

PRESSURE VESSELS & STEEL FABRICATION CATALOGUE



American Society of Mechanical Engineers
 "U" Stamp Accredited



KEYSER TECHNOLOGIES PTE LTD
 (DESIGN, MANUFACTURE OF EXPANSION JOINTS & ASSOCIATED STEEL FABRICATION WORKS)

Catalogue compiled and printed in 2009



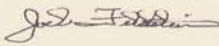
CERTIFICATE OF AUTHORIZATION

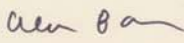
This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY: **Keyser Technologies Pte., Ltd.**
74 Tuas Avenue 11, 639093
Singapore

SCOPE:
Manufacture of pressure vessels at the above location only

AUTHORIZED: **May 22, 2008**
EXPIRES: **May 22, 2011**
CERTIFICATE NUMBER: **37,575**


Chairman of The Boiler
And Pressure Vessel Committee


Director, Accreditation and Certification



The **American Society of Mechanical Engineers (ASME)** is a professional society focused on mechanical engineering known for setting codes and standards for mechanical devices. The ASME was founded in 1880 by Alexander Lyman Holley, Henry Rossiter Worthington, John Edison Sweet and Matthias N. Forney in response to numerous steam boiler pressure vessel failures. The ASME conducts one of the world's largest technical publishing operations through its ASME Press, holds numerous technical conferences and hundreds of professional development courses each year, and sponsors numerous outreach and educational programs.

As of 2006, the ASME has 120,000 members.

Stiftelsen Det Norske Veritas or DNV, established in 1864 in Norway, is a classification society organized as a foundation, with the objective of "Safeguarding life, property, and the environment". It was established in Norway to inspect and evaluate the technical condition of Norwegian merchant vessels. Together with Lloyd's Register and American Bureau of Shipping, DNV is one of the three major companies in the classification society business. DNV has its headquarters in Norway and has 300 offices in 100 countries, with 8,400 employees.

Important industries where the company operates include ship transport, energy, aviation, automotive, finance, food, health care and information technology. It also conducts research in several fields where it operates.



DET NORSKE VERITAS MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 43360-2008-AQ-SNG-UKAS

This is to certify that the Management System of

KEYSER TECHNOLOGIES PTE LTD

At

No. 74 Tuas Avenue 11
Singapore 639093

has been found to conform to

ISO 9001:2000

This Certificate is valid for the following product or service ranges:

**DESIGN, MANUFACTURE AND SALES OF EXPANSION JOINTS AND
ASSOCIATED STEEL FABRICATION WORKS.**

Initial Certification date:
16 December 2002

This Certificate is valid until:
15 November 2010

*The audit has been performed under the
supervision of*
Chui Heng Tak
Lead Auditor



Place and date:
Singapore, 19 January 2009
for the Accredited Unit:
DNV CERTIFICATION B.V.,
THE NETHERLANDS


Peter D. Dombey
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

HEAD OFFICE: Det Norske Veritas AS, Veritasveien 1, 1322 Høvik, Norway. Tel: +47 67 57 99 00 Fax: +47 67 57 99 11 - www.dnv.com



VISION STATEMENT

Together, we will be the recognised leader in our industry for quality, service and responsiveness to customer needs.

MISSION STATEMENT

Our mission is to provide the highest quality products and services to our customers. We will do this through investments in technology, product innovations, production processes, and the people, who are our asset to growth and profitability. Keyser Technologies shall continually improve the effectiveness of the company's quality management system.

OUR VALUES

- Respect for individuals
- Superior Customer Service
 - Pride in craftsmanship
 - Honesty and Integrity
 - Teamwork
 - Strong Work Ethic
 - Simplicity
- An atmosphere of open communications





INTRODUCTION

KEYSER TECHNOLOGIES PTE LTD specializes in the Manufacturing of Thermal Expansion Joints in Singapore. Keyser was established in Year 1995, solely as a Trading Service Company in various products. In Year 1999, Keyser entered into the Metal Expansion Joints Industry and ventured with full steam into the Manufacturing of Metal Expansion Joints. This is where the first KEYFLEX bellow was produced. Since then, Keyser has progressively grown and expanded into many sectors of industry in Singapore, Asia and Pacific regions.

KEYSER TECHNOLOGIES PTE LTD is a diversified company where our main activity is to supply Expansion Joints in Metal, Rubber and Fabric types. We also provide a wide range of services, such as fabrication work and trading services. **Quality ASSURANCE** - We have obtained the Quality System Standard, as an ISO 9001:2000 Company in Singapore, certified by Det Norske Veritas (DNV). We are also accredited to ASME Stamp by Association of Mechanical Engineers (ASME). With respect to ISO 9001:2000 certification and America Society of Mechanical Engineering (ASME) U Symbol Stamp, Keyser is recognized in the Designing, Manufacturing and Sales of Thermal Expansion Joints and Associated Steel Fabrication Works. From the achieving of ISO 9001:2000 certification, Keyser holds a very strong stand in:

- Supplying high quality products;
- Prompt & efficient delivery;
- Providing premium services to our customers.

A pressure vessel is a closed container that is designed to hold gases or liquids at a pressure different from the ambient pressure.

Over the years, many occurrence of fatal accidents in their history of their development and operation are due to this difference in pressure. The definition of a pressure vessel varies from country to country, but involves parameters such as maximum safe operating pressure and temperature. From the designing all the way to manufacturing and operations are governed by engineering authorities backed up by laws.

Keyser pressure vessels which are distributed throughout the region, are designed and manufactured strictly according to these guidelines. High quality standards are maintained through continuous training and investment of staff and equipment.

KEYSER PRESSURE VESSELS APPLICATIONS:

Keyser pressure vessels are used actively in many areas in both the industrial and private sector. For example, in the industrial field, they are used in compressed air receivers and domestic hot water storage tanks. Some other examples of pressure vessels includes recompression chamber, diving cylinder, distillation towers, and vessels used in oil refineries and petrochemical plants, nuclear reactor vessel, pneumatic reservoir, rail vehicle airbrake reservoir, road vehicle airbrake reservoir and storage vessels for liquified gases such as propane, chlorine, and LPG.

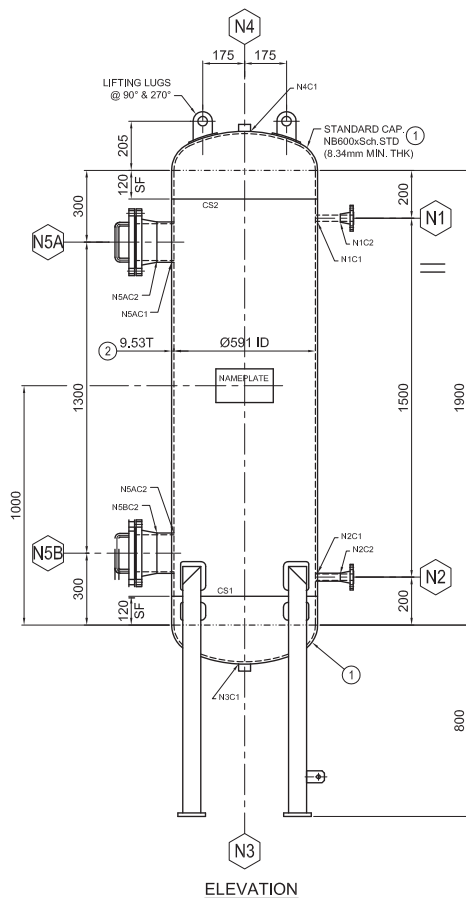
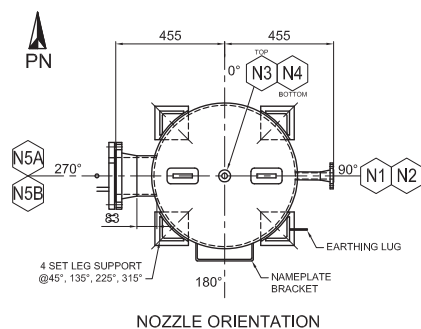


Construction Materials

Most materials with good tensile properties that is chemically stable in the chosen application can be used for the construction of pressure vessels, with steel being the most commonly material. To manufacture a spherical pressure vessel, forged parts would have to be welded together. Forging can be used to increase some of the mechanical properties of steel. However, welding can sometimes reduce these desirable properties. Carefully selected steel with a high impact resistance & corrosion resistant material should be used to meet international safety standards. Some pressure vessels which are made of wound carbon fibre held in place with a polymer. As carbon fibre possesses very high tensile strength, these vessels can be very light, but are more difficult to manufacture. Other very common materials include polymers such as PET in carbonated beverage containers and copper in plumbing.

FABRICATION OF AIR RECEIVER

This pressure vessel is an AIR RECEIVER with a capacity of 500 litres at a pressure of 8 Barg. Vessel was constructed with SA 53 Gr B shell material and SA 234 Gr WPB Standard cap. The fabrication of these pressure vessels (4 Units) was carried out in 6 days including Hydrotesting. The vessel is designed as per ASME Sec. VIII Div. 1 2007 Edition (2008 Addenda) and under DNV Inspection.



1. Dish head fit-up



5. Leg support fit-up



2. Seam welding



6. Hydrotesting



3. Nozzle preparation



4. Nozzle neck welding



7. Completed Product

Design and operation standards

All Keyser pressure vessels are designed to operate safely at a specific pressure and temperature, which are also technically defined as the "Design Pressure" and "Design Temperature". All the designing and the certification of Keyser pressure vessels are governed by design codes such as the ASME Boiler and Pressure Vessel Code in North America and other international standards like Det Norske Veritas.

CONSTRUCTION OF KEYSER PRESSURE VESSELS (CARBON STEEL)



Stage 1: Welding Shell and Head of Pressure Vessel.



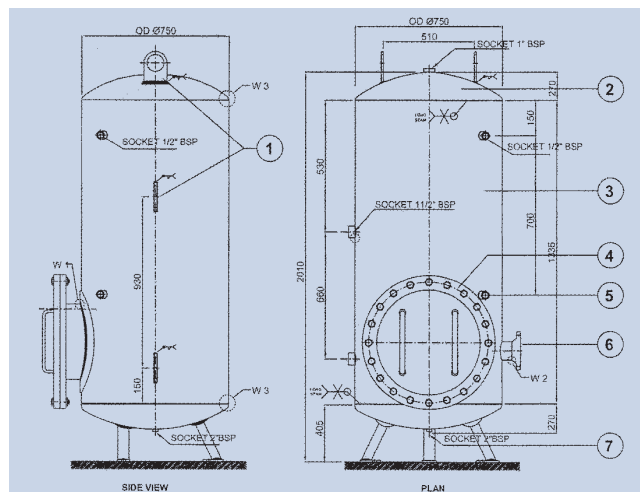
Stage 2: Fitting up on pipe inlets and outlets.



Stage 3: Non-destructive testing (NDT) on all Welded Joints as per requirements.



Stage 4: After Pressure Testing, Coating to be applied internally and externally.



STAINLESS STEEL FABRICATION & ASSEMBLY WORK



1. Preparation for welding



2. Welding process



3. Fit-up nozzle process



4. Alignment process

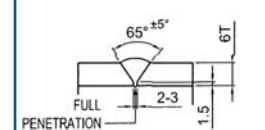
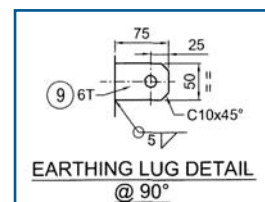
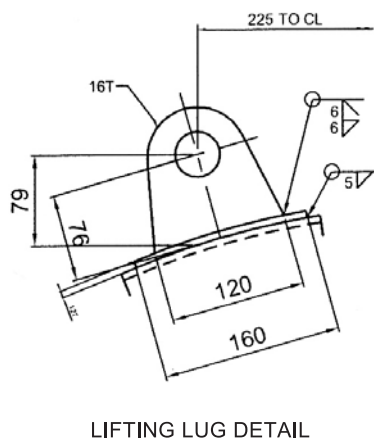
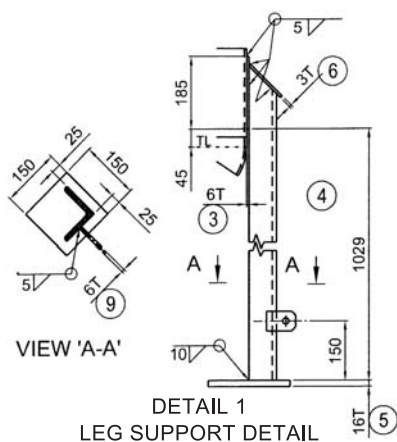


5. NDT-Radiographic Testing

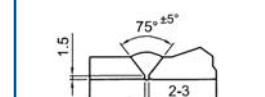


6. Completed Product

P.NO.	Description	Size	Material	Qty.	Remarks
1	Torispherical Dishends	ø750 IDx5.6T (AF): 25mm SF	SA 240 316L	2	
2	Shell Course	ø750 IDx950mm LG	SA 240 316L	1	
3	Pad Plate	6Tx165x185mm	SA 240 316L	3	
4	Leg Support	L100x100x12Tx1189mm LG	SS316L	3	
5	Base Plate	16Tx150x150mm LG	SA 240 316L	3	
6	Leg Cover	3Tx TO SUIT LG	SA 240 316L	3	
7	Lifting Pad Plate	6Tx70xLG TO SUIT	SA 240 316L	2	
8	Lifting Lug	16TxSEE DETAIL	SA 240 316L	2	
9	Earthing Lug	6Tx50x75mm LG	SA 240 316L	1	



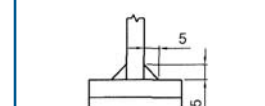
JOINT NO.: LS1,CS1,CS2
WPS NO.: WPS-SS-005 Rev.0



JOINT NO.: N1C2,N2C2,N3C2,N4C2,L1C2,L2C2,S1C1,S2C1,H1C1,H2C1
WPS NO.: WPS-SS-005 Rev.0

DN	a	T
DN25	5	4.55
DN40	5	6.05
DN150	6	7.11

JOINT NO.: N1C1,N2C1,N3C1,N4C1,L1C1,L2C1,S1C1,S2C1,H1C1,H2C1
WPS NO.: WPS-SS-005 Rev.0



TYPICAL FILLET WELD DETAIL
WPS NO.: WPS-SS-005 Rev.0

Nozzle Schedule

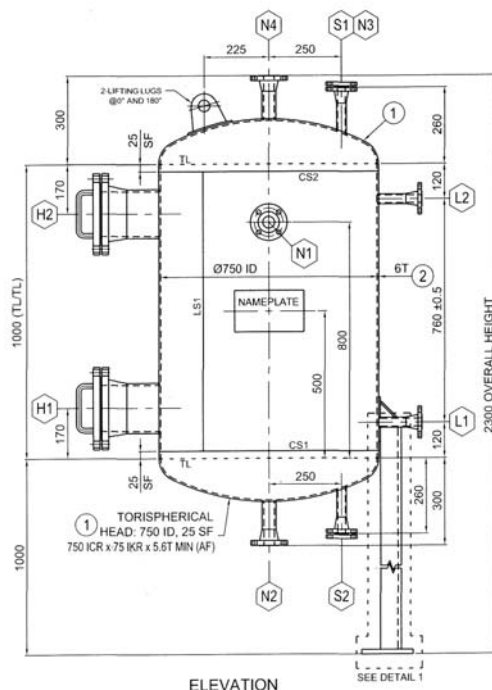
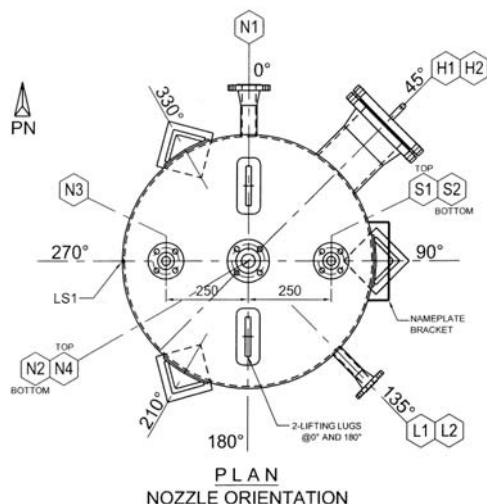
Mark	Qty	Size	Service	Flange			Neck THK	Proj. From CL/TL	Remarks
				Rating	Face	Type			
N1	1	40	Inlet	ASME 150#	RF	WN	80S	530	
N2	1	40	Outlet / Drain	ASME 150#	RF	WN	80S	300	
N3	1	25	PSV	ASME 150#	RF	WN	80S	260	
N4	1	40	Nitrogen Purging	ASME 150#	RF	WN	80S	300	
L1	1	25	LG	ASME 150#	RF	WN	80S	530	
L2	1	25	LG	ASME 150#	RF	WN	80S	530	
S1/S2	2	25	Spares	ASME 150#	RF	WN	80S	260	W/ Blinds
H1/H2	2	150	Handholes	ASME 150#	RF	WN	40S	580	W/ Blinds

General Notes:

- All dimension are in millimeters (mm) unless noted otherwise.
- All bolt holes shall straddle the main vessel axis line.
- Flanges shall conform to ANSI B16.5
- Quantity in bill of materials is for one (1) unit only.
Quantity required is three (3) units.
- All sharp edges shall be rounded off to R3 min.
- Hydrostatic testing shall be as per Hydrostatic testing procedure.
- The lifting LUG and LEG support welds shall be dye penetrant tested.

Reference Documents

Nozzle Detail Drawing	
Nameplate Detail Drawing	



Design Data

Design & Construction Code	ASME SECT. VIII, DIV.1 2007 ED. +0212-M120-00S1-0120 REV.1		
Classification Society	Not Required		
Code Stamp (U Stamp)	No		
National Board Registration	N/A		
Fluid	Fresh Water		
Specific Gravity	1.0		
Service	(Sour/Lethal)	No/No	
Design	Pressure (Int./Ext.)	250/-	kPag
	Temperature	45	°C
MAWP		1,082	kPag
MDMT		-29	°C
Test Pressure	Hydrotest	1435	kPag
	Pneumatic	None	kPag
Radiography		Spot	
Corrosion Allowance		0	mm
Post Weld Heat Treatment (PWHT)	N/A		
Impact Test	None		
Wind Load (Wind Velocity) km/hr	153		
Seismic Load	N/A		
Acceleration Due	Vertical, m/s ²	14.19	
To Vessel Motion	Transverse, m/s ²	5.08	
(Worst Case)	Longitudinal, m/s ²	1.34	
Insulation	None		
Painting	None		
Fire Proofing	None		
Weights, kgs	Empty	300	
	Operating	760	
	Hydrotest	820	

Rev	Description	DRN	CHKD	APPD	DATE
0	Issued as Built				
A	Issued for Approval				
End User					
Client					
Manufacturer : KEYSER® KEYSER TECHNOLOGIES PTE LTD 74 Tuas Avenue 11, Singapore 639093 Tel : +65 6262 0718 Fax : +65 6262 0836 Email: keyser@singnet.com.sg					
Project :					
Title : GENERAL ARRANGEMENT DETAIL WATER MIST TANKS					
Scale : 1:15 Total No. of SHTS: 1					
Drawing Number					Rev. 0

Mechanical Design Summary Sheet

Design Code		ASME Code Section VIII, DIV.1 2007 Edition +0212-M120-00S1-0120 REV.1	
Code Stamp		No	
ABS Classification		Not Required	
Inspection Authority		No	
Item Name		WATER MIST TANKS	
Item Tag No.		MBJ-6305 A/B/C	
Type		Vertical	
Design Pressure	(Internal / External)	250/-	KPag
Design Temperature	(Internal / External)	45/-	°C
Operating Pressure		150	KPag
Operating Temperature		Atmospheric	°C
Minimum Design Metal Temp. (MDMT)		-29	°C
MAWP	Internal	1,082	KPag
Hydro Test Pressure	@top	1,435	KPag
Diameter of Shell	ID	750	mm
Length of Tank	TL / TL	1,000	mm
Thickness of Shell	Nominal	6.0	mm
Thickness of Head	Min (AF) / Nominal	5.6 / 6.0	mm
Corrosion Allowance	(Internal / External)	0	mm
Specific Gravity		1.0	
Weights	Empty	300	kg
	Operating	760	kg
	Hydrotest	820	kg
Volume		470	Liters
Insulation		No	
Type of Head		Torispherical	
Radiography		Spot	
Joint Efficiency		0.85	
Post Weld Heat Treatment (PWHT)		N/A	
Impact Test		None	
Wind Speed		153	kph
Acceleration Due to Vessel Motion m/s²		ax=1.34, az=5.08, ay=14.19	
Materials Of Construction			
Shell / Head		SA 240 Gr. 316L	
Leg Support / Wear Pad		SS 316L / SA 240 Gr. 316L	
Nozzles		SS 312 TP 316L	
Flanges & Blind Flanges		SA 182 F316L	
Stud Bolts / Nuts		SA 193 Gr. 8M / SA 194 Gr.8M	
Gasket		SS316L Spiral Wound, Graphite Filled	
Lifting Kug / Pad Plate		SA 240 Gr.316L	
Remarks:		1. Hydrotest Pressure shall be as per UG-99(b)	

Pv Elite 2008 Licensee : **Keyser Technologies Pte Ltd**

File Name : MBJ-6305ABC CAL

External Pressure Calculations

Step: 4 11:59am Apr 25, 2009

External Pressure Calculation Results: ASME Code, Section VIII, Division 1, 2007

Bottom Head

Elastic Modulus from Chart: HA-4 at 38 C : 0.19305E+09 KPa.

Results for Maximum Allowable External Pressure (MAEP):

Tca	Sph. Rad	Ro / t	Factor A	B
5.600	755.60	134.93	0.0009264	63.65

$$EMAP = B / (Ro/t) = 63.6514 / 134.9286 = 471.7141 \text{ KPa.}$$

Shell

Elastic Modulus from Chart: HA-4 at 38 C : 0.19305E+09 KPa.

Results for Maximum Allowable External Pressure (MAEP):

Tca	OD	Slen	D / t	L / D	Factor A	B
6.000	762.00	1096.89	127.00	1.4395	0.0006490	58.23

$$EMAP = (4*B) / (3*(D/t)) = (4*58.2298) / (3*127.0000) = 611.3009 \text{ KPa.}$$

Tca	OD	Slen	D / t	L / D	Factor A	B
6.000	762.00	0.28E+34	127.00	.5000E+02	0.0000682	6.58

$$EMAP = (4*B) / (3*(D/t)) = (4*6.5834) / (3*127.0000) = 69.1126 \text{ KPa.}$$

Top Head

Elastic Modulus from Chart: HA-4 at 38 C : 0.19305E+09 KPa.

Results for Maximum Allowable External Pressure (MAEP):

Tca	Sph. Rad	Ro / t	Factor A	B
5.600	755.60	134.93	0.0009264	63.65

$$EMAP = B / (Ro/t) = 63.6514 / 134.9286 = 471.7141 \text{ KPa.}$$

External Pressure Calculations

From	To	Section Length mm.	Outside Diameter mm.	Corroded Thickness mm.	Factor A	Factor B N./mm ²
10	20	No Calc	755.600	5.60000	0.00092642	63.6514
20	30	1096.89	762.000	6.00000	0.00064901	58.2298
30	40	No Calc	755.600	5.60000	0.00092642	63.6514

Pv Elite 2008 Licensee : **Keyser Technologies Pte Ltd**

File Name : MBJ-6305ABC CAL

External Pressure Calculations

Step: 4 11:59am Apr 25, 2009

From	To	External Actual T. mm.	External Required T. mm.	External Des. Press. KPa.	External M.A.W.P KPa.
10	20	5.60000	No Calc	0.00000	471.714
20	30	6.00000	No Calc	0.00000	611.301
30	40	5.60000	No Calc	0.00000	471.714
Minimum					471.714

External Pressure Calculations

From	To	Actual Len. Bet. Stiff. mm.	Allow. Len. Bet. Stiff. mm.	Ring Inertia Required cm**4	Ring Inertia Available cm**4
10	20	No Calc	No Calc	No Calc	No Calc
20	30	1096.89	2.781E+33	No Calc	No Calc
30	40	No Calc	No Calc	No Calc	No Calc

PV Elite 2008 © 1993-2008 by COADE Engineering Software.

Pv Elite 2008 Licensee : **Keyser Technologies Pte Ltd**

File Name : MBJ-6305ABC CAL

Nozzle Step: 28 11:59am Apr 25, 2009

Nozzle Calculation Summary

Descripton	Internal KPa.	Ext	MAPNC KPa.	UG45	(tr)	Weld Path	Areas
N2-40	1115.38	...	...	OK	1.59	OK	NoCalc [*]
S2-25		...	...	...		OK	NoCalc [*]
S2-25		...	...	OK	1.59	OK	NoCalc [*]
N1-40		...	...	OK	1.59	OK	NoCalc [*]
L1/L2-25		...	...	OK	1.59	OK	NoCalc [*]
H1/H2-150		...	...	...		OK	Passed
N4-40		...	...	OK	1.59	OK	NoCalc [*]
N3-25		...	...	...		OK	NoCalc [*]
N3-25		...	...	OK	1.59	OK	NoCalc [*]
S1-25		...	...	...		OK	NoCalc [*]
S1-25		...	...	OK	1.59	OK	NoCalc [*]

Min. - Nozzles 1115.38 H1/H2-150

Min. Shell & Flgs 1082.35 10 20 1115.01

Computed Vessel M.A.W.P 1082.35 KPa.

[*] - This was a small opening and the areas were not computed or the MAWP of this connection could not be computed because the logitudinal bending stress was greater than the hoop stress.

Note: MAWPs (Internal Case) shown above are at the high point.

Check the Spatial Relationship between the Nozzles

From Node	Nozzle Description	Y Coordinate	Layout Angle	Dia. Limit
10	N2-40	0.000	0.000	76.200
10	S2-25	0.000	90.000	48.616
20	N1-40	800.00	0.000	76.200
20	L1/L2-25	120.000	135.000	48.616
20	H1/H2-150	170.000	45.000	308.102
30	N4-40	0.000	0.000	76.200
30	N3-25	0.000	90.000	48.616
30	S1-25	0.000	270.000	48.616

The Nozzle spacing is computed by the following:

= $\text{Sqrt} (11^2 + 1c^2)$ where

11 - Arc length along the inside vessel surface in the long. direction.

1c - Arc length along the inside vessel surface in the circ. direction.

PV Elite 2008 © 1993-2008 by COADE Engineering Software.

[illegible]

OTHER FABRICATION & ASSEMBLY WORK



Pipe Works

- Underground Piping Projects (Natural Gas Line-100% RT/NDT)



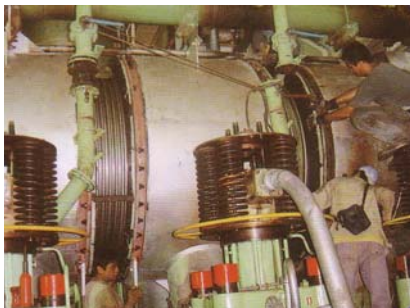
Product Fabrication

- Fabrication Work for Expansion joint



Welding

- Workmanship Expertise, Welding Specialist with Certified Welding Procedure Specifications (WPS) in accordance to the ASME Standards and DNV Rules.



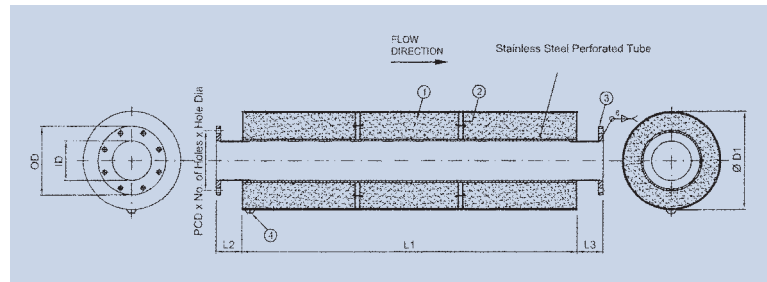
Assembly Work

- Assembling & Disassembling Work onboard vessels.



LPG Concentric Reducer

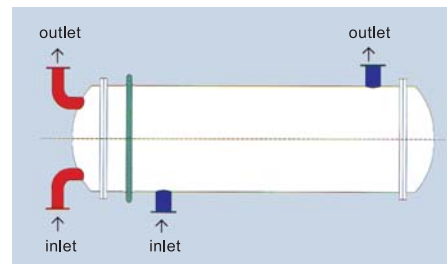
SILENCER



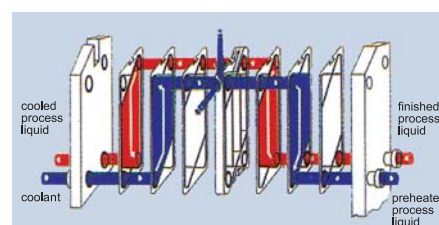
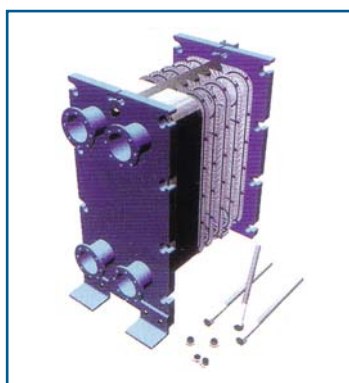
Item	Qty	Description	Material
1	1Set	Acoustic Infill	Hight Temp Long Strand Fiberglass
2	1	Internal Baffle	Depend on requirement
3	2	JIS 5K Flanges	Mild Steel / Stainless Steel
4	1	0.5" BSB Scket & Plug, Horizontal Orientation	

HEAT EXCHANGER

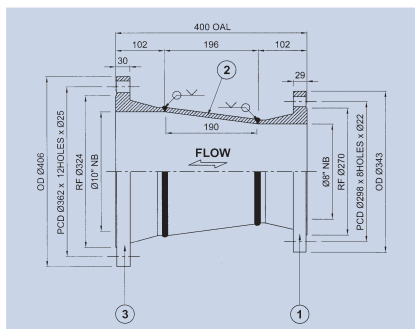
Shell & Tube



Plate

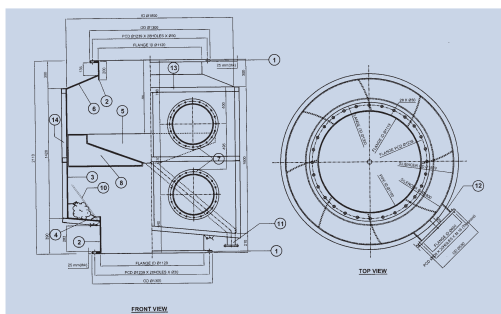


TYPE OF PRODUCTS



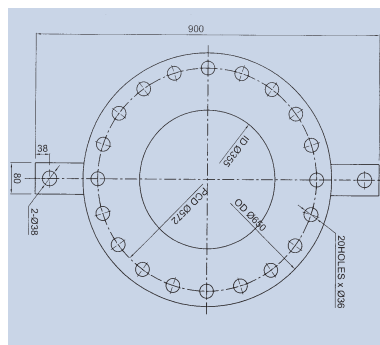
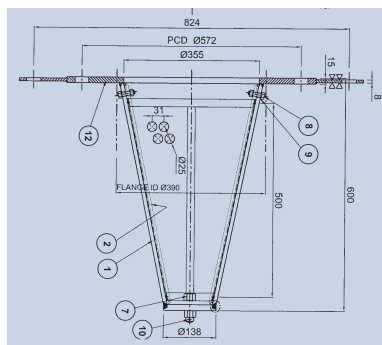
REDUCER

Reducers are designed to adapt different sized connections. They also help in reducing the flow of process medium. Reducers can be concentric or eccentric and can be designed according to application needs.



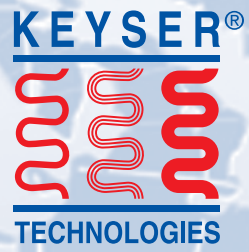
SILENCER

Silencers are designed for suppressing the noise associated with venting pressurized gas. Typical applications includes, but are not limited to, gas blowdown, compressor and steam blowoffs, start gas and process vents and steam ejector.



STRAINER

Strainers are designed to remove impurities from gas or liquids. It filters out unnecessary particles that may cause damage or contamination to the process. Strainers are made with corrosion resistant materials for long service.



Our Offices & Agents locations





HEAD OFFICE ADDRESS:

KEYSER TECHNOLOGIES PTE. LTD.

Address: 74 Tuas Avenue 11, Singapore 639093

Tel No : +65 6262 0718

Fax No : +65 6262 0836 (Admin)

Fax No : +65 6863 6508 (Sales)

Fax No : +65 6863 0107 (Production)

Email : sales@keyser.com.sg

Website : www.keyser.com.sg

PRESSURE VESSELS & STEEL FABRICATION

The background of the central section is a dark blue gradient. It features several technical drawings in white lines, including cross-sections of vessels, flanges, and piping. Overlaid on these drawings are four 3D rendered images of steel fabrication components: a conical mesh filter on the left, a circular flange with a central pipe, a smaller conical flange in the center, and a large horizontal pressure vessel on the right mounted on yellow support legs.

SUBSIDIARY OFFICES ADDRESSES:

KEYSER TECHNOLOGIES (THAILAND) CO., LTD

Address : 244 Soi Sukhumvit 95/1, Sukhumvit Road,
Bangchak, Prakhonong, Bangkok 10260

Tel No : +66 2742 4350-51

Fax No : +66 2742 4398

Email : keyser@truemail.co.th

KEYSER TECHNOLOGIES PTE LTD.

SHANGHAI REPRESENTATIVE OFFICE

Address : 10TH Floor, Unit No. 1006A, Central Plaza,
No. 381 Huaihai Zhong Road, Luwan District,
Shanghai, China

Main Line : +8621 6391 6161

KEYSER TECHNOLOGIES (VIETNAM) PTE. LTD.

Address : Road 5, Dong Xuyen Industrial Park,
Ward Rach Dua, Vung Tau City, Vietnam

Tel/Fax No : +64 614299