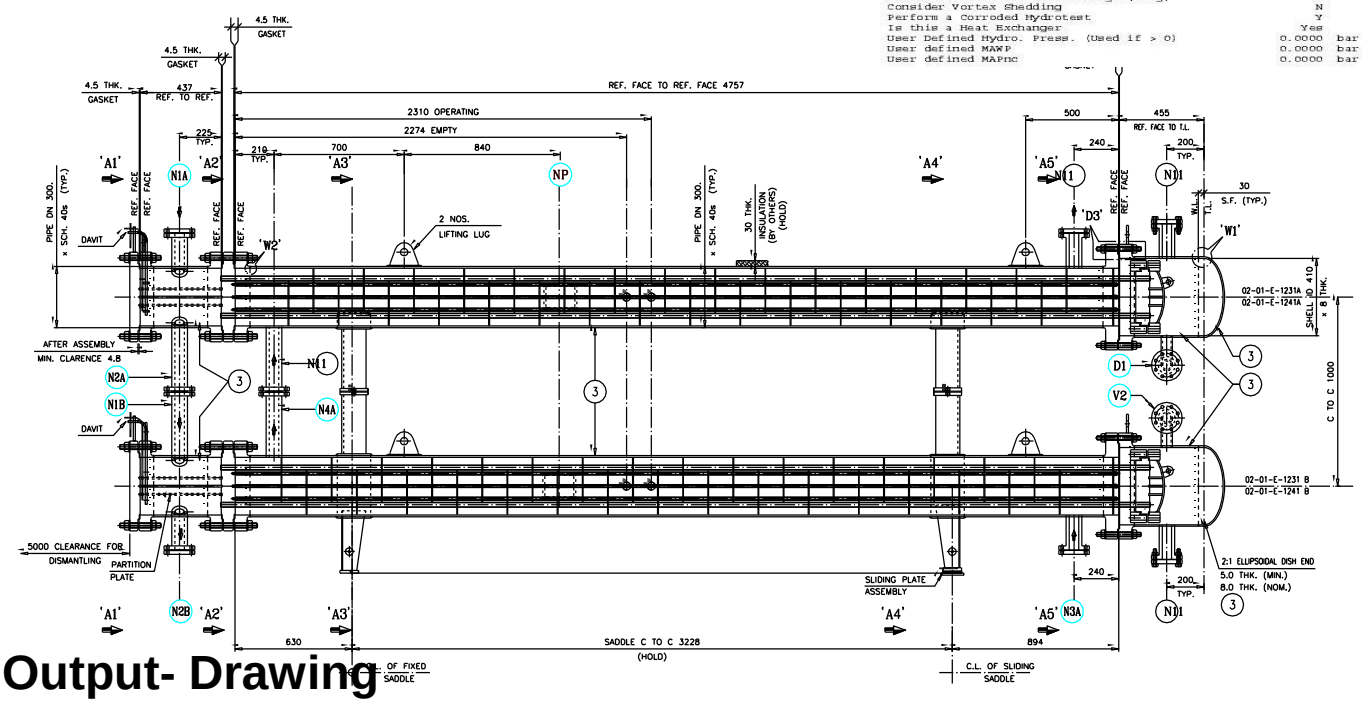
Exchanger Design Pressures and Temperatures

Shell Side Design Pressure	19.000	bar
Channel Side Design Pressure	18.000	bar
Shell Side Design Temperature	90	°C
Channel Side Design Temperature	90	°C
Type of Hydrotest	UG-99(c)	
Hydrotest Position	Horizontal	
Projection of Nozzle from Vessel Top	0.0000	mm
Projection of Nozzle from Vessel Bottom	0.0000	mm
Type of Construction	Welded	
Special Service	Lethal	
Degree of Radiography	RT-1	
Use Higher Longitudinal Stresses (Flag)	N	
Select t for Internal Pressure (Flag)	N	
Select t for External Pressure (Flag)	N	
Select t for Axial Stress (Flag)	N	
Select Location for Stiff. Rings (Flag)	N	
Consider Vortex Shedding	N	
Perform a Corroded Hydrotest	Y	
Is this a Heat Exchanger	Yes	
User Defined Hydro. Press. (Used if > 0)	0.0000	bar
User defined MAWP	0.0000	bar
User defined MAPnc	0.0000	bar

Input Data

DESIGN CONDITIONS

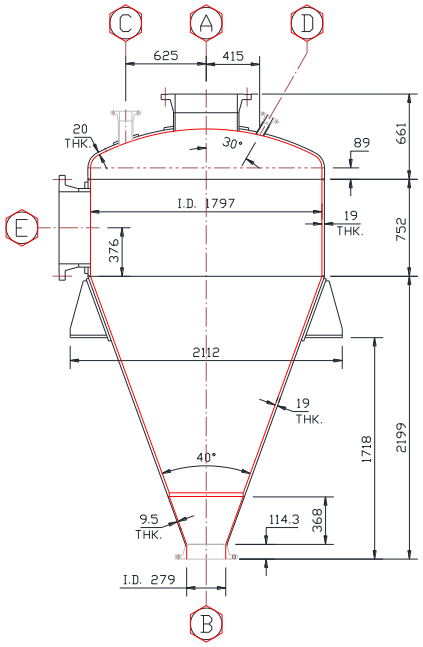
DESIGN CODE			ASME SEC.VIII, DIV1, 2007 ADD 2008.+TEMA CLASS "R", TYPE-AES	
STAMP	✓ YES	NO	--	YES NO
	✓ YES	NO		
PRESSURE		Barg	18 / FV	18 / FV
TEMPERATURE		°C	95	95
HYDROTEST PRESSURE		Barg	0.3107	0.8721
MDMT (AT MAWP)		°C	-29°C @ 0.2388	-29°C @ 0.5028
STEAMOUT PRESSURE		Barg	3.5	3.5
STEAMOUT TEMPERATURE		°C	150	150
RADIOGRAPHY (SHELL/HEAD)		--	100%	100%
JOINT EFFICIENCY (SHELL/HEAD)			1.0/1.0	1.0/1.0
MAWP AT DESIGN TEMPERATURE		Barg	0.2388	0.5028
MAP IN TEST		Barg	--	--
MAP (NEW AND COLD)		Barg	0.2390	0.517
INSULATION		TYPE/THK.	YES	YES
FIREPROOFING			SADDLE ONLY	--
CORROSION ALLOWANCE		mm	0	0
NO. OF PASSES			1	6
TOTAL FLOW RATE		kg/h	--	--
STRESS RELEVING				YES ✓ NO
FULL VACUUM REQUIRED				✓ YES NO
POST WELD HEAT TREATMENT				YES ✓ NO
LETHAL SERVICE				YES ✓ NO
FLAMMABLE SERVICE				YES ✓ NO
EXPLOSIVE SERVICE				YES ✓ NO
	REQUIRED		✓ TO CODE	BY CLIENT
	NOT REQUIRED		SHELL-HEAD	
			PIPING	
			FORGINGS	
			STANDERD FORGINGS	
			BOLTS AND NUTS	
			CODE	NOTES
EARTHQUAKE	✓ YES		IBC-2009	--
WIND	✓ YES		BS 6399-97 DESIGN WIND SPEED 93.6 Km/Hr.	--

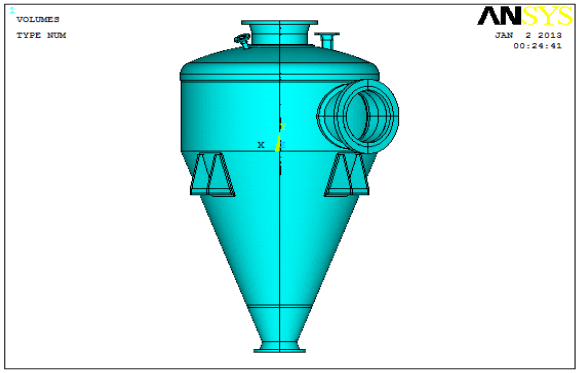


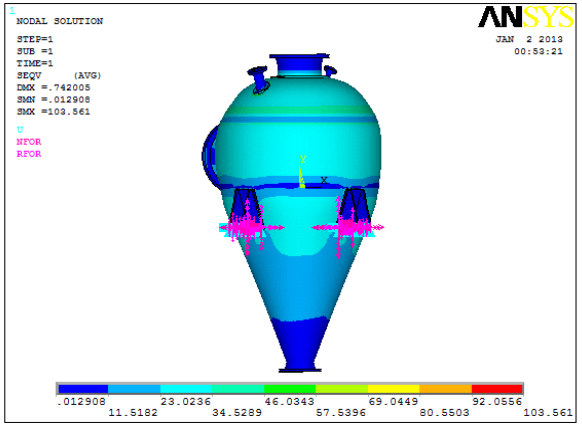
Output- Drawing

FEA – Fatigue Analysis Of Iron Ore Bin

- **Scope:**
  - ✓ Static design as per ASME section VIII div-I
  - ✓ Fatigue life evaluation for pressure fluctuation as per ASME section VIII div-II
- **Application:** Blast furnace
- **Deliverables:**
  - ✓ Design calculation report
  - ✓ Fatigue analysis report
  - ✓ Manufacturing drawing
- **Software Used:** Ansys







Document No. : PED/FEA/2012-13/WELMON/001	Rev. 1	Sheet : 19 of 31
Document Title : FATIGUE ANALYSIS REPORT OF IRON ORE PRESSURIZED BINS		

And the Stress factor used to compute X = $Y = \left(\frac{S_a}{C_{ut}}\right) \cdot \left(\frac{E_{FC}}{E_T}\right)$

= (77.67075 / 6.894757) * (195000 / 200133)

= 10.9762614

Exponent used to calculate permissible number of cycles = X =

$$X = \frac{C_1 + C_3 Y + C_5 Y^2 + C_7 Y^3 + C_9 Y^4 + C_{11} Y^5}{1 + C_2 Y + C_4 Y^2 + C_6 Y^3 + C_8 Y^4 + C_{10} Y^5}$$

X = 7.10594

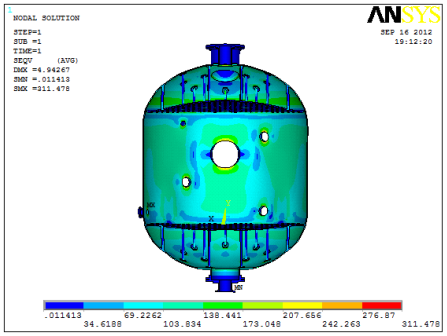
Calculated using C1 – C11 coefficients listed in table 3.F.2 listed below -

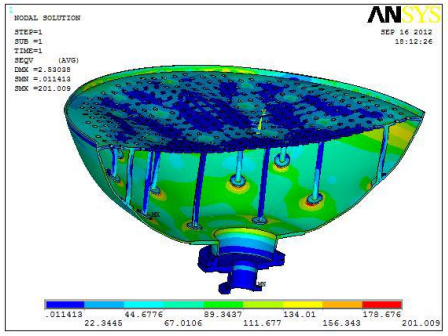
Coefficients C_i	$77.2 \le S_a \le 296 (MPa)$ $11.2 \le S_a \le 43 (ksi)$
1	1.608291E+01
2	-4.113828E-02
3	-1.023740E+00
4	3.544068E-05
5	2.896256E-02
6	1.826072E-04
7	3.863423E-04
8	0.0
9	0.0
10	0.0
11	0.0

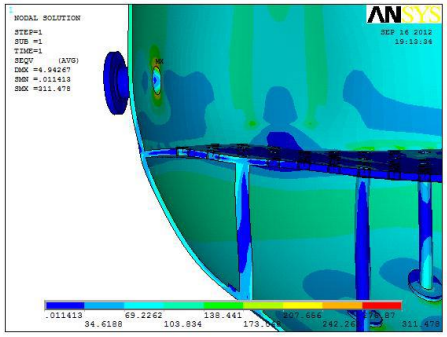
The Number of allowable fatigue cycles N = $10^X = 10^{7.10594}$= 12,762,624

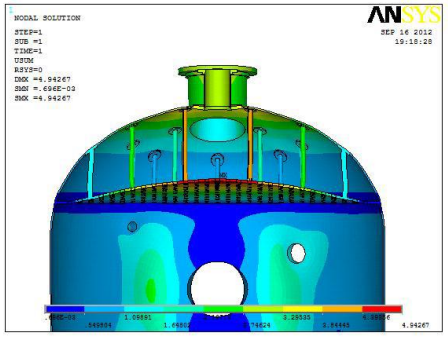
FEA – Analysis Of Vessel

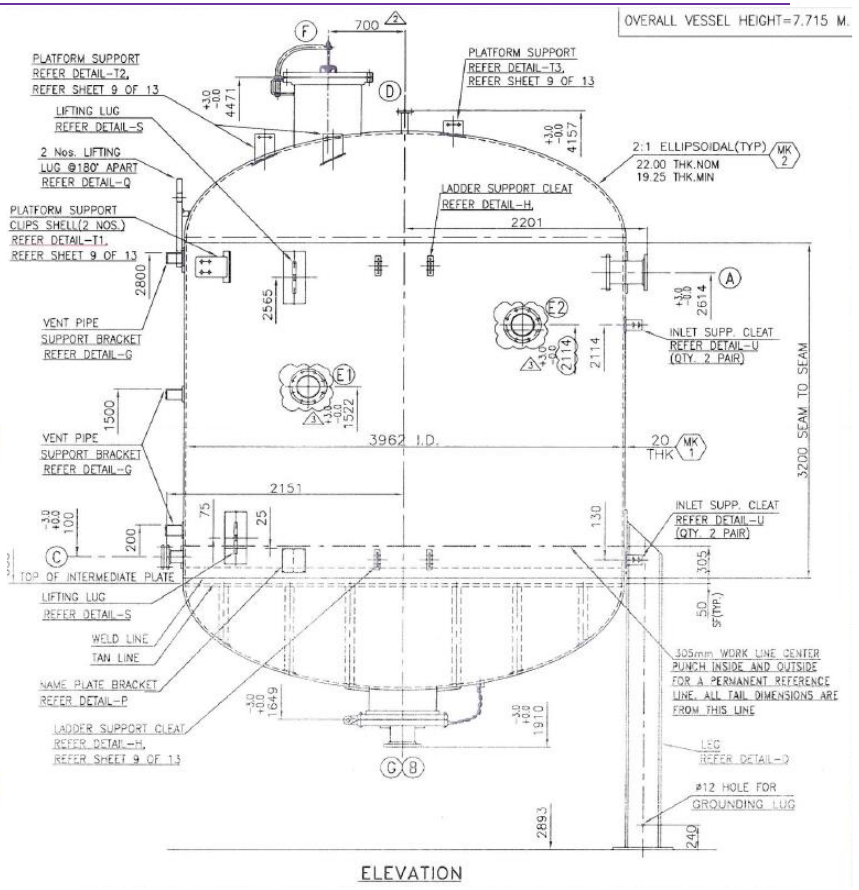
- **Scope:** Verify filter plate design as per ASME section VIII div-II
- **Application:** Water Treatment
- **Deliverables:** FEA report static linear analysis
- **Software Used:** Ansys









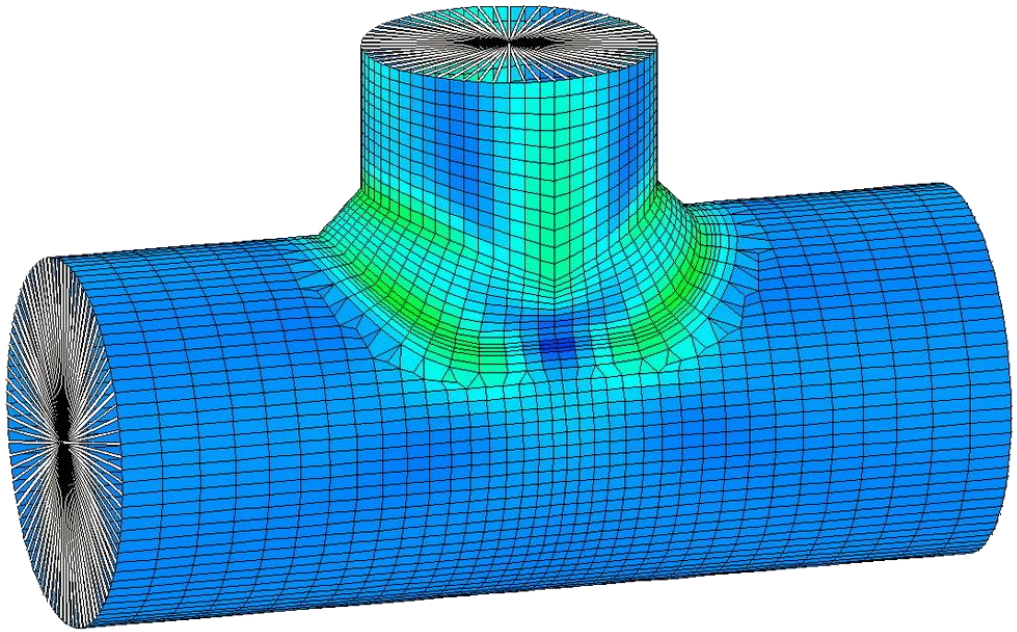


FEA – Piping Analysis

- **Scope:**
  - ✓ Analysis of piping joints for thermal loads.
  - ✓ Structural & transient analysis

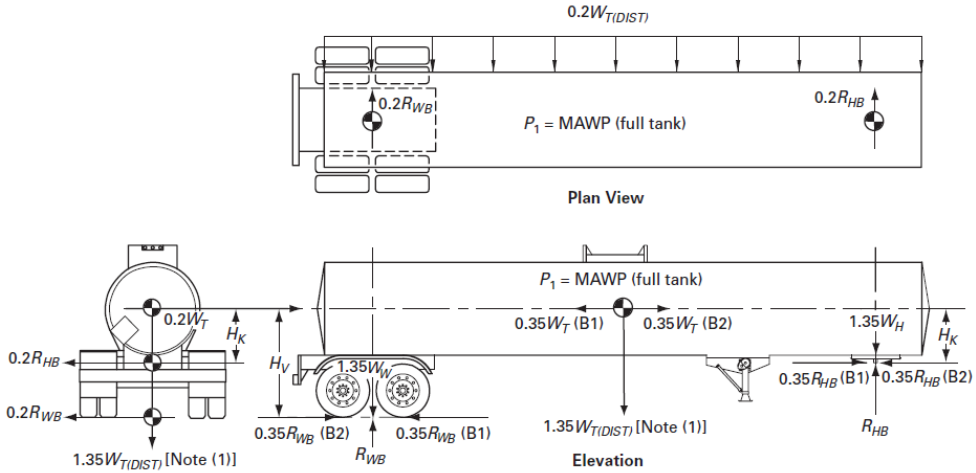
- **Deliverables:**
  - ✓ FEA report as per ASME section VIII div-II**,**
  - ✓ Design calculations as per ASME section VIII div-I,
  - ✓ Manufacturing drawings

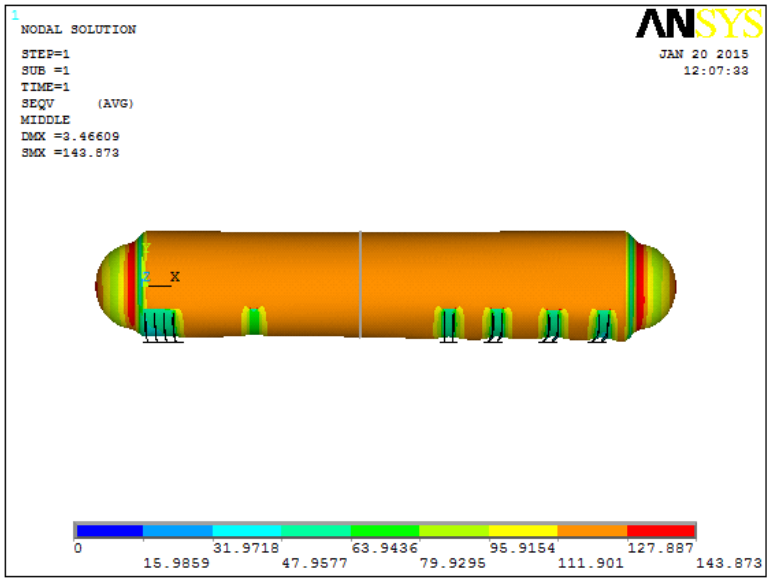
- **Software Used:** Ansys

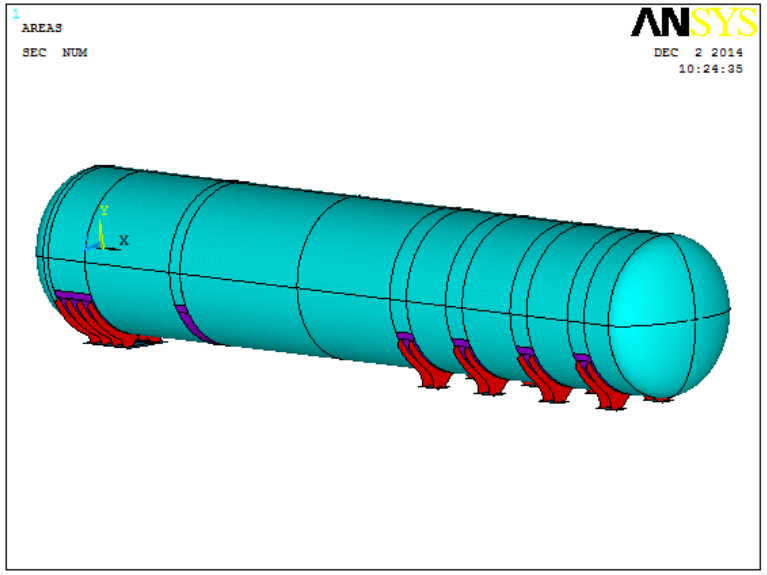


FEA – Cargo Vessel LPG Bullet

- **Scope:**
  - ✓ FEA Static Structural analysis to verify thickness
  - ✓ Verification of Support members
- **Deliverables:**
  - ✓ FEA report
  - ✓ Design calculation as per ASME section VIII div-I/ASME section XII
  - ✓ Manufacturing **drawings**
- **Software Used:** Ansys

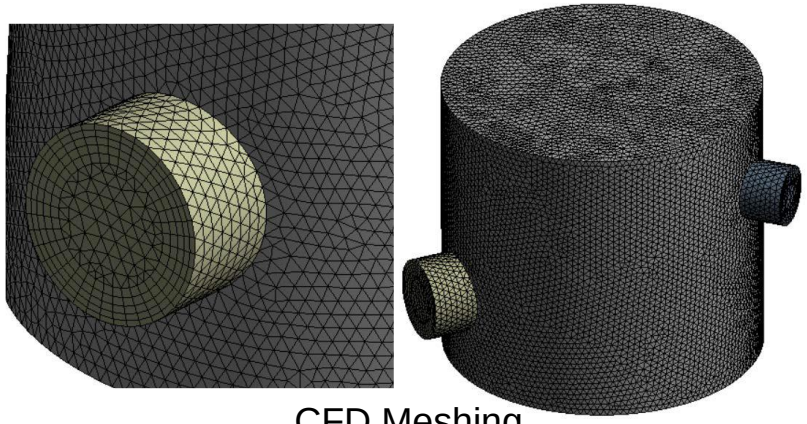




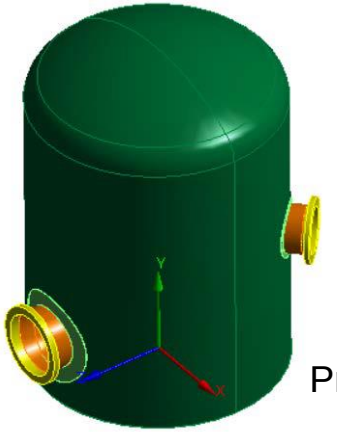


CFD – Cooling Tower Buffer Tank

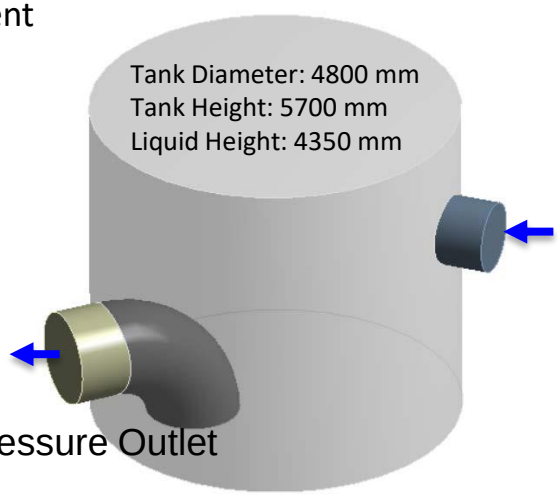
- **Scope:** Calculate the transient force acting on the tank cylinder
- **Deliverables:** CFD report
- **Software Used:** Fluent



CFD Meshing



CAD Model



Fluid Volume