

PRESSURE INSPECTION SUMMARY REPORT

API 510 Inspection of Pressure Vessel

V1-R3 ACCUMULATOR

Client : Chemical Specialties (S) Pte Ltd

Location : 31 Ayer Merbau Road, Jurong Island

Project : API Inspection

Project No : LEADS-23-03

Report No : LEADS-23-03-API-07 R1

Date of Inspection : 04-05 May 2023



PRESSURE VESSEL INSPECTION SUMMARY REPORT

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Originated by	P Rajesh (API 510 Certificate: 61416)	Signature: 
Approved by	Sudhan P (General Manager)	Signature:  



PRESSURE VESSEL INSPECTION SUMMARY REPORT

1.0 Introduction

1.1 Works Brief

Leads was engaged as a third-party inspection company to carry out the inspection based on API 510 which encompasses below.

An American Petroleum Institute (API) 510 pressure vessel external inspection for Accumulator V1-R3 at CSL facility, Jurong Island, Singapore in May 2023 has been carried out. The vessel was in service, scaffolding has been provided to perform external visual inspection & UTG inspection. This inspection complied with the API 510 standard. This vessel inspection included visual inspection of the shell, nozzles, head, foundation and internal inspection. NDT data gathered will be part of the final report.

This report is generated on data gathered from three locations: applicable codes, regulations, and laws; the observed field conditions existent during the API inspection; and material provided in written form by the facility, end-user, or client (e.g., as-builts, previous inspection reports, written transcriptions of conversations with the facility.)

This inspection report is based solely on empirically observable conditions observed during the inspection process and correspondence with the facility or end-user. Information not empirically observable or presented to us in the course of this inspection, but which may be relevant to the inspection's findings, have not been evaluated or included in this inspection. The API inspector bears no responsibility for findings which could only be ascertained by information not made available to the API inspector.

1.2 General Arrangement & Reference

This inspection report is prepared with a photo and name of each item and / or a location for reference. In addition, the report is also complemented with all the necessary equipment and personnel certification to ensure that the job was performed in line with the requirements. Please note the content of the final report and report reference numbers are number numerical in each NDT method, however they are grouped in this summary by NDT method so they may not be sequential in their grouping.

1.2.1 Reference Documents

- API 510 – Pressure Vessel Inspection Code
- Leads NDT Technical Procedures
- General Arrangement Drawing: (CSL-HX-MHI-V1R3-001 Rev 02)



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1.3 Vessel Suitability for Service Statement

This report contains all the details and evaluation results used to arrive at this vessel suitability for service determination. Based on the findings and the detailed report below, we have determined that:

- The vessel can continue to operate. However, recommendations are provided for further follow up.

1.3.1 General Condition

Accumulator V1-R3 is Vertical vessel. The vessel is approx. 2133.6mm tall with a 1549.5 mm outer diameter. Vessel was in operation from 2018.

1.3.2 Structural Integrity

We define vessel structural integrity as the capability of the vessel to remain freestanding, with or without product, under the conditions of its design basis. Structural attributes include the vessel foundation, shell, head and their attachments. Ultrasonic thickness inspections of the shell & head were performed.

Based on our inspection of the accessible components and engineering evaluation, vessel is considered to have suitable structural integrity.

1.3.3 Coating Integrity

We define coating integrity as the interior wetted coating's ability to provide an impervious, completely continuous film barrier that prevents harmful environmental and service conditions corrosive agents to penetrate to the base metal, which could over time compromise hydraulic integrity.

Although corrosion and coating failures may not indicate structural failures; they present conditions which, in time, can lead to structural integrity failures.

Based on our inspection of the accessible components and engineering evaluation, vessel is considered to have suitable coating integrity.

1.3.4 Hydraulic Integrity

Not Applicable as Hydrotest was not part of the scope this time.



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1.4 Next Inspection Schedules

External Inspection:

API 510 recommends Unless justified by an RBI assessment, each aboveground vessel shall be given a visual external inspection at an interval that does not exceed the lesser of five years or the required internal/on-stream inspection. It is preferred to perform this inspection while the vessel is in operation.

Internal, On-stream, and Thickness Measurement Inspections:

Unless justified by a RBI assessment, the period between internal or on-stream inspections and thickness measurement inspections shall not exceed one-half the remaining life of the vessel or 10 years, whichever is less. Whenever the remaining life is less than four years, the inspection interval may be the full remaining life up to a maximum of two years.

Based on the thickness measurements, we recommend the below:

- **API internal inspection (out-of-service)** shall be conducted
 - no later than **previous inspection recommendation** (shall not exceed 10 years from last internal inspection)
- **UTG inspection** shall be conducted
 - no later than **May 2033** (10 years from May-2023 inspection)
- **API external inspection (in-service)** be conducted
 - no later than **May 2028** (5 years from May-2023 inspection) for a visual inspection, and

or sooner if a change in condition has occurred.

1.5 Inspector's Certification

I acknowledge that I am familiar with API Standard 510's provisions; the inspection and evaluation performed on Vessel at CSL facility and certify that the inspection was performed per the API Standard 510 provisions, good engineering practices, and with usual and customary care.



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2.0 Vessel Summary

2.1 Project Scope

An API 510 vessel inspection has been performed on the vessel. This vessel inspection included external visual inspection of the vessel shell, nozzles, head, foundation (where accessible) & UTG. Following the API 510 inspection's completion, report with findings is provided detailing all vessel conditions and repair recommendations.

2.2 Vessel Repair Definitions

Mandatory Repairs – repairs that need to be completed before the vessel can be returned to service. Mandatory Repairs consists of any failure / deficiency that has breached the hydraulic and/or structural integrity of the vessel, and/or presents an imminent danger to personnel and/or adjacent structures.

Non-Mandatory Recommended Repairs Preceding Return-To-Service – repairs that do not meet the requirements of being a Mandatory Repair, but will help maintain or improve vessel operability / serviceability, or else are required to meet current codes. Repairs noted under this category are recommended for performance prior to the vessel being returned to service.

Future Non-Mandatory Recommended Repairs – repairs that do not meet the requirements of being a Mandatory Repair, but will help maintain or improve vessel operability / serviceability, or else are required to meet current codes. Unlike the Non-Mandatory Recommended Repairs Preceding Return-To-Service, Future Non-Mandatory Recommended Repairs are not being recommended for performance prior to the vessel being returned to service.

Recurring Maintenance Recommendations - actions that should be taken on a recurring basis

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2.3 Vessel Repair Recommendations

The API 510 inspection has resulted in the following repair conditions:

Mandatory Repairs Preceding Return To Service	
I.1	None
Non-Mandatory Recommended Repairs Preceding Return-To-Service	
II.1	None
Future Non-Mandatory Recommended Repairs	
III.1	Recommend to do surface preparation and painting of the top dish head outer flanges
III.2	Recommend to clean and touchup paint the top dish head one of the Lifting lug and nearby head
III.3	Recommend to fix the insulation damage at the top side pipe connection.
Recurring Maintenance Recommendations	
IV.1	Let the fire and safety systems be checked on an annular base by a safety engineer.
IV.2	Perform proper housekeeping on a regular base.
IV.3	Perform visual and UT inspections as per Inspection Interval Recommendation.

2.4 Vessel Design Data

DESIGN DATA	
DESIGN CODE: ASME CODE SECTION VIII DIV. 1: 2017	
EQUIPMENT ITEM NO.	V1-R3
EQUIPMENT TYPE	ACCUMULATOR
POSITION	VERTICAL
	VESSEL
SHELL MATERIAL	SA 240 316L
HEAD MATERIAL	SA 240 316L
INTERNAL LINING MATERIAL	NA
MEDIUM	PO
DESIGN PRESSURE	60 psi [4 bar] / F.V
DESIGN TEMPERATURE	200 °F [93 °C]
OPERATING PRESSURE	60 psi [4 bar] / F.V
OPERATING TEMPERATURE	140 °F [60 °C]
CORROSION ALLOWANCE	1.59 mm [1/16"]
REQUIRED MDMT	-4 °F [-20 °C]
CALCULATED MDMT	-155.2 °F [-104 °C]
MAWP	70 psi [4.839 bar]
HYDROTEST PRESSURE	75 psi [5.2 bar]
HYDROTEST POSITION	VERTICAL
FLOW RATE	-
OPERATING S.G.	1.3
DESIGN S.G.	1.3
VISCOSITY	-
PRODUCT DENSITY	1300 Kg/M ³
YEAR MANUFACTURED	1973
INSULATION	N.A
WIND DESIGN CODE	ASCE 93
WIND SPEED	22 m/s
EARTHQUAKE DESIGN CODE	NO SEISMIC
EMPTY WEIGHT	1,963 KG
OPERATING WEIGHT	6,856 KG
FULL WEIGHT	6,557.8 KG
GROSS CAPACITY	6 m ³
NET CAPACITY	5 m ³

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3.0 Inspection Checklists and Summary

The following inspection summaries list all noted deficiencies and the governing criteria with which they fail to comply fully.

3.1 Vessel External (Online) Inspection

Ladders, Stairways, Platform, Walkways (API 572 Sec 9.3.2) :		
1	Ladder attachments to concrete base (corrosion, broken):	NA
2	Bolts and fasteners on stairways and ladder stringers (tightness and corrosion):	NA
3	Welds on stairways and ladder stringers (corrosion, broken):	NA
4	Welds on spiral stairway to shell supports (corrosion, broken):	NA
5	Stairways and ladders (corrosion, broken):	NA
6	Stairways and ladders (coating or paint failure):	NA
7	Attachment welds of handrails to stairways (corrosion, broken):	NA
8	Tubular / solid bar stairway handrails (corrosion, pitting, paint failure):	NA
9	The condition of flooring on platforms and walkways	NA
10	Crevice corrosion around the heads of bolts and nuts at bracket connections	NA
11	Loose or broken parts found any	NA
Foundation and Supports (API 572 sec 9.3.3)		
12	Plumpness of column supporting spherical tank	NA
13	Settlement Survey	NA
14	Condition of connected pipe lines due to settlement	NA
15	Misalignment of the foundation with the surrounding paving or ground due to settlement	NA
16	Check for deterioration such as spalling, cracking, and settling on the foundation	NA
Anchor Bolts (API 572 sec 9.3.4)		
17	Check for deterioration of the anchor bolt below the base plate	NA
18	Distortion of anchor bolts due to foundation settlement if any	NA
19	Tightness of nuts	NA
Concrete Support (API 572 sec 9.3.5)		
20	Sealing condition between concrete support and vessel shell	NA

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Steel Support (API 572 sec 9.3.6)		
21	Check for corrosion, distortion, and cracking	NE
22	Remaining thickness of (Skirts, Columns and bracing)	U/A
23	Check for buckling, Excessive Deflection (measurement by straightedge or plumb line)	2
24	NDE (MT /PT) result of attachment weld supporting tank	NA
25	Insulation condition of supporting skirts	NA
26	Piping attachment to Spherical tank (Check for evidence of distortion due to pipe movement)	NA
27	Fireproofing Condition (Bulge , Rust stain, Crack)	2
Guy Wires (API 572 sec 9.3.8)		
28	Check for corrosion and broken strands	NA
Nozzles (API 572 sec 9.3.9)		
29	Check for distortion due to settlement	2
30	Nozzles painting / coating condition	2
31	Nozzles corrosion pitting condition	2
32	Check for flange leak (discoloration to the vessel, insulation, fireproofing, or paint, or damage)	2
33	Thickness survey reading	2
Grounding Connections (API 572 sec 9.3.10)		
34	Tightness, positive bonding to the vessels, and corrosion, Continuity of wires	2
35	Recommended Resistance achieved (5 to 25 Ohms)	NA
Auxiliary Equipment (API 572 sec 9.3.11)		
36	Evidence of Vibration if any	2
37	Drain lines and other connected piping	2
38	Gauges for liquid level, pressure, and temperature and other instruments	2
39	Safety and relief valves	NA
40	External water sprays and other fire-fighting equipment	NE
41	Instrument or utility stations	NA
42	Structural steel for platforms, supports, and lifting lugs	NA
Protective Coatings and Insulation (API 572 sec 9.3.12)		
43	Check for Rust spots, blisters, and film lifting	2
44	Condition of Insulation	NA

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External Metal Surfaces (API 572 sec 9.3.13)		
45	Picking, scraping, and limited hammering	2
46	General external painting / coating condition	3
47	General external corrosion pitting condition	2
48	Thickness survey reading	2
49	NDE (MT / PT) results of support attachment location	NA
50	Condition of weld joints wherever accessible (lower and upper equator plate, lower and upper temperate, top and bottom center crown weld joints)	2
Roof / Shell Appurtenances		
51	Manway covers secured in place, condition:	2
52	Roof nozzles condition:	3
53	Roof Platform condition:	NA

Legend:

1	Good Condition	3	Repair or alteration recommended	U/A	Un-assessable
2	Satisfactory Condition	4	Repair or alteration required	NE	None Evident
xx	Not to Code			N/A	Not applicable

Comments:

- Top dish head outer flange was observed with minor corrosion.
- Top dish head one of the Lifting lugs and nearby channel head is found with minor corrosion and algae from the water droplets.
- Top side pipe's insulation was damaged.



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3.1.1 Remaining Life Calculations:

SHELL:

When P does not exceed 0.385SE, the following formula shall apply:

$$t = \frac{PR}{SE - 0.6P} * 25.4$$

- t_{min} is the minimum required thickness in mm,

Material	- SA 240 Grade 316L
P (internal design pressure, lbf/in. ²)	- 60
R (inside radius, in.)	- 30.48
S (Max. allowable stress, lbf/in. ²)	- 16700 (for temp 200 °F, Ref ASME Sec II – part D – Table 1A)
E (Joint Efficiency)	- 0.7 (no RT details available)

$$t=3.99 \text{ mm}$$

Corrosion allowance from drawings = 1.59 mm

Actual lowest thickness – 12.93mm (0.509 in)

Maximum Allowable working pressure (MAWP) for the noted thickness:

$$P = \frac{SEt}{R+0.6t}$$

$$P = 193.30 \text{ psi}$$

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DISH HEAD:

$$t = \frac{PD}{2SE - 0.2P} * 25.4$$

- t_{min} is the minimum required thickness in mm,

Material - SA 240 316L

P (internal design pressure, lbf/in.²) - 60

D (inside diameter, in.) - 12.79

S (Max. allowable stress, lbf/in.²) - 16700 (for temp 200 °F, Ref ASME Sec II – part D – Table 1A)

E (Joint Efficiency) - 0.7 (no RT details available)

t=3.98mm

Corrosion allowance from drawings = 1.59mm

Remaining Life = $t_{actual} - t_{required}$ / corrosion rate

Plate No.	Original Thickness (mm)	Actual lowest Thickness (mm)	Wall loss (mm)	Years of Service	Long Term Corrosion Rate (mm/year)	Min. required thickness, incl. CA (mm)	Remaining Life (Years)	Next recommended UTG
Shell	12.70	12.93	NA	5	NA	5.58	Note 1	10 years
Top Head	8.58	9.58	NA	5	NA	5.57	Note 1	10 years
Bottom Head	11.43	12.54	NA	5	NA	5.57	Note 1	10 years

- UTG report number: LEADS-23-CSL-UTG-013
- Note 1: Remaining life cannot be calculated as the actual thickness is higher than the design thickness.



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3.2 Vessel Offline Inspection

Internal Nozzles		
1	Check for distortion due to settlement	NA
2	Check for flange leak (discoloration to the vessel, insulation, fireproofing, or paint, or damage)	NA
3	Thickness survey reading	NA
Internal Linings / Coatings / Cladding		
4	Check for Rust spots, blisters, and film lifting	NA
5	Check for cracks, openings	NA
6	Others	NA
Internal Metal Surfaces		
7	Picking, scraping, and limited hammering	NA
8	NDE (MT / PT) results of support attachment location	NA
9	Condition of weld joints wherever accessible (lower and upper equator plate, lower and upper temperate, top and bottom center crown weld joints)	NA
Internal Evidence of Corrosion		
10	Evidence of Atmospheric corrosion, caustic embrittlement, hydrogen blistering, and soil corrosion	NA
Internal Appurtenances		
11	Manway covers secured in place, condition:	NA
12	Attachment welds condition	NA
13	Baffle / Weir / Impingement Plates / Mixer /Agitator / Heating coil / Thermowells / Tray / Distributor (where applicable) condition:	NA



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4.0 NDT Inspection Reports

4.1 Visual Inspection Photographs

4.2 UTG Report

PRESSURE VESSEL INSPECTION SUMMARY REPORT

4.1 Visual Inspection Photographs



Photo 1: Labelled for Vessel Identification



Photo 2: General view of V1-R3. In satisfactory condition.

PRESSURE VESSEL INSPECTION SUMMARY REPORT



Photo 3: V1-R3 External view. In satisfactory condition.



Photo 4: Column support and earthing was noted in satisfactory condition

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Photo 5: Pipe supports were directly welded to the shell and in satisfactory condition



Photo 6: Top dish head nozzle was observed with minor rust.

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Photo 7: During Ultrasonic thickness measurement of nozzle head.



Photo 8: Top view of nozzle head. Flange was observed paint failure and lifting lug & nearby top dish head was observed with minor corrosion and algae.

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Photo 9: Shell nozzle were observed in satisfactory condition



Photo 10: Top view of nozzle head. Flange was observed paint failure and lifting lug & nearby top dish head was observed with minor corrosion and algae.

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Photo 11: Top dish head pipe insulation was damaged.

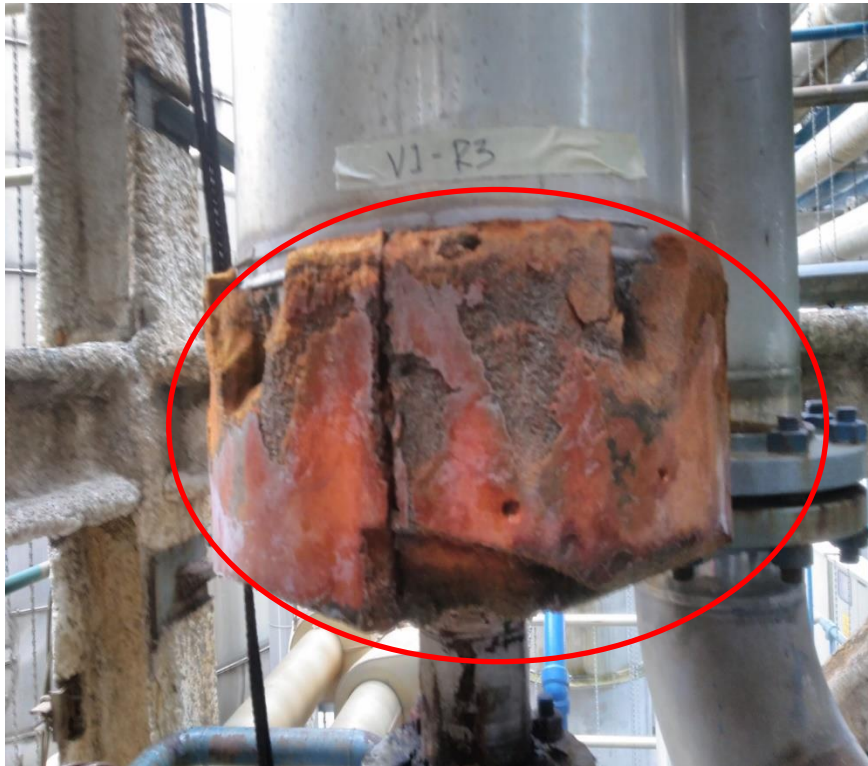


Photo 12: Top dish head pipe insulation was damaged.






PRESSURE VESSEL INSPECTION SUMMARY REPORT

4.2 Ultrasonic Thickness Measurement Report

Client : Chemical Specialties (Singapore) Pte Ltd		Report No. : LEADS-23-CSL-UTG-013	
Client Address : 31 Ayer Merbau Rd, Singapore 627717		Inspection Date : 04-05-2023	
Project Name. : V1 - R3 Accumulator		Report Date : 05-05-2023	
Location : 31 Ayer Merbau Rd		Leads Ref No. : LSS/23-05/018	
Item Description : V1 - R3 Accumulator		Client Request No. : NA	
Eq.Make / Model : 38 DL PLUS	Test Mode : Auto Echo to Echo	Procedure : LEADS-IMSP-035 REV-02	
Eq. Serial No : 193390803	Screen Range : 0-50mm	Standard : ASME Sec V Art 23 SE-797 Ed 2019	
Probe Frequency : 5 MHZ	Material : Stainless Steel	Drawing No. : Refer attached Drawing	
Probe Serial No : 1123940	Surface Cond. : Smooth	Couplant Type : Wallpaper paste	
Probe Size Ø : 11mm	Probe Type : Thru-Coat Dual / D7906	Cal Block(Sr.No) : SS-018	

S/NO	Item Description	UTG Measurement (mm)				Min	Max	AVG	Remarks
		North	East	South	West	mm	mm		
1	Top Disc - Location 1	9.58	9.68	9.90	9.68	9.58	9.90	9.71	
2	Top Disc - Location 2	9.67	9.67	9.79	9.87	9.67	9.87	9.75	
3	Top Disc - Location 3	9.78	9.78	9.66	9.77	9.66	9.78	9.75	
4	Bottom Disc - Location 1	13.20	12.57	13.16	12.95	12.57	13.20	12.97	
5	Bottom Disc - Location 2	12.91	12.85	12.98	12.54	12.54	12.98	12.82	
6	Bottom Disc - Location 3	13.07	12.55	12.93	12.98	12.55	13.07	12.88	
7	Shell - Top	13.51	13.36	13.44	13.12	13.12	13.51	13.36	
8	Shell Middle - Location 1	13.59	13.51	13.45	13.19	13.19	13.59	13.44	
9	Shell Middle - Location 2	13.15	13.53	13.49	13.14	13.14	13.53	13.33	
10	Shell - Bottom	13.57	13.16	12.98	12.93	12.93	13.57	13.16	
11	Nozzle D - 6"	6.65	6.54	6.63	6.66	6.54	6.66	6.62	
12	Nozzle B - 10"	9.55	9.86	9.52	9.72	9.52	9.86	9.66	
13	Nozzle A - 16"	9.71	9.66	10.04	10.05	9.66	10.05	9.87	
14	Nozzle P - 3"	5.67	5.74	5.56	5.65	5.56	5.74	5.66	

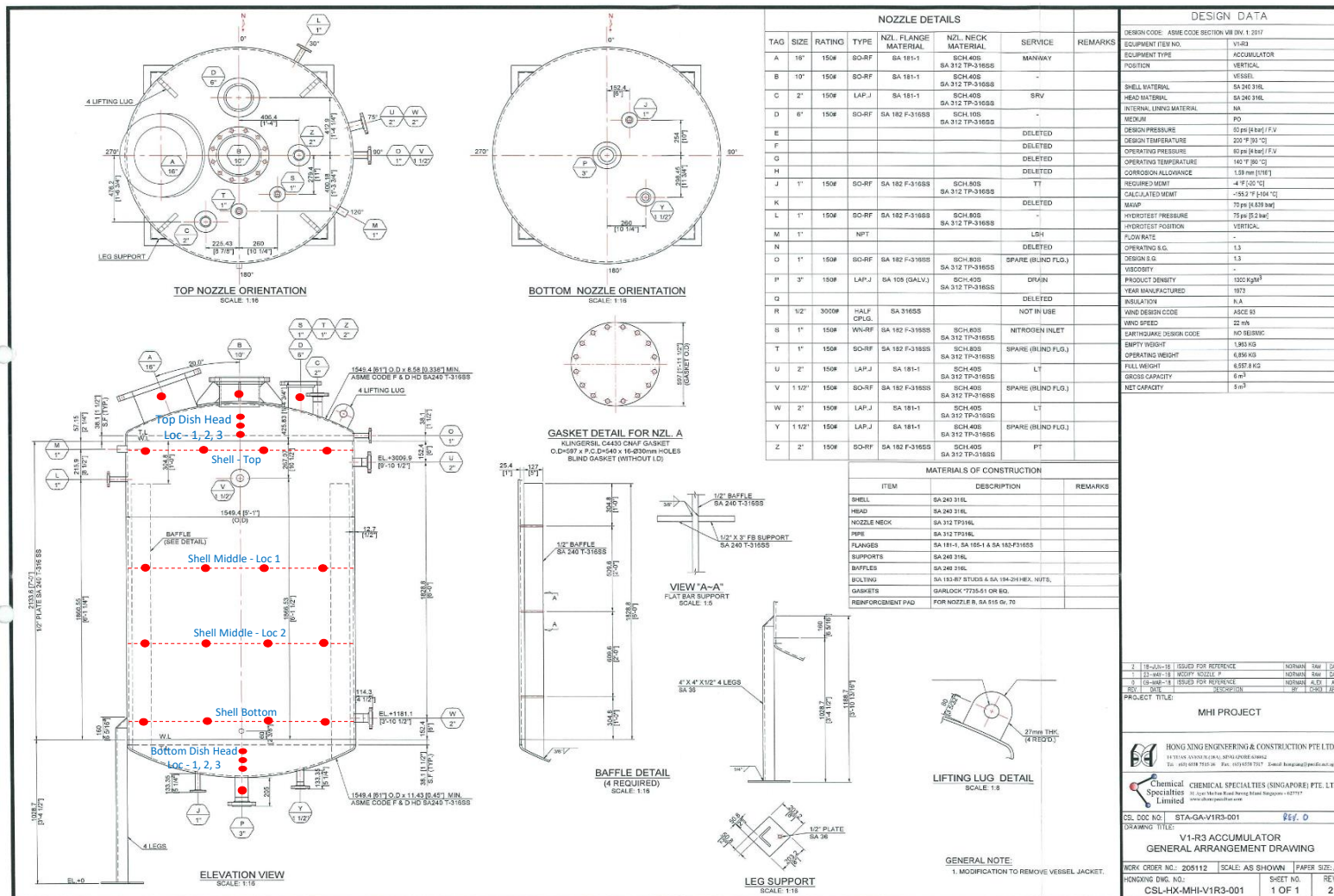
Leads Address : Leads Specialist Services Pte Ltd, Platinum@Pioneer, 32F Tuas Ave 11, Singapore 636855

Inspected By (Signature)	Approved By (Signature)	NDT Level III	CLIENT REP. (Signature)
 AL-MAHMUD 05-05-2023	 B. CHINNADURAI 05-05-2023	 P. RAJESH 05-05-2023	

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- The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council.
- Leads stand no responsibilities for changes in the quality of the same product tested in later stage with same variables but different conditions.

Client	: Chemical Specialties (Singapore) Pte Ltd	: LEADS-23-CSL-UTG-012	: LEADS-23-CSL-UTG-013
Client Address	: 31 Ayer Merbau Rd, Singapore 627717	Inspection Date	: 04-05-2023
Project Name	: V1 - R3 Accumulator	Report Date	: 05-05-2023
Location	: 31 Ayer Merbau Rd	Leads Ref No.	: LSS/23-05/018
Item Description	: V1 - R3 Accumulator	Client Request No.	: NA

UTG LOCATION MARKING





PRESSURE VESSEL INSPECTION SUMMARY REPORT

5.0 Equipment and Personnel Certificates

5.1 Equipment Calibration

5.2 Personnel Certification



PRESSURE VESSEL INSPECTION SUMMARY REPORT

5.1 Equipment Calibration



DIGITAL ULTRASONIC THICKNESS GAUGE CALIBRATION CERTIFICATE

Calibration Certificate No : LEADS-23-UTG-04

Date of Calibration : 29/12/2022

Client : LEADS

Equipment Details

Model & Make : 38DL PLUS & OLYMPUS

Product : DIGITAL ULTRASONIC THICKNESS GAUGE

Serial No : 193390803

Ambient Temperature : (24±2) ° C

Relative Humidity : (35 to 70) % RH

Calibration Accessories

Block Serial No : 5 Step Block

Certificate No. : BLD1903901-1S

This is to certify that the above instruments having serial no. 193390803 has been calibrated Under the ambient Conditions Stated according calibration Procedure ISO 16831:2012 the UTG was calibrated by comparison with a reference Calibration block the reference Standards are traceable to National Standards.

Calibration Date: 29/12/2022

Calibration Due Date: 28/12/2023

Calibrated by

Approved By

Name : M. Bharath

Name : P.Rajesh

Signature :

Signature :



Date : 29-12-2022

Date : 29-12-2022



S/No.	Reference Readings	Test Readings	Deviation	Results
1	12.5 mm	12.52	+0.02	Passed
2	10.0 mm	10.00	0.00	Passed
3	7.5 mm	7.51	+0.01	Passed
4	5.0 mm	5.02	+0.02	Passed
5	2.5 mm	2.52	+0.02	Passed

The expanded Uncertainty of measurement found to be 0.02 mm at Confidence level is approximately 95% with coverage factor $K = 2$



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5.2 Personnel Certification

API INDIVIDUAL CERTIFICATION PROGRAMS



verifies that

Peramaiyan Rajesh

HAS MET THE ESTABLISHED AND PUBLISHED REQUIREMENTS FOR API CERTIFICATION AS AN
API 510 PRESSURE VESSEL INSPECTOR

IN ACCORDANCE WITH THE KNOWLEDGE DEFINED IN THE **API Standard 510**

CERTIFICATION NUMBER **61416**

ORIGINAL CERTIFICATION DATE	September 30, 2015
CURRENT CERTIFICATION DATE	September 30, 2021
EXPIRATION DATE	September 30, 2024

Director, Individual Certification Programs





NDT CERTIFICATION

Certificate Reference No: LEADS-IMSC-NDTC-048

Date of Issue: 29/01/2020

Date of Expiry: 28/01/2025

This is to certify and authorize **Al Mahmud Mohammad (G2712531Q)** Represent Leads Specialist Services Pte. Ltd, to work in the following NDT methods, as he satisfactorily met the qualification and certification requirements of company written practice LEADS-IMSP-0029 Rev 02, which is based on ASNT RP No SNT-TC-1A 2016 Ed.



Method	NDT Level	Scope/Sectors/Categories
Magnetic Particle Inspection	Level II	Electromagnetic yoke, Visible/ Fluorescent, Dry/ Wet Particles
Ultrasonic Test	Level II	Flaw Detection
Liquid Penetrant Inspection	Level II	Visible/ Fluorescent
Ultrasonic Thickness Gauging	Level II	A Scan Thickness & Spot Measurement
Radiography Test	Level II	Radiography

This record is only evidence of competence when supported by the following evidence as specified by the minimum requirements of leads specialist services pte ltd competence management system

- Valid eye test
- Prior experience
- Examination
- No Interrupted Services of the respective NDT Methods with the previous 6 months

This inspector has met lead's requirements for the respective methods: this record is only valid during employment with Leads Specialist services pte ltd

This document is uncontrolled if printed: authorization history can be provided on demand

Authorized by	Position	Date	Signature
P. Sudhan	Operation Manager	29/01/2020	
Sengottaian Velmurugan	ASNT Level III	29/01/2020	

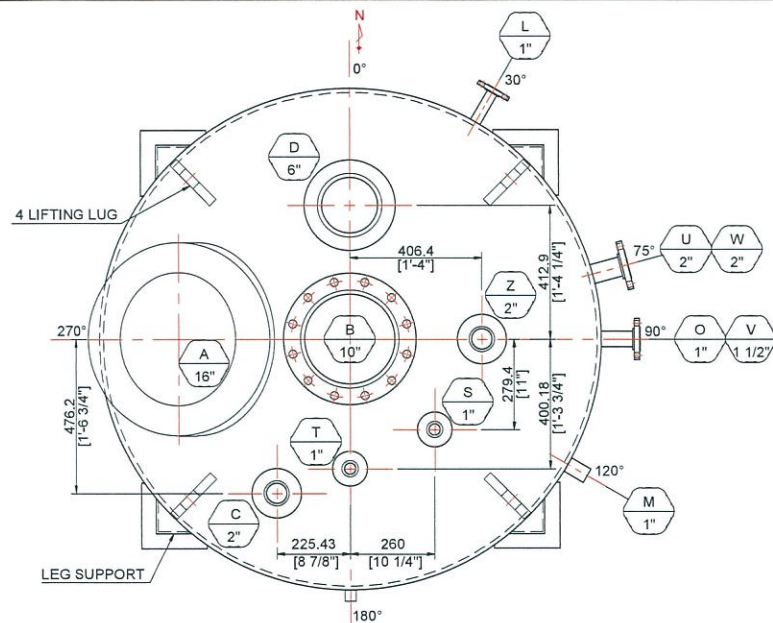
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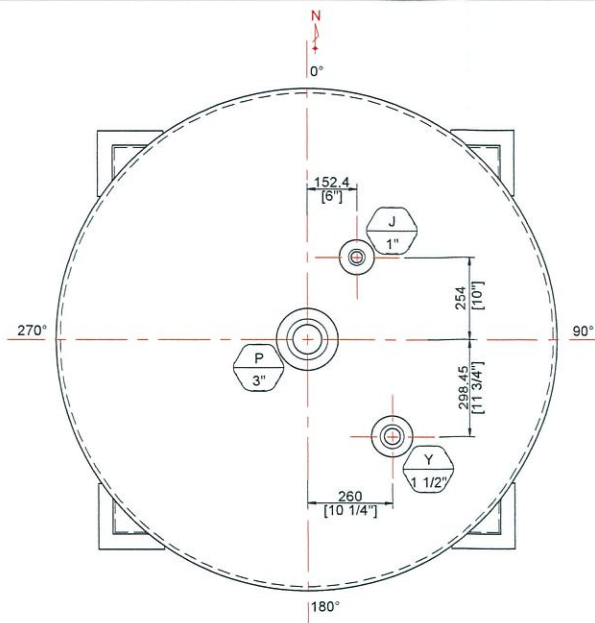


PRESSURE VESSEL INSPECTION SUMMARY REPORT

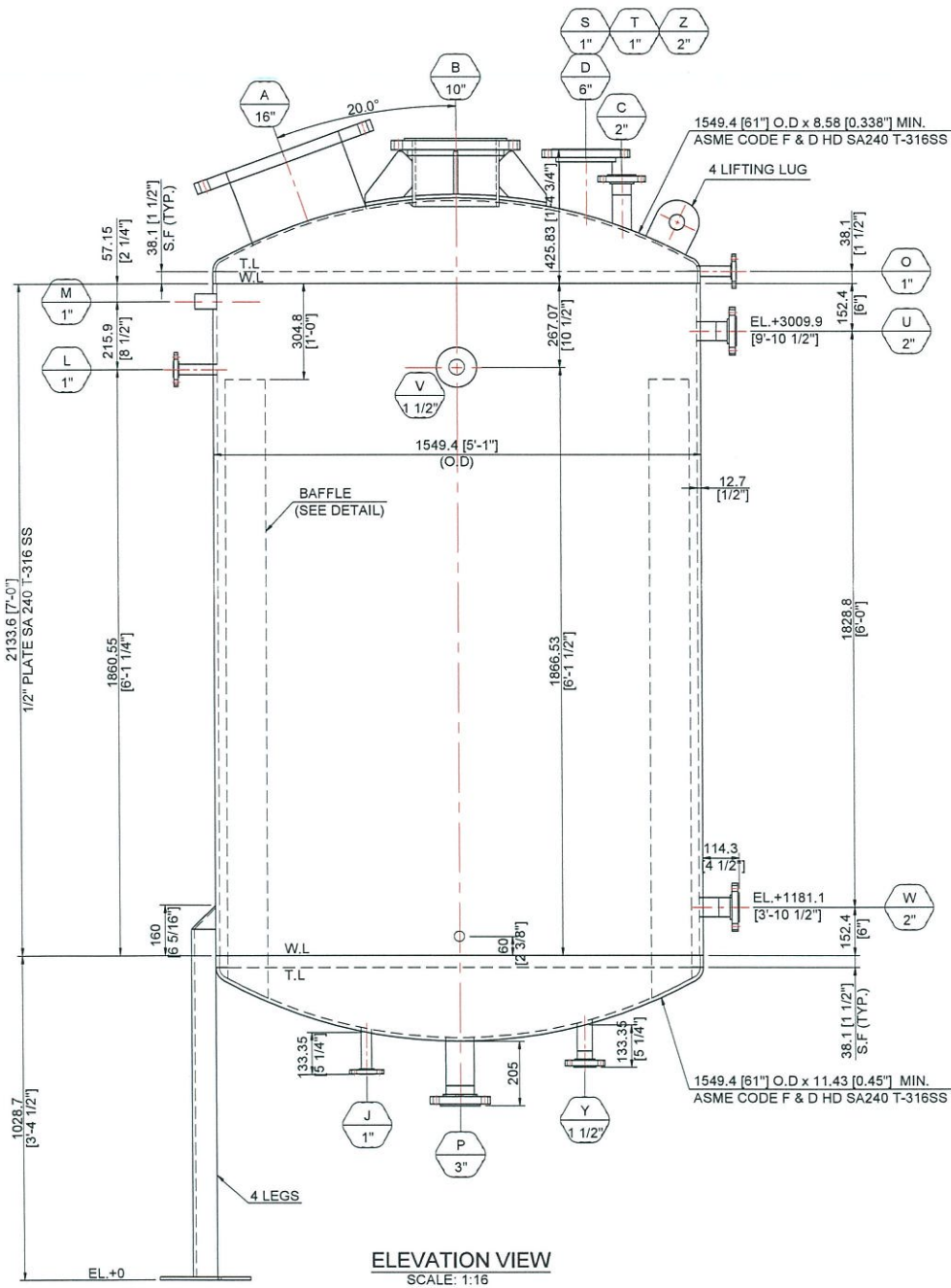
6.0 General Arrangement Drawing



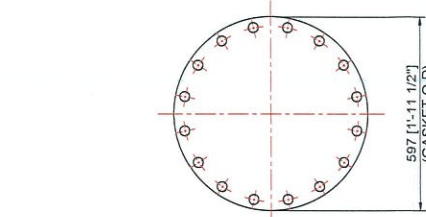
TOP NOZZLE ORIENTATION
SCALE: 1:16



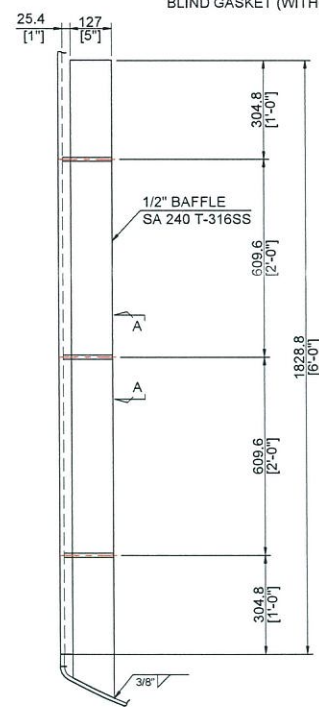
BOTTOM NOZZLE ORIENTATION
SCALE: 1:16



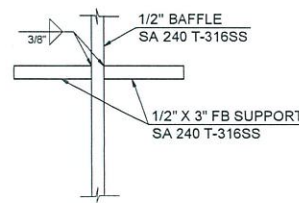
ELEVATION VIEW
SCALE: 1:16



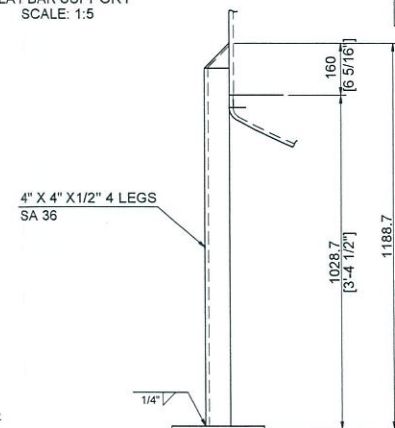
GASKET DETAIL FOR NZL. A
KLINGERSIL C4430 CNAF GASKET
O.D.=597 x P.C.D.=540 x 16-Ø30mm HOLES
BLIND GASKET (WITHOUT I.D.)



BAFFLE DETAIL
(4 REQUIRED)
SCALE: 1:16



VIEW "A-A"
FLAT BAR SUPPORT
SCALE: 1:5



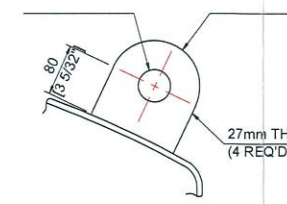
LEG SUPPORT
SCALE: 1:16

NOZZLE DETAILS

TAG	SIZE	RATING	TYPE	NZL. FLANGE MATERIAL	NZL. NECK MATERIAL	SERVICE	REMARKS
A	16"	150#	SO-RF	SA 181-1	SCH.40S SA 312 TP-316SS	MANWAY	
B	10"	150#	SO-RF	SA 181-1	SCH.40S SA 312 TP-316SS	-	
C	2"	150#	LAP.J	SA 181-1	SCH.40S SA 312 TP-316SS	SRV	
D	6"	150#	SO-RF	SA 182 F-316SS	SCH.10S SA 312 TP-316SS	-	
E						DELETED	
F						DELETED	
G						DELETED	
H						DELETED	
J	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	TT	
K						DELETED	
L	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	-	
M	1"		NPT			LSH	
N						DELETED	
O	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	SPARE (BLIND FLG.)	
P	3"	150#	LAP.J	SA 105 (GALV.)	SCH.40S SA 312 TP-316SS	DRAIN	
Q						DELETED	
R	1/2"	3000#	HALF CPLG.	SA 316SS		NOT IN USE	
S	1"	150#	WN-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	NITROGEN INLET	
T	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	SPARE (BLIND FLG.)	
U	2"	150#	LAP.J	SA 181-1	SCH.40S SA 312 TP-316SS	LT	
V	1 1/2"	150#	SO-RF	SA 182 F-316SS	SCH.40S SA 312 TP-316SS	SPARE (BLIND FLG.)	
W	2"	150#	LAP.J	SA 181-1	SCH.40S SA 312 TP-316SS	LT	
Y	1 1/2"	150#	LAP.J	SA 181-1	SCH.40S SA 312 TP-316SS	SPARE (BLIND FLG.)	
Z	2"	150#	SO-RF	SA 182 F-316SS	SCH.40S SA 312 TP-316SS	PT	

MATERIALS OF CONSTRUCTION

ITEM	DESCRIPTION	REMARKS
SHELL	SA 240 316L	
HEAD	SA 240 316L	
NOZZLE NECK	SA 312 TP316L	
PIPE	SA 312 TP316L	
FLANGES	SA 181-1, SA 105-1 & SA 182-F316SS	
SUPPORTS	SA 240 316L	
BAFFLES	SA 240 316L	
BOLTING	SA 193-B7 STUDS & SA 194-2H HEX. NUTS,	
GASKETS	GARLOCK 7735-51 OR EQ.	
REINFORCEMENT PAD	FOR NOZZLE B, SA 515 Gr. 70	



LIFTING LUG DETAIL
SCALE: 1:8

GENERAL NOTE:

1. MODIFICATION TO REMOVE VESSEL JACKET.

DESIGN DATA

DESIGN CODE:	ASME CODE SECTION VIII DIV. 1: 2017
EQUIPMENT ITEM NO.	V1-R3
EQUIPMENT TYPE	ACCUMULATOR
POSITION	VERTICAL
	VESSEL
SHELL MATERIAL	SA 240 316L
HEAD MATERIAL	SA 240 316L
INTERNAL LINING MATERIAL	NA
MEDIUM	PO
DESIGN PRESSURE	60 psi [4 bar] / F.V
DESIGN TEMPERATURE	200 °F [93 °C]
OPERATING PRESSURE	60 psi [4 bar] / F.V
OPERATING TEMPERATURE	140 °F [60 °C]
CORROSION ALLOWANCE	1.59 mm [1/16"]
REQUIRED MDMT	-4 °F [-20 °C]
CALCULATED MDMT	-155.2 °F [-104 °C]
MAWP	70 psi [4.839 bar]
HYDROTEST PRESSURE	75 psi [5.2 bar]
HYDROTEST POSITION	VERTICAL
FLOW RATE	-
OPERATING S.G.	1.3
DESIGN S.G.	1.3
VISCOSITY	-
PRODUCT DENSITY	1300 Kg/M ³
YEAR MANUFACTURED	1973
INSULATION	NA
WIND DESIGN CODE	ASCE 93
WIND SPEED	22 m/s
EARTHQUAKE DESIGN CODE	NO SEISMIC
EMPTY WEIGHT	1,963 KG
OPERATING WEIGHT	6,856 KG
FULL WEIGHT	6,557.8 KG
GROSS CAPACITY	6 m ³
NET CAPACITY	5 m ³

2	18-JUN-18	ISSUED FOR REFERENCE	NORMAN	RAM	DAREN
1	23-MAY-18	MODIFY NOZZLE P	NORMAN	RAM	DAREN
0	09-MAR-18	ISSUED FOR REFERENCE	NORMAN	ALEX	ALEX
REV.	DATE	DESCRIPTION	BY	CHKD	APPRO

PROJECT TITLE:

MHI PROJECT

HONG XING ENGINEERING & CONSTRUCTION PTE LTD
14 TUAS AVENUE (18A), SINGAPORE 638862
Tel : (65) 6558 7515-16 Fax : (65) 6558 7517 E-mail : hongxing@pacific.net.sg

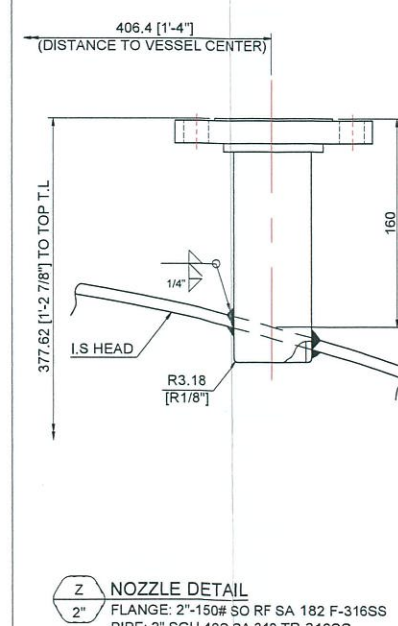
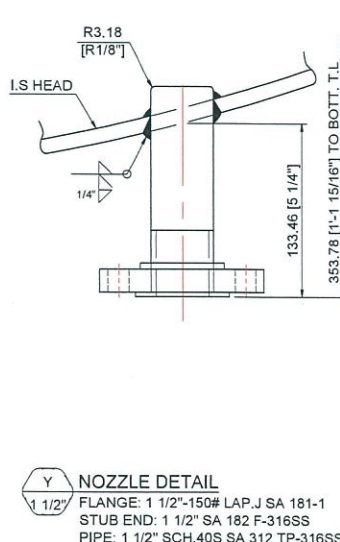
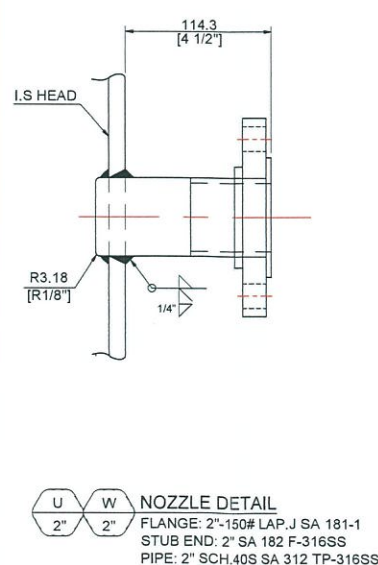
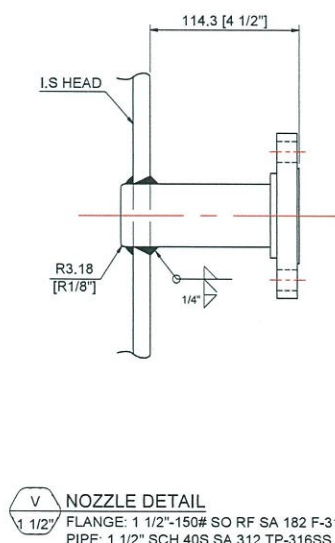
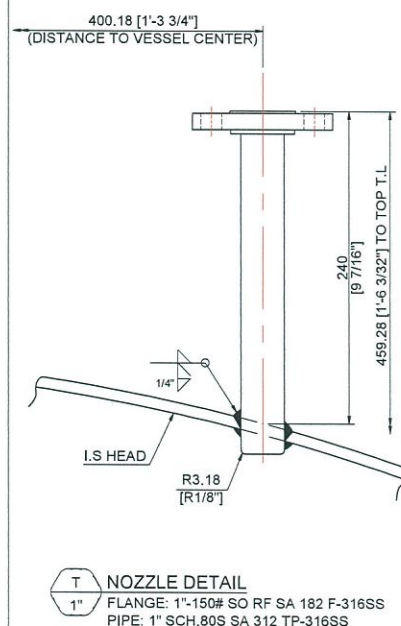
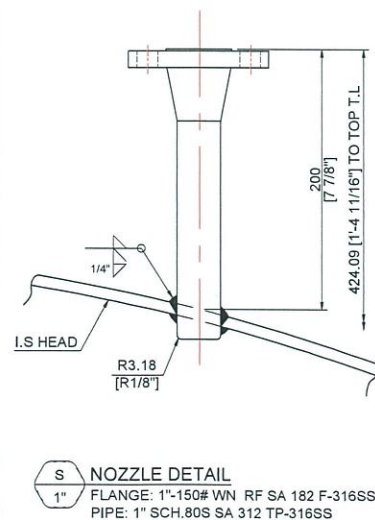
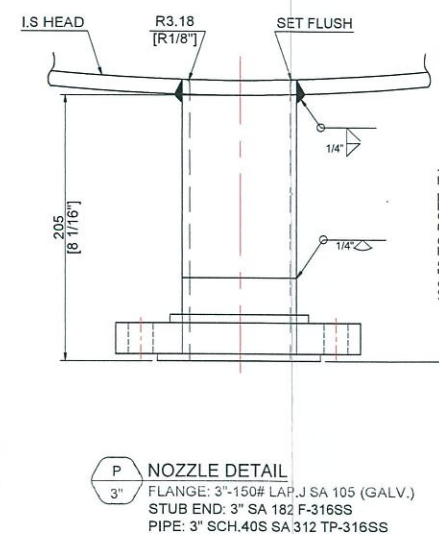
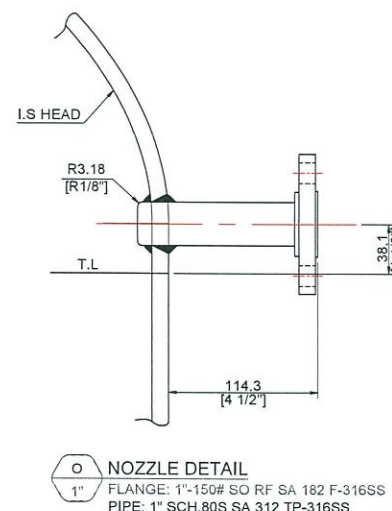
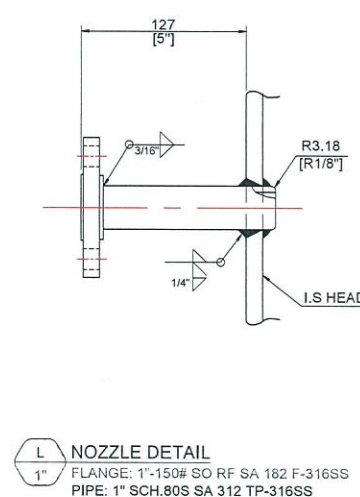
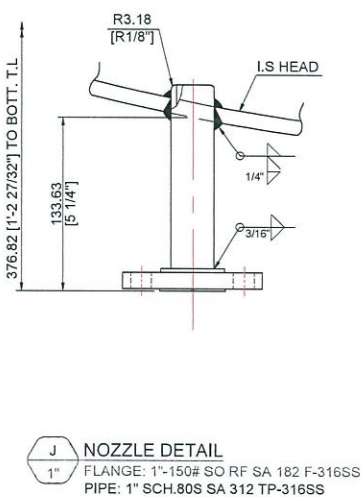
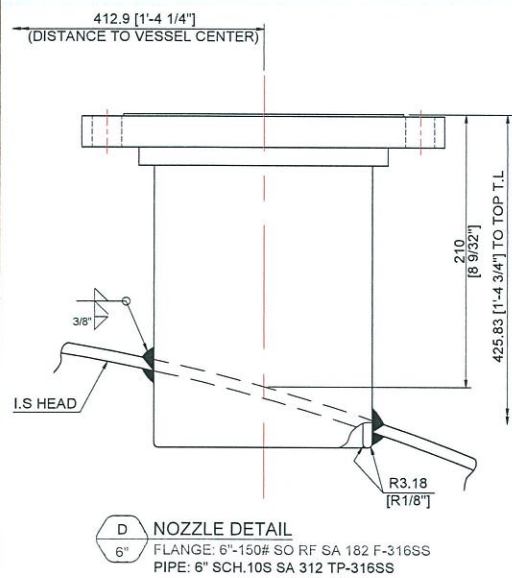
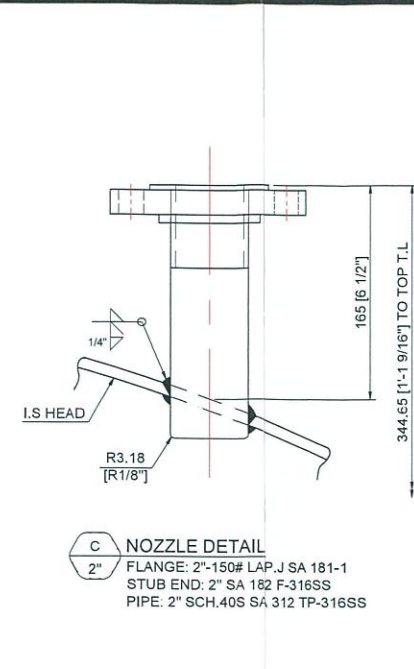
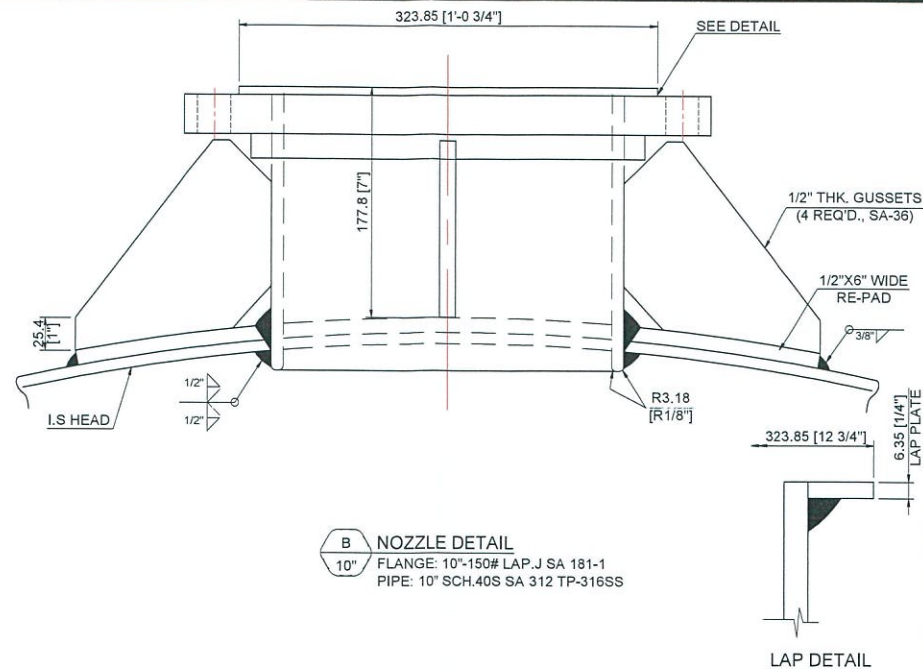
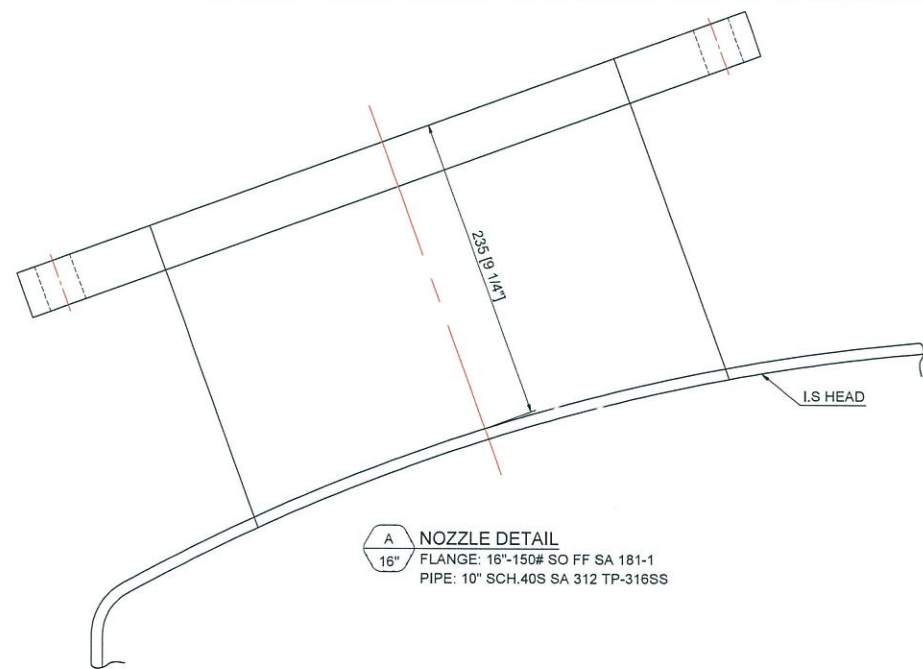
Chemical Specialties (SINGAPORE) PTE. LTD.
31 Ayer Merbau Road Jurong Island Singapore - 627717
www.chemspecialties.com

CSL DOC NO: STA-GA-V1R3-001 REV. 0

DRAWING TITLE:
V1-R3 ACCUMULATOR
GENERAL ARRANGEMENT DRAWING

WORK ORDER NO.: 205112 SCALE: AS SHOWN PAPER SIZE: A2

HONGXING DWG. NO.: CSL-HX-MHI-V1R3-001 SHEET NO. 1 OF 1 REV. 2



2	30-MAY-18	ISSUED FOR REFERENCE	NORMAN	RAM	DAREN
1	23-MAY-18	MODIFY NOZZLE P	NORMAN	RAM	DAREN
0	02-FEB-18	ISSUED FOR REFERENCE	NORMAN	ALEX	ALEX
REV.	DATE	DESCRIPTION	BY	CHKD	APPRD

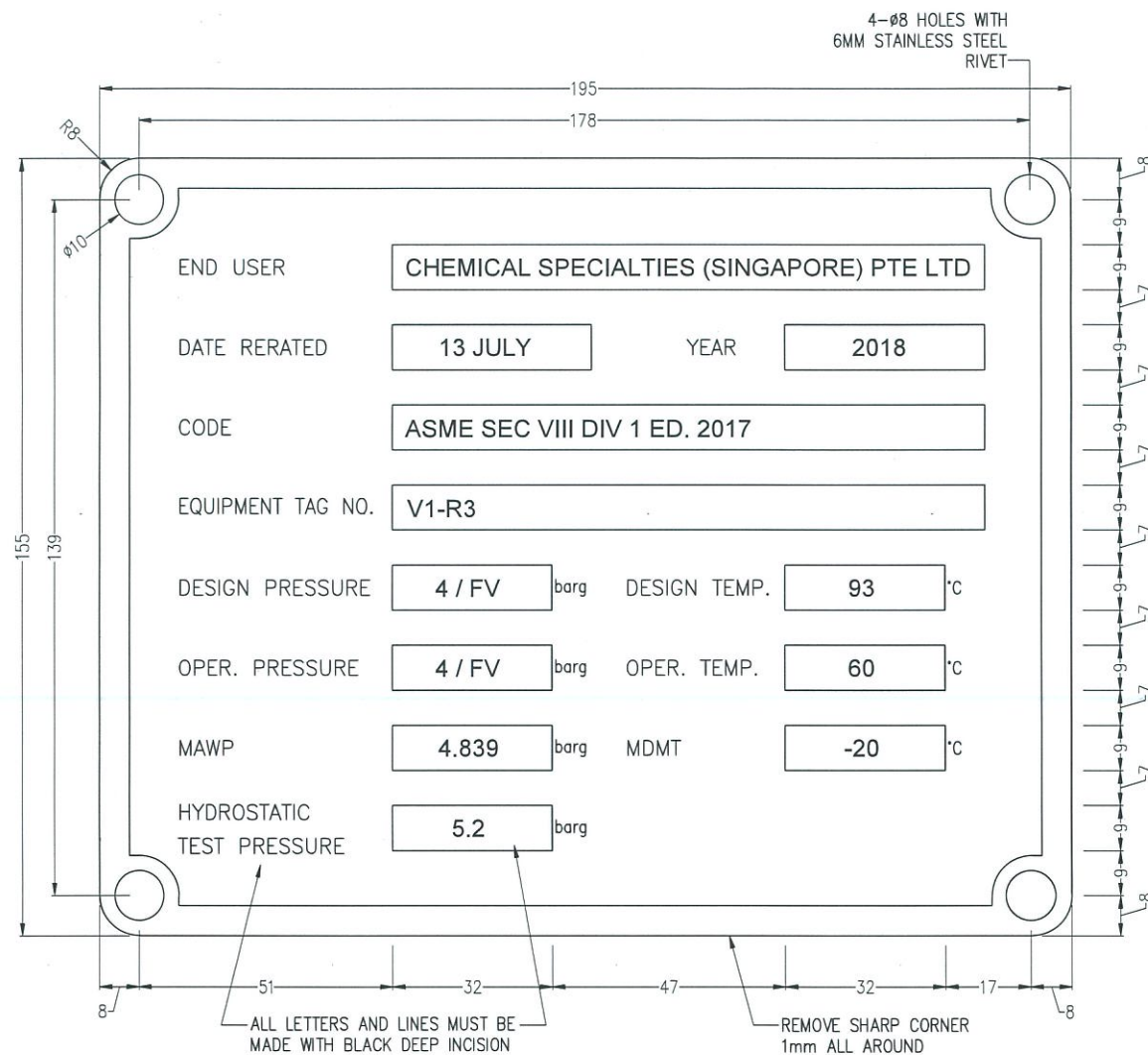
PROJECT TITLE: MHI PROJECT

HONG XING ENGINEERING & CONSTRUCTION PTE LTD
 14 TUAS AVENUE (18A), SINGAPORE 638862
 Tel: (65) 6558 7515/16 Fax: (65) 6558 7517 E-mail: hongxing@pacific.net.sg

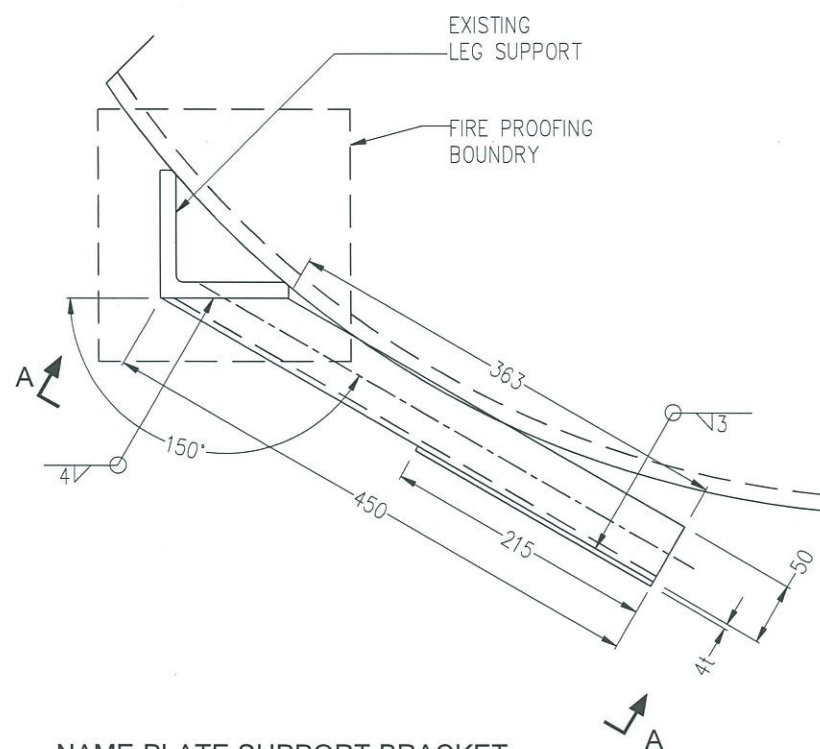
Chemical Specialties (Singapore) PTE. LTD.
 31 Ayer Marbau Road Jurong Island Singapore - 627117
 www.chemspecialties.com

CSL DOC NO.: STA-DW-V1R3-001
 DRAWING TITLE: V1-R3 ACCUMULATOR NOZZLE DETAIL DRAWING

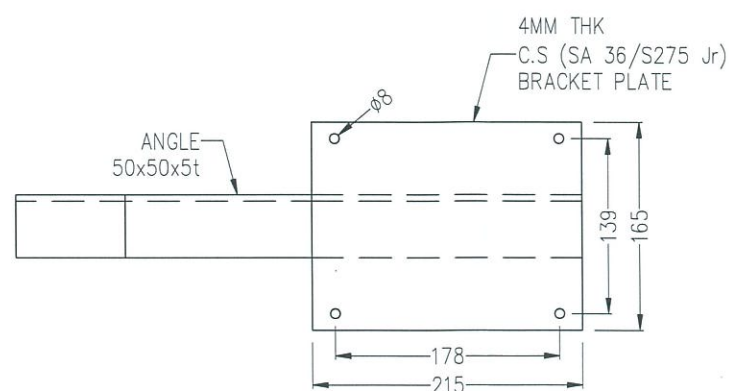
WORK ORDER NO.: 205112 SCALE: 1:4 PAPER SIZE: A2
 HONGXING DWG. NO.: CSL-HX-MHI-V1R3-002 SHEET NO. 1 OF 1 REV. 2



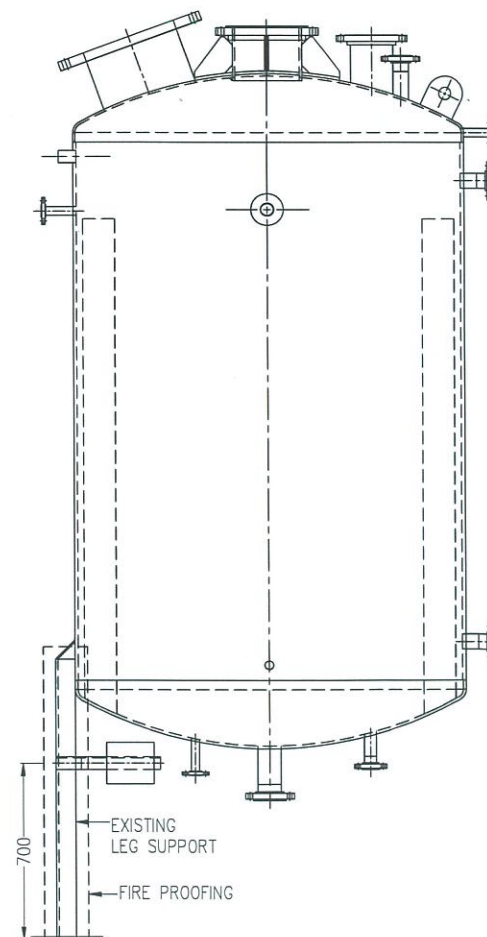
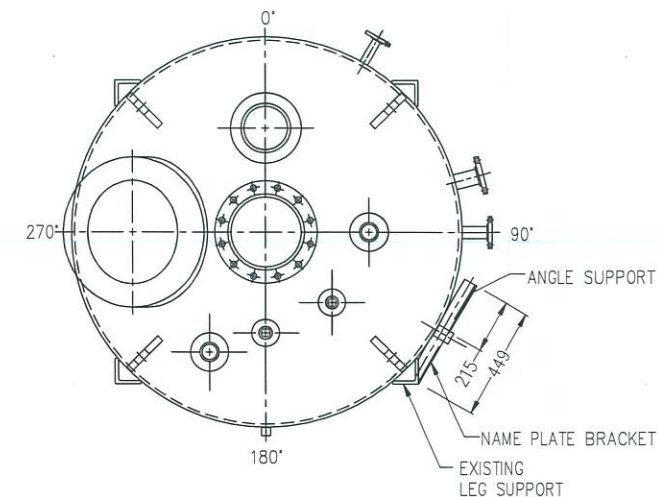
NAME PLATE
SCALE 1:1



NAME PLATE SUPPORT BRACKET
SCALE 1:5



VIEW A-A
SCALE 1:5





NAME PLATE ELEVATION & ORIENTATION
SCALE 1:20

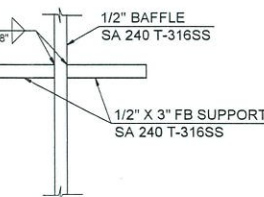
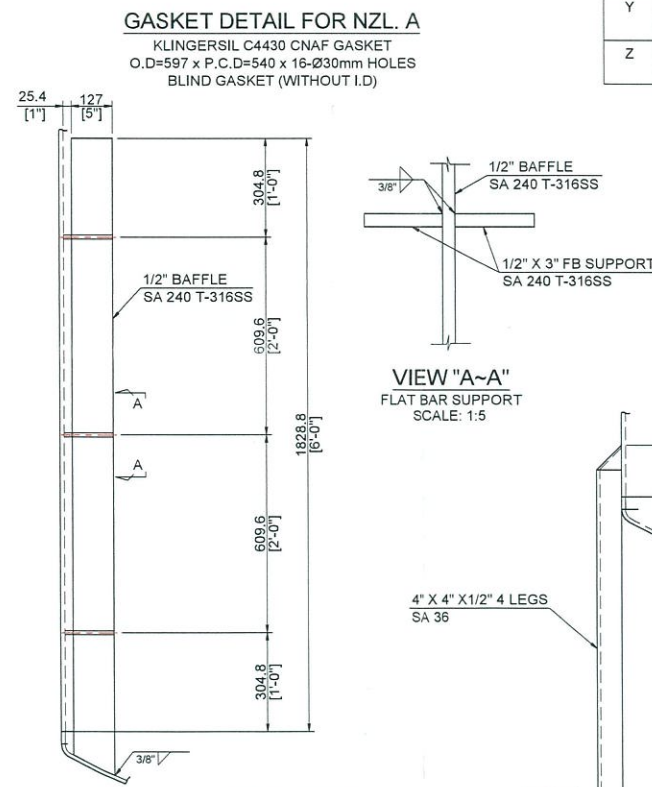
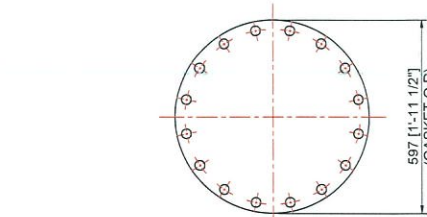
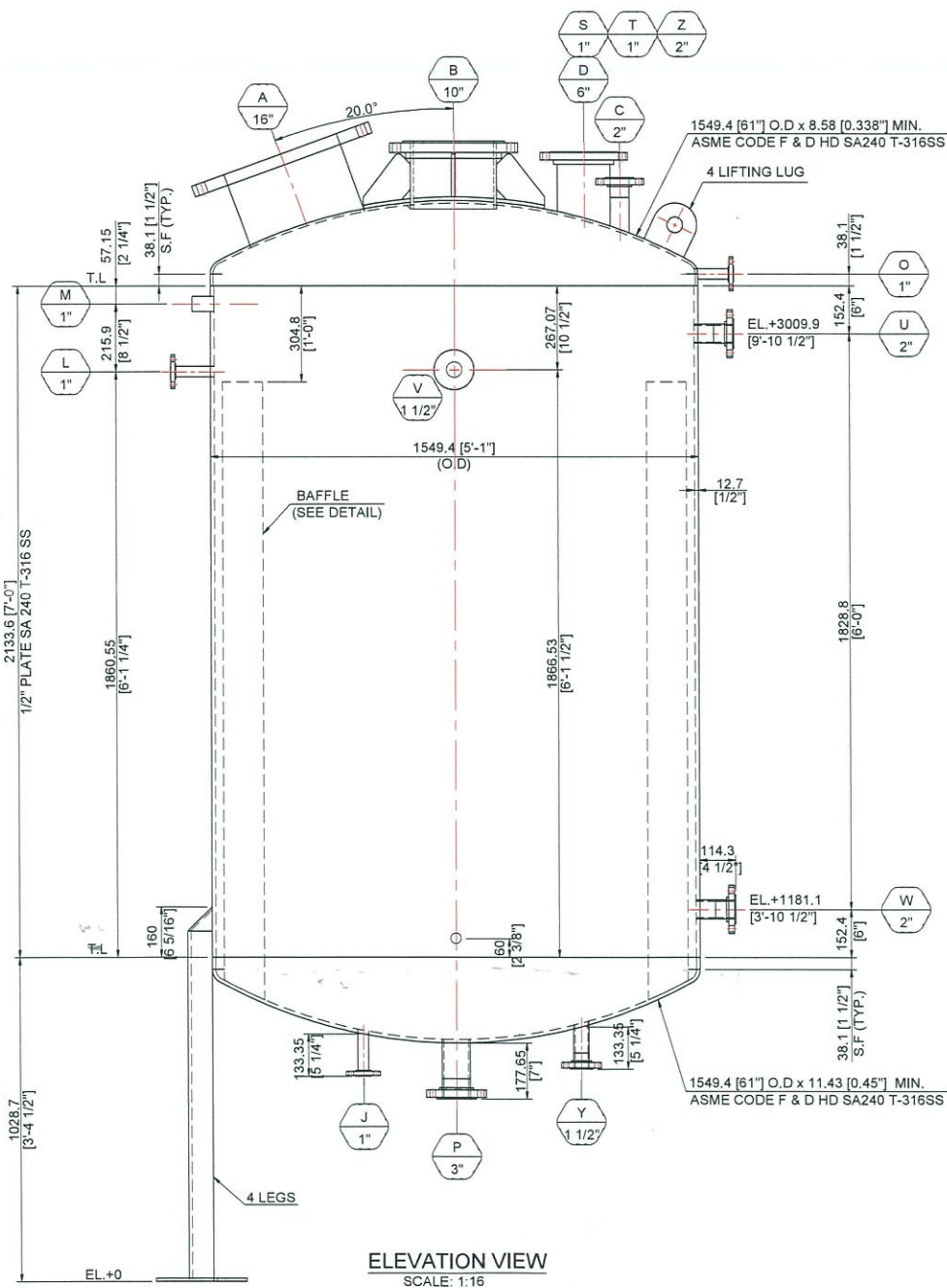
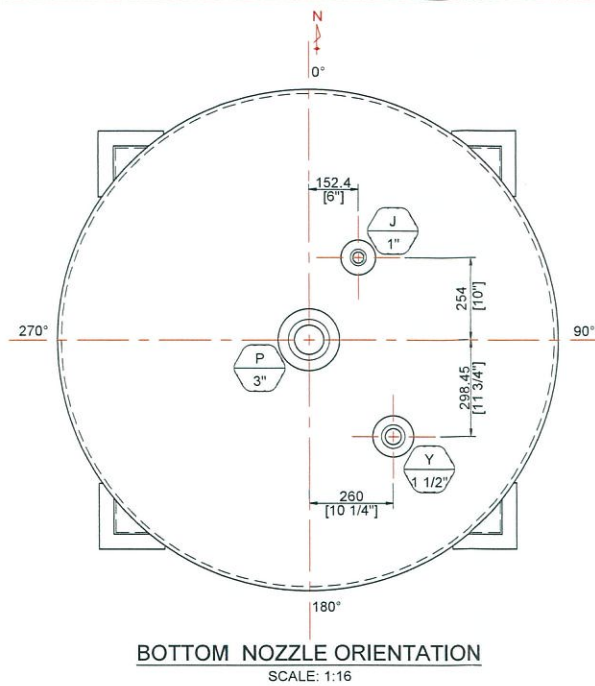
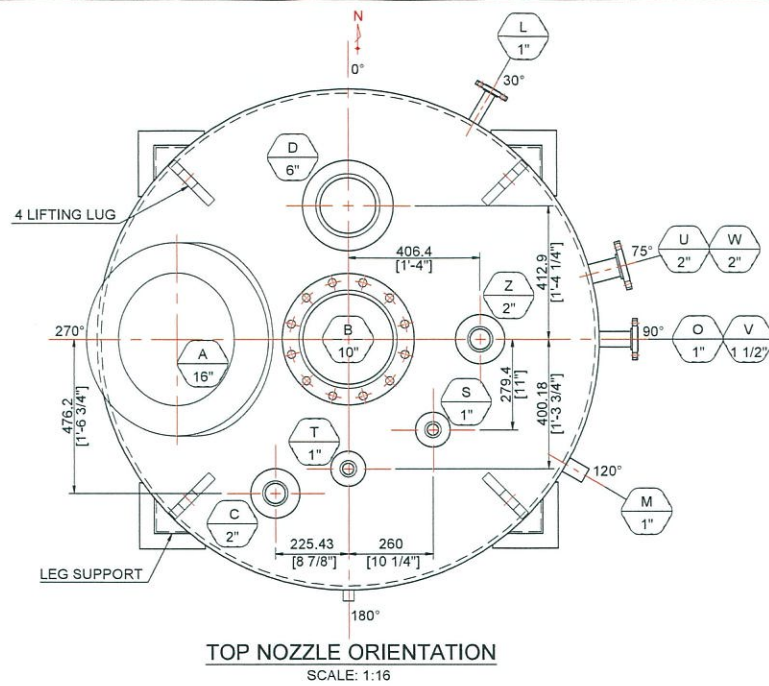
GENERAL NOTE:

1. THE LETTERS, SYMBOL AND LINE IN THE NAME PLATE SHALL BE CLEAR, COMPLETE AND SHALL NOT BE ANY STAIN AND SHADOW.
2. THE WORD TYPE OF ENGLISH, NUMBERS AND SYMBOLS ARE BOLDFACE.
3. BASIC DATA BLOCKS OUTLINES AND LETTERING SHALL BE ENGRAVED WITH MINIMUM THICKNESS 0.2MM AND WIDTH BLACK PAINTS INSIDE THE ENGRAVED AS ALTERNATIVE ALL LETTERS AND NUMBERS TO MAYBE REALIZED BY STAMPING, ALL LETTERING SHALL BE AT LEAST 4MM HEIGHT.
4. THE FILM OF PAINTING ON THE NAME PLATE SHALL BE FIRM AND FREE WRINKLES, SHEDDING AND IMPURITY.
5. REMOVE SHARP CORNER 1MM ALL AROUND.
6. REFERENCE DRAWING NO:
CSL-HX-MHI-V1R3-001
GENERAL ARRANGEMENT DRAWING

HOLD:

1. SAMPLE DATE.
2. DATE OF RERATED & YEAR BASED ON PE ENDORSEMENT DATE.

0	24-JUL-18	ISSUED FOR REVIEW	RAM	RAM	DL
REV.	DATE	DESCRIPTION	BY	CHKD	APPRO
PROJECT TITLE:					
MHI PHASE I					
CONTRACTOR:					
 HONG XING ENGINEERING & CONSTRUCTION PTE LTD 14 TUAS AVENUE (18A), SINGAPORE 638862 Tel : (65) 6558 7515/16 Fax : (65) 6558 7517 E-mail: hongxing@pacific.net.sg					
 CHEMICAL SPECIALTIES (SINGAPORE) PTE. LTD. 31 Ayer Merbau Road Jurong Island Singapore - 627717 www.chemspecialties.com					
CSL DOC NO:		STA-DW-V1R3-002		REV. 0	
DRAWING TITLE:					
V1-R3 ACCUMULATOR NAME PLATE DRAWING					
WORK ORDER NO.: 204983		SCALE: 1:1		PAPER SIZE: A2	
HONGXING DWG. NO.:		SHEET NO.		REV.	
CSL-HX-MHI-V1R3-003		1 OF 1		0	



VIEW "A-A"
FLAT BAR SUPPORT
SCALE: 1:5

4\"/>

LEG SUPPORT
SCALE: 1:16

LEG SUPPORT
SCALE: 1:16

LEG SUPPORT
SCALE: 1:16

LEG SUPPORT
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SCALE: 1:16

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SCALE: 1:16

LEG SUPPORT
SCALE: 1:16

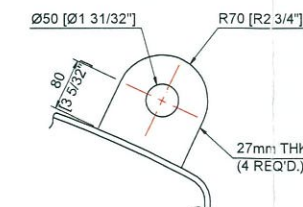
LEG SUPPORT
SCALE: 1:16

NOZZLE DETAILS

TAG	SIZE	RATING	TYPE	NZL. FLANGE MATERIAL	NZL. NECK MATERIAL	SERVICE	REMARKS
A	16"	150#	SO-RF	SA 181-1	SCH.40S SA 312 TP-316SS	MANWAY	
B	10"	150#	SO-RF	SA 181-1	SCH.40S SA 312 TP-316SS		
C	2"	150#	LAP-J	SA 181-1	SCH.40S SA 312 TP-316SS	SRV	
D	6"	150#	SO-RF	SA 182 F-316SS	SCH.10S SA 312 TP-316SS		
E						DELETED	
F						DELETED	
G						DELETED	
H						DELETED	
J	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	TT	
K						DELETED	
L	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS		
M	1"		NPT			LSH	
N						DELETED	
O	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	SPARE (BLIND FLG.)	
P	3"	150#	LAP-J	SA 181-1	SCH.10S SA 312 TP-316SS	DRAIN	
Q						DELETED	
R	1/2"	3000#	HALF CPLG.	SA 316SS		NOT IN USE	
S	1"	150#	WN-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	NITROGEN INLET	
T	1"	150#	SO-RF	SA 182 F-316SS	SCH.80S SA 312 TP-316SS	SPARE (BLIND FLG.)	
U	2"	150#	LAP-J	SA 181-1	SCH.40S SA 312 TP-316SS	LT	
V	1 1/2"	150#	SO-RF	SA 182 F-316SS	SCH.40S SA 312 TP-316SS	SPARE (BLIND FLG.)	
W	2"	150#	LAP-J	SA 181-1	SCH.40S SA 312 TP-316SS	LT	
Y	1 1/2"	150#	LAP-J	SA 181-1	SCH.40S SA 312 TP-316SS	SPARE (BLIND FLG.)	
Z	2"	150#	SO-RF	SA 182 F-316SS	SCH.40S SA 312 TP-316SS	PT	

MATERIALS OF CONSTRUCTION

ITEM	DESCRIPTION	REMARKS
SHELL	SA 240 T316SS	
HEAD	SA 240 T316SS	
NOZZLE NECK	SA 312 T316SS	
PIPE	SA 312 T316SS	
FLANGES	SA 181-1, SA 105-1 & SA 182-F316SS	
SUPPORTS	SA 240 T316SS	
BAFFLES	SA 240-T316SS	
BOLTING	SA 193-B7 STUDS & SA 194-2H HEX. NUTS,	
GASKETS	GARLOCK 7735-51 OR EQ.	
REINFORCEMENT PAD	FOR NOZZLE B, SA 515 Gr. 70	



LIFTING LUG DETAIL
SCALE: 1:8

GENERAL NOTE:
1. MODIFICATION TO REMOVE VESSEL JACKET.

DESIGN DATA

DESIGN CODE: ASME CODE SECTION VIII DIV. 1: 2017	
EQUIPMENT ITEM NO. V1-R3	
EQUIPMENT TYPE ACCUMULATOR	
POSITION VERTICAL	
SHELL MATERIAL SA 240 T316SS	
HEAD MATERIAL SA 240 T316SS	
INTERNAL LINING MATERIAL NA	
MEDIUM PO	
DESIGN PRESSURE 60 psi [4 bar] / F.V	
DESIGN TEMPERATURE 200 °F [93 °C]	
OPERATING PRESSURE 60 psi [4 bar] / F.V	
OPERATING TEMPERATURE AMBIENT → 50 °C	
CORROSION ALLOWANCE 1.59 mm [1/16"]	
REQUIRED MDMT -4 °F [-20 °C]	
CALCULATED MDMT -320 °F [-196 °C]	
MAWP 70 psi [4.839 bar]	
HYDROTEST PRESSURE 75 psi [5.2 bar]	
HYDROTEST POSITION VERTICAL	
FLOW RATE -	
OPERATING S.G. 1.3	
DESIGN S.G. 1.3	
VISCOSITY -	
PRODUCT DENSITY -	
YEAR MANUFACTURED 1973	
INSULATION NA	
WIND DESIGN CODE NA	
WIND SPEED NA	
EARTHQUAKE DESIGN CODE NO SEISMIC	
EMPTY WEIGHT 1,963 KG	
OPERATING WEIGHT 6,856 KG	
FULL WEIGHT 6,557.8 KG	
GROSS CAPACITY 6 m ³	
NET CAPACITY 5 m ³	

0	09-MAR-18	ISSUED FOR REFERENCE	NORMAN	ALEX	ALEX
REV.	DATE	DESCRIPTION	BY	CHKD	APPROD

PROJECT TITLE:

MHI PROJECT

HONG XING ENGINEERING & CONSTRUCTION PTE LTD
14 TUAS AVENUE (18A), SINGAPORE 638662
Tel: (65) 6558 7515 Fax: (65) 6558 7517 E-mail: hongxing@pacific.net.sg

Chemical Specialties (SINGAPORE) PTE. LTD.
31 Ayer Marbau Road Jurong Island Singapore - 627117
www.chemspecialties.com

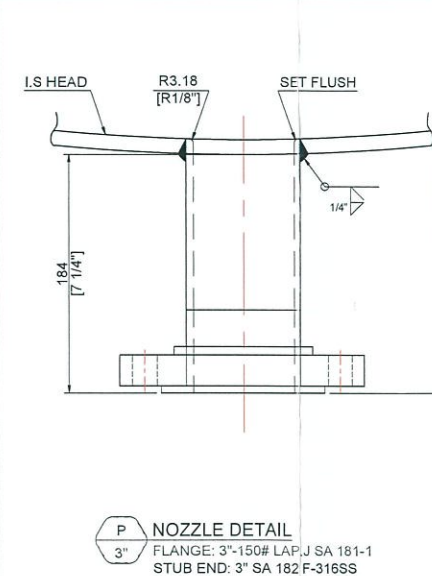
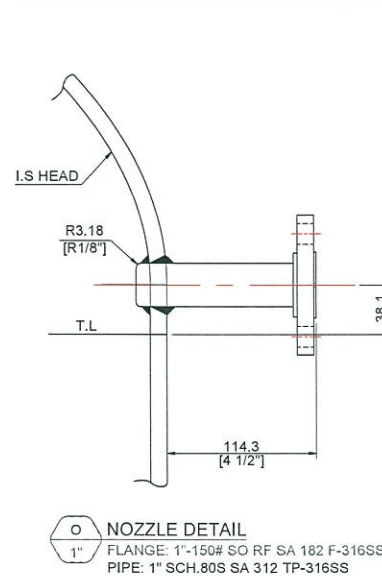
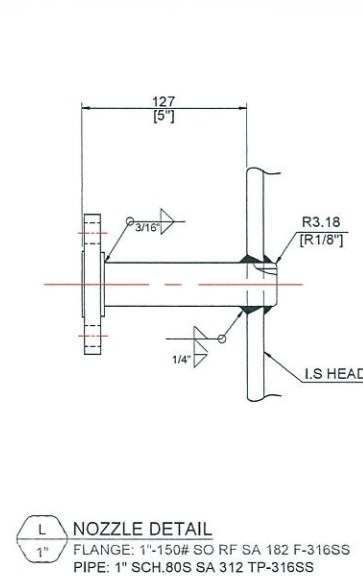
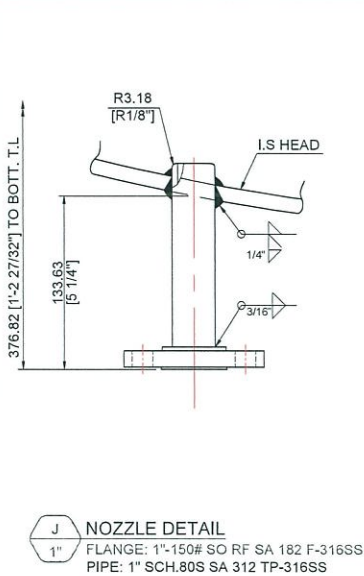
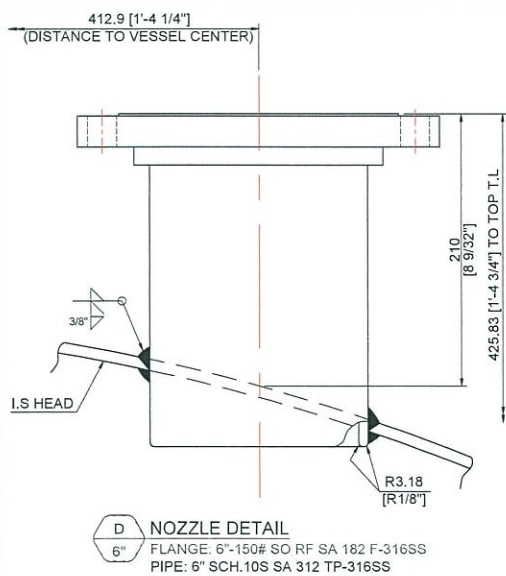
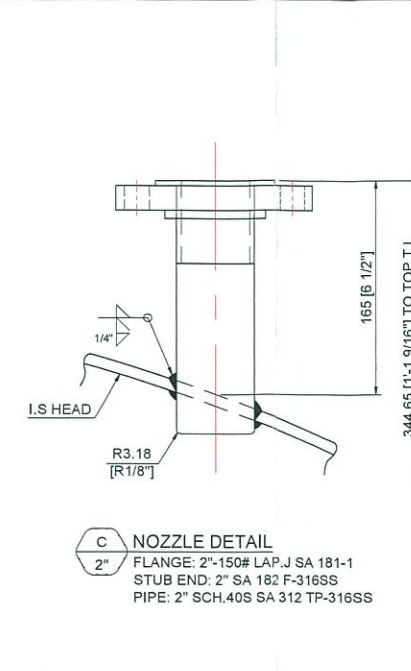
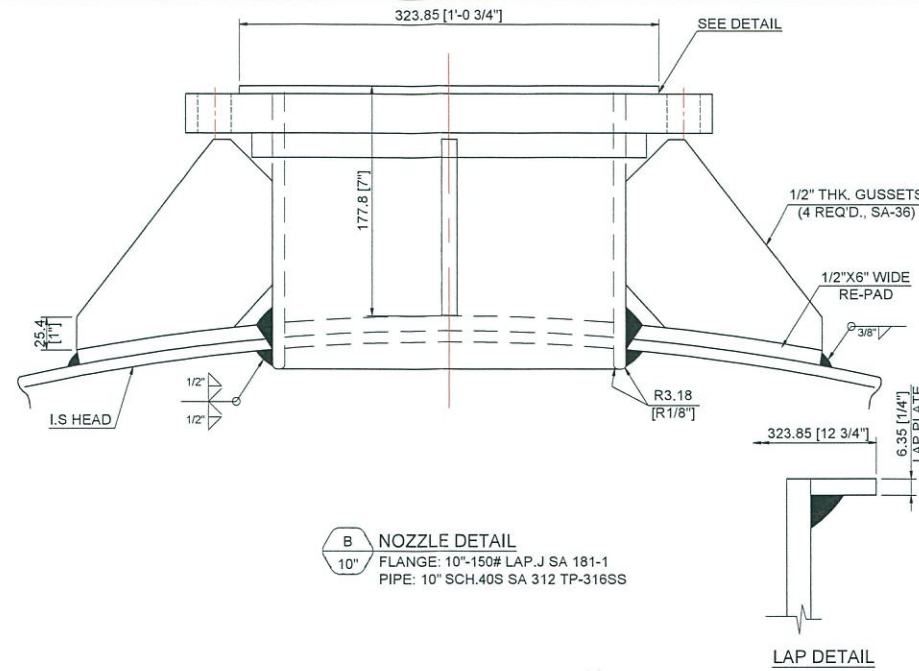
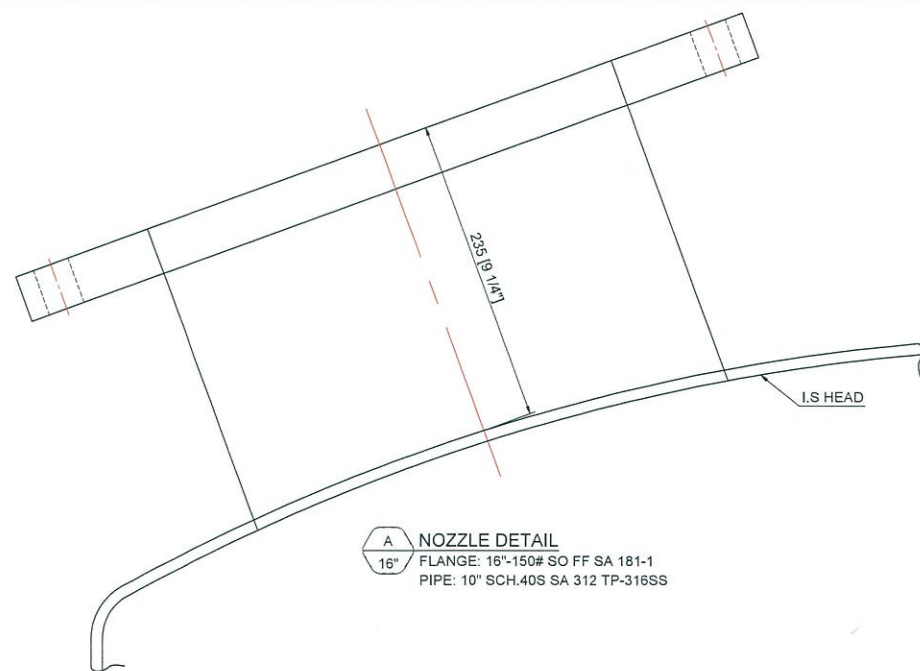
CSL DOC NO:

DRAWING TITLE:

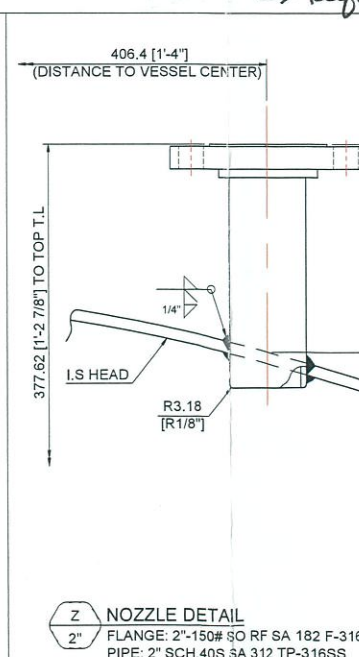
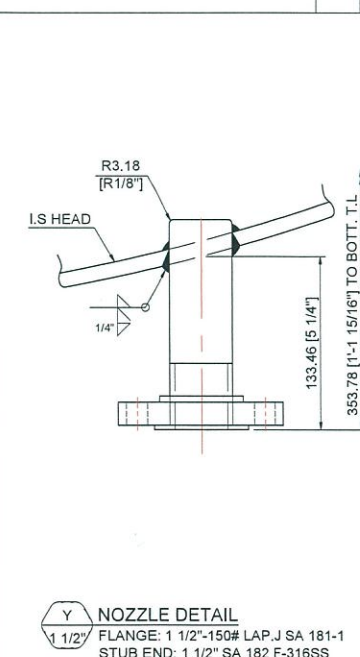
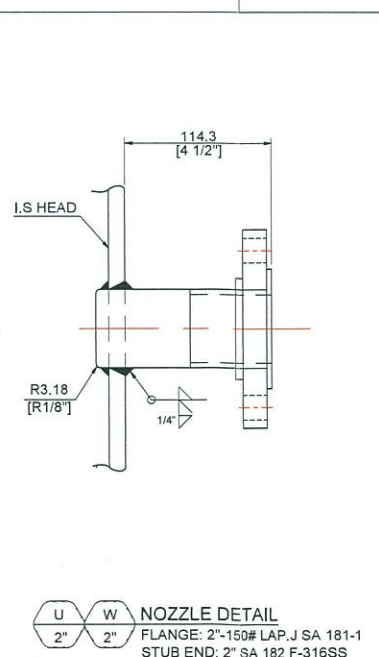
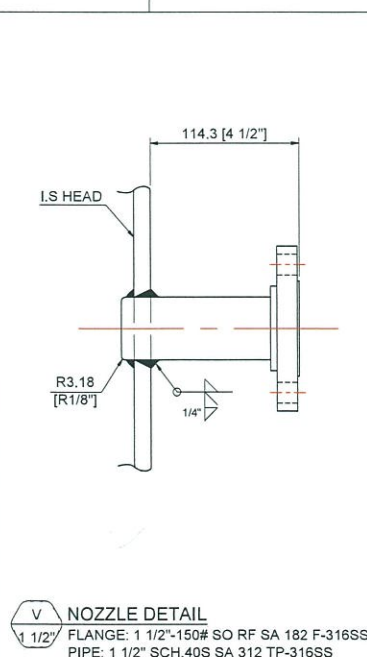
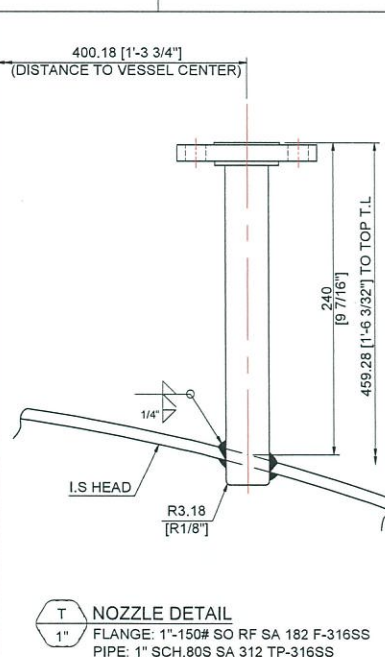
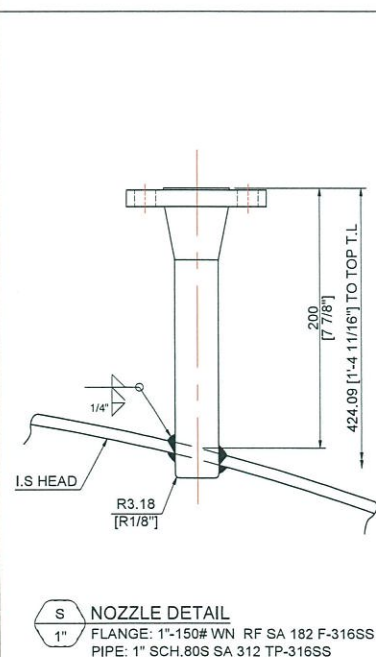
V1-R3 ACCUMULATOR
GENERAL ARRANGEMENT DRAWING

WORK ORDER NO.: SCALE: AS SHOWN PAPER SIZE: A2

HONGXING DWG. NO.: CSL-HX-MHI-V1R3-001 SHEET NO. 1 OF 1 REV. 0



→ Req'd to change to Sch 40S



REV.	DATE	DESCRIPTION	BY	CHKD	APPRD
0	02-FEB-18	ISSUED FOR REFERENCE	NORMAN	ALEX	ALEX

PROJECT TITLE: MHI PROJECT

HONG XING ENGINEERING & CONSTRUCTION PTE LTD
 14 TUAS AVENUE (18A), SINGAPORE 638862
 Tel : (65) 6558 7515-16 Fax : (65) 6558 7517 E-mail: hongxing@pacific.net.sg

Chemical Specialties Limited
 CHEMICAL SPECIALTIES (SINGAPORE) PTE. LTD.
 31 Ayer Merbau Road Jurong Island Singapore - 627717
 www.chemspecialties.com

CSL DOC NO:
 DRAWING TITLE:

V1-R3 ACCUMULATOR
 NOZZLE DETAIL DRAWING

WORK ORDER NO.: SCALE: 1:4 PAPER SIZE: A2

HONGXING DWG. NO.: CSL-HX-MHI-V1R3-002 SHEET NO. 1 OF 1 REV. 0