DB HOLDINGS

COMPANY PROFILE





CONTENTS

ABOUT US

02 CEO Message
03 About Us
07 HSE
09 Profile

TECHNOLOGY

11 Chemical Cleaning
19 Hot Oil Flushing
23 Water Flushing
25 Water Jet Flushing
29 Steam Blowing
33 Pressure Test
55 Deluge Drop Test
57 Pipe Fabrication & Installation
67 GRE
83 Insulation
99 Pig Cleaning
101 Special High Cleaning
105 Oil Purification Service

110 **HISTORY**
Work History



"We sincerely pray for the infinite development of our company."



Dear our valuable customers & partners

DB HOLDINGS was established in order to provide more efficient and economical services in petrochemical and plant, and we specialize commissioning services, piping installation, line cleaning, pressure test, total equipment rental services and engineering services. In spite of the current uncertain plant industry, all employees including myself are finding several ways to strengthen our services and expanding new business growth opportunities.

DB HOLDINGS has been grown up remarkably by our special know-how in this field.

First of all, we equip a number of cutting edge equipment which enables us to provide more customized services in order to meet customer's different and special request these days.

We, moreover, have the proven experience on both onshore and offshore, with those successes both domestically and internationally, we will continue to strive for technology and service innovation to satisfy our customers.

Our tireless efforts will never abate until we become a leading global company.
We sincerely invite clients to visit us and see what we can do for our clients and thanks for clients continuous support.

Thank you.

DB Holdings. Co.,Ltd.
President **Mr. S.U.Yun**

ABOUT US

Contact Us

DYNAMIC BUSINESS
DB HOLDINGS



MAIN

2F, 171-7 Samsan-dong, nam-gu, Ulsan, Korea
TEL +82.52.227.2017
FAX +82.52.227.2018

LOCAL

A-401,Jung-ang Building, Gohyeon-dong,
Geoje-si, Gyeongsangnam-do, Korea
TEL +82.70.7874.1355
+82.70.7874.1356

FACTORY

49-11 Deoksin-ri, Onsan-eup, Ulju-gun, Ulsan, Korea
TEL +82.52.239.2016
FAX +82.52.239.2017

Corporate R&D Center

49-4 Deoksin-ri, Onsan-eup, Ulju-gun, Ulsan, Korea
TEL +82.52.239.2016
FAX +82.52.239.2017



Certificate



Venture



Prospective Medium & Small Enterprise



Corporate R&D Center



ISO 9001



ISO 14001



OHSAS 18001

DB HOLDINGS SOLUTION

DB GROUP

DB HOLDINGS

PIPELINE SERVICES

- Flooding, Cleaning, Gauging
- Dewatering
- Drying and conditioning
- Isolation and repair
- Gel and mechanical pigging
- Nitrogen inerting and pack
- Change of service
- Vessel and bundle
- Pipe-in-pipe insulation

PROCESS SERVICES

- Chemical cleaning
- High-pressure water jetting
- Hot oil flushing
- Clean Spool Policy
- System purging
- Helium leak detection
- Onsite Machining
- Flange Management
- Hydrostatic or Pneumatic Testing
- Onsite Valve Testing

DB TECH

GENERAL PIPE INSTALLATION

- Carbon & Stainless Steel
- Cu-Ni,Alloy, Titanium Pipe

STEEL OUTFITTING

- Inclined Ladder
- HVAC System
- EXH. Gas pipe
- Vent Duct
- Heavy Spare Parts
- Platform
- Handrail

BOOHEUNG TECHNICAL

GRE PIPE INSTALLATION

- 2000M, 5000M, 7000M Series
- 2420C, 2425C Series
- Fiberbond GRE Pipe

GENERAL PIPE INSTALLATION

- Carbon & Stainless Steel
- Cu-Ni,Alloy, Titanium Pipe

PVC PIPE INSTALLATION

- CPVC, PVDF Pipe Installation

PRESSURE TEST

- Piping Hydro Test

HYDRO TECH

OFFSHORE PLATFORM SERVICE

- Construction Work Service for Mechanical, Instrument and Electrical
- Offshore Hook-up & Commissioning Work Service
- System Pressure Test and System Helium Leak Test Service
- Rental Service for Commissioning Power Generator & Air Compressor with Dryer
- Supervisor, Technician and Inspectors Manpower Supply Service

ORGANIZATION

PRESIDENT
S.U.Yun
ceo@dbholdings.asia

VICE PRESIDENT
T.Y.Choi
choi@dbholdings.asia

SALES DEP'T

GENERAL MANAGER
S.K.Cho
skcho@dbholdings.asia

- Marketing
- Work Initiative
- Cost Accounting
- Material Purchases

SUPPORT DEP'T

GENERAL MANAGER
W.H.Kim
admin@dbholdings.asia

- QC/QM
- R&D Institute
- Equipment Maintenance Management
- Work Place Communication

PRODUCTION DEP'T

GENERAL MANAGER
J.S.Kim
prdjin@dbholdings.asia

- Task Managment
- Process Managment
- Fabrication Work Planning & Production
- Production Technology

ACCOUNTING DEP'T

GENERAL MANAGER
C.H.Lee
ich@dbholdings.asia

- Record Keeping and Financial Transactions Cleanup
- Assets, Report Writing
- Taxation, Finance
- Business Analysis

SAFETY DEP'T

GENERAL MANAGER
S.Y.Kim
ksy@dbholdings.asia

- HSE Operation
- Safety Accident Analysis
- Safety Training
- Workplace Safety Inspection

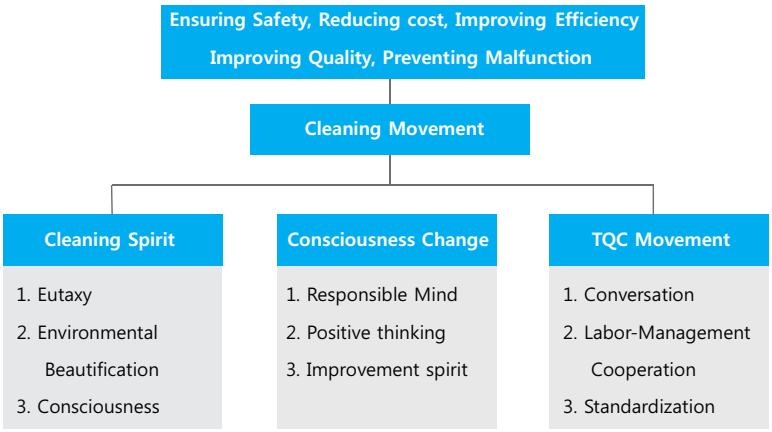
PROFILE

We do our best to satisfy the client requirements through continuous environment improvement.

Providing safe working conditions and maintaining continuity of employment is of continual concern. In this regard, At DB Holdings, co, ltd., we believe that it is possible to provide more efficient and economical services in various fields we are involved in when the safety of employees and physical property would be best ensured by a meaningful system. We, DB Holdings, has been growing up significantly by our remarkable attention for safety, health and environment. We are so conscious of the importance related to safety matters that we consider it the primary factor for company to advance forward and would continue to explore new ways of commitment to ensure safety and protection while striving to expand our business growth opportunities every day.

1. Work Environment Management Regulations

A. General Philosophy



B. Purpose

i. It is aimed to make clean working environment by cleaning dust, rust, and dirt by clearing un-necessities and extra possessions and by establishing visible management system.

ii. It is aimed to improve the will to work and betterment through reducing cost, improving efficiency and quality, preventing breakdown of equipment and safety accident, etc. by eliminating waste factors in the work place according to the ingrained habit of cleaning activity.

iii. It is aimed to make work atmosphere cheerful and worthy by improving welfare for all the employees by reorganizing working environment in order to safely work in the pleasant environment.

C. 5S MOVEMENT



5S	Definition	Effect
Disposing	To resolutely dispose of un-necessities after distinguishing what is necessary.	Space provided Prevent safety accident Cost reduction
Arranging	To pursuit the way to put objectives in accordance with the safety quality efficiency and to arrange up for anyone to use what is needed recognizing them in the designated place.	Working time reduction Cost reduction
Cleaning	To maintain operation all the time by conducting inspection of machinery and equipment with early detection and repair as keeping in dirt, contamination-free environment.	Rate of operation improved Repair time reduction Machine life extended Quality improved
Cleanliness	To make good working environment in good arranging, ordering, and cleaning state. Problems are early detected, if any, and principally, it means not to contaminate the state.	Work environment improved Morale increased Turnover rate reduction The accumulation of technology
Habituation	To master what they trained and observe the certain details.	The rationalization of management Business competitiveness enhanced Welfare increased

PROFILE

2010. May

Established for manufacturing & Construction industry

Located in second floor 171-7 Samsan-Dong, Nam-gu, Ulsan, Korea.

2010. September

Acquired EMS (Environmental Management System) Certification - ISO 14001 : 2004

Acquired QMS (Quality Management System) Certification - ISO 9001 : 2008

2010. November

Registered as Sub-Contracted Companies of HYUNDAI.

2011. April

Obtained The Venture Enterprise Certification.

2011. June

Registered as Sub-Contracted Companies of SUNGJIN GEOTEC.

2011. November

Established DB HOLDINGS's Factory Located in 49-4, Doeksin-ri, Ulju-gun, Ulsan, Korea.

2011. December

Registered as Sub-Contracted Companies of Steelflower

2012. February

Registered as Sub-Contracted Companies of SHINHAN Machinery.

2012. May

Acquired OHSAS (Occupational Health & Safety Management System) Certification - OHSAS 18001

01 Preparation

1-1. All pipe system shall be pressure tested and approved before chemical cleaning and chemical treatment except hydraulic oil system.

1-2. Equipment such as pressure gauges, transmitters, flow meters, valve, orifice plates, rupture discs etc. must be disconnected during chemical cleaning.

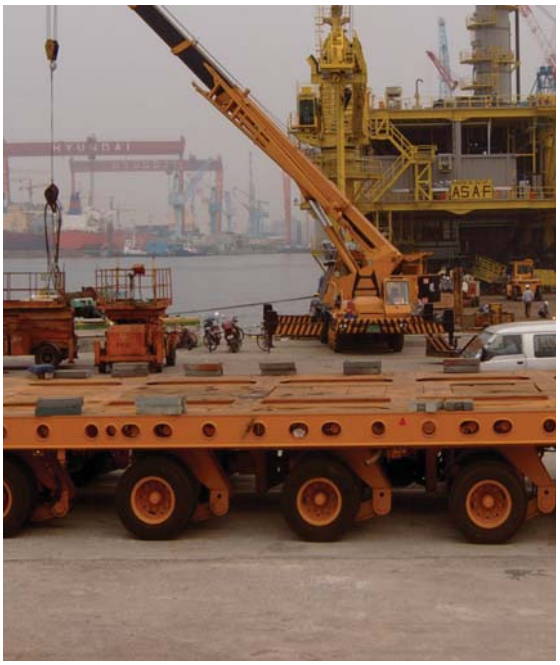
1-3. Flange to be chemical cleaned shall be installed to protect the system from acid.

1-4. A supply hose shall be connected between the pump and the pipe system on the lowest and a return hose shall be installed on the highest elevation.

1-5. Chemical cleaning equipment & related items.

Acid mixture tank	Circulation pump
Acid injection pump	Storage tank
Pipe and hose	Boiler for heating (1.5ton x 1EA) or heater
Safety outfits	Test tools & etc





02 Sequence of Chemical Cleaning

2-1. Degreasing

1) Fill the system with fresh water and Vent at the top points.
2) Open necessary valves for circulation and start the pump.
3) Heat of the water to 40 ~ 60°C
4) When the required temperature is reached, put the 3% degreasing solution of total water volume
DR-5000 (Liquid Type)

Oxalic Acid : 30.0%	Surface Active Agent : 1.0%
Methanol : 10.0%	Pure Water : 58.7%
Inhibitor : 0.3%	

5) Circulate the solution during at least 1~2 hours and check the degreasing on a suitable point.
6) When degreasing is accepted, drain the system.
The acceptance criteria of degreasing shall bevisually checked the test piece after depositing in circulation tank and compared with sample piece deteriorated.
7) The elements shall be rinsed until the PH value of the drain water is equal to that the water used to within PH 5 units and all residual sediment shall be removed.

2-2. Acid Cleaning

1) Fill the system with fresh water, vent the top points.
2) Open the necessary valves for circulation and start the pump and Check the leaks.
3) Heat of the water to 40 ~ 50°C
4) When the required temperature is reached, put the 10~15% solution of total water volume of phosphoric acid solution ;

Acid mixture tank	Circulation pump
Acid injection pump	Storage tank
Pipe and hose	Boiler for heating (1.5ton x 1EA) or heater
Safety outfits	Test tools & etc

5) Circulate the solution for at least 3 ~ 4 hours. For carbon steel, the total iron concentration must be less than 10000ppm and that of ferric iron less than 700ppm After the acid cleaning is finished, drain the solution and check as per test and inspection report attached #1.
6) When acid cleaning is accepted, flush the system with fresh water until PH 0.5 value of inlet and outlet shall be equaled and all residual sediment shall be removed.
7) Monitoring acid cleaning The acid cleaning operation shall be controlled by ;

- Monitoring the solution's acidity trend.
- Monitoring the concentration of soluble elements, in particular.
- Monitoring the corrosion inhibitor efficiency.

Visual inspection of the surfaces shall show complete acid cleaning with no traces of corrosion.







2-3. Neutralization

1) A neutralizing solution of 2% sodium carbonate shall be circulated to remove all traces of acid from the system. The solution shall be circulated for a minimum of 1 hour at 50℃ and then drained.
2) Neutralization shall be checked and accepted until the PH 9~10 value of the drain water is equal to that of the rinsing water.
3) After neutralizing, the system shall be rinsed with water until all traces of acid and neutralizing solution have been removed.

2-4. Phosphate Coating

After rinsing, the descaled pipe shall be passivated to minimize further corrosion by applying a phosphate coating. The phosphate solution shall be circulated for 1 hour at 50~80℃, and consist of the following :

Disodium Phosphate : 0.25%	Sodium Nitrite : 0.50%





BP THUNDER HORSE
SEMI SUBMERSIBLE PDQ 6036



2-5. Drying and Preservation

1) After phosphate coating, the system shall be drained and dried thoroughly with dry air or nitrogen.
   The system shall not be flushed with water after phosphate coating. Blowing hot (60 to 80°C) dry and oil free air. After drying, the pipe shall be closed tightly and blanked with an inert gas pressurized to 5 psi (0.35kg/cm²) or filled with oil to minimize corrosion but not for gas lines.
2) Check for drainage of water from pipe system before preservation work is completed.
3) When the chemical cleaning is accepted, reinstall / preserve the pipe system.

2-6. Restitution

After acid cleaning, remove all valve, temporary pipe and hose at the connection area new gasket to be used. Then, consideration should be taken not to enter impurities into pipe line. Complete reinstatement shall be checked by QM personnel.



2-8. Waste Water Treatment

Waste water used for acid cleaning shall be gathered in storage tank and neutralized by PH 5 ~9 and there after consign waste disposal to special waste treatment company.



2-7. Inspection

An inspection report shall be required in accordance with compay specification and DB procedure

- Visual Examination

This method is used to check up whether pollutants such as paint, oil, grease, welding slugs, scales, which was formed from heat treatment, dust, metal wastes, abrasive particles and fragments are removed according to standards. The visual test is performed by using sun light and other auxiliary lights (including bulb).

The surface strength of light during the test shall be 250 Food Candles (2690 Lux) in common, at least 100 Food Candles (1076 Lux).



01 Preparation

1-1. Preparation

1) All pipe system shall be pressure tested and approved before chemical cleaning and chemical treatment except hydraulic oil system.
2) Equipment such as pressure gauges, transmitters, flow meters, valve, orifice plates, rupture discs etc. must be disconnected during chemical cleaning.
3) Flange to be chemical cleaned shall be installed to protect the system from acid.
4) A supply hose shall be connected between the pump and the pipe system on the lowest and a return hose shall be installed on the highest elevation.
5) Chemical cleaning equipment & related items.

Acid mixture tank	Circulation pump
Acid injection pump	Storage tank
Pipe and hose	Boiler for heating (1.5ton x 1EA) or heater
Safety outfits	Test tools & etc



02 Sequence of passivation

2-1. Degreasing

1) Fill the system with fresh water and Vent at the top points.
2) Open necessary valves for circulation and start the pump.
3) Heat of the water to 30 ~ 40°C
4) When the required temperature is reached, put the 3% degreasing solution of total water volume DR-5000

Oxalic acid : 30.0%	Surface Active Agent : 0.1%
Methanol : 10.0%	Pure Water : 58.7%
Inhibitor : 0.3%	

5) Circulate the solution during at least 1~2 hours and check the degreasing on a suitable point.
6) When degreasing is accepted, drain the system. The acceptance criteria of degreasing shall be visually checked the test piece after depositing in circulation tank and compared with sample piece deteriorated.
7) The elements shall be rinsed until the PH value of the drain water is equal to that the water used to within PH 5 units and all residual sediment shall be removed.



2-2. Pickling

1) Fill the system with fresh water, vent the top points.
2) Open the necessary valves for circulation and start the pump and check the leaks.
3) Heat of the water to 5 ~ 50°C.
4) When the required temperature is reached, put the 10~15% solution of total water volume of Nitric acid solution ;
   DR-600

DR-66 (Liquid Type)	Water : 30.0%
Phosphoric Acid : 60.0%	Ethanolamine : 3.0%
Ammonium sulfate : 7.0%	

5) Circulate the solution for at least 3 ~ 4 hours.



2-3. Passivation

1) Fill the system with fresh water, vent the top points.
2) Open the necessary valves for circulation and start the pump and check the leaks.
3) Heat of the water to 5 ~ 50°C
4) When the required temperature is reached, put the 10~15% solution of total water volumn of Nitric acid solution ;
   DR-600A

Nitric Acid : 38.0%	Water : 38.0%
Surface Active Agent : 7.0%	Polymer Compound : 14.0%
Corrosion Inhibitor : 3.0%	

Circulate the solution for at least 1 ~ 2 hours.



2-4. Drain & Air blowing

1) The system shall be drained with dry air or nitrogen.
2) Check for drainage of water from pipe system before connection work is completed.
3) When the chemical cleaning is accepted, reinstall / preserve the pipe system.

2-5. Visual inspection

1) This method is used to check up whether pollutants such as paint, oil, grease, welding slugs, scales,
   which was formed from heat treatment, dust, metal wastes, abrasive particles and fragments are
   removed according to standards.
2) The visual test is performed by using sun light and other auxiliary lights (including bulb).
   The surface strength of light during the test shall be 250 Food Candles (2690 Lux) in common, at least 100 Food Candles (1076 Lux).

2-6. Waste solution treatment

1) Treatment of degreasing solution and rinse water shall be collected into the waste solution treatment tank and discharged to a designated place after adjusting their PH (to become 5 ~ 9) with hydrochloric acid.
2) Treatment of acid solution and rinse water.
   The acid treated solution and rinsed water shall be collected into the waste solution treatment tank and be discharged to a designated place after the PH valve is adjusted 5 ~ 9 with sodium carbonate.

What is Passivation?

Passivation is the process of forming a protective oxide film on stainless steel. However, some confusion still exists about the definition of passivation and what really causes a passive film to form on the surface of stainless steel.

On one hand, ASTM A380-99 notes that "Passivation is a process by which a stainless steel will spontaneously form a chemically inactive surface when exposed to air or other oxygen-containing environments.

It was at one time considered that an oxidizing treatment was necessary to establish this passive film, but it is now accepted that this film will form spontaneously in an oxygen-containing environment providing that the surface has been thoroughly cleaned or descaled."

On the other hand, ASTM A380-99 also notes that "Passivation is removal of exogenous or free iron or iron compounds from the surface of a stainless steel by chemical dissolution, most typically by a treatment with an acid solution that will remove the surface contamination but will not significantly affect the stainless steel itself. Unless otherwise specified, it is this definition of passivation that is taken as the meaning of a specified requirement for passivation."

Thus, passivation may refer to the chemical removal of free iron or iron compounds from the surface, or it may refer to the spontaneous development of a chemically inactive surface (protective oxide film) on the stainless steel.
While it is essential that surface contamination be removed completely, it is the latter interpretation of passivation that relates to establishing the corrosion resistance of stainless steels. Once the surface is cleaned and the bulk composition of the stainless steel is exposed to air or an oxygen-containing chemical environment, the passive film forms immediately.

01 Preparation

- All of the cleaning workers should be educated for the safety of Passivation
- Preparation of operation: Fresh water, Chemical, Brush, Grinder and PPE, etc
- This below procedure covered on Welding heat tint area and surface contamination

02 De-scaling and Mechanical Cleaning

- To remove a thick visible oxide scale and Weld spatter from the surface
- Operation Method: Brushing or Grinding

03 Degreasing

- The surfaces need to be free of oil, marks and organic films
- To remove mineral oil, grease, and other oils contaminated on surface
  - Use Chemicals : DR-5000
  - Operation method: brushing or spray.
  - Water rinsing may be done several times until no degreaser can be detected. (pH 6-8)

04 Passivation Treatment

- After degreasing, acid passivation is carried out to remove residual contaminants and oxide scales, burnt areas by welding and other iron powders.
  - Chemicals : DR-500
  - Operation method : brushing or spray

- Over passivation must be avoided. Uniform removal of scale with acid passivation depends on the acid used, acid concentration, solution temperature, and contact time.
- The effective time of the passivation treatment is usually 1~6 hours, as it also depends on the factors of the treatment condition such as atmosphere temperature, humidity, or scale thickness, latent heat, etc.

05 Rinsing

- Rinsing with a 1% solution of nitric acid will remove any traces of alkalinity or hard water deposits left by the alkaline cleaning
- Operation method : washing with distilled water and soft cloth or Jet washing
- Rinsing may be done several times until no acid can be detected. (pH 5-7)

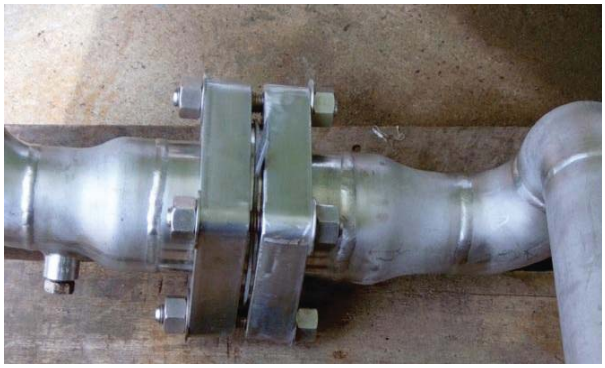
06 Drying



- Drying should be done in the natural condition

07 Inspections

- Visual inspection should be done under a bright light. (minimum : 1,000 lux)
- Visual inspection should be supplemented with bore scopes, mirrors, and other aids, as necessary, to properly examine inaccessible or difficult-to-see surfaces



PRECAUTIONS & SAFETY INSTRUCTIONS

1) Precautions
- Avoid skin wetting : Protective articles should be used to avoid skin wetting
- Avoid to inhale acid gas
  - Plain gas masks with acid absorbent cartridge should be used
  - Keep working in air ventilated area
  - During operation inside of structure: another person should take care of the condition

2) Safety Instructions
- If accidental splashes are made to skin, wash with soap and water
- If splashes to eyes occur, wash with copious quantities of water and seek medical advice
- To inhale of heavy gas, should inhale oxygen and rest.
- Refer to the Material Safety Data Sheet for further information







Hot Oil Flushing

01 Scope

1-1. Scope of oil flushing shall be carried out as follows ; - Hydraulic oil system
Hydraulic oil pipe or tube : Oil flushing

1-2. Oil flushing lines shall be indicated on isometric drawings or P&ID.

02 Preparation



2-1. In order to remove debris and contaminants from the hydraulic system, all hydraulic lines shall be thoroughly cleaned with flushing oil before any testing is carried out.
The flushing shall be carried out in order to obtain a cleanliness of code 14/13 in accordance with ISO 4406.
The flushing shall be carried out in accordance with BFPA/P9
Prior to flushing of hydraulic lines all in-line filters shall have the filter element. The filter element shall be reinstalled immediately after flushing.
The system shall be pressure tested with hydraulic oil to 1.5 times the system design pressure (If client request). Any leaks shall be rectified, the test repeated and the pressure held for 10 minutes, minimum, in accordance with ASME B31.3.
After the pressure testing, the hydraulic oil does not need to be drained off.
All valves and flanges are to be clearly marked: "SYSTEM PRESSURISED".



2-2. Systems subject to oil flushing shall be in accordance with the Isometric drawings, P&ID and Specifications.

2-3. Burrs in sharp edges must be removed from before oil flushing.

2-4. Marking
1) Piping spools or systems that have been oil flushed shall be marked in a unique manner.
2) Marked up drawing of the system must be available as part of the recording system.

2-5. Avoid skin wetting : Protective articles should be used to avoid skin wetting.

2-6. Avoid to inhale acid gas.
- Plain gas masks with acid absorbent cartridge should beused.
- Keep working in air ventilated area.

2-7. During operation inside of structure, another person should take care of the condition.

03 Oil Flushing

3-1. The flushing oil shall be the same grade for the operating system as following ;
- Hydraulic oil system : Oil as specified by the equipment Vendor

The system shall be flushed with oil at a velocity of not less than 1.2 m/sec (4 ft/sec) .
The velocity produces a turbulent flow with a Reynols greater than 3500.
Minimum required flow rate for the actual pipe is calculated from the following Formula

3-2. The flow condition pipe or hose can be assessed using Reynolds Number as follows: Re = V x d / ν x 10
where : Re = Reynold Nunmber
V = mean flow velocity in m/s
d = pipe internal diameter in mm
ν = kinematic viscosity of fluid in cst
The relationship between flow velocity, flow rate and internal diameter is given by : V = 21.2 x Q / d
Where : Q = flow rate in L/min
Hence, Re = 2.12 x 10^4x Q / (νx d)
To have complete confidence that turbulent flow is occuring, Reynolds Number Re must be greater than 4000.
Re = 2.12 x 10^4x Q / (νx d) > 4000
The flow rate required to achieve this condition can be determined as follows : Q > 0.189 x νx d

3-3. Oil samples shall be taken on the return side of the flush unit when required temperature and flow rate have been achieved.

3-4. Oil flushing shall be continued until required cleanliness level is achieved in accordance with 14/13 to ISO 4406 (NAS 1638) as specifiedby the equipment vendor.

- Cleanliness Requirements of Parts used in Hydraulic Systems.

- NAS 1638

PARTICLE \ GRADE	00	0	1	2	3	4	5	6	7	8	9	10	11	12
5 ~1 5	125	250	500	1000	2000	4000	8000	16000	32000	64000	128000	216000	512000	1024000
15 ~ 25	22	44	89	178	356	712	1425	2850	5700	11400	22800	45600	91200	182400
25 ~ 50	4	8	16	32	63	126	253	506	1012	2024	4050	8100	16200	32400
50 ~ 100	1	2	3	6	11	22	45	90	180	360	720	1440	2880	2882
Over 100	0	0	1	2	2	4	8	16	32	64	64	256	512	1024

3-5. Oil flush flanges / flanges in the pipe system that are to be loosened / removed, must be cleaned before discon necting to prevent any contamination from entering the pipe system.
If the pipe spool are not to be connected in the operating position, cleaned blind flanges shall be connected.

3-6. When oil flushing is completed, the piping and tubing shall be marked with date and signature.

3-7. Temporary flushing filters shall be installed in accordance with the oil flushing package drawings.

3-8. Prior to commencing the flushing, the filter elements shall be removed from the primary and secondary filters.

3-9. Where the system has parallel flow paths, it may be necessary to alternate some flow paths to achieve the required flow velocity.

3-10. The system shall be flushed in a systematic manner to clean it sequentially and prevent contamination of sections that have already been flushed.





3-11. Drains, vents, instrument connections, dead legs, etc., shall be fitted with temporary hoses to facilitate periodic blowdowns.

3-12. The Seat-valves normally shall be fully open during the oil flushing.

3-13. Provision shall be made for flushing the lines downstream of all relief valves.
Relief valve normally should be removed for flushing.

3-14. The system shall be thermally, mechanically and hydraulically shocked to dislodge dirt, particulate and foreign material.

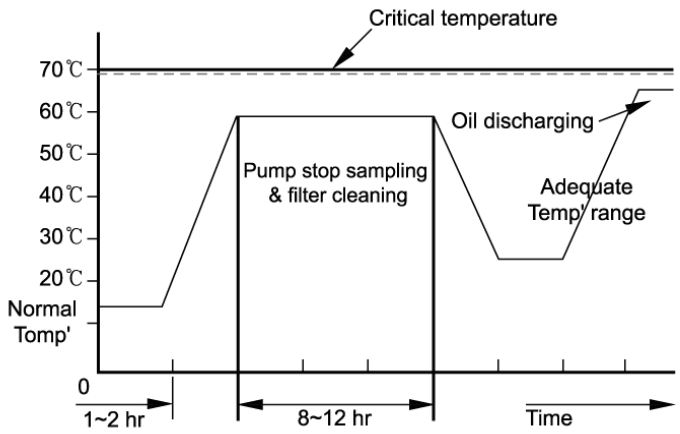
1) Thermal Shock
During the flushing, the oil temperature will be oscillated between 60°C (140°F) and 80°C (176°F).
This will be achieved by additional heaters as necessary and the oil coolers.

2) Mechanical Shock (If Required)
Weld joints, fittings and other areas where dirt and particle can congregate Shall be lightly hammered frequently with a proper hammer during the flushing.
Hammering is to be done to eliminate scales inside of the piping by wooden hammer. Rubber hammer and copper hammer may be utilized.

3) Hydraulic Shock
The system shall be hydraulically shocked by shutting down the pumps to interrupt the flow. The pumps shall be shut down to allow the lines to drain and then restarted to restore full flow.



Hot oil flushing cycle



04 Acceptance

4-1. Inspection

After each circuit has been flushed for several hours, the circuit shall be isolated and the filters removed for inspection. The frequency of the inspections shall be governed by the amount of debris arrested by the filter. When each filter is proved clean after being in operation for a minimum of 2 hours, the circuit shall be considered clean and the filter may be removed.

4-2. Filter Acceptance Criteria

A filter shall be considered clean when the test results are in accordance with ISO 4406. The system shall be considered clean when such foreign matter as scale, rust, metal shavings and sand are not visible to the eye and grittiness is not detectable to the touch.

4-3. Final Acceptance

Final acceptance shall be determined when the oil quality complies with the specified ISO 4406 (NAS grade). Final samples to undergo full particulate count and certification (ISO 4406) issued accordingly (Will be inspect by pall portable particle counter).
Finishing of flushing is to be determined by cleanliness of filter in the temporary oil tank in the presence of COMPANY QM'S personnel.
When all filters have been proved clean and have been removed, the primary and secondary filter elements shall be reinstalled and the flushing restarted with the oil being circulated through the filters.
When the differential pressure across the filters ceases to show any significant value, the entire system shall be considered clean and all filters shall be replaced with new filters.

05 Preparation for service

5-1. After flushing is completed, the system shall be returned to normal including the following ;
1) All temporary vent and drain hose connections, etc., furnished for the flushing shall be disconnected.
2) The system checked to confirm all flushing shall be removed.
3) Instruments etc. shall be reinstated.

5-2. The sample oil will be filtrated and checked with 100㎖ bottle by microscope at the laboratory.
The remaining oil will be tagged and stored.
To verify if necessary.

5-3. If either sample indicates the oil is unacceptable, the complete charge shall be dumped and replaced by clean oil.
The system shall not be used until results of laboratory tests are confirmed and approved as being acceptable.

5-4. Care should be taken as described in the data sheet for each individual oil type.
Where hoses and other equipment are pressurized, the area shall be closed for admission.

5-5. Systems will be clearly tagged and locked off on final acceptance to prevent unauthorized using, and to avoid any possibility of contamination.





06 Documentation

6-1. Documentation shall be provided after chemical cleaning.
Data sheets for chemicals used must be available and recorded, as should batch and chemical traceability documentation.

6-2. Documentation shall be provided after oil flushing. The compliance to specified ISO 4406 (NAS 1638) or grade as specified by respective vendors requirements shall be documented by relevant laboratory analysis certificates or other acceptable methods.

01 Water Flushing

1-1. Water flushing shall be used to clean the piping for removal of weld slag, blast grit, sand, trash, dirt, loose scale, other debris and foreign material.

1-2. Water flushing shall be applied to piping of 24 in NPS and below for systems specified for water flushing. Large diameter piping need not be flushed but cleaned mechanically and visually inspected. Engine Exhaust piping will be mechanically cleaned and visually inspected.

1-3. Any piping that cannot be adequately cleaned in place may be dismantled. If necessary, the pipe for installation can be cut for preparation of flushing loop, and then flushed. After flushing the additional welding points shall be completed using Gas Tungsten Arc Welding and then pressure tested without re-flushing.

1-4. Flushing medium shall be fresh water.

1-5. The chloride ion content of the water used for stainless steel lines shall be less then 50 ppm. The flushing/hydrotest medium shall be fresh water/inhibited seawater can be used at offshore

1-6. Piping shall be flushed with water at velocity of 10 feet per second to obtain desired degree of cleanliness. Refer to Table1.

Table 1. Flow Rates

SIZE(in)	A(m^2)	V(m/sec)	Q(m^3/hr)
2	0.002	3.048	22
4	0.008	3.048	89
6	0.018	3.048	200
8	0.032	3.048	356
10	0.051	3.048	556
12	0.073	3.048	800
14	0.099	3.048	1089
16	0.130	3.048	1423
18	0.164	3.048	1801
20	0.203	3.048	2223

1-7. For fire water system, to be applied as Table 2.

The primary fire water system shall be flushed before connections are made to sprinkler systems. Each hydrant and control valve shall be opened and closed under the water pressure to ensure proper operation. A flow sufficient to produce a velocity of 1.52m/sec to 1.83m/sec (5 to 6 feet per second) shall be used.

The following flow rates correspond approximately to the required velocity.

Table 2 Flow Rates

Pipe (inch)	Flow (m^3/hr) (gpm)
4	45.5(200)
6	113.6(500)
8	182 (800)
10	284 (1,250)
12	398 (1,750)

1-8. The piping shall be flushed from high point to low point. Where two or more high points or alternative flow paths exist, multiple flushing inlets and discharge points will be required.

1-9. It necessary, the pipe line for installation should be cut for the preparation of flushing loop, and then flushed, after flushing, the additional welding points shall be completed by using the approved welding procedure specification and will be hydrotested without reflushing. Upon completion of cutting beveling and grinding, an internal inspection shall be completed to verify that the pipe is free form debris. Company shall be given prior written notification of the visual inspection.

1-10. All valves shall be flushed in fully open position, except control valves shall be removed from the line.

1-11. Flushing through equipment, if required, shall not be carried out unless approved by COMPANY.

1-12. Compressed air may be injected into water while flushing to increase turbulence.

1-13. Water shall be flushed through a temporary 20-mesh strainer and continued until clean flushing medium appears at discharge points (Until deleting of debris more than 20-mesh).

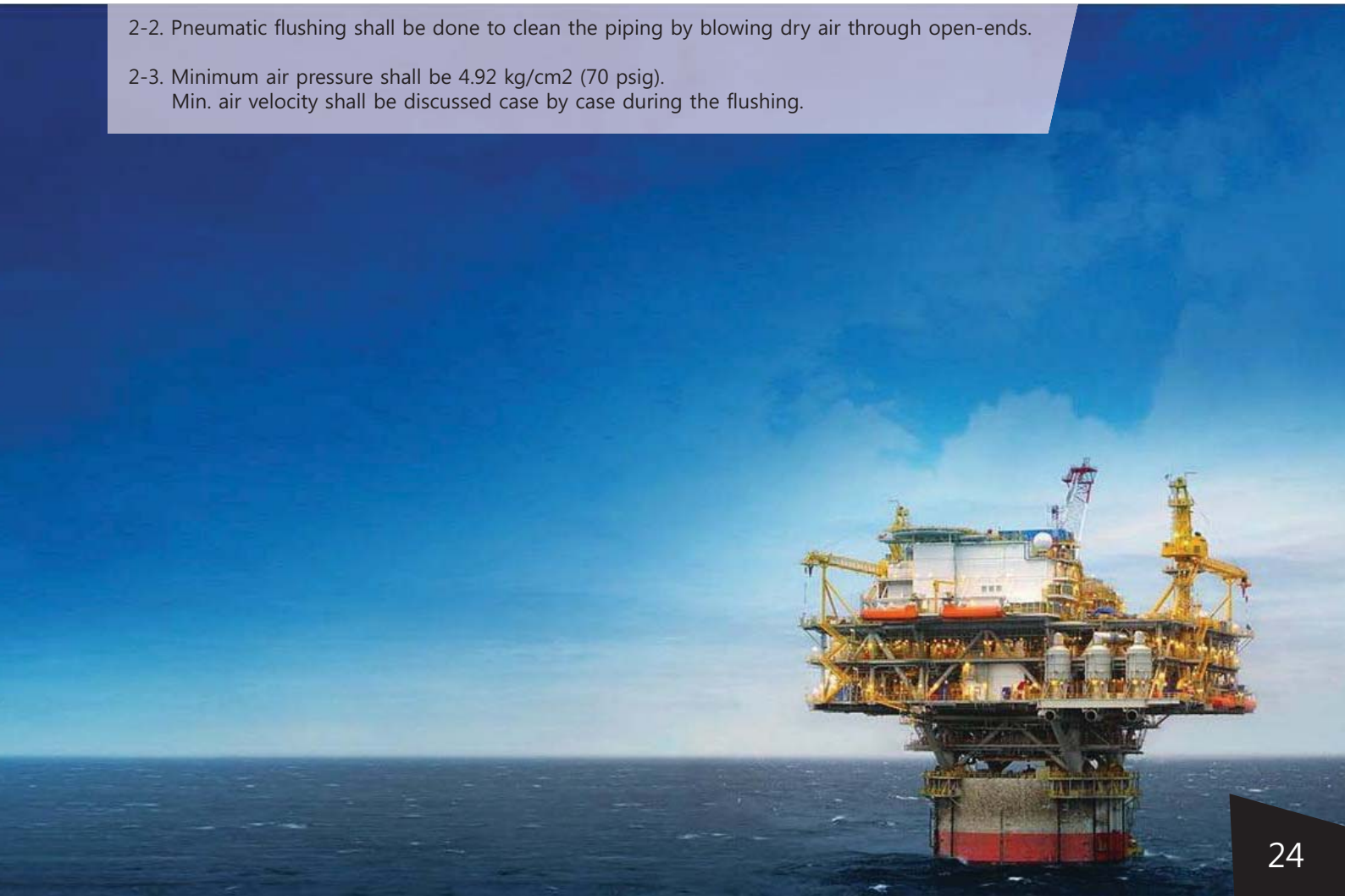
1-14. After flushing the piping systems shall be completely drained and protected against corrosion.

02 Pneumatic flushing (Air Blowing)

2-1. Piping and piping systems, which cannot be flushed with water because presence of water is unacceptable, shall be pneumatically flushed.

2-2. Pneumatic flushing shall be done to clean the piping by blowing dry air through open-ends.

2-3. Minimum air pressure shall be 4.92 kg/cm2 (70 psig).
Min. air velocity shall be discussed case by case during the flushing.



Water Jet Flushing

01 Preparation for Cleaning

1-1. Before cleaning line should be accepted by visual Inspection.

1-2. The cleaning shall be only performed after company's approval. The final authorization will be given by signature of company on the form shown in inspection report

1-3. Following items that can be damaged by dirt loose scale and debris or items that may trap the debris, compromising the effectiveness of cleaning shall be removed or isolated from the line prior to cleaning.

A) Control velves

B) Pressure relieving device (rupture disk, relief valves)

C) Flame arrestors

D) Orifice plates, Rotameters, Turbine meters and Positive displacement meters

E) Venturi tube

F) Check valve Disk

G) Filters (Temporary suction strainer)

H) Internally coated vessel heat exchanger and etc.

02 Water Jet Flushing

2-1. There are no pipe size limitation on Water Jet Flushing

2-2. Rotating nozzle shall be used for lines 4" and above.
For 2"~ 4" line water flushing shall be application.
Minimum performance for use of rotating nozzle to be 150 bar at a flow rate 50 liters per minute.
Over 2~5 point Elbow can not work at pipe line.
Pipe length which can work to the universality is 50m.
They are possible but to maximum 70m according to task condition.

2-3. For the line 6" and below size, flushing velocity shall be minimum 8~12 ft/sec.
To carry out the dirt and debris along with water. The circulating rate shall be determined by pump head curve and pipe size.

2-4. Compressed air may be injected into the water while flushing to increase turbulence and velocity.

2-5. Items of equipment that would be sensitive to damage during water flushing shall be removed block off or isolated.

2-6. All valves shall be flushed in fully open position, except control valves shall be removed form the line.

2-7. The flushing medium in general shall be fresh water.
The chloride ion content of the water used for stainless steel lines shall be less then 30 ppm.
The flushing/hydrotest medium shall be fresh water/ inhibited seawater can be used at offshore.

2-8. After flushing the piping systems shall be completely drained protected against corrosion.



WC1G3643



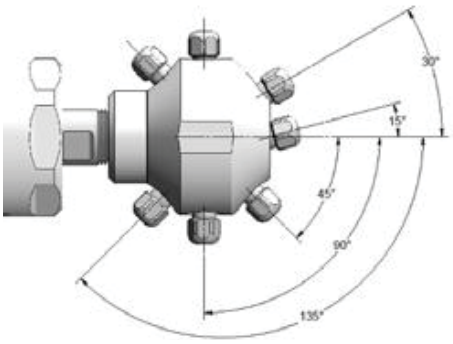
Angola BB Platform–2005

01 Preparation for Water Jet Blasting



1-1. The first step in selecting a pipe cleaning tool to determine what tool will fit into the pipe being cleaned, and whether the pipe is straight or has elbows. The next consideration is the deposit to be cleaned and selecting a tool that is capable of the pressure and flow rate to be used.
Depending on the difficulty of the material to be removed, the use of centralizers and extension arms may be needed to decrease stand-off distance, improving jet impact in larger pipes. Once the tool is selected, determine jet placement in the head of the tool. How much pulling force is required to make the run and whether the pipe has scale or is partially or fully blocked will determine the location and number of orifices in the cleaning head. Finally, select the rotation speed of the head based on the size of the pipe and the nature of the deposit to be removed.
Typically use faster rotation speeds in pipes up to 36 in, and slower rotation speeds in larger pipes or if the deposit is very thick and hard requiring more dwell time.

1-2. All DB HOLDINGS® tools rotate and clean. Self-rotary tools have the advantage of using fewer and thus larger orifices than non-rotary heads while achieving complete coverage of the walls of the pipe being cleaned.



The location and quantity of the orifices in the rotary head are dependent on whether the pipe is blocked requiring forward facing jets, or has scale on the walls, requiring outward jets, and how much pulling force is needed, requiring rearward facing jets.
Orifices of equal sizes should be installed opposite each other to balance the head from side to side.
DB HOLDINGS® , we refer to jet angles from the front to the back as shown in the illustration. When a tool is making a horizontal run, each pound of pulling force from the jets will pull between 1.5 and 3 m (5 and 10 ft) of hose, depending on the weight of the hose and the vibration created by the pump pulsations. If a tool must climb straight up, the jet pull must be at least equal to the weight of the tool and the weight of the length of hose being lifted.

1-3. Safety

We have recommended limits on cleaning large pipe diameters for each tool as a safety precaution.
Operators must be very cautious to not run a tool in a pipe that is small enough to turn it self around and come directly back at him. To prevent this, add a rigid lance to the inlet of the tool or choose a larger tool.
We recommend a device that is 1-1/2 times the inner diameter of the pipe. **DB HOLDINGS®** also offers safety devices called Back-Out Preventors which will also provide protection from hydraulic-flushing.

1-4. Cleaning Large Pipes

The most important task to manage is reducing the distance from the end of the nozzle to the surface being cleaned. We offer Extension Nipples, detailed add document, and Centralizers add document.
Extension Nipples not only reduce the stand off distance but also reduce turbulence which improves jet quality. Centralizers keep the tool centered in the pipe which allows for equal and effective cleaning..

Attack Tip® Orifice Flow Chart (in gpm)

ORIFICE ID		Pressure - kpsi & bar										
in.	mm	2 138	4 276	6 414	8 552	10 700	12 827	14 966	16 1103	18 1241	20 1400	Flow Rating
.018	0.46	0.39	0.55	0.68	0.78	0.87	0.96	1.0	1.1	1.2	1.2	0.6
.020	0.51	0.48	0.68	0.83	0.96	1.1	1.2	1.3	1.5	1.5	1.5	0.7
.022	0.56	0.58	0.82	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.8	0.8
.024	0.61	0.69	0.98	1.2	1.4	1.6	1.7	1.8	2.0	2.1	2.2	1.0
.026	0.66	0.81	1.2	1.4	1.6	1.8	2.0	2.1	2.3	2.4	2.6	1.1
.029	0.74	1.0	1.4	1.7	2.0	2.3	2.5	2.7	2.9	3.0	3.2	1.4
.032	0.81	1.2	1.7	2.1	2.5	2.8	3.0	3.3	3.5	3.7	3.9	1.7
.035	0.89	1.5	2.1	2.6	3.0	3.3	3.6	3.9	4.2	4.4	4.7	2.1
.038	0.97	1.7	2.5	3.0	3.5	3.9	4.3	4.6	4.9	5.2	5.5	2.5
.042	1.07	2.1	3.0	3.7	4.2	4.7	5.2	5.6	6.0	6.4	6.7	3.0
.047	1.19	2.7	3.8	4.6	5.3	5.9	6.5	7.0	7.5	8.0	8.4	3.8
.052	1.32	3.3	4.6	5.6	6.5	7.3	8.0	8.6	9.2	9.8	10	4.6
.057	1.45	3.9	5.5	6.8	7.8	8.7	9.6	10	11	12	12	5.5
.063	1.60	4.8	6.8	8.3	9.6	11	12	13	14	14	15	6.8
.069	1.78	5.7	8.1	9.9	12	13	14	15	16	17	18	8.1
.075	1.91	6.8	9.6	12	13	15	17	18	19	20	21	9.6
.082	2.08	8.1	12	14	16	18	20	21	23	24	26	12
.090	2.29	9.8	14	17	20	22	24	26	28	29	31	14
.098	2.49	12	16	20	23	26	28	31	33	35	37	16
.106	2.69	14	19	23	27	30	33	36	38	41	43	19
.115	2.92	16	23	28	32	36	39	42	45	48	50	23
.125	3.18	17	27	33	38	42	46	50	53	56	60	27
.135	3.43	22	31	38	44	49	54	58	62	66	69	31
.145	3.68	25	36	44	51	57	62	67	72	76	80	36
.155	3.94	29	41	50	58	65	71	77	82	87	92	41
.165	4.19	33	46	57	66	73	80	87	93	98	100	46

02 Pipe Water Blast Centralizers



DB 070 Skid

This is a versatile system with interchangeable plastic skids that bolt on to collars and change out easily. The skid works well through elbows and can handle up to 12″ diameter pipes effectively. This skid accepts all DBV™ nozzles and is shown in the Upper right photo. Ask about additional skid sizes when ordering.



DB 070 Plastic Skid Style
Available in 6", 8", 10" & 12" Interchangeable Skid Sizes (152 mm, 203 mm, 254 mm, & 305 mm)

DB 286
6-Wheel Adjustable

This is a versatile system with interchangeable plastic skids that bolt on to collars and change out easily.
The skid works well through elbows and can handle up to 12″ diameter pipes effectively.
This skid accepts all DBV™ nozzles and is shown in the upper right photo.





MODEL	RANGE OF ADJUSTMENT	MODEL
DB 286 -S	9-18 in. 230-460 mm	20 IBS 9 kg
DB 286 -M	13-40 in. 330-1010 mm	30 IBS 15 kg
DB 286 -L	16-60 in. 410-1520 mm	40 ibs 18 kg

DB 288
8-Wheel Adjustable

This centralizer is designed to travel through elbows easily. It has adjustable telescopic steel legs with tough plastic wheels and is easily converted among the 15k, 20k and 40k psi DBV™ nozzles.



MODEL	RANGE OF ADJUSTMENT	MODEL
DB 288 - S	16 - 21 in. 410 - 530 mm	12 ibs 5.5 kg
DB 288 - M	22 - 29 in. 560 - 740mm	13 ibs 6 kg
DB 288 - L	30 - 37 in. 770 - 940 mm	16 ibs 7.3 kg

01 Definitions, Purpose and Scope

1-1. Definition of Steam Blowing

Steam Blowing refers to a work procedure to eliminate rust, weld slag, spatter, and mill scale as well as dust and debris inside pipeline, by steam flow and repetitive contraction and expansion of pipe line in cycling process to have pipeline (Steam line) heating, blowing, cooling down, using heat effect and kinetic energy of steam flow. The ultimate purpose of Steam Blowing is, by eliminating all the foreign materials stated above, to prevent filter/strainer, etc. from blocking during the operation, prevent damage to flow meter, control valve, etc. and prevent turbine blade, which is the most important, from shutting down by preventing its damage.

There are two types of steam blowing according to the requirement of End user.

1) Targeted Steam Blowing: It shall be applied to HPS & MPS steam in case Steam is supplied to Steam Turbine Driver, which means to determine the Steam quality by target plate — the result of the determination by Steam Turbine Vendor supervisor is absolute. (Usually, by Blowing package, about a week is taken — consecutively operated day and night)
2) Service Blowing: It shall be applied to LPS & VLPS Steam line in case Steam is supplied to heat exchangers, ejectors, vessels, Steam tracing, etc. Working procedure is as same as that of Targeted steam blowing, but what is altered is the method to inspect: to be determined visually instead of by blow point. (The work by Blowing Package usually takes about a week — mainly operated at night)
   Pearl GTL's Steam type for reference :
   a. High Pressure Steam (HPS) : 66.0 Bar g, 420℃
   b. Medium Pressure Steam (MPS) : 15.0 Bar g, 260℃
   c. Low Pressure Steam (LPS) : 7.0 Bar g, 185℃
   d. Very Low Pressure Steam (VLPS) : 3.5 Bar g, 146℃

1-2. Purpose

It is aimed to provide the standard of preparation for Steam Blowing, such as installing temporary piping, eliminating Control valve, Flow meter, etc., and other works, which is applied to eliminate Debris, loose scale, rust, etc. from steam line installed recently by welding (to loosen foreign materials through thermal shock, contraction/expansion, and finally to blow them off by Blowing), safety inspection and measures, steam blowing operation, test and approval criteria, recovery preservation, etc.

1-3. Scope

This procedure shall be applied to Steam Line of Gas Plant, including Service Steam Blowing of Low pressure steam line and Target Steam Blowing of Steam Turbine line.

02 Steam Blowing Conducting Step

2-1. The Main Supplies and Equipment

1) Temporary Silencer about the Lines more than 6" to prevent noise when Blowing
2) Hose & Connection points for Quenching water supply to reduce noise
3) Fabricate Items to uninstall In-lines and temporary piping and Support about Blowing Point.
4) Lagging materials about temporary piping
5) Small Air compressor for Opening/Closing Target Plate during Target Plate & Blowing
6) Steam Hose for draining Mud pot, Temporary Silencer, etc.
7) Protection materials (steel plate, tent, etc.) to prevent Damage around Blowing Point and contamination 8) Hard Barricade & Purple tape (commissioning tape) to prohibit access around Blowing point, Drain point and Silencer
9) Infrared thermometer to measure temperature of steam
10) PPE (Ear plug, Ear-muff, Flame proof coverall, hard hat, safety shoes, Hand gloves, Full body harness, etc.)
11) Mega-phone for Control around Blowing Point, etc.
12) (Explosion-proof) radio
13) Other Documents (Procedure, Method Statement, Work Permit, etc), tools and instrument, equipment, etc. required to prepare, carry out, recover, and inspect Steam Blowing

2-2. Preparations

1) Prepare Work Package (including marked-up P&ID).
2) Prepare Steam Blowing Method Statement.
   a. Mark preparations such as all of the Temporary valves, spools, spades, etc. on Marked-up drawing
   b. Mark line, the position of major valve and working sequence to blow on P&ID.
   c. Mark recovery related matters on P&ID.
   d. Mark simple work procedure by stage on each Blow Point.
   e. Mark the position of valves inside the system in the stage of Steam Blowing star-up.
   f. Make JSA (Job Safety Analysis) or JHA (Job Hazards Analysis)
   g. Calculate Disturbance Factor of CFR (Cleaning Force Ratio = K factor) to check the achievement of the Cleaning force required. (See the next page.)
3) Uninstall the Permanent spool on connecting side of Turbine, and when Blowing on the separated Permanent Pipe in which temporary piping is installed, Prepare Stress Analysis by thermal expansion.

$$DF = \frac{R_b^2 d_o}{R_o^2 d_c}$$

where Rb = flow rate during blowing,
Ro = flow rate during operation,
dc = density of cleaning medium,
do = density of operating medium
DF more than 1.5 in experience point indicates well-Cleaned status.
The Mass flow rate required is determined by Mass flow/Volume ratio, which is known as CFR (Cleaning Force Factor) or K Factor. It can also determine the velocity of Stream inside Pipe and in Steam Generator.

$$\mathrm{K} = \frac{(m_b)^2 \cdot V_B}{(m_v)^2 \cdot V_v} > 1.2\ t\ o 1.7$$

mB	Mass flow during steam blowing
mV	Mass flow at full load
VB	Specific volume during steam blowing
VV	Specific volume at full load

During Blowing, Mass flow mB can be calculated with the following equation (with data on Steam Table) :

$$m_B \geq m_V \cdot \frac{V_V}{V_V}$$

4) Preparations

- In advance of starting Steam Blowing related work, see if all the related piping, Process equipment, etc. are fully installed in accordance with P&ID, Piping System is Hydrotested, insulation work is finally completed, and then commence the work mentioned below. (It is possible to partially commence the work after System Inspection.)
- Eliminate the machinery below which may be damaged or make Steam Blowing activity delayed or interrupted while Steam blowing, and fabricate temporary piping & fitting, equivalent to Permanent in safety, test water pressure, and install : Safety valve, Check Valve, Rupture disks, Orifice plates of flow meter elements, in-line mixers/strainers/filters, spargers, spray nozzles, control valves, self-actuated valves, Emergency shut off valves, thermowells, Condensate and moisture separator, and other items which may result in difficulties. (However, special measurement is required to prevent damage to Items impossible to be eliminated in the condition of the site.)
- Eliminate Permanent Spool to secure Blowing point in connection sides between Turbine & Vessel, and then install Temporary Valve (sacrificial valve or restriction orifice) in order to protect temporary piping and Permanent Valve.
- Eliminate permanent spool in connections to Turbine, and then install Temporary support where temporary piping is installed in order to prevent Permanent spool from deforming.
- These areas shall be Blinded where Permanent spool is eliminated in connection to Turbine and where foreign materials can enter after eliminating other Items.
- Install Silencer connected to temporary pipe on Blowing Point more than 6" in order to prevent noise (service Blowing point which would be finished only at night may be worked without Silencer), and Install Temporary hose for Condensate to be Drained, and then conduct enough Anchoring.
- Install steam hose for Draining to the Ground level on Mud pot and Steam trap and Hard barricade around Mud pot and Steam trap.
- All the area around Blow point shall be protected by appropriate materials (steel plate, staging board, Tent, etc.) in order to prevent damage to permanent facility.
- All the area around Blow point shall be Masking-treated thoroughly in order to prevent contamination when Blowing.
- Eliminate Permanent spool in connection to Turbine, Install temporary connection point (flange) for installing Target Plate as close as to Turbine, connect Air hose for opening & closing Target plate from Air Compressor, and check whether it is operated or not.
- Among the temporary piping installed, protect the part with heat insulating materials where accessible for inspectional and other purpose while Steam Blowing, in order to prevent safety accident. (No cladding needed.)
- Enclose near Blowing point, Temporary Silencer & Temporary piping with Hard Barricade such as Fence, in proper distance, to prohibit unauthorized access, and Install Purple tape and Warning notice sign board simultaneously.
- After finishing heat-insulation, release (unlock) Spring Hanger Lock Nut immediately before steam Blowing.
- Isolation Valves, etc. of Battery limit, etc. shall be closed and managed in the method of LOTO (Lock Out & Tag Out).
- Perform Gross Air Leak Test throughout the entire pipe (Test pressure shall be about 4 bar g).
- All the Dirt pockets and Low point drains shall be open in advance of initial warming-up.
- Before starting Steam Blowing, Safety walkdown about whole System (Route) to take Steam Blowing shall be carried out, supplemented, if any, and be prepared for actual Steam Blowing to commence.
- Notify the pre-schedule to the parties involved and establish the organization confirmed and Communication protocol for Steam Blowing.
- Conduct training for safety education against Noise related to Steam Blowing, Hot Temperature, Flying object, Steam & Drain water (condensate), etc. (Repeat several times at all the site.)
- Publicize the Steam Blowing by sector schedule and Layout in advance.

Steam Blowing Work Sequence

- Hydro Test
- Reinstatement
- System Inspection
- Temporary Piping Fabrication & Hydro Test
- FE, C/V, etc. Elimination and Temporary Piping Installation
- Gross Air Leak Test
- Safety Walkdown & TBT
- Steam Warming up
- Steam Blowing
- Target Plate
- Temporary Piping Uninstallation and Reinstatement
- Preservation

2-3. Conduct Steam Blowing

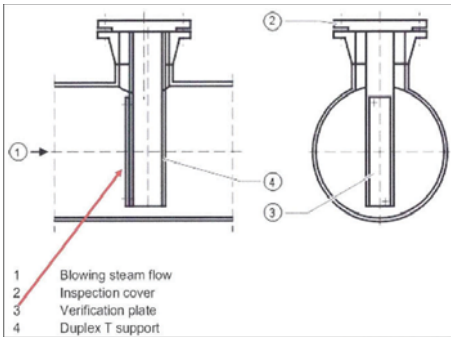
- Steam Blowing proceeds from Upstream to Down stream as follow: Main Header (or Common Header → Unit Header) → Sub Header (manifold) → Branch Lines.
  (However, Conduct blowing from the largest steam line which is composed of Single sub-header or manifold.)
- All the Dirt pockets and Low point drains shall be open in advance of Initial warming-up of steam Line.
- While Steam blowing of Upstream connection line, Steam Trap shall be bypassed for the first time. When the cleanness of Upstream line is secured, immediately inspect and check the function to modify in the status of Service. Discharge Condensate of Steam trap to the grade level until Condensate indicates clean, and reinstate to flow automatically toward Condensate system, if clean.
- All the Steam Header Branch Lines shall be closed while Steam Blowing of Main Header.

Step-1. Warming Up

- Warming-up steps shall be proceeded gradually, opening Steam supply valve, and all of Condensate from the Steam line shall be drained till Dry steam is blowing out on Blow point, in order to prevent to create Steam Hammer. (Keep blow-off end part open to prevent from forming Vacuum inside piping.)
- Warm up Sub-header line by gradually opening By-pass valve on Battery Limit.
- Vent Steam through Blow Point positioned on high level while Warming up.
- Keep monitoring the state to be drained by Drip leg drain point, etc., and immediately eliminate if the Drip leg valve, etc. is Plugging or blocking line.
- The state of system leakage shall be inspected while Warming-up and monitored to check if all the Expansion parts are in free status, and if Pipe shoe and Guide is kept intact.
- When Steam comes to appear from Drip leg on the side of Upstream, request to raise the supply rate of Steam, and keep the process till Steam is flowing through all of the pipe system.

Step-2. Target Blowing for lines equipped with a Target Plate

- Once Blowing circuit completes Warming up, and it reaches to the stable status in the required amount of steam supply, Steam Blowing shall be in progress.
- Carry out Steam blowing at least more than 4 hours to provide enough time for mill scale, etc. dropped from pipeline to escape out.
- Keep the time at least 10 to 20 min per Blow, and observe the state.
- The actual Blowing time may be shortened or extended in accor dance with the result of Target Plate.
- Check if all the parts of Expansion are in free state and Pipe shoe and Guide remains intact.



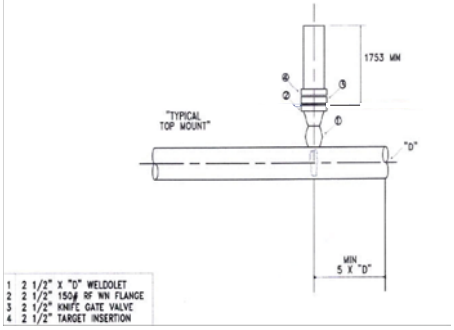
Step-3. Cooling down

- Cooling shall be accomplished by natural cooling or by Air Blowing.
- Provide at least 240 min (4 hours) of period to cool down in case the Line is heated while Blowing.
- In order for effective Steam Blowing, Heating, blowing, and Cooling shall be circulated according to time or temperature monitoring.

Step-4. Repeat the process from Step-1 to Step 3 at least 3 times

Step-5. Target Plate Installation

- Requirement of Target Plate: Polished steel, copper, aluminum, etc. are usually used; however, Copper is mainly used. In case of Bare Aluminum, the one which have a width of 40mm, a thickness of 1mm, Brinell Hardness HB25 to 35 is preferred, and the length shall be almost proximate to the relevant Pipeline size.
- Install Target plate perpendicular to Steam flow around Blow-off end area immediately after completing final Steam Blowing step.



01 Introduction

This document specifies procedure and general methodology to be adopted for Pneumatic Pressure testing piping systems at CLIENT yard.

02 Purpose / Objective

This document is prepared to achieve following objectives:

2.1 To specify pressure testing- requirements, application and methodology.
2.2 To ensure that CLIENT requirements are met.
2.3 To specify scope of piping and piping items to be flushed and pressure tested.
2.4 To prepare pressure testing documentation for CLIENT approval.

03 Scope

Scope of this procedure includes the following, related to pipe and vessel Pneumatic testing, prior to Commissioning for CLIENT scope of piping and pressure vessel

3.1 Preparation for Pneumatic pressure testing.
3.2 Pneumatic pressure testing requirements for Pneumatic testing
3.3 Post test requirements.
3.4 Repair and Re-testing.
3.5 Safety measures during Pneumatic pressure testing.
3.6 Preparation of pressure test packages and documentation.

04 References

The latest edition of the following codes and standards need to be referred, as applicable to pressure testing.

4-1. Code / Standards

ASME B16.5 : Pipe Flanges and Flanged Fittings, NPS 1/2 in. through NPS 24 in.
ASME B31.1 : Power Piping
ASME B31.3 : Process Piping & Drilling Piping
ASME B31.4 : Liquid Transportation systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols
ASME B31.8 : Gas Transmission and Distribution Piping Systems
API 6A : Specification for Wellhead and Christmas Tree Equipment

4-2. Specification

CLIENT Specification requirement



CHEVRON TEXACO AGBAMI
PROJECT 6043

05 Pneumatic Pressure Testing Procedure

5-1. Preparation for Pressure Testing

5.1.1. Prior to any testing, DB HOLDINGS shall provide a written test procedure to CLIENT for review and comment. This procedure shall include the following information as a minimum:

1) Drawings shall show the location of all skillets, blind flanges and other modifications to the system for the test.
2) Test pressure for each system shall be clearly indicated on the drawings.
3) Listing of systems to be tested shall include test pressure.
4) The location and routing of all jumps over connections.

5.1.2. Pneumatic pressure packs shall be submitted for CLIENT information to pressure test.

5.1.3 Documentations to be prepared before Pneumatic pressure testing as follows;

1) Weld Record – CLIENT System
2) Piping Installation Check Sheet
3) Piping Cleaning Record
4) Current calibration certificates for all test gauges and chart recorders must be sighted and accepted by CLIENT Inspector

5.1.4. The following inline items shall not be subjected to field Pneumatic pressure testing and shall be either blanked off or replaced by dummy spool for testing. Unless specifically identified in this procedure or the referenced procedures listed under Section 4 above, all inline items and valves shall remain in place for the duration of the pressure test.

a) Control valves
b) Positive displacement meters
c) Turbine meters
d) Rotameters
e) Pressure Relieving Devices (Rupture discs, Relief & Safety valves)
f) Orifice plates
g) Venturi tubes
h) Flame Arrestors
i) Temporary suction strainer (Basket strainers shall be installed with the basket or filter elements removed)
j) Locally mounted pressure gauges
k) Equipment like pumps, compressors or rotating machinery shall not be included within hydrotest limits and must be physically isolated. (Including company request items)
l) Fire water nozzles and sprinkler heads.
m) Any other equipment designated by CLIENT.
n) Safety valves & pressure transmitters.

5.1.5. If possible, all ball valves & Actuated Ball valves to be half opened during Pneumatic pressure test. All pressure testing shall be against plugged, blinded, or spaded connections.



06 Pneumatic Pressure Testing Requirements

6-1. Pneumatic pressure Testing

6.1.1 Upon completion of fabrication and inspection(NDE and Air flushing), CLIENT piping systems listed items and shall be pressure tested in accordance with applicable sections of ASME B31.3 & classification rules to verify piping systems prior to commissioning.

6.1.2. Pneumatic testing shall be carried out if piping or connected equipment might get damaged by water and even a small amount of water left out in the system could contaminate the system

6.1.3. For safety reasons, a relief valve should be installed downstream of the isolation valve with set pressure as per para 345.5.2 of ASME B31.3. The relief valve will be installed for any test pressure above 20Kg/cm2.

6.1.4. Pneumatic test pressure shall start at 1.76 Kg/cm2. When pneumatic testing at over 1.76 Kg/cm2, a preliminary test at 1.76 Kg/cm2 shall be made to locate major leaks, and then the pressure shall be increased gradually to test pressure.

6.1.5. Pneumatic test pressure shall be 1.1 times of the design pressure or CLIENT Specification as indicated in line list unless noted otherwise and shall not exceed 90% of the specified minimum yield strength of the tested piping. Piping shall be tested in accordance with the test isometric drawings or P&ID.

6.1.6. Expansion joints shall be pressure tested along with piping system to check the restraining devices, only when test pressure is not higher than shop test pressure. At no time shall the presence of expansion joint dictate test pressure to be below required pressure. In such cases, expansion joints will be removed.

6.1.7. A pressure gauge shall be provided at pump/compressor discharge to check appropriate test pressure of the system and avoid over pressurizing. The pump shall be maintained constantly during pressurizing by an authorized operator. Additionally a pressure gauge will be placed at the system high point vent to ensure adequate pressure throughout the system.

6.1.8. After full test pressure has been reached and temperature stabilized, all pipe joints shall be inspected with soap solution for leak detection. All welds and flanges are to be exposed during pressure test as per applicable standards

6.1.9. Until completion of Pneumatic testing, all piping joints (including flanged, threaded or welded) shall be left un-insulated.

6.1.10. Appropriate pressure rated blinds shall be used to separate test systems.

6.1.11. Piping shall not be pneumatic pressure tested at minimum metal temperature 0℃ and below tempera ture. Surface of pipe will be measured by temperature gun.

6.1.12. Test equipment

DB HOLDINGS shall be supply all materials and equipment for the test.
The Pneumatic test shall employ two (2) pressure gauges calibrated by Dead Weight Tester, one (1) pressure recorder (chart type) and one (1) temperature recorder (chart type). Alternatively a dual pen chart recorder for pressure and temperature may be used.

A. Pressure gauges and recorders used in the tests shall be dead weight calibrated (full scale) and calibrated every six (6) months frequency. Calibration certificates shall be provided to CLIENT Inspectors.

B. Materials, equipment or components damaged during tests shall be replaced.

C. Packing shall be replaced in equipment, such as valves, if leaks cannot be stopped by normal tightening of the packing glands.

D. Dial pressure gauges shall have a range approximately twice the intended maximum test pressure but not less 1.5 times and not more than 3 times and shall be graduated.

E. Two pressure gauges, one each as closely as possible to the high point and the low point of the system shall be installed in the test loop. Hydrostatic head on the gauge shall be taken into account, depending on location of the gauge. Test pressure shall be as read from the highest gauge on the test system.

6.1.13. Pneumatic test pressure shall be maintained for a maximum of 1 hour or CLIENT Specification after stabili zation of pressure and temperature. Perform a visual inspection of all joints and connections at internal test design gauge pressure using leak detection fluid during pressure tests all joints including welds will be visually inspected for leaks and left un-insulated and exposed for examination as per applicable standards.

6.1.14. Pneumatic test pressure test data shall be recorded. As a minimum, test records shall include the following information:
- Test Loop Number
- Test date
- Test type
- Test duration
- Design pressure and temperature
- Test pressure and temperature
- Test medium
- Test Result
- Remarks concerning defects
- CLIENT approval signatures
- Chart recorder number
- Pressure gauge number

6.1.15. Instrument take-off piping shall be tested to the outlet side of the piping block-valve with the connected piping. The piping block valve shall be fitted with a blind or plug, as required.

6.1.16. Systems with test pressures greater than or equal to 50 barg shall be pressurized in stages of 50 barg incre ments up to test pressure. At each increment stage the pressure shall be held and rested for five (5) minutes, during which time the system shall be checked for leaks. In the event of a leak the system shall be completely depressurized and the joint tightened. Under no circumstances shall the joint be tightened whilst the system is under pressure. The test period shall commence once the system test pressure has reached.

6.1.17. The test pump or compressor shall be physically disconnected from the system after pressuring the system and during the pressure test inspection period.

6-2. Test Medium

The test medium shall be clean compressed air or dry nitrogen as test medium. The test medium for instrument, service air shall be dry unless otherwise specified and dew point – 20℃ above.

6-3. Post Test Requirements and Lay up

After testing, the system shall be returned to operational condition and verified by CLIENT inspector in accordance with the following:

6.3.1. Temporary blanks and blinds shall be removed, operating blinds shall be returned to proper position and all lines and piping components shall be completely drained.

6.3.2. All vents of lines being drained shall be open.

6.3.3. Piping systems downstream of check valves shall be inspected to ensure complete drainage.

6.3.4. The system shall be purged and dried with compressed air or nitrogen.

6.3.5. Valves, orifice plates, expansion joints and short pieces of piping which have been removed shall be reinstalled with correct gaskets in place.

6.3.6. Skillets shall be removed and flanges tightened to the satisfaction of CLIENT inspector. The inspector may require a leak test for the flange.

6.3.7. The inspector may require, at his discretion, a leak test for the reassembled piping.

6.3.8. Flanges and/or weld caps welded at the end of a pipe to facilitate hydrotesting shall be removed after the test is completed and the pipe end shall be beveled in accordance with ASME B31.3.

6.3.9. Direct connected transmitters at orifice flanges shall be disconnected when replacing orifice plate to avoid distorting the connections.

6.3.10. After lines have been pressure vented, temporary supports shall be removed and insulation and painting completed.

6.3.11. Flanged joints at which test blinds have been removed shall be leak tested.

6.3.12. Special length bolting and gaskets shall be removed and replaced with line class bolts and gaskets.

6.3.13. Instruments which were removed or blocked out for test shall be reinstalled and blocks placed in the normal operating position.

6.3.14. Acceptance of Testing

CLIENT inspector shall review and comment on the Pneumatic pressure test based on the following criteria:

A. Test was carried out in accordance with CLIENT requirements.
B. The system was free of leaks, seeps and other abnormalities by visual inspection while under pressure.
C. The system maintained test pressure for one (1) hour or CLIENT specification. This shall be witnessed by CLIENT inspector and verified by the pressure recorder and temperature recorder charts. The charts shall include the date and time of the test, as well as CLIENT inspector's and DB HOLDINGS representative's signatures.

6-4. Repair and Retesting

6.4.1. When leaks are identified, the pressure shall be slowly reduced and removed before flange bolts are torqued to stop the leak. Where leak cannot be stopped, inspection for evidence of other problems shall be carried out, which may require depressurizing. After depressurization the leaking flanges will be reassembled with new gaskets. In no circumstances shall leaking flanges or other connections be tightened whilst the system is under pressure.

6.4.2. If repairs or additions are made following the pressure test, the affected piping shall be retested, except that for minor repairs or additions CLIENT may waive retest requirements when precautionary measures are taken to assure sound construction.

07 Safety Measures

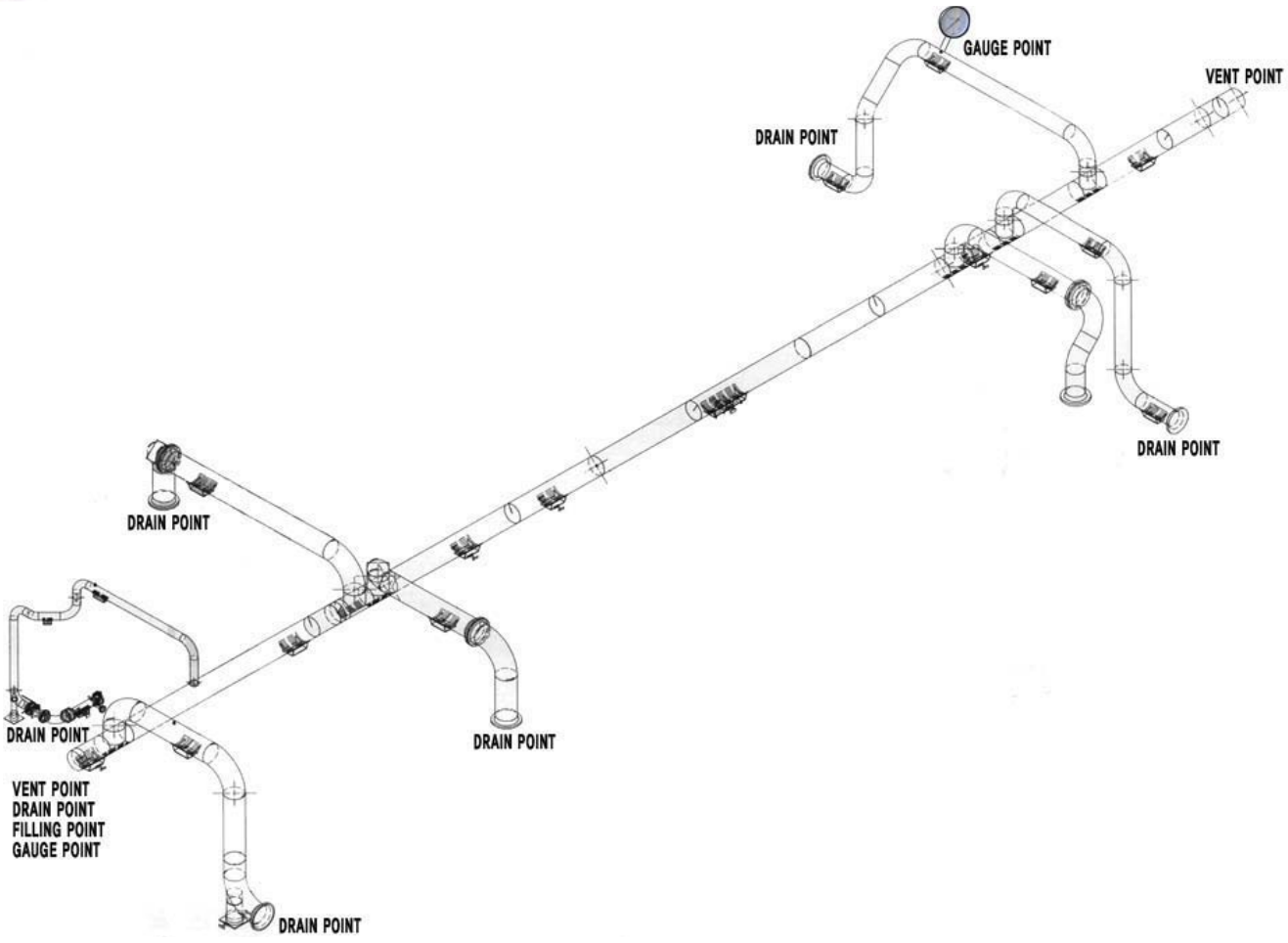
7.1 General safety requirements shall comply with CLIENT safety procedure

7.2 All pressure testing operations shall be conducted by observing and adhering to stringent safety precautions. Special care shall be taken during pressure tests involving high pressures for high-pressure systems. 'High pressures' in the context of this procedure refer to test pressures greater than or equal to 50 barg.

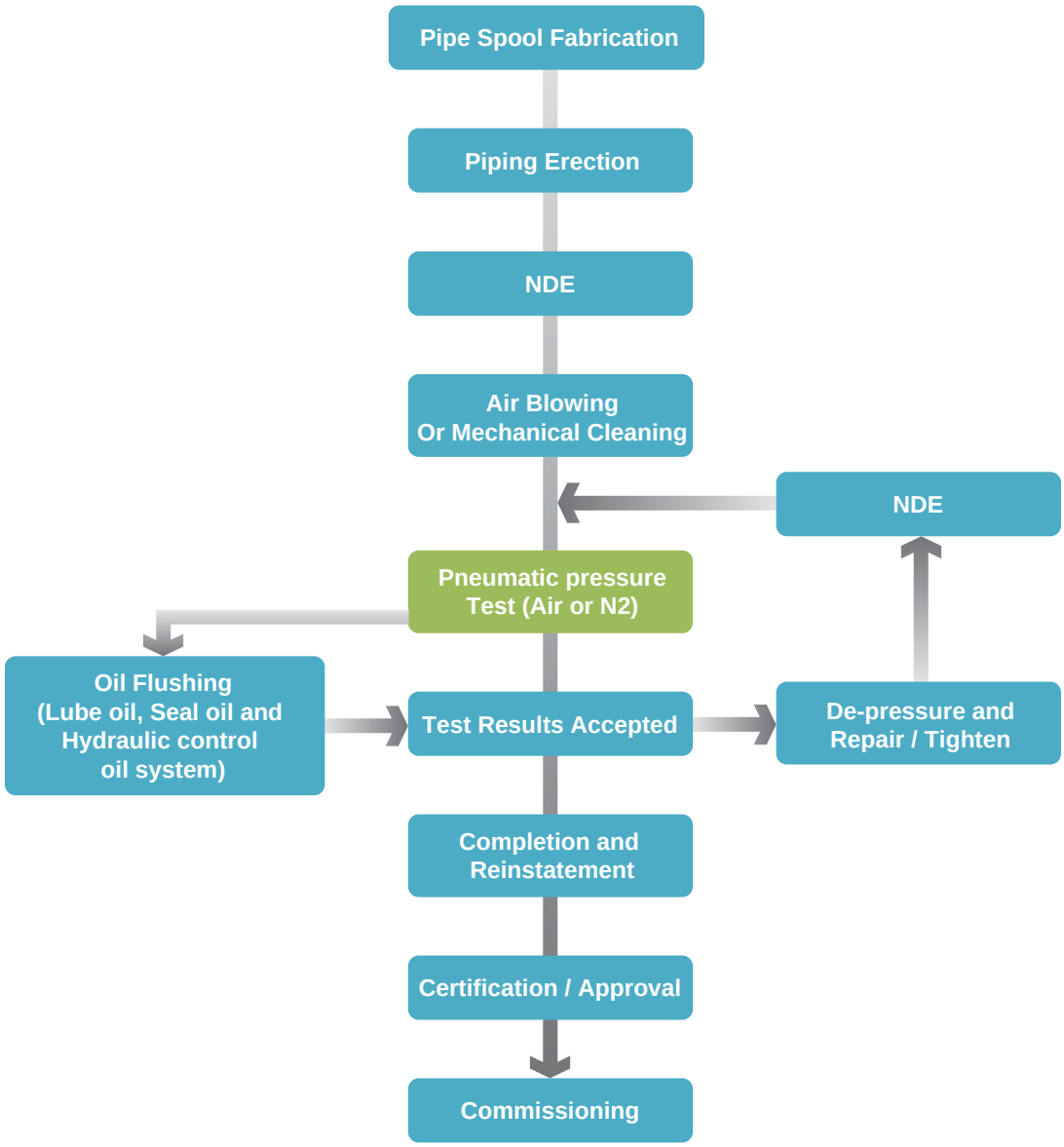
7.3 Access to test areas shall be restricted to personnel absolutely required to conduct the tests. Proper warning indications such as warning flag or signboard shall be placed around test areas and all access points to the Pneumatic pressure test area before commencement of test.

7.4 No test shall be conducted until CLIENT Inspector verifies that all safety requirements are satisfactory.

08 Test Pack Sample



09 Process Flow Chart for Air Blowing & Pneumatic Pressure Testing



10 Pressure Test Symbols

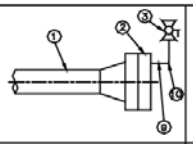
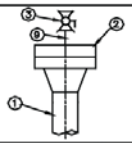
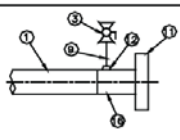
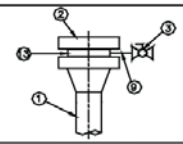
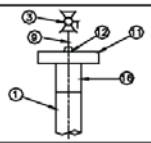
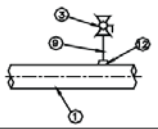
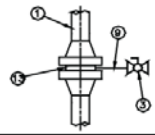
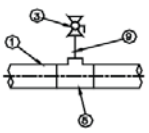
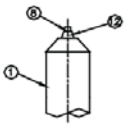
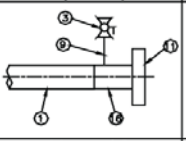
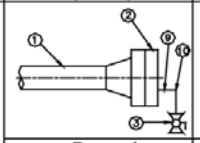
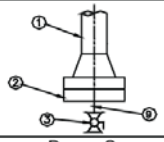
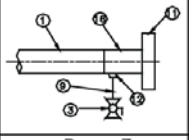
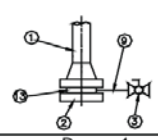
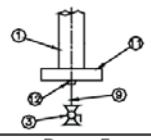
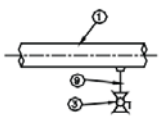
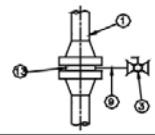
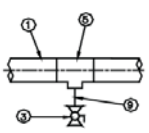
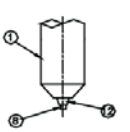
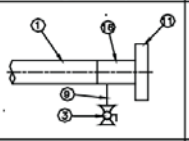
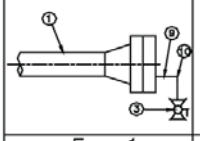
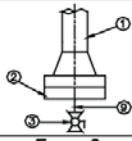
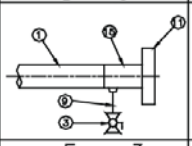
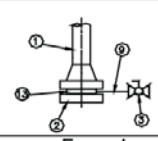
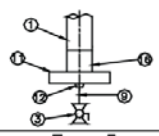
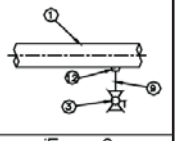
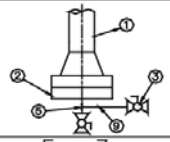
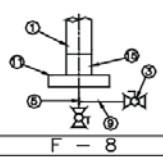
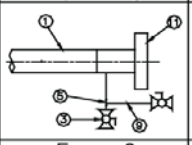
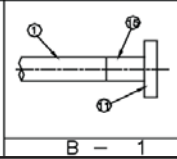
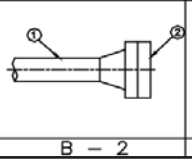
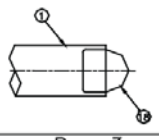
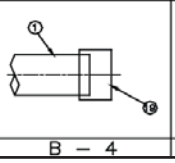
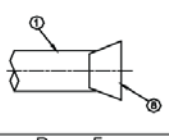
ITEMS

1. PIPE TO BE TESTED
2. BLIND FLANGE
3. GLOBE, BALL, GATE VALVE
4. UNION
5. TEE
6. HALF COUPLING
7. SWAGE
8. PLUG
9. NIPPLE
10. ELBOW
11. BLIND PLATE
12. O-LET, BOSS
13. BLEED RING
14. SPECTACLE PLATE
15. REDUCER
16. SHORT PIPE
17. HUB, COUPLING
18. GRIP LOCK PIPE PLUG
19. CAP

ABBREVIATION

- (ED) EXCLUDE DISK
- (EF) EXCLUDE FILTER
- (EP) EXCLUDE PLATE
- (FP) FILLING POINT
- (IB) INSTALL BYPASS LINE
- (RC) REMOVE DURING CLEANING
- (RT) REMOVE DURING TEST
- (TB) BLIND POINT
- (TD) DRAIN POINT
- (TV) VENT POINT
- (TFD) FILLING AND DRAIN
- (TFV) FILLING AND VENT
- (TG) PRESSURE GAUGE
- (TRG) TEST RECORDING GAUGE
- (TT) TEMPERATURE INDICATOR
- (VC) VALVE CLOSE DURING TEST
- (VO) VALVE OPEN DURING TEST
- (VI) VISUAL INSPECTION
- (1FP) 1ST FILLING POINT
- (2FP) 2ND FILLING POINT FOR DIFFERENTIAL POINT
- (DP) DUMMY SPOOL
- TEST PACKAGE LIMIT

PRESSURE TEST SYMBOL TABLE

VENT	 V – 1	 V – 2	 V – 3	 V – 4	 V – 5	 V – 6
	 V – 7	 V – 8	 V – 9	 V – 10	RELEASE BOLT & THREAD FOR VENT V – 11	
DRAIN	 D – 1	 D – 2	 D – 3	 D – 4	 D – 5	 D – 6
	 D – 7	 D – 8	 D – 9	 D – 10	RELEASE BOLT & THREAD FOR VENT D – 11	
FILLING	 F – 1	 F – 2	 F – 3	 F – 4	 F – 5	 F – 6
	 F – 7	 F – 8	 F – 9			
BLIND	 B – 1	 B – 2	 B – 3	 B – 4	 B – 5	

01 INTRODUCTION

1-1. This document specifies procedure and general methodology to be adopted for Pressure testing piping systems at CLIENT yard.

02 PURPOSE/OBJECTIVE

This document is prepared to achieve following objectives:

2-1. To specify pressure testing- requirements, application and methodology.
2-2. To ensure that CLIENT requirements are met.
2-3. To specify scope of piping and piping items to be pressure tested.
2-4. To prepare pressure testing documentation for CLIENT approval.

03 SCOPE

Scope of this procedure includes the following, related to pipe pressure testing, prior to Commissioning for CLIENT scope of piping:

3-1. Preparation for pressure testing.
3-2. Pressure testing requirements for Hydrotesting
3-3. Post test requirements.
3-4. Repair and Re-testing.
3-5. Safety measures during pressure testing.
3-6. Preparation of pressure test packages and documentation.

04 REFERENCES

The latest edition of the following codes and standards need to be referred, as applicable to pressure testing.

4-1. CODE / STANDARDS

ASME B16.5 : Pipe Flanges and Flanged Fittings, NPS 1/2 in. through NPS 24 in.
ASME B31.1 : Power Piping
ASME B31.3 : Process Piping & Drilling Piping
ASME B31.4 : Liquid Transportation systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols
ASME B31.8 : Gas Transmission and Distribution Piping Systems
API 6A : Specification for Wellhead and Christmas Tree Equipment

4-2. SPECIFICATION

CLIENT Specification

05 HYDRO PRESSURE TESTING PROCEDURE

5-1. Preparation for Pressure Testing

5.1.1. Prior to any testing, DB HOLDINGS shall provide a written test procedure to CLIENT for review and comment. This procedure shall include the following information as a minimum:

1) Drawings shall show the location of all skillets, blind flanges, and check valves with flappers removed and other modifications to the system for the test.
2) Test pressure for each system shall be clearly indicated on the drawings.
3) Listing of systems to be tested shall include test pressure.
4) The location and routing of all jump-over connections.



5.1.2. Pressure test packs shall be submitted for CLIENT information to pressure test.

5.1.3. Documentations to be prepared before Pressure Testing as follows;
1) Weld Record (CLIENT system)
2) Piping Installation Check Sheet
3) Piping Cleaning Record
4) Current calibration certificates for all test gauges and chart recorders must be sighted and accepted by DB HOLDINGS and "CLIENT" Inspector

5.1.4. Pressure testing shall not commence until completion and acceptance of system flushing.(before and after case by case)

5.1.5. The following inline items shall not be subjected to field pressure testing and shall be either blanked off or replaced by dummy spool for testing. Unless specifically identified in this procedure or the referenced procedures listed under Section 4 above, all inline items and valves shall remain in place for the duration of the pressure test.

a. Control valves
b. Positive displacement meters
c. Turbine meters
d. Rotameters
e. Pressure Relieving Devices (Rupture discs, Relief & Safety valves)
f. Orifice plates
g. Venturi tubes
h. Flame Arrestors
i. Check Valve Disc or Check Valve.
(Any valve flapper that is removed shall be secured to or near the valve during the test. Flapper replacement shall be verified by CLIENT inspector in writing. Alternatively, in the case of check valves, pressure equalizing "jump-over" connections may be installed. The location and routing of all such jump-over connections shall be indicated on the drawings submitted in the test pack)
j. Temporary suction strainer (Basket strainers shall be installed with the basket or filter elements removed)
k. Locally mounted pressure gauges
l. Equipment like pumps, compressors or rotating machinery shall not be included within hydrotest limits and must be physically isolated.
m. Vessels / Tanks having test pressure less than the piping system test pressure shall not be tested along with piping system. If hydrostatic head on a vessel may cause pressures that would damage other equipment in the system being tested, the vessel shall be blinded off from the system.
n. Fire water nozzles and sprinkler heads.
o. Any other equipment designated by CLIENT.
p. Safety valves & pressure transmitters.

5.1.6. Temporary supports shall be installed as necessary to prevent sagging or excessive stress on the piping system. Special consideration shall be given to supporting partially liquid packed or gas piping systems and systems having spring / counterweight supports expansion joints or loops.

5.1.7. All ball valves & XV valves to be half opened during hydrotest. In the case of actuated valves where the ball cannot be partially opened Contractor shall hydrotest through the valve in the fully opened position. Care shall be taken when holding actuated valves in the open position (applicable only to fail closed valves) – as unexpected closing of the valve during pressure test because of loss of air/hydraulic pressure on the actuator can be extremely hazardous. Under no circumstances shall pressure testing be carried out against a closed valve. All pressure testing shall be against plugged, blinded, or spaded connections.

5.1.8. The spring hangers shall be in temporarily locked position to sustain weight of test liquid, during the pressure test.(According to vendor recommendation)

5-2. Pressure Testing Requirements

5.2.1. Upon completion of fabrication and inspection (NDE and Flushing), CLIENT piping systems listed items shall be pressure tested in accordance with applicable sections of ASME B31.3 & classification rules to verify piping systems prior to commissioning.

5.2.2. Pressure testing shall not be allowed during rain unless entire piping system under test is protected from weather and piping shall be kept dry to permit visual detection of leaks. Pressure testing shall not be carried out when the ambient temperature is less than 0°C (32°F).

5.2.3. Hydrotest pressure shall be 1.5 times of the design pressure as indicated in CLIENT line list unless noted other wise and shall not exceed 90% of the specified minimum yield strength of the tested piping. Piping shall be tested in accordance with the test isometric drawings or P&ID.

5.2.4. Hydrotest fluid shall be fresh water and in case of testing in offshore, corrosion inhibitor is required. Pressure test fluid shall not contain suspended solids that may possibly plug orifices or small lines. The chloride ion content of water for hydrotesting austenitic or duplex stainless steel piping systems and equipment shall not exceed 50 PPM. Test medium can be transferred from one system to another for test purposes provided that the medium has not become contaminated.

5.2.5. Test fluid shall be filled in lowest part of the piping system as possible. Air shall be bled-off at the highest point through an open valve or loose flange. Gas or air entrapment in piping under test must be minimized to prevent damage to piping or personnel in the event of unexpected failure and to reduce the possibility of pressure fluctuations during testing.

5.2.6. Expansion joints shall be pressure tested along with piping system to check the restraining devices, only when test pressure is not higher than shop test pressure. At no time shall the presence of expansion joint dictate test pressure to be below required pressure. In such cases, expansion joints will be removed.

5.2.7. A pressure gauge shall be provided at pump discharge to check appropriate test pressure of the system and avoid over pressurizing. The pump shall be maintained constantly during pressurizing by an authorized operator. Additionally a pressure gauge will be placed at the system high point vent to ensure adequate pressure throughout the system.

5.2.8. All vents and other connection which serve as vents shall be open during filling to ensure proper venting of all air or gases.

5.2.9. Until completion of pressure testing, all piping joints (including flanged, threaded or welded) shall be left un-insulated.

5.2.10. Appropriate pressure rated blinds shall be used to separate test systems.

5.2.11. Vents required only for hydro testing can be installed without a valve and capped with a blind flange or 316 SS Hex head plug as permitted by the applicable piping materials class.

5.2.12. The temperature of the hydro-test fluid shall not be less than 0°C (32°F). If freezing is a possibility during testing, the test medium shall include glycol or methanol in sufficient concentration to eliminate the possibility of freezing. No residue shall remain after testing.





5.2.13. Test equipment

DB holdings shall supply all materials and equipment for the test.
The hydrotest shall employ two (2) pressure gauges calibrated by Dead Weight Tester, one (1) pressure recorder (chart type) and one (1) temperature recorder (chart type). Alternatively a dual pen chart recorder for pressure and temperature may be used.

A. Pressure gauges and recorders used in the tests shall be dead weight calibrated (full scale) and calibrated every six (6) months frequency. Calibration certificates shall be provided to CLIENT Inspectors.

B. Materials, equipment or components damaged during tests shall be replaced.

C. Packing shall be replaced in equipment, such as valves, if leaks cannot be stopped by normal tightening of the packing glands.

D. Dial pressure gauges shall have a range approximately twice the intended maximum test pressure but not less 1.5 times and not more than 3 times and shall be graduated.

E. Two pressure gauges, one each as closely as possible to high point and low point of the system shall be installed in the test loop. Hydrostatic head on the gauge shall be taken into account, depending on location of the gauge. Test pressure shall be as read from the highest gauge on the test system.

5.2.14. Pressure shall be maintained for a maximum of 2 hour or CLIENT Specification after stabilization of pressure and temperature. During pressure tests all joints including welds will be visually inspected for leaks and left un-insulated and exposed for examination as per applicable standards.

5.2.15. Pressure test data shall be recorded. As a minimum, test records shall include the following information:



- Test Loop Number
- Test date
- Test type
- Test duration
- Design pressure and temperature
- Test pressure and temperature
- Test medium
- Test Result
- Remarks concerning defects
- CLIENT approval signatures
- Chart recorder number
- Pressure gauge number

5.2.16. Instrument take-off piping shall be tested to the outlet side of the piping block-valve with the connected piping. The piping block valve shall be fitted with a blind or plug, as required.

5.2.17. Systems with test pressures greater than or equal to 100 barg shall be pressurized in stages of 100 barg increments up to the test pressure. At each increment stage the pressure shall be held and rested for five (5) minutes, during which time the system shall be checked for leaks. In the event of a leak the system shall be completely depressurized and the joint tightened. Under no circumstances shall the joint be tightened whilst the system is under pressure. The test period shall commence once the system test pressure has reached.

5.2.18. Large diameter lines that are grouped together on common supports shall not be simultaneously hydrotested in case supports get overstressed.

5.2.19. The test pump shall be physically disconnected from the system after pressuring the system and during the pressure test inspection period.

5.2.20. GRE piping systems test procedure as below or CLIENT Specification

1) GRE piping shall be pressurized directly to 100% of design pressure, held for five (5) minutes.
2) The pressure/de-pressure cycle shall be carried out two (2) consecutive times. There shall be no rest between total de-pressure and the start of the next cycle.
3) After completion of the fourth de-pressurization the GRE system shall be pressurized up to the test pressure and held for the duration of the test.
4) The test time shall commence once test pressure has been reached.
5) In the event of any leaks, the system shall be completely de-pressured, the leak tightened, and the test reset and restarted from zero cycles.
6) In the event of failure the test shall immediately be stopped. The failure shall be repaired and inspected and a new test rescheduled.

Due to the fragile nature of GRE material and the likelihood of catastrophic failure, great care shall be taken whilst the pressurization and testing are in progress.

1) Access to the testing area shall be restricted to only those personnel directly involved in the test activities.
2) Extensive signage and barriers shall be erected to prevent the entry of non- critical personnel into the test area.
3) Inspection and acceptance of the signage and barriers by CLIENT Inspectors shall be carried out before the test shall be commenced.
4) During pressure cycling and pressure testing personnel shall stand well clear of all GRE pipe joints.
5) In no circumstances shall pressurized GRE piping be tapped, hit, moved or otherwise touched.

5-3. Test Medium

5.3.1. The test medium shall be fresh water with a maximum Chloride contents of 50 mg/l. Corrosion inhibitor is not required for hydrotesting carried out in Contractor's yard using fresh water. Corrosion inhibitor shall be used for all hydrotesting carried out offshore.

5.3.2. The test medium shall be analyzed before use and the results reviewed and commented by DB HOLDINGS and CLIENT.

5.3.3. The water used for hydrotest shall be clean and free of contaminants such as silt, sand and rust and may require chemical treatment to inhibit bacterial growth and/or prevent freezing.

5.3.4. If freezing is a possibility during testing, the testing medium shall include glycol or methanol in sufficient concentration to eliminate the possibility of freezing. No residue shall remain after testing. CLIENT shall take into consideration the ductile to brittle transition temperature (DBTT) of the piping material and shall exercise appropriate precautions to promote personnel safety and minimize the risk of damage to piping and equipment.

5.3.5. Water used for austenitic stainless steel or duplex shall have less than 50 PPM chloride ion content.

5-4. Post Test Requirements and Lay up

After testing, the system shall be returned to operational condition and verified by DB HOLDINGS and CLIENT inspector in accordance with the following:

5.4.1. Temporary blanks and blinds shall be removed, operating blinds shall be returned to proper positions and all lines and piping components shall be completely drained.

5.4.2. All vents of lines being drained shall be open.

5.4.3. Piping systems downstream of check valves shall be inspected to ensure complete drainage.

5.4.4. The system shall be purged and dried with compressed air or nitrogen.

5.4.5. Drain and vent valves shall be operated several times during purging to remove the maximum amount of water.

5.4.6. Valves, orifice plates, expansion joints and short pieces of piping which have been removed shall be reinstalled with correct gaskets in place.

5.4.7. Skillets shall be removed and flanges tightened to the satisfaction of "COMPANY" and CLIENT inspector. The inspector may require a leak test for the flange.

5.4.8. Check valve flappers removed for the test shall be reinstalled to the satisfaction of DB HOLDINGS and CLIENT inspector.

5.4.9. The inspector may require, at his discretion, a leak test for the reassembled piping.

5.4.10. Flanges and/or weld caps welded at the end of a pipe to facilitate hydrotesting shall be removed after the test is completed and the pipe end shall be beveled in accordance with ASME B31.3.

5.4.11. Direct connected transmitters at orifice flanges shall be disconnected when replacing orifice plate to avoid distorting the connections.

5.4.12.After lines have been drained, temporary supports shall be removed and insulation and painting completed.

5.4.13. Spring hangers provided with stops to carry the test load shall have these stops removed after installation.

5.4.14. Flanged joints at which test blinds have been removed shall be leak tested.

5.4.15. Special length bolting and gaskets shall be removed and replaced with line class bolts and gaskets.

5.4.16. Instruments which were removed or blocked out for test shall be reinstalled and blocks placed in the normal operating position.

5.4.17. Acceptance of Testing

DB HOLDINGS and CLIENT inspector shall review and comment on the pressure test based on the following criteria:

1) Test was carried out in accordance with CLIENT requirements.
2) The system was free of leaks, seeps and other abnormalities by visual inspection while under pressure.
3) The system maintained test pressure for two (2) hours or "CLIENT" Specification. This shall be witnessed by DB HOLDINGS and "CLIENT" inspector and verified by the pressure recorder and temperature recorder charts. The charts shall include the date and time of the test, as well as DB HOLDINGS inspector's and "CLIENT" representative's signatures.

5-5. Repair and Retesting

5.5.1. When leaks are identified, the pressure shall be reduced and removed before flange bolts are torqued to stop the leak. Where leak cannot be stopped, inspection for evidence of other problems shall be carried out, which may require depressurizing. After depressurization the leaking flanges will be reassembled with new gaskets. In no circumstances shall leaking flanges or other connections be tightened whilst the system is under pressure.

5.5.2. If repairs or additions are made following the pressure test, the affected piping shall be retested, except that for minor repairs or additions CLIENT may waive retest requirements when precautionary measures are taken to assure sound construction.

06 Safety Measures

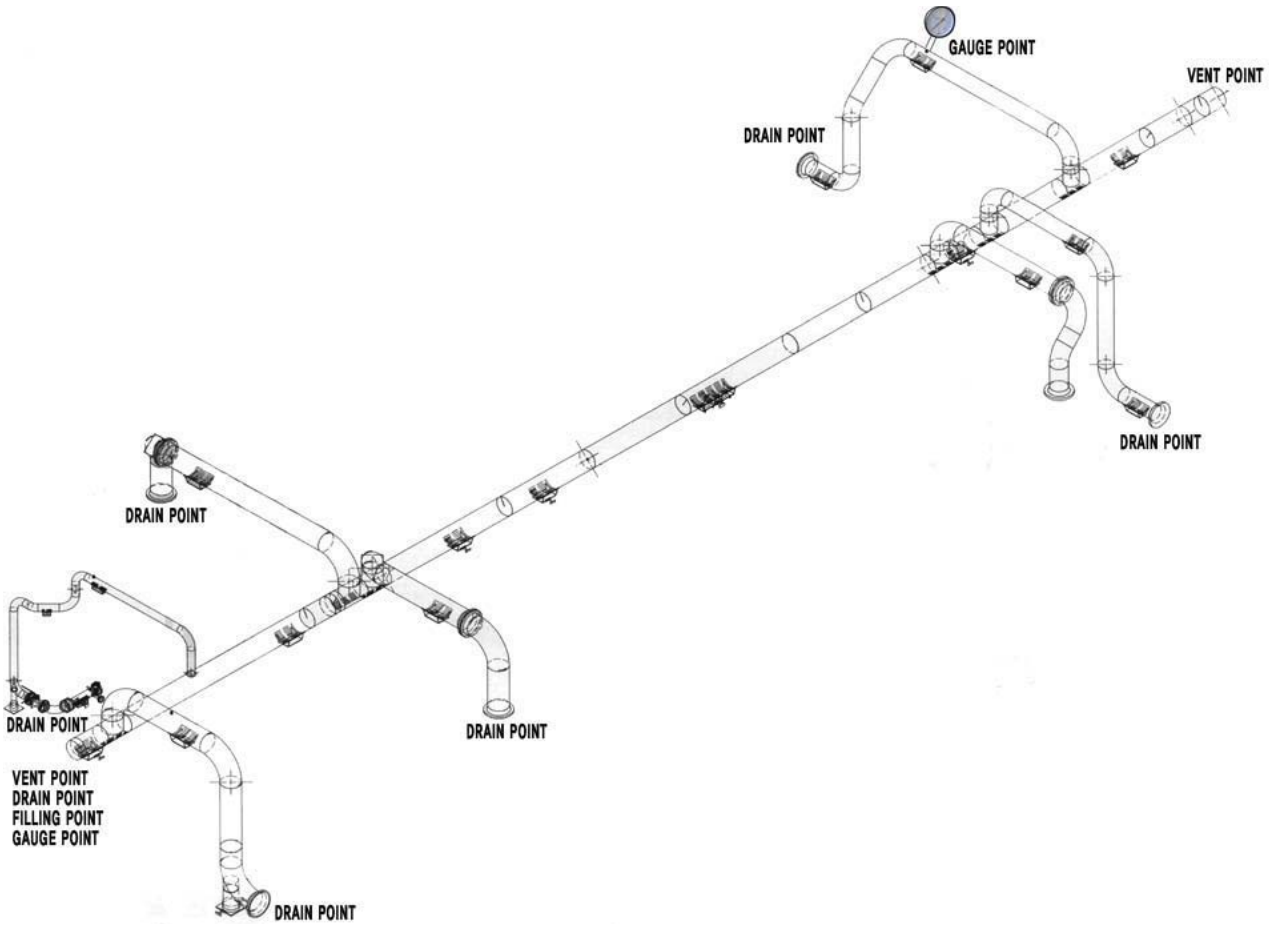
6-1. General safety requirements shall comply with CLIENT safety procedure

6-2. All pressure testing operations shall be conducted by observing and adhering to stringent safety precautions. Special care shall be taken during pressure tests involving high pressures for high-pressure systems. 'High pressures' in the context of this procedure refers to test pressures greater than or equal to 300 barg.

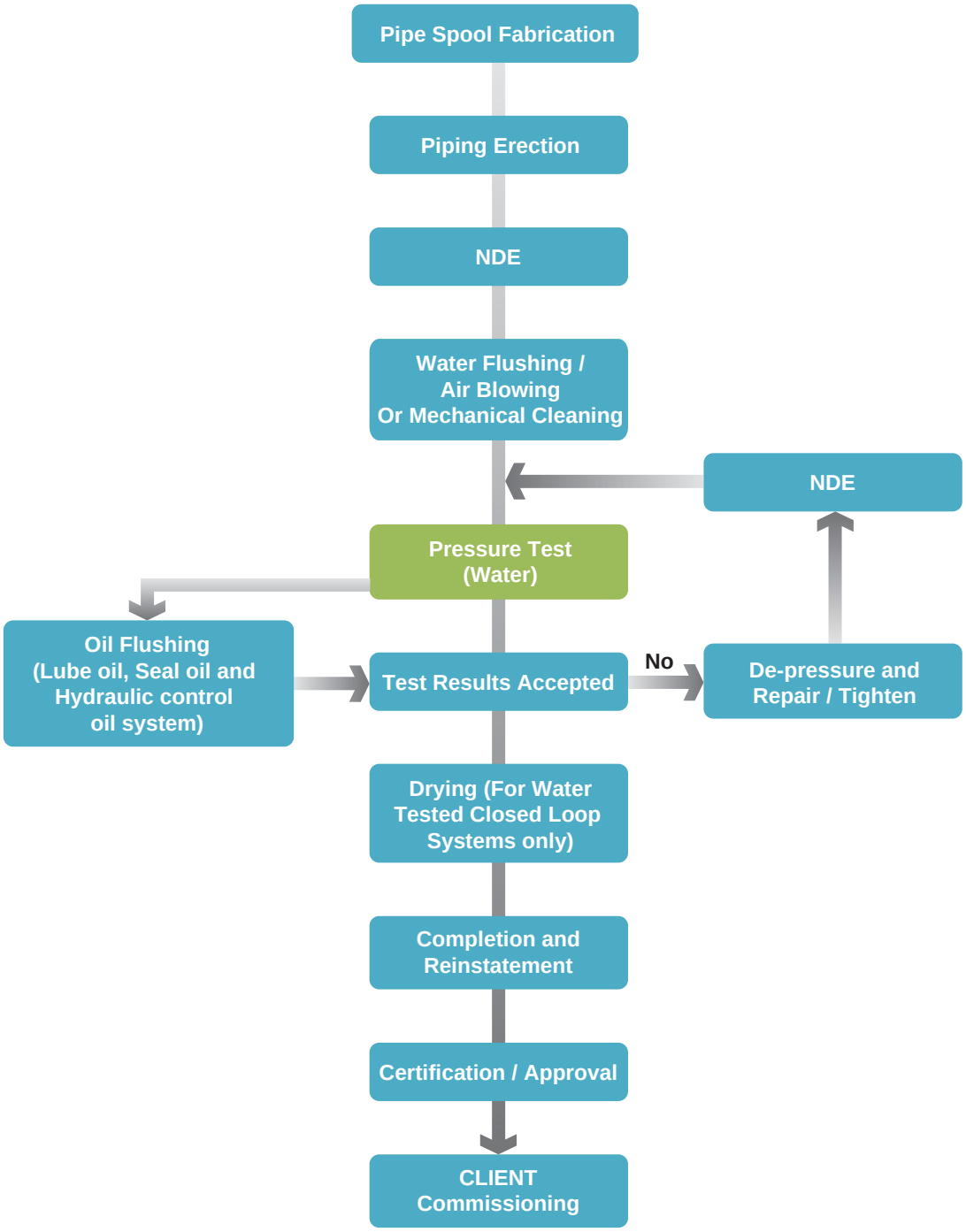
6-3. Access to test areas shall be restricted to personnel absolutely required to conduct the tests. Proper warning indication such as warning flag or signboard shall be placed around test areas and all access points to the hydrotest area before commencement of test.

6-4. No test shall be conducted until CLIENT Inspector verifies that all safety requirements are satisfactory.

07 Test Pack Sample



08 Process Flow Chart for Flushing & Pressure Testing



10 Pressure Test Symbols

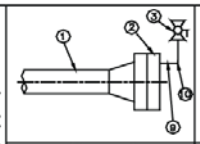
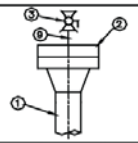
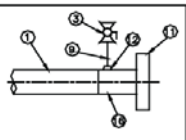
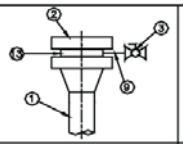
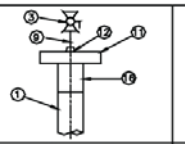
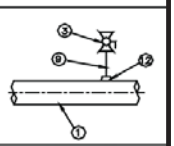
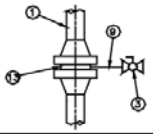
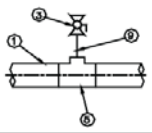
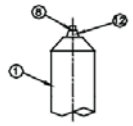
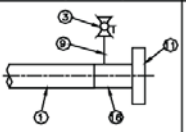
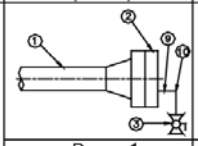
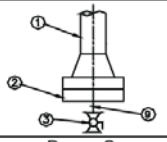
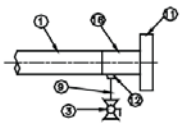
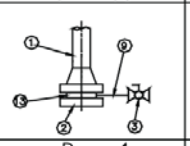
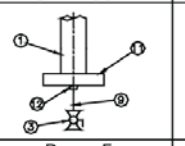
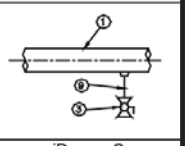
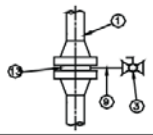
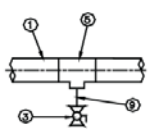
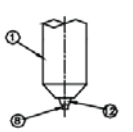
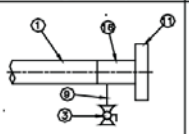
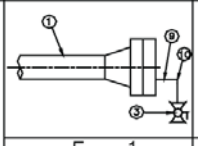
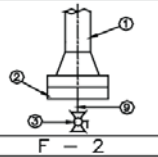
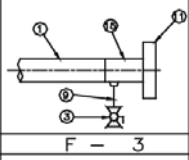
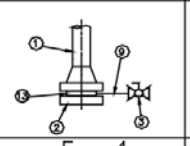
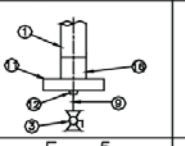
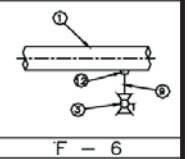
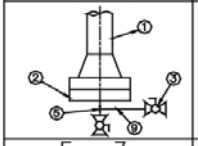
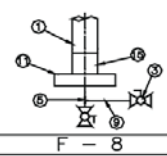
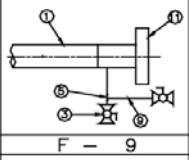
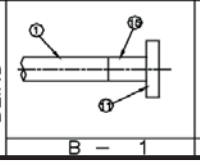
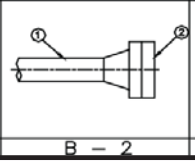
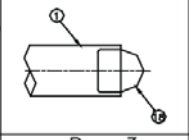
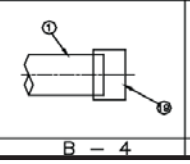
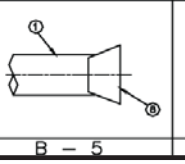
ITEMS

1. PIPE TO BE TESTED
2. BLIND FLANGE
3. GLOBE, BALL, GATE VALVE
4. UNION
5. TEE
6. HALF COUPLING
7. SWAGE
8. PLUG
9. NIPPLE
10. ELBOW
11. BLIND PLATE
12. O-LET, BOSS
13. BLEED RING
14. SPECTACLE PLATE
15. REDUCER
16. SHORT PIPE
17. HUB, COUPLING
18. GRIP LOCK PIPE PLUG
19. CAP

ABBREVIATION

- (ED) EXCLUDE DISK
- (EF) EXCLUDE FILTER
- (EP) EXCLUDE PLATE
- (FP) FILLING POINT
- (IB) INSTALL BYPASS LINE
- (RC) REMOVE DURING CLEANING
- (RT) REMOVE DURING TEST
- (TB) BLIND POINT
- (TD) DRAIN POINT
- (TV) VENT POINT
- (TFD) FILLING AND DRAIN
- (TFV) FILLING AND VENT
- (TG) PRESSURE GAUGE
- (TRG) TEST RECORDING GAUGE
- (TT) TEMPERATURE INDICATOR
- (VC) VALVE CLOSE DURING TEST
- (VO) VALVE OPEN DURING TEST
- (VI) VISUAL INSPECTION
- (1FP) 1ST FILLING POINT
- (2FP) 2ND FILLING POINT FOR DIFFERENTIAL POINT
- (DP) DUMMY SPOOL
- TEST PACKAGE LIMIT

PRESSURE TEST SYMBOL TABLE

VENT	 V – 1	 V – 2	 V – 3	 V – 4	 V – 5	 V – 6
	 V – 7	 V – 8	 V – 9	 V – 10	RELEASE BOLT & THREAD FOR VENT V – 11	
DRAIN	 D – 1	 D – 2	 D – 3	 D – 4	 D – 5	 D – 6
	 D – 7	 D – 8	 D – 9	 D – 10	RELEASE BOLT & THREAD FOR VENT D – 11	
FILLING	 F – 1	 F – 2	 F – 3	 F – 4	 F – 5	 F – 6
	 F – 7	 F – 8	 F – 9			
BLIND	 B – 1	 B – 2	 B – 3	 B – 4	 B – 5	



PETROSERV GVA 7500
SEMI 3024

01 SCOPE

This procedure is prepared to explain general methodology to be adopted for sensitive Leak Test. This procedure is applicable for main process (Hydrocarbon) and Flare systems which are agreed between COMPANY and CONTRACTOR after the required hydrostatic test and pneumatic tests are performed, where applicable.
Leak check will be done to ensure integrity of the complete piping installation, after hydrotesting.
The following joints are covered under this procedure;

1) Flanged joints.
2) Control valve, Flowmeter, Strainer and Safety valve flange joints.
3) Equipment nozzle, Flange joints, valve bonnets & covers, vessel manways which are disassembled for the hydro-test. Joints mentioned above which are not disassembled for the hydro-test will be also covered. Special equipment such as compressor, cargo pumps and etc. will be isolated for leak testing. This will be represented on Test Mark-up P&ID.

02 REFERENCE DOCUMENTS

2-1. Project Specification which is relevant to leak test

2-2. ASME B31.3, Process Piping

03 SAFETY CONTROL

All leak testing activities shall be controlled by the 'Company Permit to Work' System.
Particular precautions shall be as follows:

3-1. Except the related operators and inspectors for leak testing, all other workers shall be separated from the area being tested for safety and security. Proper warning indication such as warning flag or warning board shall be prepared and placed around the test area. Stringent safety precautions are to be observed and adhered to no unauthorized person to be allowed in the vicinity of testing area at any stage during the test.

3-2. No test will be done until authorized person and company's inspector verify that safety requirements are satisfactory.



04 Leak Test Package Constitution

Leak test package will be prepared as part of this procedure separately later on and will be submitted for approval. The leak test package will be indicated and marked upon the P&IDs with necessary instructions, therein.

- System to be pressurized is to be marked with triangle flag clarifying the Test Package Limit.
- Valves to be opened during testing, if necessary, will be marked on Test Package.
- Filling points are to be marked on Test Package.
- All primary and secondary isolation valves will be marked on Test Package.
- All secondary leak points will be marked on Test Package.
- Any appropriate pressure gauge on the system line can be used for reading the system pressure during the leak testing.
- All connection points for pressure gauges or transmitters fitted by leak testing contractor will be marked on Test Package.
- All witness joints that result from the test will be shown on Test Package.
- Pressure recorder is used for Test Package pressure recording.









4-1. Test Fluid

Air or inert gas mixture (99% nitrogen and 1% helium) will be used as a test medium for leak test of pressurized systems. System pressure for leak test shall be 100% normal operating pressure or 90% of PSV set pressure, whichever is lesser.

4-2. Test Preparation

The test shall be performed only after completion of all hooks-up, hydrotest, drying/air blowing of the piping system.

- Following steps shall be followed before pressurization.
- Ensure safety related process is completed.
- Ensure all spectacle blinds are installed as per P&ID. If necessary, the valve located at the end of test package can be used instead of spectacle blinds.
- Ensure all instruments are installed as per P&ID.
- Ensure all control valves and safety valves, if any, are installed.
- Ensure all valves including control valves, shut down valves are in open/close position as indicated in the test package.
- Ensure all valves including isolation valves, vent valves, drain valves are closed as.
- All flanged connections shall be masked with tape and a small pinhole punched in the tape to facilitate the identification of leaks.

4-3. System Pressurization

System shall be pressurized with Air or Inert gas mixture (99% Nitrogen and 1% Helium) up to the test pressure as applicable for individual test packages. If any gross leaks are detected pressurization will be stopped, vented to atmosphere, and leak will be repaired and system will be pressurized again.

- Under no circumstances shall any attempt be made to repair a leak under pressure without first depressurizing the test package.
- Each test package will be kept pressurized after pressure stabilization. Pressure will be monitored through pressure indications provided on the system.
- After the system has withstood the pressure, the system shall be checked for leaks by pouring soap solution on the tape over joints or helium detector.
- All piping flanges, control valves, PSVs, check valve bonnets and instruments connections shall be checked for leakage.

Pressure Leak Test / N2 + Helium

4-4. Completion of Leak Test

- System shall remain kept pressurized to allow for examination of joints and flanges.
- Acceptance criteria to be applied in the assessment of leaks are below 50 scf/yr or Company specification. If leak is detected to the extent of above 120 scf/yr, mandatory repair should be done.
- All joints failing quality, to be de-pressurized, repaired and tightened, then the test shall be re-performed to satisfaction.
- Gaskets on all joints disturbed during the leak test shall not be used. New gaskets shall be used, and nuts / bolts shall be replaced if their threads get damaged.
- Seal rings of gasket such as RTJ rings and Graylocs which disturbed as a result of leak rectification shall be inspected and reused if still within manufacturer's specification
- Leak check shall be inspected by COMPANY and CONTRACTOR QA/QC representatives.
- Leak check formats shall be signed on satisfactory completion of the test.
- Any joints which are disturbed for commissioning activities after leak testing will be recorded in a Witness Joint Register. Examples are removal of commissioning blinds/spades. The quantity of disturbed joints shall be kept to a minimum. COMPANY operation personnel shall witness the preparation of these joints and their reassembly and re-torguing and hence they will not require re-leak testing.

05 Documentation After Leak Test

The leak test pressure, start time, hold period and finish time shall be recorded on a recorder chart. Temperature shall be recorded on a calibrated recorder throughout the hold period.





TOTAL FINAEIF E&P DALIA FPSO 6041

Deluge Drop Test / Procedure

01 Purpose of Test

The purpose of the deluge water drop test is to ensure the spray coverage of spray nozzles and to ensure that deluge nozzles are delivering the deluge water volume demanded by each deluge water system at the rated system pressure which is fire water ring main pressure.

02 Preparation of test Equipment

2.1. Test pump: DBE - W - P110 – 014 & 015
- Capacity: 1200㎥ / H@ Head 80 meter x 2set

2-2. Test water storage:
- Temporary water Tank
- Storage volume: depending on test volume (We DB have 45 ㎥x 4 tanks)

2-3. Test water: fresh water
2-4. Strainer on test water suctions



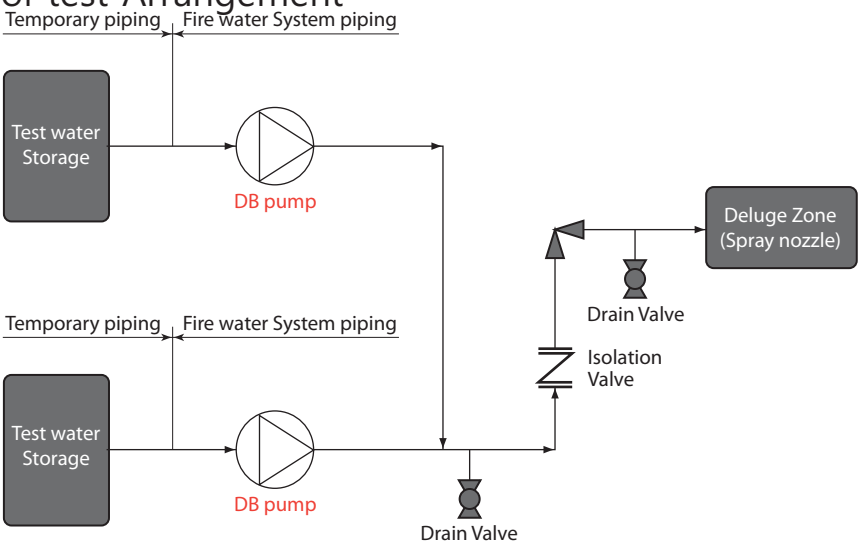
03 Test Condition

3-1. Test medium: Fresh water
3-2. Test pressure: 2 ~ 5 Barg at test ring main.
3-3. Test water temperature: atmospheric temperature
3-4. Test flow rate: Project specification.

04 Test Sequence

4-1. Complete temporary piping between Storage Tank and two DB pumps
4-2. To check all nozzles and piping have been correctly completed prior to test based on the relevant P&ID.
4-3. To especially check all nozzle spray directions for equipment coverage.
4-4. Run DB pumps to fill test water in firewater line and to pressurize test water to test pressure.
4-5. Open manually the deluge valve related to test loop and run firewater pump.
4-6. Check the coverage of deluge nozzles.
4-7. If the deluge coverage is not adequate to equipment protection and area protection, stop firewater pump and mark deluge nozzles that are not satisfied with the coverage.
4-8. Complete the test record sheet.
4-9. After completing this test, close isolation valve and open drain valve on deluge valve in order to drain reaming water.
4-10. After completing deluge drop test of all modules, remaining firewater in pipe must be drained.
4-11. Reinstall the removed firewater suction lines.

05 Diagram of test Arrangement





ODFJELL GVA
SEMI DRILLING RIG 3023

01 Introduction

1-1. This document specifies procedure and general methodology to be adopted for Fabrication and Installation of piping spools at our fabrication shop and CLIENT yard.

02 Purpose / Objective

This document is prepared to achieve following objectives:

2-1. To specify Fabrication and Installation requirements, application and methodology.
2-2. To ensure that CLIENT requirements are met.
2-3. To specify scope of piping and piping items to be Fabricated and Installation.
2-4. To prepare spool fabrication and installation inspection documentation for CLIENT approval.

03 Scope

Scope of this procedure includes the following, related to pipe spool fabrication and installation of piping:

3-1. Fit-up for shop fabrication.
3-2. Welding for shop Fabrication spool and Installation spool Filed joints.
3-3. Final Visual and Dimension check for shop spools and Filed weld joints.
3-4. NDE Requirements
3-5. Post Weld Heat Treatment requirements.
3-6. Repair and Re-testing.
3-7. Safety measures during pressure testing.
3-8. Preparation of pressure test packages and documentation.

04 References

The latest edition of the following codes and standards need to be referred, as applicable to pressure testing.

4-1. Code / Standards

ASME B16.5 Pipe Flanges and Flanged Fittings, NPS 1/2 in. through NPS 24 in.
ASME B31.1 Power Piping
ASME B31.3 Process Piping & Drilling Piping
ASME B31.4 Liquid Transportation systems for Hydrocarbons,
Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols
ASME B31.8 Gas Transmission and Distribution Piping Systems
API 6A Specification for Wellhead and Christmas tree Equipment
CLASS Standards

4-2. SPECIFICATION

CLIENT Specification

05 Ping Spool Fabrication & Installation Procedure

5-1. Material Storage

5.1.1 When Pipe materials are stored, Carbon Steel (FERROUS) shall be separated from NON-FERROUS and Fabrication of Carbon Steel and NON-FERROUS shall be done in a Separated area.

5.1.2 Each Material to make easy identification is required on color coding at the purchasing stage, if necessary

5-2. Pipe Cutting

5.2.1 Each Pipe Piece is to be marked on a Heat Number before cutting original pipes

5.2.2 Heat Numbers of Carbon steel pipes are to be marked by a Marking pen and Heat Numbers of Non-Ferrous pipes are to be used by a vibrator or a sticker



5-3. Fit-Up

5.3.1 Each Heat number is transferred to Drawings after checking Material grades, Material types in accordance with drawings

5.3.2 The bevel, weld gap, root face are to be verified by approved WPS during Fit-up inspection

5.3.3 When adjusting of pipe alignment, it is possible to use the jack bolt pieces as temporary. The used jack bolt pieces, however, shall be removed by grinding and then 100% MPI shall be carried out.



5-4. Pre-Heating & Welding

5.4.1 Preheating temperature is to be checked at 75mm distance from the weld joint.

5.4.2 Preheating, Inter-pass temperature, welding consumable, amperage, voltage, travel speed etc. are to be verified by approved WPS.

5.4.3 Welder shall carry crayon or digital thermometer to check Pre-heating, Inter-pass temperature and check repeatedly.

5.4.4 Welders shall record welder identification on weld joints after welding

5.4.5 The fillet welding for piping support is carried out without removal of structural primer

5.4.6 Non-Destructive Inspection(NDE) & Post Weld Heat Treatment (PWHT) shall comply with approved CLIENT Procedure

5-5. Piping Installation

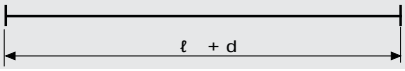
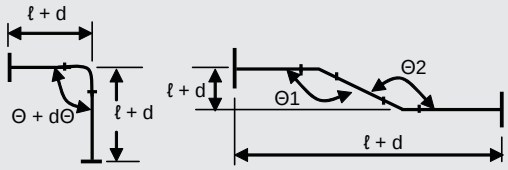
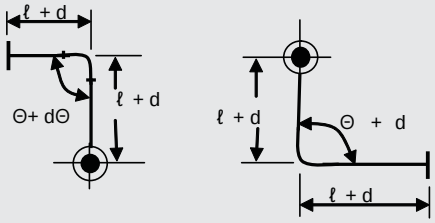
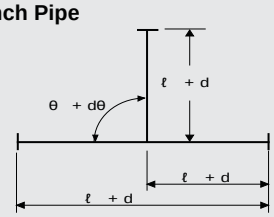
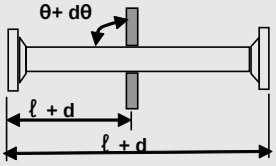
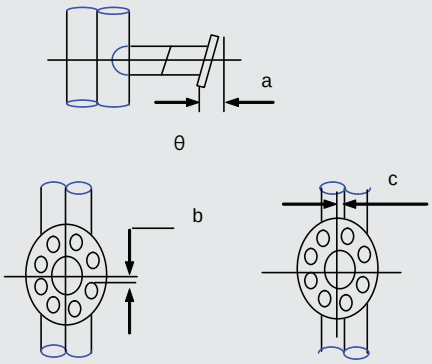
5.5.1 Piping Installation Inspection shall be performed in accordance with ISO DWG or P&ID

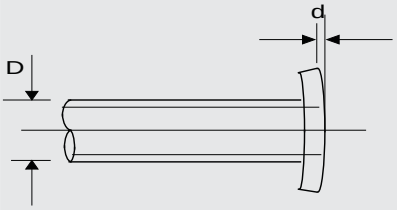
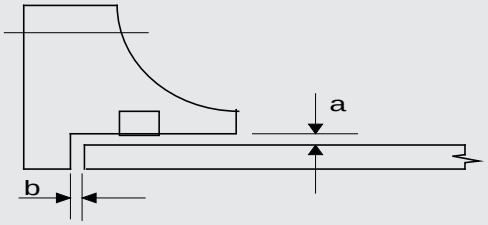
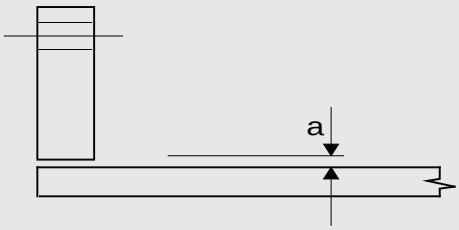
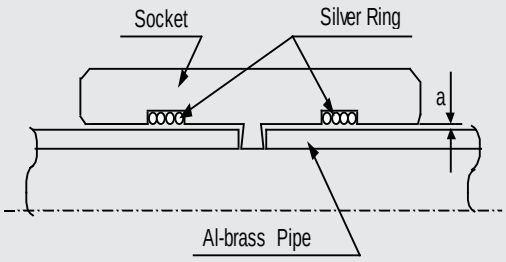
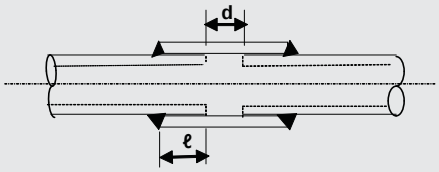
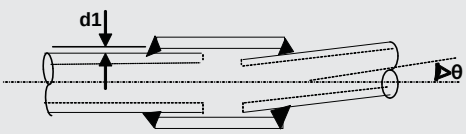
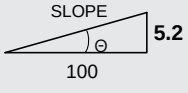
5.5.2 Gasket type, Bolt material, Valve type and Valve orientation are to be verified during Installation inspection

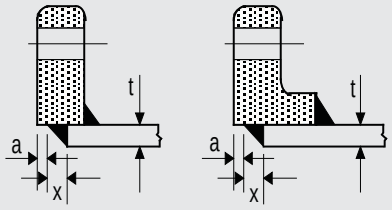
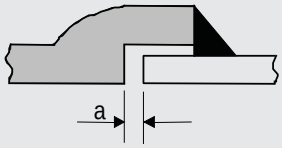
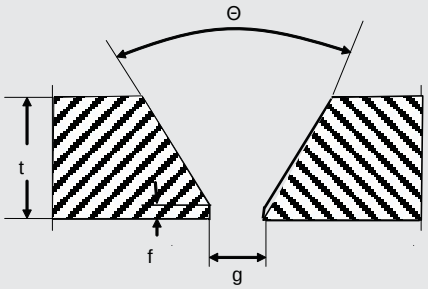
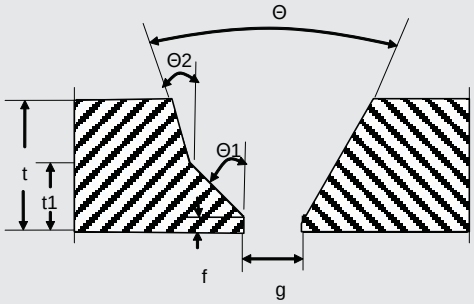
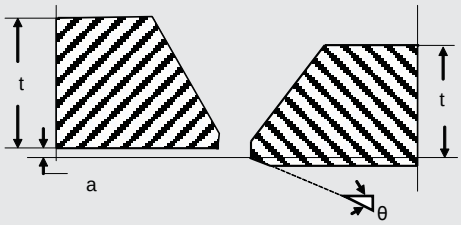
5.5.3 Piping for Drain is to be checked on SLOPE according to Drawings

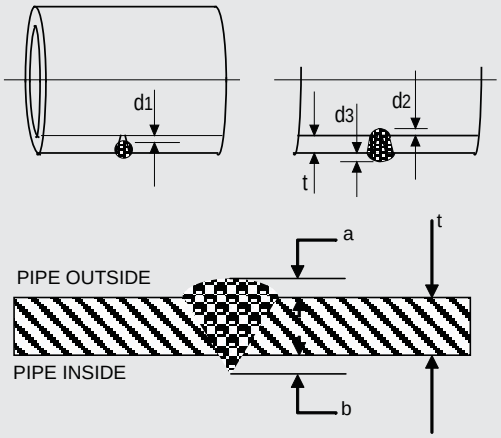
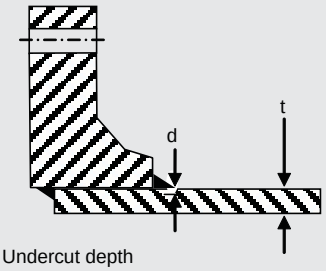
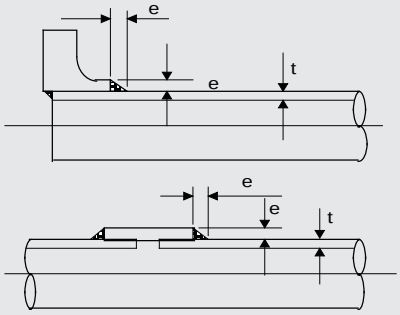
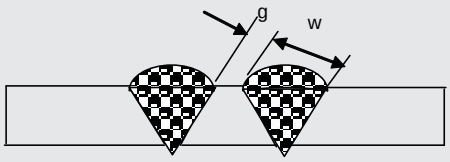
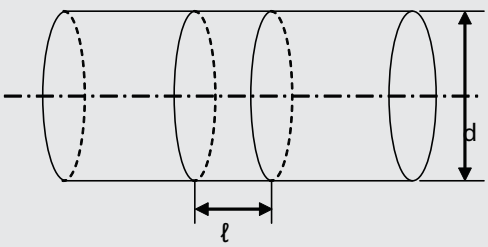
5.5.4 The Joints in bolts released connected to Nozzles of Rotating Equipment are to be checked for the alignment Inspection

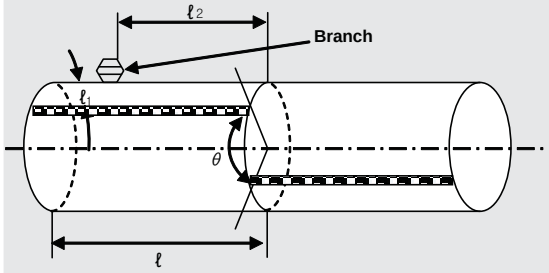
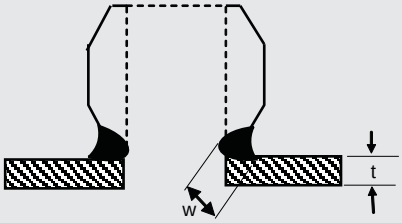
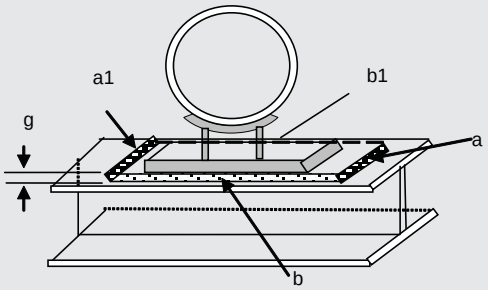
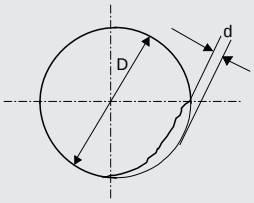
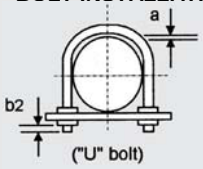
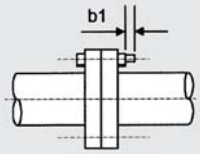
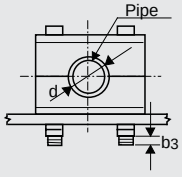
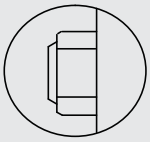
5.5.5 Piping installation shall comply with CLIENT and Non-Destructive Inspection(NDE) & Post Weld Heat Treatment (PWHT) shall comply with CLIENT approved Procedure

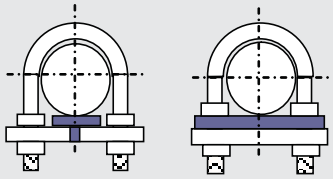
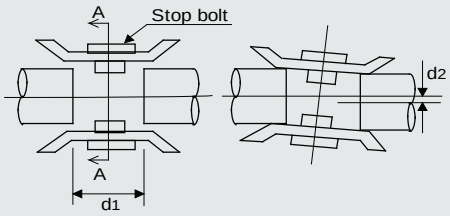
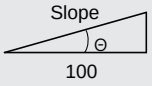
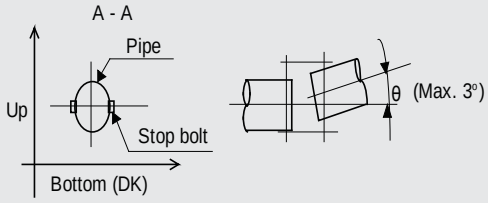
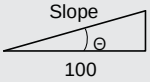
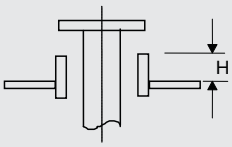
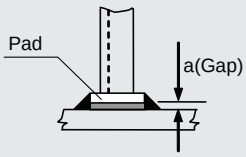
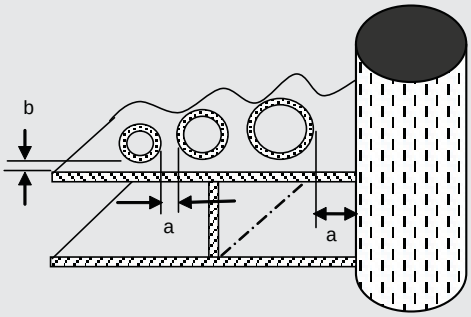
Detailed Items	Allowable Limitations	Remark
6.1 DIMENSIONS **1) Linear Tolerances** 	**d = ≤ 10" (± 3)** **12"~24" (± 5)** **≥ 24" (± 6)**	
2) Curve Tolerances 	**d = ± 3** **d = ± 0.5°** **l Θ 1-Θ 2 l ≤ 2°**	
	**d = ± 3** **dΘ = ± 0.5°**	
3) Branch Pipe 	**d = ± 3** **dΘ = ± 0.5°**	
4) Pipe Penetration 	**d = ± 3** **dΘ = ± 0.5°**	
6.2 INSTALLING FLANGE TO PIPE **1) Flange Fit-Up** 	**Θ ≤ 0.5°** **a : ± 1.0** **b : ± 2.0** **c : ± 3.0**	

Detailed Items	Allowable Limitations	Remark
2) Flange facing bent 	**D < 200,** **d ≤ 0.5** **200≤ D≤ 450,** **d ≤ 1.0** **D > 450,** **d ≤ 1.5**	
6.3 NON-FERROUS PIPE CONNECTION **1)Flange Silver Brazing** 	**0.05≤ a≤ 0.13** **b ≤ 1.6**	
2)Flange Brass Brazing 	**a ≤ 0.3**	
3)Pipe Silver Brazing 	**0.05≤ a≤ 0.13**	
6.4 SLEEVE JOINT WELDING  	**ℓ ≥ 15** d **≥ 2.0** **d1 : Max. 2.5** **θ < 3°**	

Detailed Items	Allowable Limitations	Remark
6.5 SLIP ON FLANGE JOINT) WELDING 	**a ≤ Max. 1,5** **X :Pipe THK. + 3mm**	
6.6 SOCKET JOIT WELDING 	**a ≤ 1.5~6.0**	
6.7 BEVELING 	**θ= 50° ~ 80°** **t = 4.8 ~ 60** **f = 1.5 ± 0.8** **g = 2.0 ~ 5.0**	**ASME B31.3 328.4.2 Detailed Items to be followed with Approved WPS**
	**θ= 50° ~ 80o** **θ1= 37.5° ± 2.5°** **θ2= 10° ± 2.5°** **t > 22** **t1 = 19** **f = 1.5 ± 0.8** **g = 2.0 ~ 5.0**	**ASME B31.3 328.4.2 Detailed Items to be followed with Approved WPS**
	**θ= 30°** **Max.(1:4)** **a = 1.6**	**ASME B31.3 328.4.2 Detailed Items to be followed with Approved WPS**
Θ : ANGLE OF WELD GROOVE **Θ 1~ Θ 2: ANGLE OF WELD BEVEL** **T~T1: PIPE THICKNESS** **F: ROOT FACE** **G: ROOT GAP** **A: MISALIGNMENT**		

Detailed Items	Allowable Limitations	Remark
6.8 WELD BEAD HEIGHT (inside/outside) 	**1) t ≤6.0 (1/4")** **d2, d3 ≤1.5** **2) 6.0 < t≤13 (1/2")** **d2,d3 ≤3.0 (1/8")** **3) 13 < t ≤25 (1")** **d2,d3≤4.0 (5/32")** **4) t > 25 (1")** **d2,d3≤5.0 3/16")** **▶HIGH PRESSURE (CHAPTER IX)** **1) t ≤ 13 (1/2")** **a, b=1.5 (1/16")** **2) 13 < t ≤51 (2")** **a, b=3.0 (1/8")** **3) t > 51 (2")** **A, b=4.0 (5/32")**	**ASME B31.3 (TABLE K341.3.2)**
6.9 UNDER CUT  d: Undercut depth t: Pipe thickness	**d ≤1mm(1/32")** **and ≤ t/4** **▶HIGH PRESSURE (CHAPTER IX) UNDERCUT not allowable**	
6.10 LEG FILLET WELD 	**e: to be followed with Design Practice**	
6.11 WELD BEAD WIDTH AND WELD SPAN  **15.2.6 PUP PIECE**  **d: Pipe Diameter** **ℓ : Minimum Span of Circumference butt weld**	**g: Welding wire dia. x Quadruple** **w: ≤ 19** **ℓ = Pipe Thickness x Quadruple or 25mm which one is greater**	

Detailed Items	Allowable Limitations	Remark
6.12 PIPE CONNECTION  **θ : Span of Longitudinal Butt weld** **ℓ 1, ℓ 2 : Longitudinal Butt weld**	**ℓ1, ℓ2, θ =** **Pipe Thickness x Quadruple or 25mm which one is greater**	
6.13 SOCKOLET / WELDOLET (O-LET) WELDING  	**W ≥ 1.5t**	
6.14 HANDLING PLAN FOR GAP AGAINST FOR SHOE TYPE SUPPORT  	**Inserting Shim Plate (1ea or 2ea)** **g: ≤ 30** **a, a1: welding** **b,b1: using EPOXY PUTTY instead of welding (CLIENT approved)**	
6.15 CUTTING PIPE HOLE – PIPING INSTALLATION  	**d ≤ D/50**	
6.16 BOLT INSTALLATION  ("U" bolt)  (Flange bolt)	**0.1 ≤ a ≤ 3.0** **b1 : 0 ~ 1D** **b2 : 0 ~ 3D** **b3 : 0 ~ 1D** **D : Bolt diameter** **d : Pipe external diameter+1**	
6.17 PLASTIC CLAMP INSTALLATION  	 **b1, b2, b3 = "0"**	

Detailed Items	Allowable Limitations	Remark
6.18 TEFLON PAD TYPE INSTALLATION 	**Full Tight**	**NOTE: Adhesive is possible for putting Teflon Pads on Supports , if no holes in supports**
6.19 DRESSER INSTALLATION 	**For Short type** **d1 = 40 ± 5** **Θ ≤ 3o** **1) More than 500A** **d2 ≤ 5.0** **2) 450A and less d2 ≤ 4.0**	 **5.2**
	**Θ ≤ 3o** **1) More than 500A** **d1 = 80 ± 40** **d2 ≤ 10** **2) 450A and less** **d1 = 70 ± 30** **d2 ≤ 5**	 **5.2**
6.20 SLEEVE / COAMING INSTALLATION  **H: Deck / Grating upper sleeve height**	**Generally,** **H = 100 (4")**	
6.21 GAP WELDING FOR REINFORCING PAD 	**a ≤ 3.0:** **1 Pass welding** **3.0 < a ≤ 5.0:** **increasing weld throat** **5.0 < a :** **inserting Extra pads**	
6.22 SPAN BETWEEN STRUCTURE AND PIPING  **a: Spans for Pipe and Pipe , Pipe and Flange** **b: Cross Span for Pipe and Structure**	**a: ≥ 25** **b: ≥ 10** **(But, PFP part excluded)**	

Detailed Items	Remark

6.23 TOLERANCES OF DEFECTS FOR THE END OF FLANGE

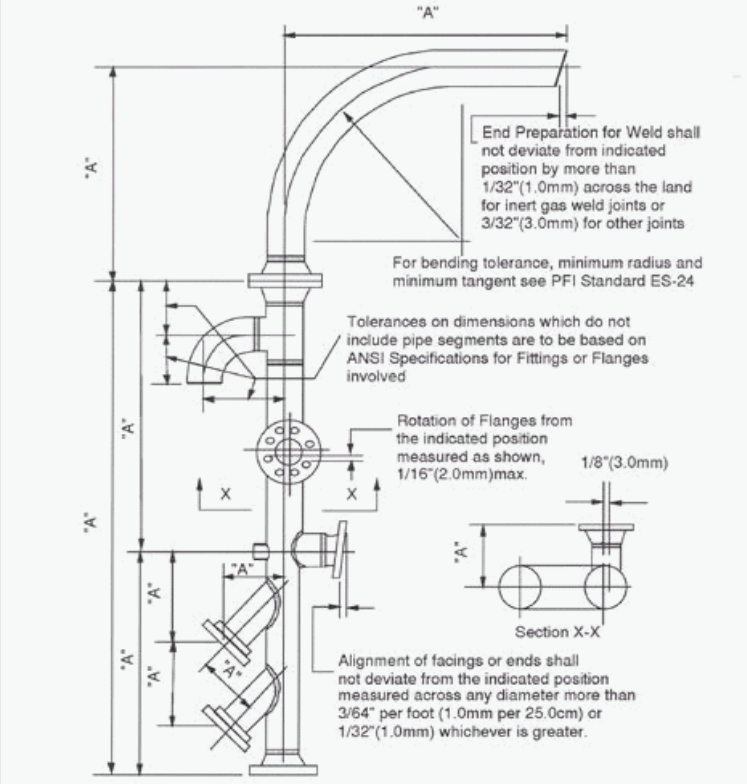
(NPS)	Serration Projected Defect (Inch / mm)	Serration Projected Depth Defect (Inch / mm)
1/2”	0.12 (3.0)	0.06 (1.5)
3/4”	0.12 (3.0)	0.06 (1.5)
1”	0.12 (3.0)	0.06 (1.5)
1 1/4”	0.12 (3.0)	0.06 (1.5)
1 1/2”	0.12 (3.0)	0.06 (1.5)
2”	0.12 (3.0)	0.06 (1.5)
2 1/2”	0.12 (3.0)	0.06 (1.5)
3”	0.18 (4.6)	0.06 (1.5)
3 1/2”	0.25 (6.4)	0.12 (3.0)
4”	0.25 (6.4)	0.12 (3.0)
5”	0.25 (6.4)	0.12 (3.0)
6”	0.25 (6.4)	0.12 (3.0)
8”	0.31 (7.9)	0.18 (4.6)
10”	0.31 (7.9)	0.18 (4.6)
12”	0.31 (7.9)	0.18 (4.6)
14”	0.31 (7.9)	0.18 (4.6)
16”	0.38 (9.7)	0.18 (4.6)
18”	0.50 (12.7)	0.25 (6.4)
20”	0.50 (12.7)	0.25 (6.4)
24”	0.50 (12.7)	0.25 (6.4)

ASME B16.5 TABLE 3

More than 1/3 Flange serration through rectangular direction is not acceptable.

6.24 TOLERANCES FOR PIPING INSTALLATION

Figure 1: Application of Pipe Tolerances



6.25 NDE

NDE shall be followed with Approved Procedure.
NDE(Non-Destructive Evaluation)

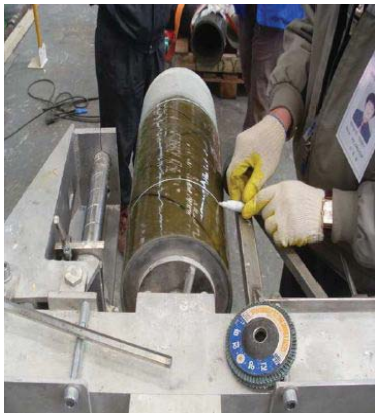
6.26 HEAT-TREATMENT

1) More than 19.1mm Thickness of Pipes Shall be heat-treated and P/No. 3, 4, 5 materials shall be performed by NDE after Heat-Treatment.
2) Detailed particular shall be followed with Approved Procedure.

6.27 PIPING INSULATION

Piping insulation shall be followed with Approved Procedure.





01 INTRODUCTION

1-1. This document specifies procedure and general methodology to be adopted for Installation of GRE/FRP spools at CLIENT yard.

02 PURPOSE / OBJECTIVE

This document is prepared to achieve following objectives:

2-1. To specify Installation requirements, application and methodology.
2-2. To ensure that CLIENT requirements are met.
2-3. To specify scope of piping and piping items to be installed.
2-4. To prepare spool installation inspection documentation for CLIENT approval.

03 SCOPE

Scope of this procedure includes the following, related to GRE pipe spool installation of piping:

3-1. Fit-up for Spool shaving.
3-2. Bonding for Installation spool filed joints.
3-3. Repair and lamination.
3-4. Safety measures during pressure testing.
3-5. Preparation of pressure test packages and documentation.

04 REFERENCES

The latest edition of the following codes and standards need to be referred, as applicable to pressure testing.

4-1. CODE / STANDARDS

ASME B16.5 Pipe Flanges and Flanged Fittings, NPS 1/2 in. through NPS 24 in.
ASME B31.1 Power Piping
GRE Vendor Standards

4-2. SPECIFICATION / CERTIFIED

CLIENT Specification
Adhesive bonded joints can only be made by fully trained and certified personnel

05 GRE PIPING SPOOL BONDING & INSTALLATION PROCEDURE

5-1. Material Handling / Storage

To insure long life and trouble free service from any GRE materials, careful handling is required at all times Oftentimes, the problems found after the installation of GRE materials are due to mishandling, specifically impact damages

To avoid mishandling problems, the following are recommended

5.1.1 Avoid lifting pipes in bundles.
5.1.2 Do not drag or slide the pipes in any way they may result in abrasion.
5.1.3 Avoid excessive bending stress when lifting the pipes by lifting at two locations or using spreader bars.
5.1.4 Protect GRE material from all types of impact, avoid bumping the pipes from any structure.
5.1.5 Do not throw or drop GRE materials.
5.1.6 When downloading the pipes, ensure that wooden bearing boards at least 76mm (3inch) wide are placed not more than 3 meters apart under the pipes.

5-2. Shaving of the Cut End of the Pipe



Ensure that all necessary tools and materials are available (see chapter 12. and 4.1.)

5.2.1 Support and hold the pipe in position firmly.
- a) Contaminated pipe surfaces should be cleaned prior to shaving the pipe ends
- b) When holding the pipe in a vice, use rubber padding to protect from damage

5.2.2 Carefully insert the arbor into the pipe
- a) Fix the arbor to the inside of the pipe by turning
- b) The central tensioning bolt clockwise

5.2.3 Adjust the shaver to the required spigot diameter

5.2.4 Shave the taper spigot
- a) Maximum shaving depth / feed is 2 mm
- b) Repeat the shaving action until the required spigot diameter / spigot nose thickness is achieved







5-3. Sand all bonding surfaces

5.3.1 Thoroughly sand within 2 hours from assembly
5.3.2 Use flapper wheel sanders with a small drilling machine (1700 - 2000 rpm) or emery cloth with a grit of 60
5.3.3 Bonding surfaces must be dry and clean before sanding
5.3.4 Sanded surfaces must have a dull, fresh finish, not a polished look

5-4. Dry Fit

5.4.1 Measure back from the edge of the spigot the required insertion depth plus 50 mm and scribe a line
5.4.2 During final assembly the spigot may slip approximately 5 mm further
into the bell, therefore the dry fitted
assembly should be approximately 5 mm longer per joint
a) Install the band clamps
b) Dry the bonding surfaces
c) Pre-heat or cool down the bonding surfaces
d) Re-send

5-5. Applying the adhesive

Before adhesive bonding, all safety precautions will need to be checked

5.5.1 Select the proper size adhesive kit
5.5.2 Prepare the adhesive
5.5.3 Never use adhesive that has started to gel
5.5.4 Apply a thin layer of adhesive

5-6. Curing of the Adhesive Joint

5.6.1 Apply the heating blanket
5.6.2 Determine the curing time – Adhesive vendor recommendation
- a) Normal Curing time for Easy fit adhesive is one hour (see fig. 5.6.2.a) and one hour warming up time
- b) The temperature of the heating blanket should be at least 90°C (195°F) for applications of medium below 65°C (114°F) and 125°C (257°F) for medium temperatures between 65°C (114°F) and 90°C (195°F) for the Easy fit adhesive

5.6.3 Activate the heating blanket

a) During the time of curing the functioning of the heating blanket should be checked regularly; if a cold heating blanket is found remedy the problem and start the complete curing cycle

b) During curing the joint should not be moved, vibrated

c) During the time of curing the functioning of the heating blanket should be checked regularly; if a cold heating blanket is found remedy the problem and start the complete curing cycle

d) During curing the joint should not be moved, vibrated

e) Curing time starts after the surface of the pipe has reached the required temperature underneath the heating blanket.

f) During curing the joint should be insulated for example by using an insulation blanket and seal off the pipe ends to prevent draught through the pipe.

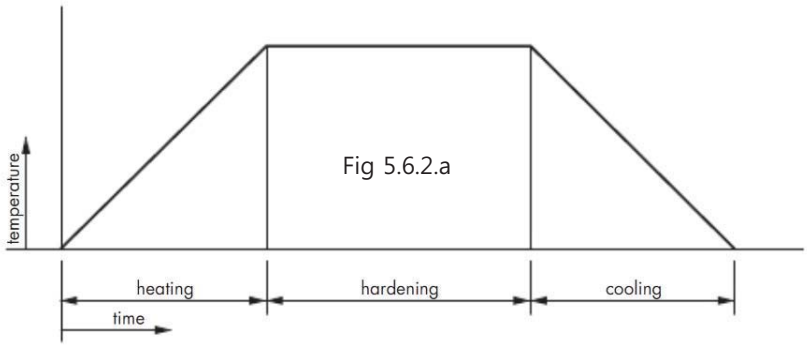
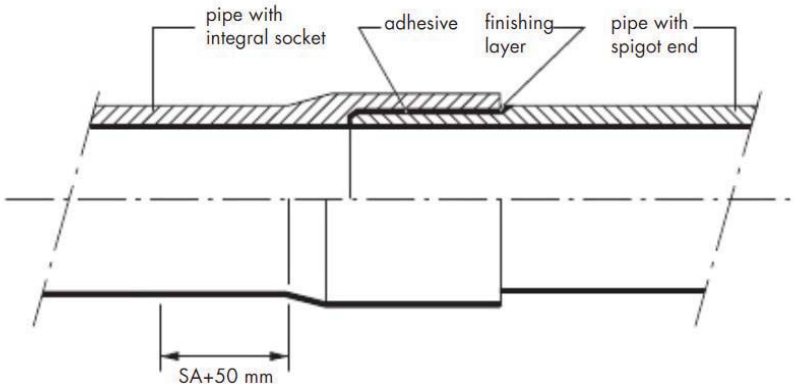


Fig 5.6.2.a

GENERAL BOND JOINT DETAIL









CHEVRON TEXACO BENGUELA BELIZE 6040

FIBERGLASS PIPING SYSTEMS WORK INSTRUCTION FOR BUTT AND WRAP JOINT WITH EPOXY RESIN SYSTEMS (16bar)

01 Scope

This process description covers the butt and wrap joint system. The butt and wrap joint outlined in this procedure may be used under factory' and site conditions. This procedure covers pipe sizes 1" to 36" with a maximum pressure rating of 232 psi (16 bar).
All used components must be approved by manufacturer. Included in this description is a general description of the product, a list of raw materials, and a description of the steps involved in the butt and wrap process.

02 Description

Joints made in accordance with this process description contain pipes with a 0.5mm (0.02") C-veil liner for Series 2000M/6000/2400. The pipes are filament wound (54 degrees). The laminate (hand lay-up part) consists of resin impregnated multiple layers of woven roving and boat tape.

03 Materials of Construction

3-1. Reinforcements

Glass
Woven Roving : 100mm (4") width, 500-610 gr/m² or
160mm (6 1/4") width, 500-610 gr/m²

3-2. Resin

3.2.1 Epikote-827 or DOW-330	:	100 pbw
Curing Agent, I.P.D	:	24 pbw
3.2.2 Adhesive for Jointing	:	RP-34 or RP-48 Adhesive RP-60 for Conductive Product

3-3. Equipment

- Heat blanket;
- Band clamps with D-rings
- Air release roller (3/4" Dia x 3"L)
- Pipe filter's wraparound
- White grease pencil or soapstone
- Folding rule, 10' (3m);
- Duster brush or clean rag;
- Scissors or knife;
- Weighing scale;
- Paint brush (4" and 6");
- Rubber scraper plate;
- Methylene chloride (for cleaning equipment);
- Rubber mallet, 2lb (1 kg), shore A Durometer 70-80, 2 1/2" – 3" Dia;
- EL dr 1/4" (6m) drill motor, 1700-2000 rpm (for 1" to 12");
- Belt sander (for sizes above 14");
- Flapper wheel sander (for 1" to 2")
- Ratchet winch
- Hack saw, saber saw or abrasive wheel
- Level
- Measuring tap, 50' (15m)
- Dust respirator/ mask

04 Laminate Procedure

Cutting
The pipe section to be cut shall be marked using a "wrap around" and a white marker. Make sure that the squareness of the cut has been properly made. If possible the two pipe ends can be machined tapered to get a more reliable joint (see Figure 1 and 2 for straight and tapered joint systems).

05 Hand Lay-up Laminate

5-1. Prepare all tools and glass materials required for the lamination (see Table Ⅱ).

5-2. Sand-blast or sand and clean the total external surface. Make sure that the pipe ends are sanded as well as the required spigot length. Sanded area for pipes larger than 10" = 0.5 x Normal Size (Length L, see Figures 1 and 2). Sanded area for pipes to or smaller than 8" : L = 120 mm.
Start laminating within two hours after sanding; if greater than two hours. Sanding is again required.

5-3. The cross section of the pipes (cut ends) has to be sanded and coated with adhesive to protect against penetration of the medium. Continue the procedure as per paragraph 5.4 immediately.

5-4. After the pipe sections are positioned, prepare the adhesive and coat the external surfaces of the pipe ends approx. 50-150mm width. Wet out the boat tape (2" or 4" width adhesive and apply two layers circumferentially on the pipe ends (Figures 1 and 2). A rubber squeegee or small spatula can be used to smooth the adhesive. Use a heating blanket for one-hour curing. Sand the surface after curing before continuing with paragraph 5.5.

5-5. Prepare resin mix with correct mixing ratio (be aware of the pot-life after mixing). The amount of mix depends on the diameter. Be sure that the curing agent is carefully mixed in the resin. Resin and curing agent should not exceed temperatures of 27°C.

5-6. For pipes equal to or smaller than 3"; Use boat tape as in Table I with 50% overlap. For pipes greater than 3"; Use boat tap and woven roving as in Table I with 50% overlap.

5-7. Apply the required numbers of layer of boat tape (2" or 4" width) with 50% overlap individually in circumferential direction on the pipe ends. Simultaneously impregnate the boat tape with the resin mix (see Table Ⅰ).
Apply the required numbers of layer of woven roving (50% overlap) individually in circumferential direction on the pipe joint ends; simultaneously impregnate the woven roving with the resin mix.

5-8. Tie the woven roving down, using a 50mm or 100mm wide boat tape on the complete external joint surface (spirally). Simultaneously impregnate the boat tape with resin. The boat tap has to be wrapped around under tension and with an overlap of 50%. To avoid air getting into the laminate, use air relieve rollers continuously.

5-9. Before curing, use a heat gun to allow the laminate to gel.

5-10. Cure
Use infra-red burners when applicable, or heating blankets. Curing temperature; 150°C (300°F) for 2.5 hours; 4 hours when heating blankets are used. If possible, apply heating blankets on the inside as well.

6 Finishing

Sand rough edges and generally smooth external surface Coat the sanded area with RP66 for appearance and protection.

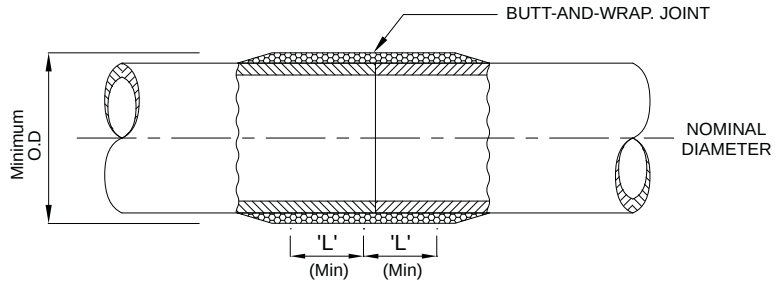
LAYERS FOR BUTT AND WRAP JOINTS 16 bar Pressure

Table I

Ø	1”	1 1/2”	2”	3”	4”	6”	8”	10”	12”	14”	16”	18”	20”	24”	30”	36”
L = (mm)	120	120	120	120	120	120	120	125	150	175	200	225	250	300	375	450
1	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
2	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
3	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
4	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
5	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
6	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
7	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
						WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
						BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
							BT	WR	WR	WR	WR	WR	WR	WR	WR	WR
								BT	WR	WR	WR	WR	WR	WR	WR	WR
									BT	WR	WR	WR	WR	WR	WR	WR
										BT	WR	WR	WR	WR	WR	WR
											WR	WR	WR	WR	WR	WR
											BT	WR	WR	WR	WR	WR
												BT	WR	WR	WR	WR
													BT	BT	BT	BT
														WR	WR	WR
														WR	WR	WR
														BT	WR	WR
															WR	WR
															BT	BT
															WR	WR
															WR	WR
															BT	WR
																WR
																BT
																WR
																WR
																BT

Note: Overlap is 50% of each layer.

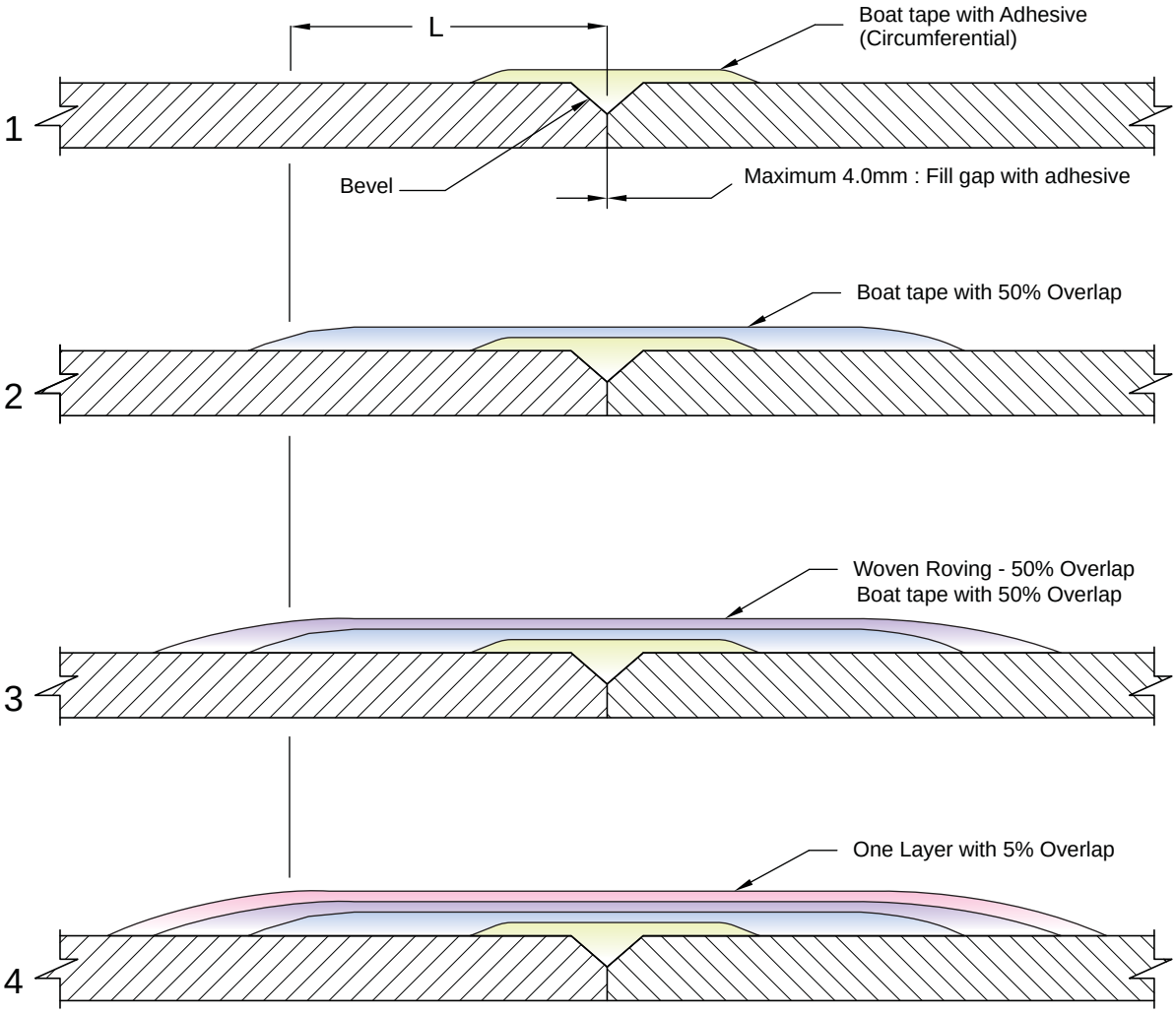
MATERIAL REQUIREMENT FOR FIELD BUTT & WRAP JOINTS (16 BAR)



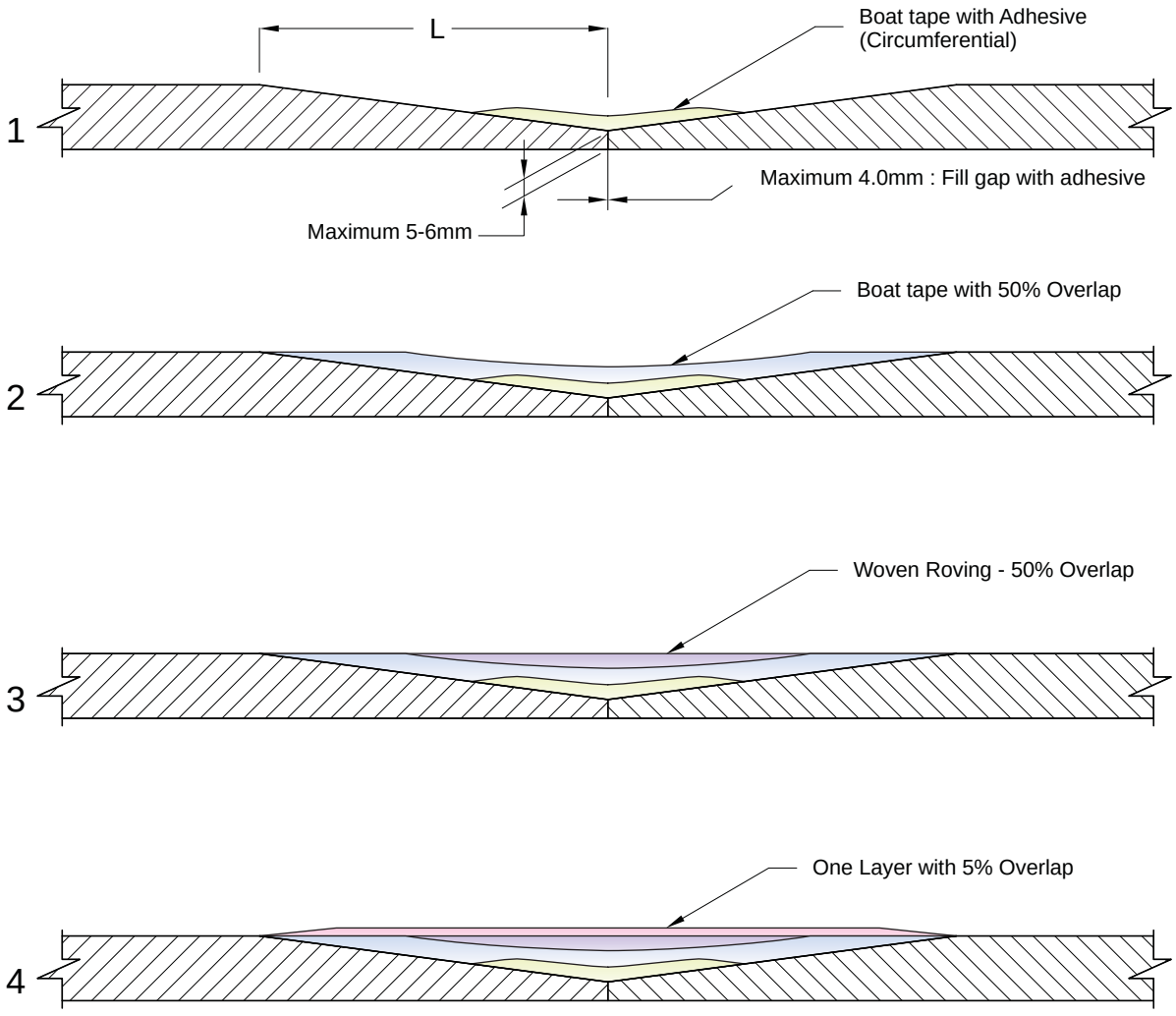
NOTE : L = 120 mm for ND ≤ 200 mm. (8″ Ø)
L = 1/2 ND for ND ≥ 250 mm. (10″ Ø)

Table II

Nom. Dia. (mm)	Adhesive RP-34 or RP-48 6 oz. Kit	Boat Tape (kg)	Woven Roving (kg)	Epoxy Resin (kg)	Curing Agent I.P.D (kg)
25	1/4	0.166	-	0.132	0.036
40	1/4	0.227	-	0.181	0.050
50	1/2	0.278	-	0.222	0.061
80	1/2	0.397	-	0.317	0.087
100	1/2	0.131	0.523	0.627	0.173
150	1/2	0.188	0.752	0.902	0.248
200	1	0.270	1.082	1.298	0.357
250	1	0.348	1.393	1.811	0.498
300	1	0.493	1.972	2.564	0.705
350	2	0.628	2.513	3.267	0.898
400	2	0.840	3.361	4.369	1.201
450	2	1.159	4.634	6.952	1.912
500	3	1.572	6.287	9.431	2.593
600	3	2.677	10.706	16.060	4.416
700	3	4.961	19.842	29.763	8.185
750	3	5.736	22.942	34.413	9.464
800	3	6.907	27.627	41.440	11.396
900	4	9.710	38.838	58.258	16.021



STRAIGHT JOINT BUTT AND WRAP
(Figure-1)



TAPERED BUTT AND WRAP JOINT
(Figure-2)

FIBERGLASS PIPING SYSTEMS WORK INSTRUCTION FOR BUTT & WRAP OVER ADHESIVE JOINT

1 Scope

This process description covers the wrap joint system over adhesive bonded joints. The wrap over joint is made under conditioned circumstances and is meant to reinforce the adhesive bonded joint.

All components used must be approved by manufacturer. Included in this description are a general description of the product, a list of raw materials, and a description of the steps involved in the wrapping process.

2 Description

Joints made in accordance with this process description contain pipes and fittings with or without a 0.5mm (0.02") C-veil liner. The pipes are filament wound (54 degrees). The laminate (hand lay-up part) consists of resin impregnated multiple layers of woven roving and boat tape.

3 Materials of Construction

3-1. Reinforcements

Glass

Woven Roving : 100mm (4") width, 500-610 gr/m² or
160mm (6 1/4") width, 500-610 gr/m²

Boat Tape : 50mm (2") width, 150 gr/m² or
100mm (4") width, 500-610 gr/m²

3-2. Resin

3.2.1	Epikote-827 or DOW-330	:	100 pdw
	Curing Agent, I.P.D	:	24 pdw

3-3. Equipment

- Pipe support
- White marker
- Wrap around
- Flapper wheel (grit 60)
- Drill machine (air drill/electric drill)
- Balance (weighing scale) 10kg capacity
- Air release rollers 1.5" through 0.375" dia
- Infra-red burners or air-guns
- Heating blankets
- Resin mixer
- Rubber scrapper plate
- 4" brush

4 Hand Lay-up Laminate

4-1. Prepare all tools and glass materials required for the lamination.

4-2. Sand-blast or sand and clean the total external surface (for cleaning use "cleaner 12" or equivalent). Make sure that the adjacent areas of the joint are sanded. Sanded area for pipes larger than 16"=0.5 x nominal size (length L. see figure I).
Ensure the area is thoroughly sanded and that the wrapping process to carried out immediately after sanding. Slightly taper the female bell of the adhesive bonded joint to allow for a smooth transition at the joint area (see figure 2). Alternatively, build up the lower end with glass (woven roving) till it levels up with the bell (See figure 3).

4-3. Prepare resin mix with correct mixing ratio (be aware of the pot-life after mixing). The amount of mix depends on the diameter. Be sure that the curing agent is carefully mixed in the resin.

4-4. Apply woven roving and boat tape as specified in Table 1. Impregnate the woven roving and boat tape with working resin.

4-5. Apply heating blanket to cure the joint. The curing temperature shall be 100 to 150 degrees C and curing time is 2-5. hours minimum..

5 Finishing

Sand rough edges and generally smooth external surface.

LAYERS FOR BUTT & WRAP JOINTS 16 bar Pressure

Table I

Ø	1"	1.5"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"
L = (mm)	120	120	120	120	120	120	120	125	150	175	200	225	250	300	375	450
Sequence No. of Layers																
1	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
2	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
3	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
4	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
5	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
6	BT	BT	BT	BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
7	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
8						WR	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
9						BT	WR	WR	WR	WR	WR	WR	WR	WR	WR	WR
10							BT	WR	WR	WR	WR	WR	WR	WR	WR	WR
11								BT	WR	WR	WR	WR	WR	WR	WR	WR
12									BT	WR	WR	WR	WR	WR	WR	WR
13										BT	WR	WR	WR	WR	WR	WR
14											WR	WR	WR	WR	WR	WR
15											BT	WR	WR	WR	WR	WR
16												BT	WR	WR	WR	WR
17													BT	BT	BT	BT
18														WR	WR	WR
19														WR	WR	WR
20														BT	WR	WR
21															WR	WR
22															BT	BT
23															WR	WR
24															WR	WR
25															BT	WR
26																WR
27																BT
28																WR
29																WR
30																BT

Note : Overlap is 50% of each layer.

FIGURE 1

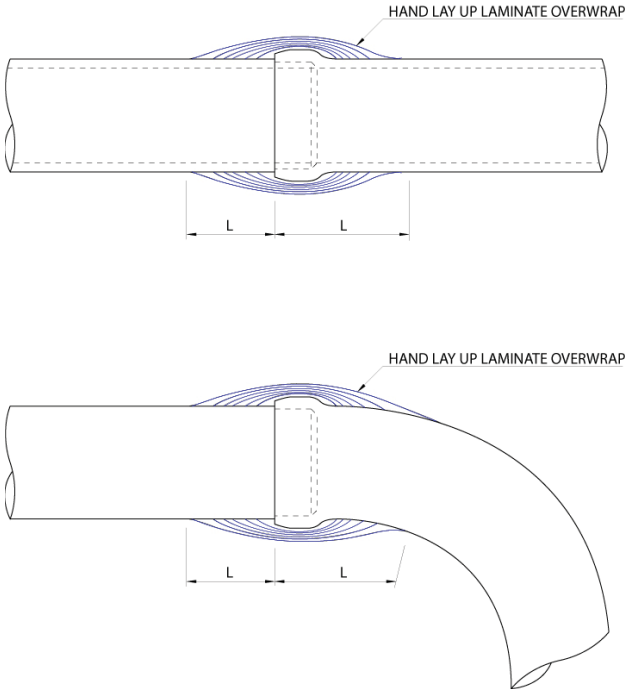


FIGURE 2

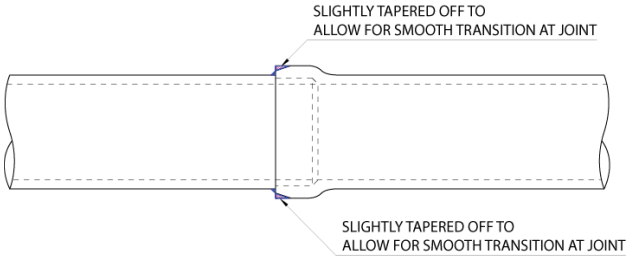


FIGURE 3

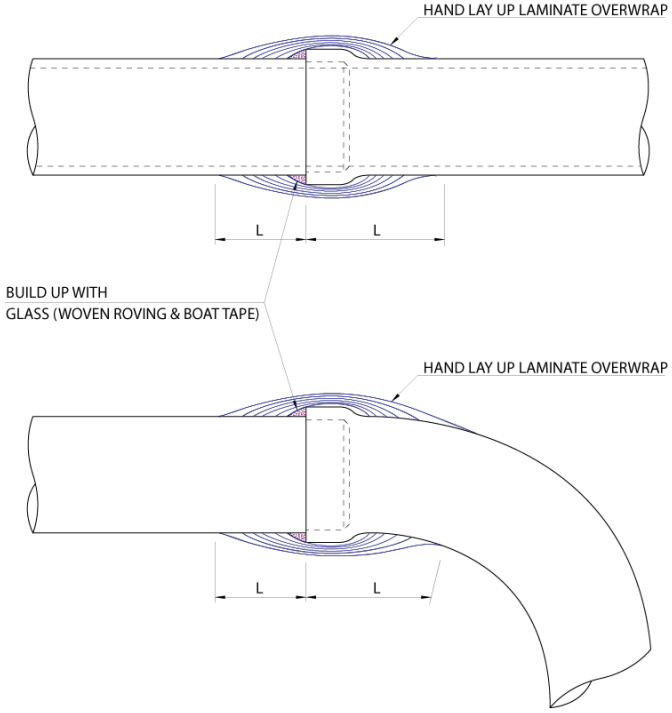
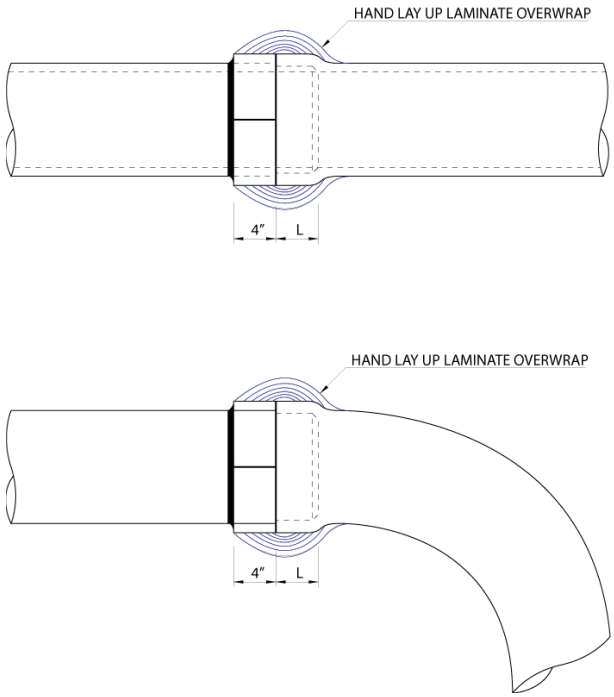
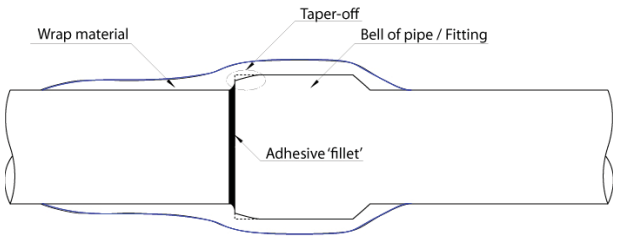


FIGURE 4

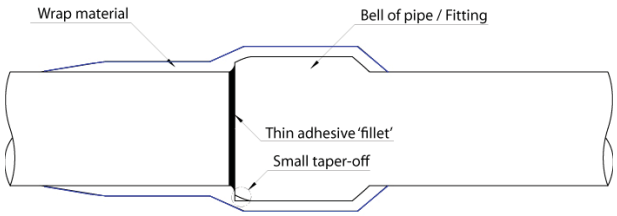


LAMINATION OVER BELL OF PIPE / FITTINGS

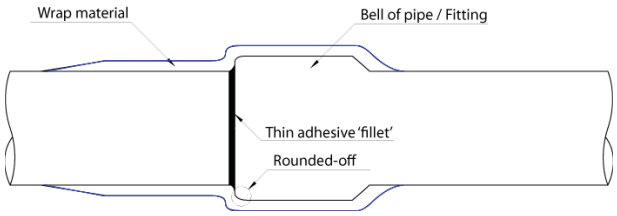
Type 'A'



Type 'B'

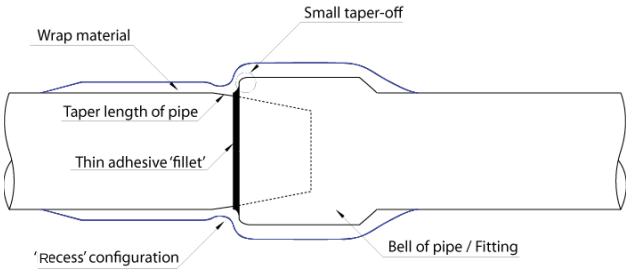


Type 'C'

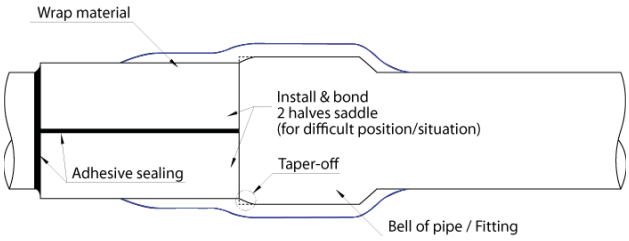


LAMINATION OVER BELL OF PIPE / FITTINGS

Type 'D'

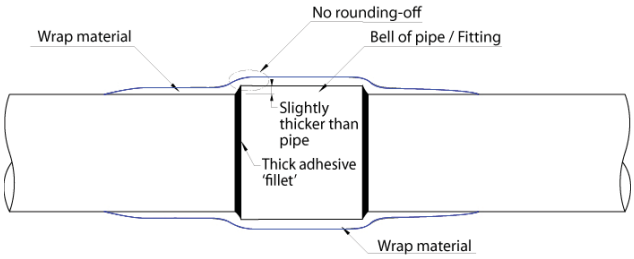


Type 'E'

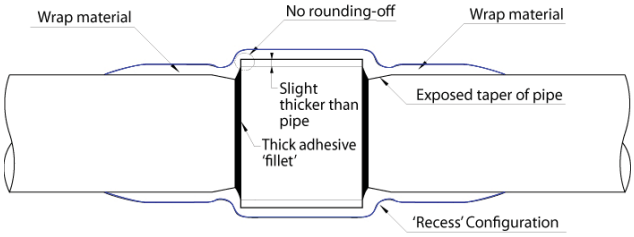


LAMINATION OVER COUPLINGS

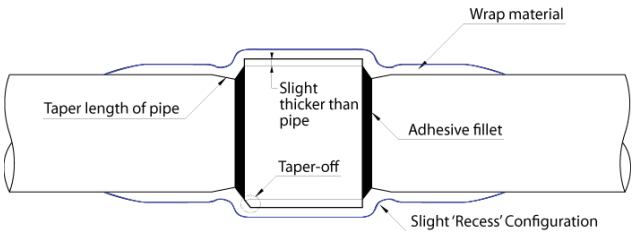
Type 'A'



Type 'B'



Type 'C'



5BLOCK
ASABB MODULE







Insulation

01 Scope

This specification defines requirements for the design, selection, supply, and the application of insulation materials to piping, pressure vessels, exchangers and equipment for personnel protection, heat conservation and acoustical abatement for use on an offshore platform and onshore power piping systems.
Insulation SUPPLIER and DB HOLDINGS shall be solely responsible for providing insulation in full compliance with all applicable Industry Codes and Standards, Government Regulations and CLIENT Standards.

02 References

Applicable requirements in the latest edition (or the edition indicated) of the following industry standards and references, shall be considered an integral part of this specification



2-1. Industry Codes and Standards

2.1.1. American Petroleum Institute (API)

1) API RP 14C, "Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms"
2) API RP 14E, "Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems"

2.1.2. American Society for Testing and Materials (ASTM)

1) ASTM B209, "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate"
2) ASTM C195, "Standard Specification for Mineral Fiber Thermal Insulating Cement"
3) ASTM C450, "Recommended Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments"
4) ASTM C552, "Specification for Cellular Glass Thermal Insulation"
5) ASTM C585, "Recommended Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)"
6) ASTM C871, "Standard Test Method for Chemical Analysis of Thermal Insulation Materials for Leachable Chlorides, Fluoride, Silicate and Sodium Ion"
7) ASTM C892, "High-Temperature Fiber Blanket Thermal Insulation"
8) ASTM C1086, "Standard Specification for Glass Fiber Felt Thermal Insulation"
9) ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials"

2-2. CLIENT Standards

2-3. Conflicts

Any conflicts between the referenced documents shall be identified to COMPANY in writing for resolution. In general, when resolving conflicts, the following order of precedence shall apply:



1) Purchase Order
2) Data Sheet
3) CLIENT drawings
4) This specification
5) Referenced CLIENT Standards
6) Referenced Industry Codes and Standards

03 Environmental Conditions

Insulation shall be designed to perform satisfactorily under the conditions detailed in accordance with CLIENT specification

04 Technical Requirement

4-1. General

1) Refer to Appendix A for selecting insulation thickness for heat conservation and personnel protection.
2) The minimum insulation design thickness shall be 1-1/2 inches, unless otherwise noted in this specification.
3) Thickness of basic insulation on vessel heads shall be same as thickness of adjacent cylindrical section of vessel.
4) Thickness of basic insulation on pipe fittings shall be same as thickness of adjoining pipe.
5) If heater exhaust stacks or ducting are to be insulated, thickness of insulation shall be computed to maintain flue gas temperature above dew point.
6) VENDOR or INSTALLER shall submit the following documents for review and approval by CLIENT:
   a. MSDS (Material Safety Data Sheet) for insulation, sealant, cement, adhesive
   b. Details of insulation supports, insulation expansion joints and design of weather jackets to prevent water intrusion.

4-2. Materials

1) All non-metallic materials shall be fire-resistive with a flame-spread rating of 25 or less, and a smoke development of 50 or less in accordance with ASTM E84, and a fuel contribution of 50 or less in accordance with ASTM E286.
2) Insulation and ancillary materials shall be formulated without asbestos.
3) Insulation and accessory materials shall be new and shall be used prior to the expiration date.
4) Materials shall not have leachable chloride content of more than 50 ppm when tested in accordance with ASTM C871.
5) Materials shall conform to the following table:

Material/Product	Manufacturer	Operating Temp. Limit (°C)	Reference
Heat Conservation/Personnel Protection Insulation/Anti-Sweat Insulation:			
Cellular Glass/Foamglas Bulk Density = 9 lb/ft^3 (min.)	CLIENT recommended	- 267 to 427	ASTM C552
Acoustical Insulation:			
Mineral Wool Bulk Density = 8 lb/ft^3 (min.)		649	
Fiberglass Bulk Density = 4 lb/ft^3 (min.)		343	
Removable Cover Insulation:			
Glass Fiber Felt		649	ASTM C1086
Ancillary Materials:			
Weatherproofing:			
(a) Piping/Horizontal Vessels			
Flat sheet of 316SS or aluminum alloys 3003 or 5005-H14 with factory bonded internal layer of 0.01-inch thick polyethylene moisture barrier. Metal thickness = 0.016-inch.			ASTM B209
(b) Vertical Vessels			
Corrugated sheet of 316SS or aluminum alloys 3003 or 5005-H14 with factory bonded internal layer of 0.01" thick polyethylene moisture barrier. Metal thickness = 0.020-inch, 0.032; Corrugations = 1-1/4 inches			ASTM B209
(c) Acoustical			
Flat sheet of 316SS or aluminum alloys 3003 or 5005-H14 with factory applied acoustical coating 0.01-inch thick visco-elastic film adhesive having STC (Sound Transmission Class) of 23. The metal thickness shall be 0.020-inch.			ASTM B209
Sealant/Cement/Liner/Mastic:			
(a) For Inner Layer or Direct Contact With Metal:			
Hi-Temp RTV Silicone Adhesive	CLIENT recommended	-52 to 260	Do not use above 260°C
(b) For Outer Layer Joints			
Pittseal 444N Sealant or Equivalent	CLIENT recommended		
(c) For Cyclic/Vibrating Service			
Gypsum Cement/Hydrocal B-11 Powder or Equivalent	CLIENT recommended	Above 65	Do not use on SS due to stress corrosion cracking
(d) For Finish Coating			
Mastic			
(e) Anti-Sweat Insulation			
Anti-Abrasive Compound			Urethane based
Vapor-Sealing Coating			
Open-Weave Glass Membrane			10 x 10 mesh/inch
Miscellaneous:			
Bands	SS316, 0.02-inch thick, 1/2-inch wide (pipe and equipment) and 3/4-inch wide (for vessels)		
Wire	SS-316, Soft Annealed, 16 gauge		
S-Clips	SS-316, 3/4-inch wide x 0.02-inch		
Screws	316 SS, Self-tapping, slotted head with neoprene backed washers		
Ultrasonic Test Plug	Access Plug Flange, Inc. or NDT Seals, Inc.	Elastometric material must be suitable for the specified operating temperature	

4-3. Design Criteria

4.3.1. General

1) Areas Normally Not Insulated

Unless otherwise specified, insulation shall be omitted from the following surfaces unless noted otherwise on the drawings or herein:

a. Nameplates
b. Support legs and vessel skirts
c. Saddle supports for equipment
d. Pipe plugs
e. Blinds on vents and drains
f. Steam tracing tubing fittings
g. Piping and equipment sliding supports
h. ASME Classes 150# and 300 #bolted piping and equipment flanges that operate over 204°C and 399°C respectively shall not be insulated.
i. Sour service bolted piping and equipment flanges shall not be insulated.
j. Manual drains and vents for vessels
k. Dummy supports
l. Thermowell bosses

2) Removable Type Insulation Blanket

a. Items listed below shall be provided with a removable type insulation blanket or cover for ease in maintenance and operation:
   ① Channel covers and flanges of heat exchangers
   ② Valves, flanges, flanged fittings, unions, manways, manholes and steam traps
   ③ Expansion joints
b. The blanket shall be quilted construction of a layer of thermal insulation between a stainless steel foil and silicone impregnated or Teflon coated fiberglass cloth. The materials of construction shall be layered (from the hot side) as follows:
   ① Knitted SS 316 wire mesh
   ② SS 316 foil, 0.02-inch thick
   ③ Thermal insulation, 2 inches thick fiberglass (C1086) see Section 4.2
   ④ Silicone impregnated or Teflon coated fiberglass cloth
c. The blanket shall be constructed so that its natural seam is positioned on the gravitational bottom of the fitting.
d. Each piece of the blanket shall have an embossed metal tag with applicable information such as equipment number, fitting type, etc.

3) Removable Insulation Plug

Removable insulation plugs that allow for ultrasonic thickness measurements shall be installed on hot insulation systems (i.e., piping, vessels, shell, and tube heat exchangers). The location of the plug will be decided by COMPANY's inspector.

4.3.2. Personnel Protection

1) General

Readily accessible surfaces with surface temperature 140 ° F and above shall be insulated or guarded (as specified in Section 4.3.2.4) for personnel protection. Equipment and piping requiring personnel protection will be noted on P&IDs. Where personnel protection is required, protected surface shall extend 7 feet (2M) vertically above and 3 feet (1M) horizontally from the periphery of platforms, walkways or ladders. The insulated surface temperature shall not exceed 60°C.

2) Materials

See Section 4.2

3) Insulation Thickness

Insulation thickness for personnel protection shall be in accordance with Appendix A for Cellular Glass or CLIENT requirement.

4) Guards for Personnel Protection

a. Personnel protection shall be provided by woven wire, expanded metal or perforated sheet metal guards or by guard railings for the following:
   ① Where insulation is not permitted.
   ② Where area is small compared to the entire treated surface.
   ③ Where surfaces normally require ambient air cooling.
b. Woven wire, expanded metal, or perforated sheet metal guards shall be mounted on Nelson studs and supported every 24 inches maximum.
c. The surface temperature of the guard shall not exceed 60℃, and the openings shall be such that the hot surface cannot be inadvertently touched.
d. Metal mesh guards shall be spaced at 1 inch per 38°C from the hot surface.
e. Where guard railings are used for personnel protection, the railings shall be placed not less than 3 feet (1M) from the vertical plane of the hot surface.

4.3.3. Heat Conservation

1) General

Equipment and piping where noted on P&IDs, Data Sheets and/or other project documents as requiring for heat conservation shall be insulated for heat conservation.

2) Materials

a. See Section 4.2

b. Equipment and piping insulated with cellular glass and subject to cyclic expansion and contraction and/or vibration shall have a liner or mat as listed in Section 4.2, to prevent erosion and abrasion. This application is also called "bore-coating".

3) Insulation Thickness

Insulation thickness for heat conservation shall be in accordance with Appendix A for cellular glass or CLIENT requirement.

4-4. Application

4.4.1. General

1) Preparation

a. Equipment and piping to be insulated shall be cleaned and coated in accordance with CLIENT specification. All NDE and pressure testing shall be successfully completed before any insulation is applied.

b. Insulation work shall be completed in accordance with MANUFACTURER's instructions.

2) Application

a. Insulation shall not be applied to damp surfaces.

b. Protective measures shall be taken to prevent moisture from working underneath or into partially applied insulation.

c. Surfaces to be insulated shall be free of oil, grease, loose scale or other foreign matter before applying insulation.

d. Bands shall be jig-stretched and sealed under tension.

e. Pre-formed insulation materials shall be used to the greatest extent possible.

f. Expansion joints in insulation shall be provided to compensate for the differences in the coefficient of thermal expansion (or contraction) between the insulating material and the piping and/or equipment material.

g. Attachments and projections such as angle stiffeners that extend beyond the normal insulation line on piping and equipment shall be insulated to the same thickness and finished in the same manner as the piping and equipment.

3) Storage

a. All insulation materials shall be stored in covered, weather-protected areas above floor level and stacked in a manner to prevent damage.

b. Insulation materials shall be stored and maintained in a dry condition. Insulation that becomes wet or damaged shall be discarded and replaced with new material.

4.4.2. Piping

1) Insulation Type

Pipe insulation shall be of the sectional semi-cylindrical type as manufactured in standard lengths and thicknesses.

2) Support

a. Insulation support rings are required at approximately 18-foot intervals on insulated vertical piping when the insulating thickness is >2 inches thick, when pipe diameter is ≥6 inches nominal diameter or the vertical run is >20' long.

b. Insulation support rings shall be 1/2-inch wide x 1/4-inch thick (minimum) and be of the same class of material as the piping.

c. Insulation support rings shall have a maximum width of 1/2-inch less than the insulation thickness.

d. Pipe support rings may be bolted in place in lieu of seal welding.

e. A 1 inch expansion joint shall be provided under the supports ring.

3) Application

a. Sectional pipe insulation shall be applied in one (1) or two (2) layers to make up the thickness specified:

① If insulation thickness exceeds 2-1/2 inches, the insulation shall be applied in two (2) layers.

② Where layered, circumferential and longitudinal joints shall be staggered.

③ Where single layers are used, longitudinal joints shall be staggered.

b. Joints shall be tightly butted and held in place with SS bands on 12-inch centers. Joints can be sealed by using appropriate sealant as listed in Section 4.2.

c. Small breaks, cracks, voids and ragged edges in insulation shall be filled and coated with Mastic.

4) Weatherproofing
a. Flat sheet 316SS or aluminum shall be machine rolled to fit the circumference of the pipe and shall be held in place by Type 316 SS bands.
b. Each individual jacket shall be applied with a 2-inch minimum lap at all joints and arranged to shed water.
c. Stainless steel banding shall be applied at each end of the joint, at the midpoint, and at a minimum of every 12 inches.
d. Vertical piping shall have S-clips installed to keep jacket sheets from sliding.
① S-clips shall be spaced at 12-inch intervals.
② Each sheet shall have at least two (2) S-clips.
③ Bands at the joints shall be installed inside of the S-clip to keep bands from sliding
④ Longitudinal and vertical joints shall be away from the prevailing wind.

4.4.3. Pipe Fittings
1) General
a. Insulation for fittings shall be shop-fabricated or pre-molded in accordance with ASTM C450. Fittings shall be insulated with the same material and in the same manner as the adjacent pipe. Insulation thickness shall be the same as the adjacent pipe.
b. Where shop fabricated or pre-formed insulation is not possible, insulation shall be built up to the proper thickness using portions of curved segmental blocks or pipe insulation segments, and all cracks shall be sealed with appropriate sealant and coated with Mastic as per Section 4.2. For 6 feet and larger fittings, all insulation pieces shall be held in place by banding.
c. Insulation located at a flange or a similar appurtenance shall have a 45° bevel as required to permit removal of flange bolts or coupling without damage to the insulation. Cut back shall be equal to the bolt length plus 1 inch. The beveled edge shall be sealed with coated with Mastic.
2) Weatherproofing
a. Insulation on fittings shall be covered with a jacket similar to the piping.
b. In sizes where preformed covers are not available, field-fabricated aluminum covers shall be used.
c. 316SS or Aluminum covers on fittings that cannot utilize banding shall be held in place using SS screws on 4-inch centers.
d. Openings between the weatherproofing and piping shall be flashed with an appropriate sealant as per Section 4.2.

4.4.4. Pressure Vessels
1) General
a. Insulation shall be applied to the pressure vessel shell using the broken- joint method starting with alternate one-half and full length curved segments for pressure vessels 6 feet in diameter and smaller.
b. Pressure vessels larger than 6 feet in diameter may use flat blocks beveled to fit.
c. On vertical pressure vessels, the application shall start at the insulation support and proceed upward, and on horizontal pressure vessels, the application shall start at one (1) end of the pressure vessel and proceed circumferentially and horizontally.
d. Insulation for pressure vessel heads shall be applied in the same manner as prescribed for shells using either special factory-shaped discs, head segments, or standard flat blocks trimmed in the field to fit.
e. Expansion and contraction joints shall be provided in the insulation on maximum of 12-foot intervals at insulation rings provided with the vessel.
f. Insulation at vessel connections shall be beveled back to the vessel surface and sealed with appropriate sealant as listed in Section 4.2. Drain/weep hole shall be provided below the flange joint.
g. Insulation is not required on the bottom heads or skirts of vertical pressure vessels unless shown on the P&IDs, Data Sheets and/or other project documents.
2) Support
a. Each layer of insulation shall be held in place with 3/4-inch wide x 0.020-inch thick Type 316 SS bands on approximately 9-inch centers.
b. Head insulation shall be firmly secured by girth loops, bands and/or hairpins.
c. Insulation support rings shall be installed on vertical pressure vessels at the bottom of the insulated area and at the bottom of the top pressure vessel head.
d. A 2-inch space shall be left between the top of the insulating block and the insulation ring. The 2-inch space shall be packed with loose mineral wool before the weatherproofing is applied.
e. See drawings in accordance with CLIENT Specification for details of insulation support rings.

3) Weatherproofing
a. All insulation shall be weatherproofed as follows:
① Horizontal pressure vessels – 0.020-inch thick aluminum sheets, flat sheet
② Vertical pressure vessels – 0.024-inch thick 316SS or aluminum sheets, 1-1/4-inches corrugated
b. Jacketing shall be lapped at least 3 inches at all joints, both vertical and horizontal, and held in place using Type 316 SS banding on 18-inch centers. At expansion or contraction joints in vertical vessels, the overlap shall be at least 6 inches. The two (2) sheets shall be unfastened at the overlap to prevent buckling from shell expansion.
c. Top heads of vertical pressure vessels shall have shop fabricated 0.020-inch thick flat sheet 316SS or aluminum head covers.
d. Openings for nozzles, manways and other connections shall be beveled and sealed with appropriate sealant as listed in Section 4.2 to prevent moisture from entering behind the 316SS or aluminum jacket. Cut back shall be equal to the bolt length plus 1 inch.
4) Nameplates
a. Insulation shall be tapered at 45° from nameplates.
b. Insulation and ancillary materials shall not obstruct the view of the nameplate.
c. Nameplate areas shall be sealed by means of appropriate sealant as listed in Section 4.2.

4.4.5 Heat Exchangers
1) General
a. Insulation of heat exchangers shall follow the same procedures and thicknesses as specified for pressure vessels except that insulation at channel flanges and shell cover flanges shall be cut back/beveled and left un-insulated to permit removing bolts without damaging the insulation. A cut back equal to bolt length plus 1 inch shall be provided.
b. The insulation thickness required for the shell portion of the heat exchanger may differ from the thickness on the channel portion of the exchanger.
c. Double-pipe or hairpin exchangers shall be fully enclosed with fabricated box sections.
2) Weatherproofing
Weatherproofing shall consist of 0.020-inch flat sheet 316SS or aluminum as listed in Section 4.2 over all insulated surfaces.

4.4.6. Turbine Exhaust Ducts
Insulation of exhaust ducts shall be in accordance with Turbine VENDOR and CLIENT specification.

4.4.7. Engine Exhaust
1) On exhaust piping operating in excess of 315℃, a 2-inch air gap shall be formed by installing standoff bands spaced no more than 12 feet apart or VENDOR shall specify design and submit for CLIENT approval.
2) Insulation shall not be applied to flanges, valves or bellows joints.

4-5. Acoustical Insulation (Lagging)
4.5.1. Materials
1) See Section 4.2
2) The outer barrier shall be a minimum 1 lb/ft3 of either loaded vinyl or sheet lead laminated to 316SS or aluminum jacket.



SANHA CONDENSATE 6037

4.5.2. Application

1) All seams of insulation shall be tightly butted and any voids shall be filled with loose insulation using electrometric adhesives. There shall be no gaps and insulating cements shall not be used. Preformed insulation shall be used for piping.
2) The insulation fibers shall be oriented parallel to the surface onto which they are applied (not radial).
3) Insulation shall be held in place with 1/2-inch wide x 0.020-inch thick Type 316 SS banding and fasteners 3 inches from all seams and significant penetrations and on 9-inch centers over the insulation.
4) The barrier and jacket shall be installed with a minimum 3-inch overlap at all joints and arranged to shed water. All joints of barrier/jacket and insulation shall be staggered.
5) All seams and penetrations shall be completely sealed and weatherproofed using non-hardening caulking. A minimum of 0.25-inch diameter bead for all joints shall be applied.
6) The outer jacket shall be secured with 1/2-inch wide x 0.020-inch thick Type 316 SS banding, 3 inches from all seams and penetrations and on 12-inch centers over the jacket.
7) Jacket closure screws shall not be used.
8) Rigid pipe supports shall be insulated down to the steel base.
9) There shall be no direct or indirect metal-to-metal contact of equipment or pipe walls with outer jacketing materials.
10) Vertical runs shall have S-clips installed to keep jacket sheets from sliding. See paragraph 4.4.2.4 (d) for details.
11) Flanged valves shall be insulated using flexible removable reinforced blanket covers (see Section 4.3.1.2) designed to cover the entire valve body including flanges. The covering shall be of wrap around single piece design where practical and fastened with SS fasteners or Velcro strips.
12) At all exposed flanges and at the end of the insulation treatment, the acoustic insulation shall be terminated with an end cap. For exposed flanges, the end cap shall be located as close to the flange as possible and shall not interfere with the requirements for bolt removal.
13) At locations where the cladding would be attached directly to the pipe (such as at an end cap), resilient seals with a minimum thickness of 0.125-inch and a minimum width of 2 inches shall be used between the pipe and the cladding. The edges of the cladding or end cap shall be folded where they rest on the resilient seal and sealed with non-hardening, non-shrinking type caulking.

4-6. Anti-Sweat Insulation (Condensation Control)

1) General

Anti-sweat insulation is used for prevention of sweating if the operating temperature is between 0°C and the normal dew point temperature. Unless otherwise specified, the piping and equipment that becomes cold only intermittently, such as pump-out, drain, or start-up lines, need not be insulated for sweat prevention.

2) Materials

See Section 4.2

3) Insulation Thickness

a. Pipe size (1/2 to 12 inches): 1-1/2 inches thick
b. Pipe size (14 inches to flat): 2 inches thick

4) Application

a. Low temperature urethane based anti-abrasive compound shall be applied to the inner surface of insulation for single-layer applications. On multi-layer applications, only the inside surface of the inner layer shall be coated. Anti-abrasive compound is preferably factory applied.
b. All joints shall be buttered with a joint sealer.
c. After installation of the insulation, vapor-sealing coating shall be applied over the surface of the insulation. The coating wet thickness shall be approximately 1/32-inch thick.
d. While still wet, an open-weave glass membrane (10 x 10 mesh per inch) shall be laid smooth and embedded in the vapor-sealing coating.
e. Before the surface becomes dry to the touch, a second vapor-sealing coat (approximately 1/8-inch thick, when wet) shall be applied over the fabric reinforced layer.
f. When dry, metal jacketing shall be installed.
g. Suitable number of vapor stops shall be used, for example, at all insulation terminations, at protrusions, flange connection terminations, one foot up and down of valves and elbows.

5BLOCK
ASAFA MODULE







05 Thickness of Cellular Glass Insulation for Heat Conservation

ASTM C552
Economic Thickness of Insulation - Inches

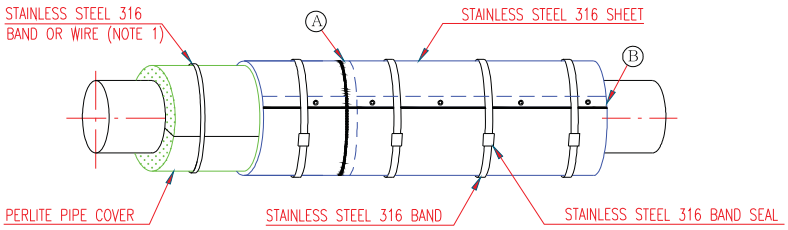
Nominal Pipe Size, Inches	Operating Temperature, °F													
	To 150	151 to 200	201 to 250	251 to 300	301 to 350	351 to 400	401 to 450	451 to 500	501 to 550	551 to 600	601 to 650	651 to 700	701 to 750	751 to 800
1/2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5
3/4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5
1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5
1-1/2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.5	2.5
2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	2.5	2.5	2.5
3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.5	2.5	2.5
4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0
6	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.5	2.5	3.0	3.0	3.0
8	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.5	2.5	3.0	3.0	3.0
10	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	3.0	3.0	3.0	3.0	4.0
12	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	3.0	4.0
14	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	4.0	4.0	4.0
16	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.5	3.0	3.0	3.0	4.0	4.0	4.0
18	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0
20	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0
24	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0
30	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	40.
36	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0
Flat	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0

06 Thickness of Cellular Glass Insulation for Personnel Protection

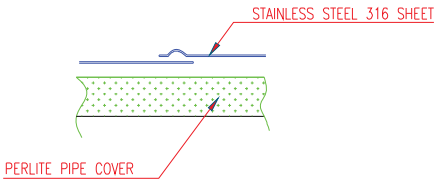
ASTM C552
Maximum Insulation Thickness
to Limit Maximum Surface Temperature to 140 °F

Nominal Pipe Size, Inches	Operating Temperature, °F													
	140	151 to 200	201 to 250	251 to 300	301 to 350	351 to 400	401 to 450	451 to 500	501 to 550	551 to 600	601 to 650	651 to 700	701 to 750	751 to 800
1/2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5
3/4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5
1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0
1-1/2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.5
2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.5	3.5
3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	3.0	3.5	3.5	4.0
4	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.0	3.5	4.0	4.5
6	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	3.0	3.5	4.0	4.5	5.0
8	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.0	3.5	4.0	4.5	5.0
10	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
12	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0
14	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	3.5	4.0	5.0	5.5	6.0
16	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.0	4.5	5.5	6.0
18	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
20	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
24	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.5
30	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.5	6.0	6.5
36	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	5.0	5.5	6.0	6.5
Flat	1.5	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	5.0	5.5	6.0	6.5

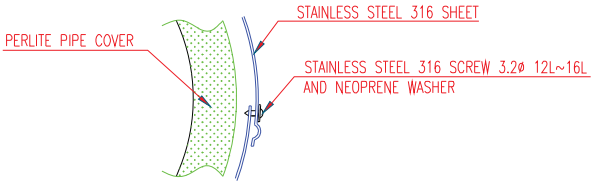
07 Piping & Equipment Heat Conservation Insulation Standard



Insulation of Horizontal and Vertical Piping



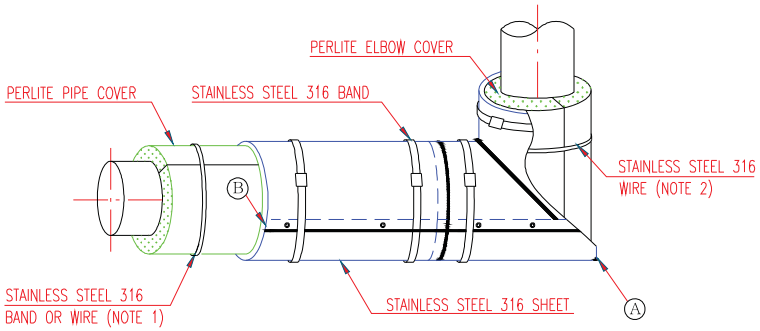
DETAIL "A"



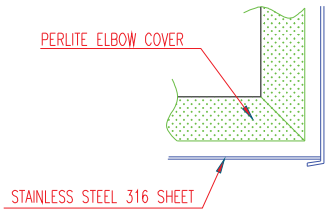
DETAIL "B"

Typical Note
1) Wire shall be used only in pipe in size smaller than 4" NPS
2) Wire shall be used only on Elbows in pipe in size less than or Equal to 8" NPS

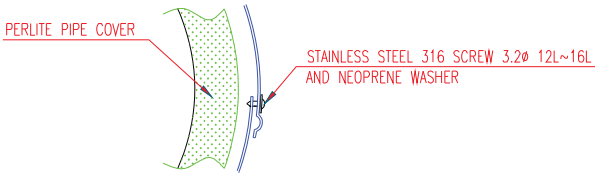
Please Specify overlap requirements at seam as follows;
1) Pipes Size < 4in NPS : 30 mm
2) Pipes Size ≥ 4in NPS : 50 mm
3) Mitered Elbow Sections : 20 mm



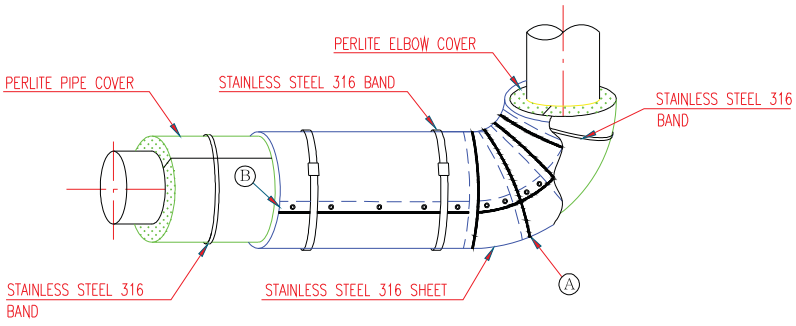
Insulation of Horizontal with Elbow Piping (Smaller than or Equal to 8in NPS)



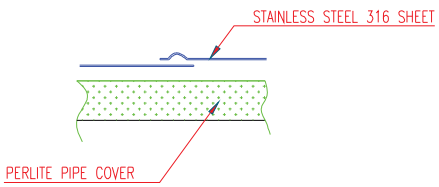
DETAIL "A"



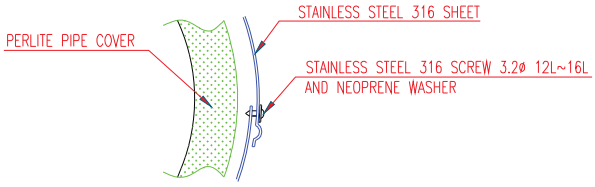
DETAIL "B"



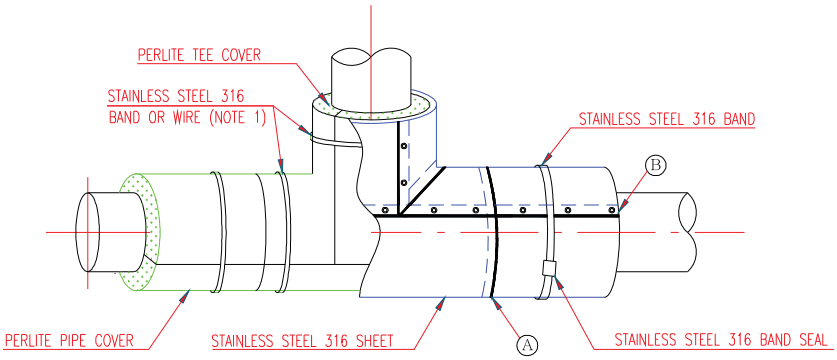
Insulation of Horizontal with Elbow Piping (Larger than or Equal to 8in NPS)



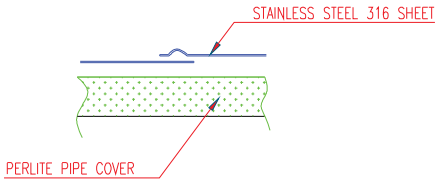
DETAIL "A"



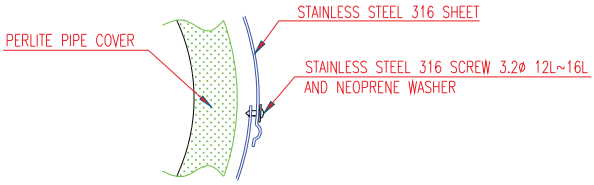
DETAIL "B"



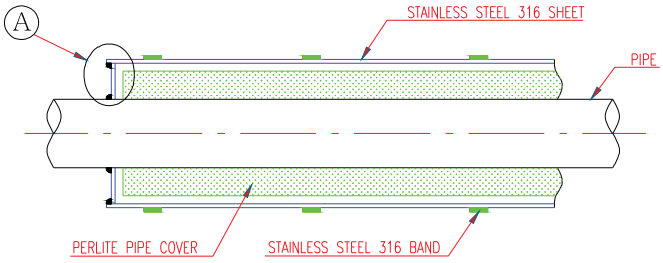
TYPICAL INSULATION OF TEE

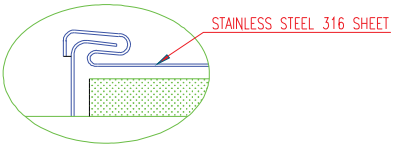


DETAIL "A"

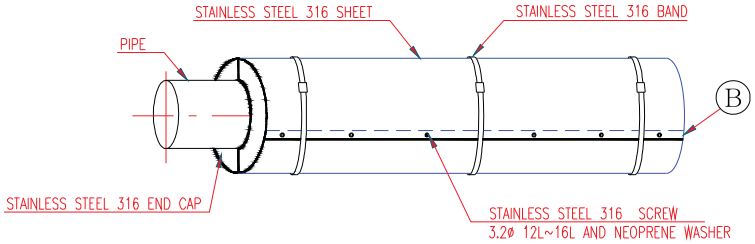


DETAIL "B"

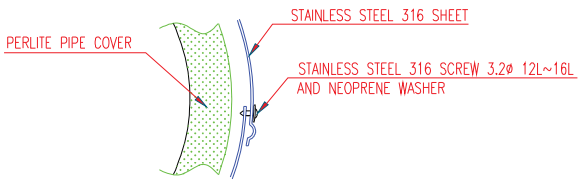




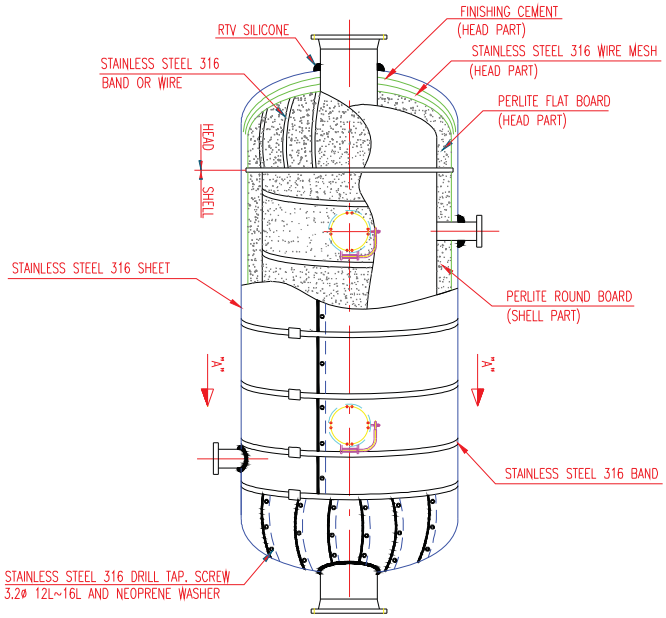
DETAIL "A"

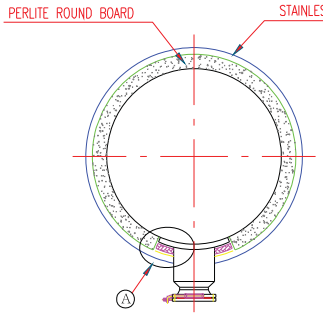


TYPICAL INSULATION OF END POINT

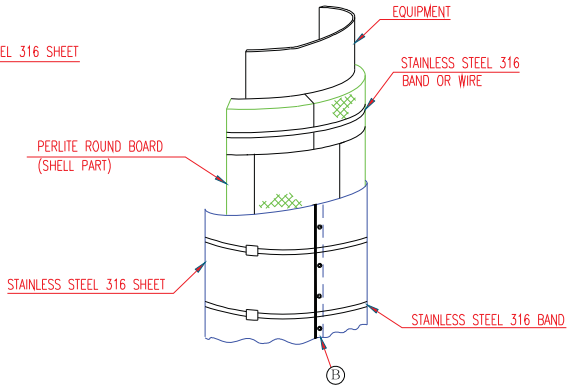


DETAIL "B"

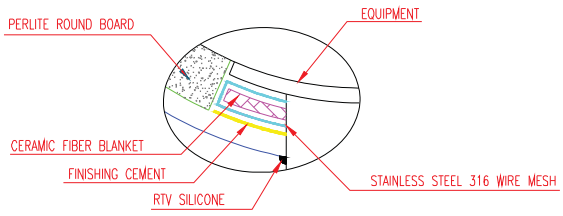




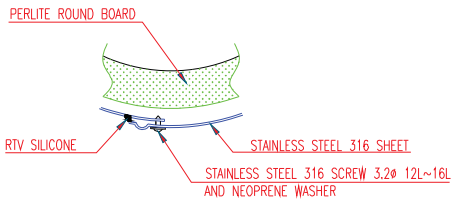
SECTION "A"–"A"



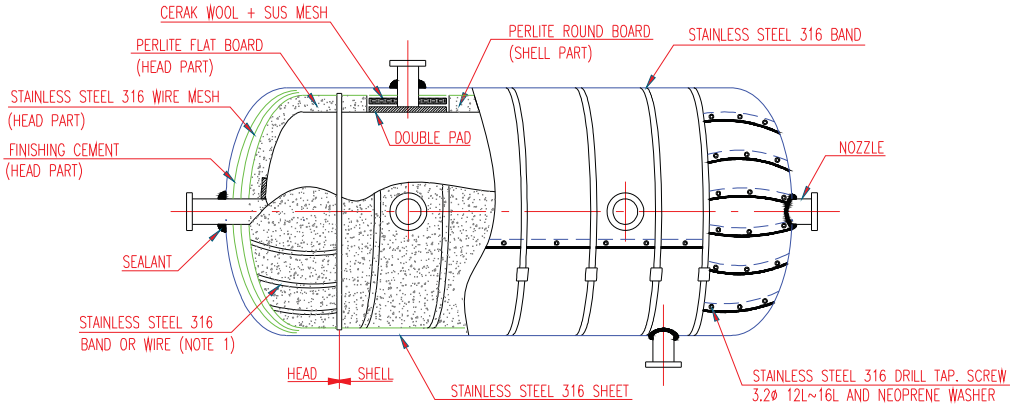
TYPICAL INSULATION OF VESSEL

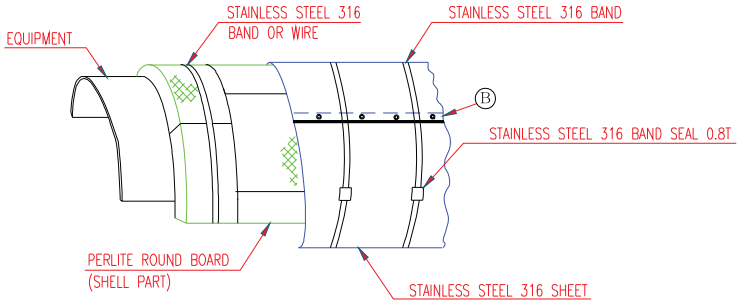


DETAIL "A"

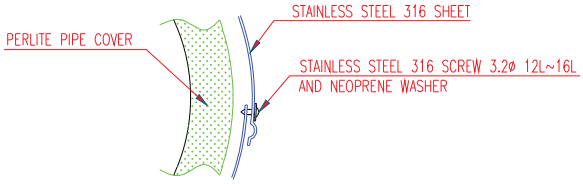


DETAIL "B"

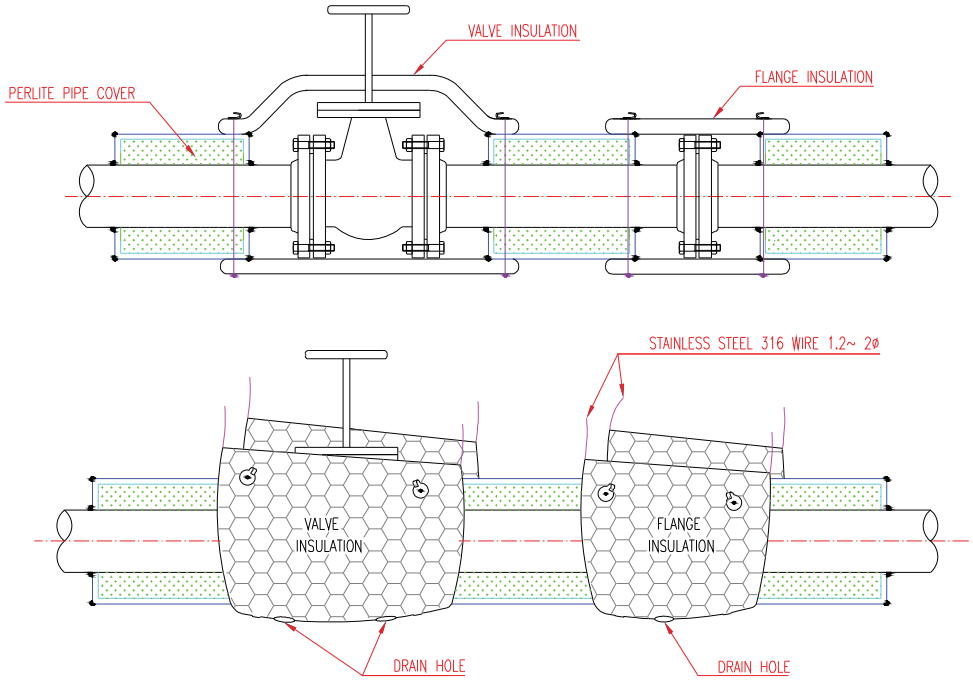




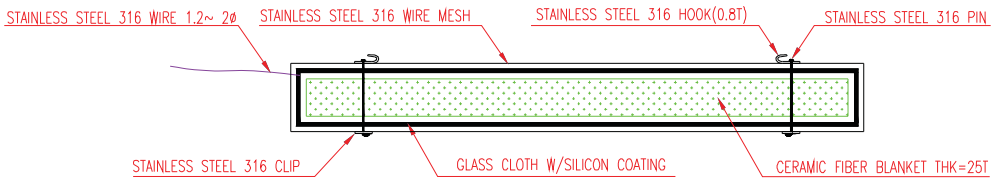
TYPICAL INSULATION OF VESSEL



DETAIL "B"



TYPICAL INSULATION OF VALVE & FLANGE



DETAIL OF REMOVAL MAT

Drain Hole		
VALVE	PIPE O.D (INCH)	DRAIN HOLE (EA)
	8″ ~ 20″	1 EA
	22″ and above	2 EA
FLANGE	PIPE O.D (INCH)	DRAIN HOLE (EA)
	10″ ~ 20″	1 EA
	22″ and above	2 EA





ATLANTIS SEMI RIG
PROJECT 6038

01 General Pigging Steps

Have a platform operator present during any pig trap procedure.
Follow all Safe Operating Procedures. If in doubt GET HELP
DB will be Prepare and submit with Client Approve Detail piggig procedure (Case by Case)



Have a platform operator present during any pig trap procedure.
Follow all Safe Operating Procedures. If in doubt GET HELP

Pig Trap Operating Procedure
To Open:
1. Isolate pig trap
A. Open By-pass Valve.
B. Close valves to all pressure sources.
C. Utilize Lockout/Tagout procedures on ALL pressure sources.
2. Open drain and bleed valves.
3. Verify 0 pressure on gauge.
4. Leave drain and bleed valves open.
5. Do not stand in front of barrel or in the line of fire.
6. Begin to open closure slowly listening for pressure.
7. After ensuring that all pressure is bled off, open closure fully.

NOTE: WHILE TRAP IS OPEN INSPECT DRAIN AND BLEED VALVES
TO ENSURE THAT THEY ARE COMPLETELY UNOBSTRUCTED.

To Close:
1. Ensuring all bleed valves are open, properly reinstalled and secure closure.
2. Close drain valve(s) and bleed valve(s).
3. Remove all Lockout/Tagout devices.
4. Pressure up trap slowly and check for leaks.
5. Position valves as required.






SEMI DRILLING RIG 3019

Special High Cleaning

01 General

This procedure describes cleaning, inspection, packing strategy of piping, fitting, flange to secure the cleanliness, especially process-fluid surfaces, since fabrication to avoid or minimize contamination resulting from cleaning step and management requirements are grease, iron, water, dust and any other foreign material which can influence on the purity, and the cleaning should not affect the original nature of equipment under test.





02 Scope

This procedure applies to all items which contacts with process-fluid.

03 Cleaning Instruction

This procedure defines the instruction of process related to cleaning to be carried out advance of fabrication of items is completed and the items are stocked.
The scheme shall be reflected from purchase of materials, design, and fabrication to review.

3-1. Mechanical Polishing

1) Warehousing Inspection
- Inspect the dimension and surfaces of products.
- Weld Bead Waves on weld-joint area shall be smooth by mechanical polishing.

3) Selecting an abrasive
- Select an abrasive in the light of surfaces of materials.

4) Sequence
- Install machinery after confirming surfaces of products.
- The work shall precede in consistent direction by revolving abrasive stick.
- The work shall be carried out in the order of #40, #80, #120, #200
- After mechanical polishing, remove foreign materials with compressed air. Confirm the surfaces using flashlight then.
- Visual and surfaces inspection shall be carried out by mechanical polishing phase.
- After completing mechanical polishing, whether foreign materials are present and the work is completed or not.

3-2. Inspection method and criteria

1) Visual inspection
- Confirm whether work is done evenly on whole surfaces of materials.
- Confirm whether dent or crack is present on surfaces of materials.
- Perform visual inspection using flashlight.
- Wavy and veining which are formed in the process of the work can be acceptable.

2) Illumination inspection
- After completion of visual inspection, illumination photometry shall be carried out with illumination meter.
- Measured value shall be Ra ≤1.2 ㎛.
- Illumination photometry shall be carried out for only the area where can be perform with illumination meter.

In case of small caliber items which Illumination photometry can not be carried out with illumination meter the inspection can be exempted.

3-3. High pressure cleaning(a minimum of 20kg/㎠, Filtered water 20㎛)

1) All items after surface treatments shall be be cleaned in high pressure to remove dust and other foreign materials thoroughly on both internal and external surface, and drying shall be followed with oil free and dry air(0.1㎛ filter).

3-4. Degreasing

1) Degreasing shall be carried out using surface-active agent.
2) Degreasing method
   a. Surface Cleaning
   b. Deeping
   c. Circulating
   d. Spray

   Use one of the methods above.

3) Items shall be exposed into surface-active agent.
   a. Concentration : 20%
   b. Temperature : Room Temperature (15~20℃)
   c. Exposure Time : 30min ~ 1Hr

3-5. Water cleaning

1) After degreasing, the items shall be high pressure cleaned (demineralized water : less than Min 1㏁, cm@25℃) to rinse surface-active agent until ph value of surface obtains the same ph value of demineralized water.
2) After water cleaning, SS/Alloy materials facilities and A grade of cleaning shall be proceed to acid cleaning step, in case of B grade of cleaning, it shall be proceed to drying step directly.

3-6. Acid cleaning

1) Acid cleaning shall be carried out separately stainless steel (including allow steel) and carbon steel.
2) Method of Acid Cleaning
   a. Surface Cleaning
   b. Deeping
   c. Circulating
   d. Spray

   Use one of the methods above.

   During Acid cleaning, base metal shall not be affected from Acid and as necessary, inhibitor shall be used. The method of Acid Cleaning can be altered by Company and Acid Cleaning procedure shall be prepared and submitted for approval of Company.



3) Stainless Steel / Allow Steel
   a. Items shall be exposed into Acid Cleaning solution.
      . Concentration : 20%
      . Temperature : (15~20℃)
      . Exposure Time : 1 ~ 2Hr
   b. Once Acid Cleaning is completed, high pressure water cleaning shall be carried out with demineralized water until obtaining 5.8 to 8.6 of PH value.
4) Carbon Steel
   Items shall exposed into cleaning solution(HCl). (in case of A class)
   a. Concentration : 5%
   b. Temperature : Room Temperature (15~20℃)
   c. Exposure Time : 10 ~ 30min



- As soon as Acid Cleaning is completed, deeping shall be carried out with neutralization and anticorrosion solution($NaNO_2$). After that Anticorrosion treatment shall be carried out by atomizing surface anticorrosion solution using high pressure atomizer.
   a. Concentration : 15%
   b. Temperature : Room Temperature (15 ~ 20℃)
   c. Exposure Time : 30min ~ 1Hr

3-7. Dry

As soon as water cleaning is completed, Purge and Drying steps shall be carried out with oil-less and dry air(0.1 ㎛ Filter).

3-9. Inspection

As soon as Water Cleaning and Drying steps are completed.
a. UV light Inspection
b. 10 times of Clean Wiper Inspection
Above all, there shall not be any foreign materials during Visual Inspection under bright light. If contamination is detected, IPA Cleaning or Water / Acid Cleaning shall be repeated.

3-9. Final Rinsing

In terms of approved items, wipe the items with IPA lastly, N2(purity : 5N with 0.1㎛ filter) & charge shall be carried out. N2 purge shall be carried out 5 times at 1.5kg/ ㎠, but if design pressure is less 25kg/ ㎠, it shall be carried out 5 times at operating pressure.
(Drying Condition : moisture concentration : Dew Point -30℃ / Oxygen concentration : less than 0.5% volume)
If necessary, particle counting may be carried out.

04 Sealing

4-1. Sealing and packing shall be carried out in clean area.

4-2. 0.3 ~ 0.5kg/㎠ of sealing pressure shall be held at least 3 months and observed several times.

4-3. After sealing items, all nozzle (in case of small, whole facility) of the items shall be wrapped with clean vinyl or PE sheet, and internal air shall be substituted with N2.

4-4. After Fitting and Capping, the items shall be laid to vinyl and sealed with N2. and after N2 sealing of CS pipe & fittings is completed, external of the items shall be painted(Epoxy Primer 1Coat) to prevent corrosion.

Piping material shall be identified by attaching stickers on caps.

05 Packing

5-1. The packing materials which can be damaged easily shall not be used.

5-2. Packing list shall be attached to identify internal wrapping materials.

06 Storage

6-1. Before installation, N2 of instruments inspection is completed shall not be discharged without approval of process engineers.

6-2. When it is possible to be rust and foreign materials resulting from low concentration of N2 during installation, install Line Filter(0.1㎛) and N2 shall be supplemented to maintain the cleanliness.

07 Cleaning Class

7-1. "A" class : Degreasing + Acid Cleaning Item (All SS / Alloy / major C.S)

7-2. "B" class : Degreasing Item (Just for general Carbon Steel)

08 Cleaning Inspection

8-1. Bright Light Inspection
When inspecting surface of cleaning under bright light, there shall not be any foreign materials.

8-2. Clean Wiper Inspection
When the cleaned surfaces are wiped with moderate vigor that can not damage clean wiper, there shall not be any grease and foreign materials on the wiper.

8-3. UV Light Inspection
When inspect the cleaned surfaces with UV Light, confirm that grease, particle, dust are removed thoroughly.

09 Precautions

9-1. All chemicals used for acid cleaning shall be premixed and designated as acid cleaning, the components of all detergent solutions shall be approved prior to use.

9-2. All personnel should wear the appropriate protective clothing, gloves, safety boots etc during the operations, and work in teams of two.

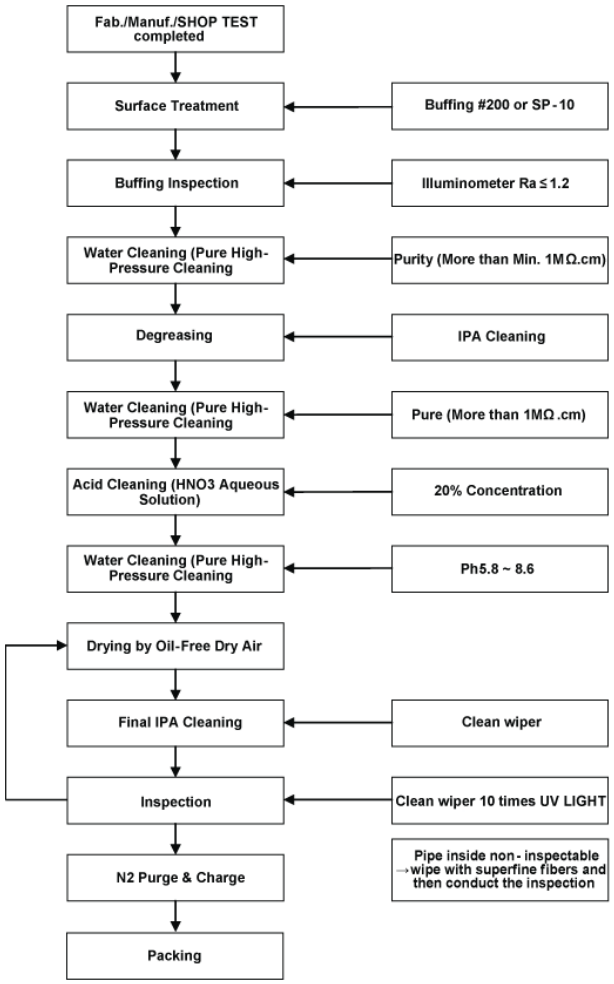
9-3. Nature of materials, metallographic, condition of surfaces shall not be affected from cleaning.

9-4. After completion of the work, high pressure water rinsing shall be carried out to remove residual chemicals on the floor.

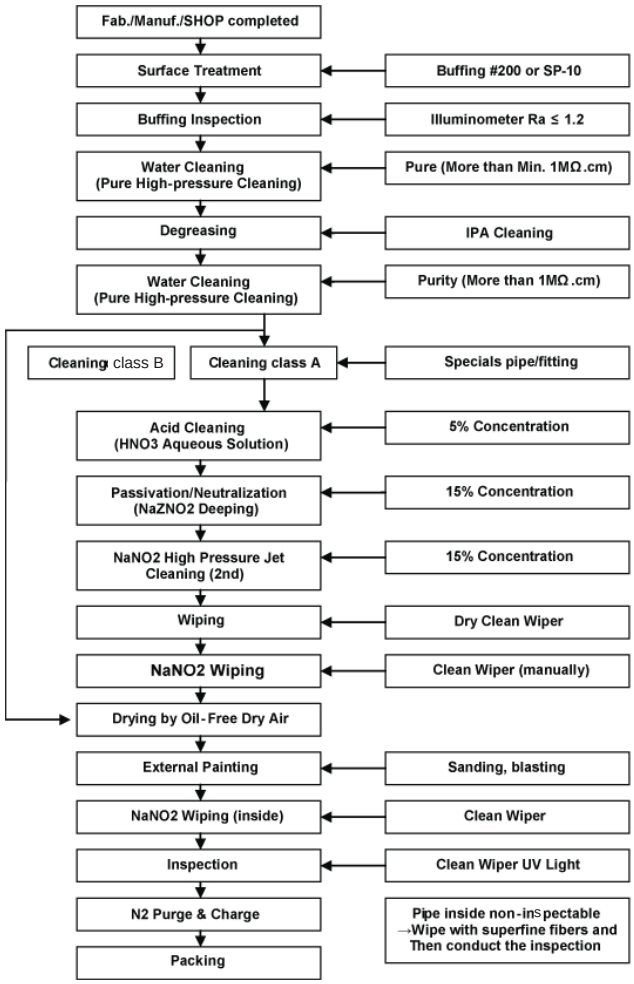
9-5. Rinsed water shall be disposed in accordance with water pollution control regulations.

9-6. The area in which the cleaning and fabrication operations are being conducted shall be isolated from welding, cutting, heating areas and kept clean and free of debris at all times.
Attachment : flow-chart 1st

Flow Chart (Pipe for SS/Alloy Steel)



Flow Chart (Pipe for Carbon Steel)



Oil Purification Service

We Manufacture and Export high quality Oil Cleaning Systems
We are providing Filtration Services, provide Replacement Filter Elements and have an extensive Rental Fleet for lubrication, fuel, and many chemical applications.
The majority of our filtration applications involve the removal of particulate and water from Oils and Fuels. We are committed and focused in providing innovative filtration solutions and services for demanding applications on a global scale.
If the oils & fuels become contaminated, companies call us for solutions

EQUIPMENT PERFORMANCE :

- Flow Rates Range From 20 GPM To 2000 GPM
- Particulate Removal - Achieve Very Low Particle Counts As Low As ISO 14/12/9 Utilizing High Efficiency Pleated Microglass Filter Elements Rated Beta(c)>1000 per ISO 16889
- Water Removal - Remove Free Water Utilizing Water-Removal Filter Elements (Absorptive Type)

DESIGNED FOR USE ON :

- Hydraulic Oil
- Turbine Oil
- Lubrication Oil
- Gear Oil (ISO VG 220 ~ ISO VG 680)
- Transformer Oil
- Diesel Fuel
- Water Glycol (Coolants)

Water Removal Results



Before	After Filtration
Water Concentration	Water Concentration
1300 PPM	11 PPM

OIL FILTERING PROCEDURE

1) Filtering should be done with a two stage filter.
2) The first stage should use a Cellulose cartridge designed to remove particles 25 microns or larger.
3) The second stage filter should be designed for removal of particles 0.5 microns or larger.
4) A pump will also be required to circulate the oil through the filters.
5) The pump should be suitable for use with oil.

The hookup of the equipment is relatively simple.
Once the equipment is properly connected, the pump should be run for about 8 hours with oil and then heated approximately 49℃ to remove the contaminants from the fluid
It should be continuously run till it satisfies the owner's requirement (ISO grade).
The flow rate of the pump should not exceed the maximum allowable flow through the filters



The flow rate of the pump should not exceed the maximum allowable flow through the filters

PFC400W Portable Particle Counter





PFC 400W

Date : 2012-11-03
Time : 13:25:42
Mach ID:
Test ID:
Average of 3 runs
Results: NAS 7
Temp. : 29
Water : 21%SAT

diam	parts per 100ml
> 4um(c):	141513
> 6um(c):	16216
>10um(c):	890
>14um(c):	200
>21um(c):	60
>30um(c):	40
>38um(c):	10
>70um(c):	0





HISTORY

2003 03

WEST SENO FPU PROJECT
CHEMICAL CLEANING & OIL FLUSHING.
AREA : HHI CO.,LTD.(UL SAN)

BLOCK5 DEVELOPMENT PROJECT 2001
8AF/4AB/4BA/4CA/4EA
CHEMICAL CLEANING & OIL FLUSHING.
AREA : HHI CO.,LTD.(UL SAN)

2003 07

HPU SUCTION PIPE CHEMICAL CLEANING.
NO.0001 CABLE HANDING HPU SUCTION PIPE
CHEMICAL CLEANING.
AREA : SAMSUNG FINE CHEMICAL CO.,LTD.(UL SAN)

2003 08

LNG SHIP PROJECT
SHIP NO : 0201,0202, 0134, 0133, 0111, 0137, 0138,
0146, 0140, 0142, 0125, 0126, 0127, 0128
CHEMICAL CLEANING & PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2003 09

KIZOMBA "A" PROJECT
OUTSIDE PASSIVATION
AREA : HHI CO.,LTD.(UL SAN)

2003 10

BP THUNDER HORSE 6036 PROJECT
" PONTOON " WATER JET & WATER FLUSHING.
AREA : HHI CO.,LTD.(UL SAN)

2003 12

BP THUNDER HORSE 6036 PROJECT
" DECK " WATER JET & WATER FLUSHING.
" DECK " ACID CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2004 02

LNG SHIP PROJECT
SHIP NO : 0225,0226,0227,0143,0144,
0250,0254,0255,0258,0378,0228,0205,0203,
0204,0221,0220,0219,0218,0217,0235,0234.
CHEMICAL CLEANING & SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(GEO JE)

2004 06

BP THUNDER HORSE 6036 PROJECT
" PONTOON " WATER JET & WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2004 08

BP ATLANTIS 6038 PROJECT
"DECK" AREA WATER JET & WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2004 09

BP ATLANTIS 6038 PROJECT
ACID CLEANING & OIL FLUSHING & HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2004 10

BB BANGULRA BILIGE 6040 PROJECT
52, 53 MODULE WATER JET & WATER FLUSHING.
51,52,53,54,55 MODULE ACID CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2005 03

BP ATLANTIS 6038 PROJECT
OIL & WATER HYDRO TEST (AUTOCLAVE TUVE).
AREA : DSME CO.,LTD.(GEO JE)

2005 05

DALIA FPSO 6041 PROJECT
11M,12M,13M,22M,23M,33M,34M WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

DALIA FPSO 6041 PROJECT
13M,23M,33M HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2005 10

DALIA FPSO 6041 PROJECT
OIL FLUSHING & OIL HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2005 11

DALIA FPSO 6041 PROJECT
CHEMICAL CLEANING & PASSIVATION.
AREA : DSME CO.,LTD.(GEO JE)

DALIA FPSO 6041 PROJECT
IMPULS & UMBILICAL TUBE HIGH PRESSURE HYDRO.
AREA : DSME CO.,LTD.(GEO JE)

2005 12

KIZOMBA "A" PROJECT
OUTSIDE PASSIVATION.
AREA : DSME CO.,LTD.(GEO JE)

2006~2009 Work History

2006 01

EXXONMOBIL SABLE TIER 2 COMPRESSION PROJECT
OIL HYDRO TEST & OIL FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2006 05

EXXONMOBIL SABLE TIER 2 COMPRESSION PROJECT
CHEMICAL CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

3600TON FLOATING CRANE BARGE GOO1 PROJECT
OIL HYDRO TEST & OIL FLUSHING & AIR FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2006 06

CHEVRON TEXACO AGBAMI FPSO PROJECT
TUBE SYSTEM OIL HYDRO TEST & N2 CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2006 09

CHEVRON TEXACO AGBAMI FPSO PROJECT
HULL WATER HYDRO TEST & HOT OIL FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2006 10

CHEVRON TEXACO AGBAMI FPSO PROJECT
PIPE RACK HYDRO TEST & WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

CHEVRON TEXACO AGBAMI FPSO PROJECT
TOPSIDE WATER JET & WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2007 02

CHEVRON TEXACO AGBAMI FPSO PROJECT
TOPSIDE HOT OIL FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2007 03

LPG SHIP PROJECT
SHIP NO : 1142,1143,1144,1146,1153.
SUS SURFACE PASSIVATION.
AREA : SKHI CO.,LTD.(UL SAN)

2007 05

CHEVRON TEXACO AGBAMI FPSO PROJECT
TOPSIDE METHANOL SYSTEM HYDRO TEST 1056BAR.
AREA : DSME CO.,LTD.(GEO JE)

2007 08

SEADRILL H.3019 GVA 7500 SEMI RIG PROJECT
TUBE LINE HYDRO TEST
AREA : DSME CO.,LTD.(GEO JE)

LNG SHIP PROJECT
LNG : 1144,1149 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

LPG SHIP PROJECT
SHIP NO : 0419,0407,0475,2023,2024,
2029,2030,0467,0468,0469
CARGO TANK SUS SURFACE PASSIVATION
AREA : HMD CO.,LTD.(UL SAN)

SHIP NO :0452,2018,0453,0454,0455,
0456,0446,0447,2022
CARGO TANK SUS SURFACE PASSIVATION
AREA : HMD CO.,LTD.(UL SAN)

2007 09

SEADRILL H.3019 GVA 7500 SEMI RIG PROJECT
ALL PIPING SYSTEM HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

H.2254 RV LNG SHIP REGAS SYSTEM
PNEUMETIC TEST 202BAR.
AREA : DSME CO.,LTD.(GEO JE)

2007 11

LPG SHIP PROJECT
LPG : 1150, 1154 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

SEADRILL H.3019 GVA 7500 SEMI RIG PROJECT
HOT OIL FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2007 12

LNG SHIP PROJECT
SHIP NO : 0478,2041,2019,2055,0479,0470,2025,2056,
2008,2014,2123,2031,2034.
CARGO TANK SUS SURFACE PASSIVATION.
SHIP NO : 2009,2124,2043,2020,2125,2026,2057,2042,
2015,2032 2035,2010 CARGO TANK SUS
SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

SEADRILL H.3019 GVA 7500 SEMI RIG PROJECT
INSIDE PIPING CHEMICAL CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2008 01

LPG SHIP PROJECT
LPG 1151 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

CHEVRON TEXACO AGBAMI FPSO PROJECT
OFFSHORE ALL SYSTEM LEAK TEST & OIL FLUSHING.
AREA : DSME CO.,LTD.(NIGERIA)

2008 02

SAMCHEOK DONGYANG CEMENT EXHAUST HEAT
BOILER 1st,2nd,3rd,4th HRSD CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

2008 03

HANHWA ELECTRIC POWER STATION 10,11,12th.
HRSD CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

2008 04

YANGSAN STEAM SUPPLY AND POWER GENERATION
STATION 1st,2nd HRSD CHEMICAL CLEANING.
1151,1160,1161 SUS SURFACE PASSIVATION.
AREA : SKHI CO.,LTD.(UL SAN)

3023 ODFJELL SEMI. DRILLING RIG PROJECT
ALL PIPING SYSTEM HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2008 05

LPG SHIP PROJECT
LPG 1152 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

3023 ODFJELL SEMI. DRILLING RIG PROJECT
HOT OIL FLUSHING & CHEMICAL CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2008 06

LNG SHIP PROJECT
SHIP NO : 1162,1168,1165
SUS SURFACE PASSIVATION.
AREA : SKHI CO.,LTD.(UL SAN)

CHEVRON TEXACO TOMBUA LANDANA PROJECT
WATER JET FLUSHING & WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2008 07

LPG SHIP PROJECT
LPG 1157 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

LNG SHIP PROJECT
SHIP NO : 8005,8006,8007,8008,8009,8010,8017,8018
CARGO TANK SUS SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

LNG SHIP PROJECT
SHIP NO : 8011,8012,8013,8014.
CARGO TANK SURFACEPASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2008 08

LPG SHIP PROJECT
SHIP NO : 1158,1163,1169 SUS SURFACE PASSIVATION
AREA : SKHI CO.,LTD.(UL SAN)

LNG SHIP PROJECT
SHIP NO : 2128,2012,2058,2127,2027,2037,2129,
2044,2036,2059,2013.
CARGO TANK SUS SURFACE PASSIVATION
AREA : HMD CO.,LTD.(UL SAN)

SHIP NO : 2130,2021,2038,2111,2094,2067,2060,
2016,2068,2061,2028 2112.
CARGO TANK SURFACEPASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

S.S.V PETROSERV SEMI. DRILLING RIG PROJECT
ALL PIPING SYSTEM HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

CHEVRON TEXACO TOMBUA LANDANA PROJECT
ALL PIPING SYSTEM HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2008 09

LNG SHIP PROJECT
LNG 1159 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

CHEVRON TEXACO TOMBUA LANDANA PROJECT
H.2263 RV LNG SHIP REGAS SYSTEM.
AIR HYDRO TEST 202BAR.
DELUGE DROP TEST.
AREA : DSME CO.,LTD.(GEO JE)

2008 10

CHEMICAL TANKER SHIP PROJECT
CHEMICAL TANKER 1165 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

2008 11

LNG SHIP PROJECT
SHIP NO : 1166,1170,1175 SUS SURFACE PASSIVATION
8011,8012,8013,8014.
CARGO TANK SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2008 12

LPG SHIP PROJECT
LPG 1154 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO.,LTD.(UL SAN)

LPG SHIP PROJECT
2039,2017,2095,2098,2045,2062,2203,2070,2069,2139
CARGO TANK SUS SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2198,2096,2049,2082,2204,2159,2040,2145,2102,2071
CARGO TANK SUS SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2009 01

CHEVRON TEXACO TOMBUA LANDANA PROJECT
OFFSHORE ALL SYSTEM LEAK TEST & OIL FLUSHING.
AREA : DSME CO.,LTD.(ANGOLA)

2009 02

LNG SHIP PROJECT
SHIP NO : 2050,2088,2099,2046,2199,2113,2040,
2080,2103,2063,2048.
CARGO TANK SUS SURFACE PASSIVATION.
AREA : HMD CO., LTD.(UL SAN)

LNG SHIP PROJECT
SHIP NO : 2050,2088,2099,2046,2199,2113,
2040,2080,2103,2063,2048.
CARGO TANK SUS SURFACE PASSIVATION.
AREA : DSME CO., LTD.(GEO JE)

2009 03

LNG SHIP PROJECT
NG : 1171,1172,1173,1174 DIEGEL FUEL & LUBE OIL LINE.
INSIDE PIPING CHEMICAL CLEANING.
AREA : SKHI CO., LTD.(UL SAN)

2009 04

LNG SHIP PROJECT
LNG : 1167,1176,1171,1179,1177,1172.
CARGO SYSTEM SURFACE PASSIVATION.
AREA : SKHI CO.,LTD.(UL SAN)

2009 05

3025 ODFJELL SEMI. DRILLING RIG PROJECT
ALL PIPING SYSTEM HYDRO TEST.
AREA : DSME CO.,LTD.(GEO JE)

2009 07

3025 ODFJELL SEMI. DRILLING RIG PROJECT
HOT OIL FLUSHING & CHEMICAL CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2009 08

LNG SHIP PROJECT
SHIP NO : 2072,2064,2047,2073,2052,
2065,2097,2051,2160
CARGO TANK SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

LNG SHIP PROJECT
SHIP NO : 2053,2089,2283,2114,2054,
2066,2183,2200,2081
CARGO TANK SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2009 09

LNG SHIP PROJECT
LNG : 1178,1173,1180,1174,1181
CARGO SYSTEM SURFACE PASSIVATION.
AREA : SKHI CO.,LTD.(UL SAN)

2009 11

P.6045 TOTAL PAZPLOR FPSO PROJECT
7 MODULE HYDRO TEST.
7 MODULE WATER FLUSHING & JET FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

2009 12

3026 GRUPO-R SEMI. DRILLING RIG PROJECT
HOT OIL FLUSHING & CHEMICAL CLEANING.
AREA : DSME CO.,LTD.(GEO JE)

2010 01

H.2272 RV LNG PROJECT
PNEUMATIC PRESSURE TEST 202BAR.
AREA : DSME CO.,LTD.(GEO JE)

2010 02

LNG SHIP PROJECT
SHIP NO : 2107,2090,2189,2284,2149,2141,
2161,2173,2100,2108,2147,2083.
CARGO TANK SURFACE PASSIVATION.
AREA : HMD CO.,LTD.(UL SAN)

2010 03

3025 ODFJELL SEMI. DRILLING RIG PROJECT
FLEXIBLE 10" RASER HOSE WATER FLUSHING.
AREA : DSME CO.,LTD.(GEO JE)

H.1187 SUPPLY VESSEL PROJECT
INSIDE PIPING CHEMICAL CLEANING & OIL FLUSHING.
AREA : SKHI CO.,LTD.(UL SAN)

2010 04

BP SKARV FPSO PROJECT
TURRET HYDRO TEST & WATER FLUSHING.
AREA : SHI CO.,LTD.(GEO JE)

2010 05

ESTABLISHED FOR THE MANUFACTURING & CONSTRUTION INDUSTRY.
DB HOLDINGS CO.,LTD.

LOCATED IN SECOND FLOOR LOCATED IN 171-7 SAMSAN-DONG, NAM-GU, ULSAN, KOREA
DB HOLDINGS CO.,LTD.

2010 06

HALLIBURTON AGENT BP SKARV FPSO PROJECT
TURRET HELIUM LEAK TEST
AREA : SHI.CO.,LTD.(GEO JE)

2010 07

OFFSHORE H7964 SAIPEM 12000 DRILLSHIP PROJECT
BOP SYSTEM CHEMICAL CLEANING
AREA : SHI.CO.,LTD.(CONGO)

2010 08

KEARI OIL SAND PROJECT
WATER JET FLUSHING
AREA : SGT.CO.,LTD.(UL SAN)

HYDRILL(GE Oil & Gas)
BOP SYSTEM CHOKE & KILL LINE
1,700BAR HYDRO TEST
AREA : DBHOLDINGS.CO.,LTD.(UL SAN)

2010 09

ACQUIRED EMS (ENVIRONMENTAL MANAGEMENT SYSTEM)
CERTIFICATION - ISO 14001 : 2004

ACQUIRED QMS (QUALITY MANAGEMENT SYSTEM)
CERTIFICATION - ISO 9001 : 2008

2010 11

SABIYA PROJECT
CHEMICAL CLEANING & WATER JET BLASTING
AREA : HHI.CO.,LTD.(UL SAN)

REGISTERED HYUNDAI SUB-CONTRACTED COMPANY HYUNDAI CO.,LTD.

2010 12

USAN FPSO PROJECT
WATER JET BLASTING
HP/LP COMPRESSOR PIPE LINE
AREA : HHI.CO.,LTD.(ULSAN)

PROVISION OF OIL PURIFICATION SERVICES
DSME CASTROL ALPHA SP150 NAS1638 GRADE6
SYSTEM OIL REFINNING 28,000 LITER
AREA : DBHOLDINGS.CO.,LTD.(ULSAN)

2011 01

USAN FPSO PROJECT
HP/LP COMPRESSOR LINE CHEMICAL CLEANING
AREA : HHI CO.,LTD.(UL SAN)

PROVISION OF OIL PURIFICATION SERVICES
SHELL TELLUS S2V46 NAS1638 GRADE6
SYSTEM OIL REFINNING 40,000 Liter
AREA : SHI CO.,LTD.(GEO JE)

H.3605 GE Oil & Gas DRILLSHIP PROJECT
MIXING UNIT PIPE INSULATION
AREA : DSME CO.,LTD.(GEO JE)

2011 04

USAN FPSO PROJECT
HYDRAULIC TUBE HOT OIL FLUSHING
AREA : HHI CO.,LTD.(UL SAN)

OBTAINED THE VENTURE ENTERPRISE CERTIFICATION
VENTURE ENTERPRISE CERTIFICATION

2011 06

REGISTED ONTO SUNGJIN GEOTEC AS A SUB-CONTRACTED COMPANY.
SUNGJIN GEOTEC CO.,LTD.

2011 07

IGD DAS PROJECT
CHEMICAL CLEANING & WATER JET FLUSHING
AREA : HHI CO.,LTD.(UL SAN)

2011 08

KEARI OIL SAND PROJECT
42 MODULE WATER JET FLUSHING
AREA : SGT CO.,LTD.(UL SAN)

2011 09

KEARI OIL SAND PROJECT
VESSEL CHEMICAL CLEANING
AREA : SGT CO.,LTD.(UL SAN)

DEAWOO SHWE PROJECT
PIPE SPOOLS WATER JET FLUSHING
AREA : HHI CO.,LTD.(UL SAN)

2011 10

OFON PROJECT
VESSEL CHEMICAL CLEANING
AREA : SGT CO.,LTD.(UL SAN)

2011 11

USAN FPSO PROJECT
OFFSHORE PIPE SPOOLS CHEMICAL CLEANING
AREA : HHI CO.,LTD.(UL SAN)

DB HOLDINGS'S FACTORY LOCATED
ESTABLISHED DB HOLDINGS'S FACTORY LOCATED IN 49-4, DOEKSIN-RI, ULJU-GUN, ULSAN, KOREA.

2011 12

REGISTERED ONTO STEEL FLOWER SUB-CONTRACTED COMPANY.
STEEL FLOWER CO.,LTD.

2012 01

GORGON PROJECT BARROW ISLAND LNG PLANT
PIPE WATER JET BLASTING
PASSIVATION VPCI-649
Client : STEEL FLOWER CO.LTD.(PO HANG)

2012 02

3402 LIVING QUARTER
POTABLE WATER SYSTEM WATER FLUSHING
Client : SHIN HAN MACHINERY CO.,LTD.(UL SAN)

REGISTERED ONTO SINHAN MACHINERY SUB-CONTRACTED COMPANY.
Client : SINHAN MACHINERY CO.,LTD.

2012 03

DAEWOO SHWE PROJECT
PIPE SPOOLS WATER JET CLEANING
Client : HHI CO.,LTD.(UL SAN)

2012 04

DAEWOO SHWE Q522 PROJECT
CHEMICAL CLEANING & HOT OIL FLUSHING
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
96 BUNDLE 48 BEY
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

2012 05

GORGON PROJECT BARROW ISLAND LNG PLANT
PIPE WATER JET BLASTING
PASSIVATION VPCI-649
Client : STEEL FLOWER CO.LTD.(PO HANG)

GORGON PROJECT BARROW ISLAND LNG PLANT
UAGA MODULE AIR FIN COOLER & LUBE OIL COOLER
CHEMICAL CLEANING.
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
UAGA MODULE PNEUMATIC PRESSURE TEST
SANA MODULE PNEUMATIC PRESSURE TEST
Client : HHI CO.,LTD.(UL SAN)

ACQUIRED OHSAS (OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM)
CERTIFICATION - OHSAS 18001.

2012 06

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF OIL PURIFICATION SERVICES
NAS1638 CLASS 610,000Liter
78500062-SI-1385
WORK AREA : DBHOLDINGS FACTORY.(UL SAN)
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF AIR DRYER AND ACCESSORIES
78500062-SI-1377
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF GENERRATORS
25KVA 3Phase 415V 50Hz 2SET
78500062-SI-1362
Client : HHI CO.,LTD.(UL SAN)

H1190 SWIRE PACIFIC AHTS SUPPLY VESSEL
PIPING INSTALLATION
STEEL OUTFITTING INSTALLATION
WORK AREA : SGT CO.,LTD.(GEO JE)
Client : SGT CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
UAGA, SANA MODULE LINE CLEANING
CHEMICAL CLEANING
WATER FLUSHING
AIR BLOWING - QOV (Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

2012 07

GORGON PROJECT BARROW ISLAND LNG PLANT
GROSS AIR LEAK TEST
UAGA MODULE GALT TEST
SANA MODULE GALT TEST
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF OIL SPILL PALLETS AND PART BINS
IBC OIL SPILL PALLET : 10EA
DRUM OIL SPILL PALLET : 2EA
PART BIN : 20EA
78500062-SI-1292
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF MECHANICAL SEAL SYSTEM AND TOOLS
Plan 53B mechanical seal system Refill Cart
Nitrogen charging kit VG3
Nitrogen charging kit VGU
78500062-SI-1252
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
TAJA MODULE 32 BUNDLE 16 BEY
TAJB MODULE 40 BUNDLE 20 BEY
78500062-SI-1508
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GOLIAT FPSO (Q524) PROJECT
EFCS HYDRAULIC TUBING
OIL FLUSHING 28 SYSTEM
Client : HHI CO.,LTD.(UL SAN)

2012 08

OFON PROJECT
CARBON STEEL PIPE 9,285 SPOOLS
WATER JET BLASTING
BIO CHEMICAL CLEANING
WORK AREA : DB HOLDINGS FACTORY
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PNEUMATIC PRESSURE TEST FOR 1E-1103 AND 1E-1104
1E-1103 : 20 BUNDLE 10 BEY
1E-1104 : 12 BUNDLE 6 BEY
78500062-SI-1559
WORK AREA : YUM-PO WHARF ULSAN.
Client : HHI CO.,LTD.(UL SAN)

2012 09

GOLIAT FPSO (Q524) PROJECT
EFCS HYDRAULIC TUBING
CHEMICAL CLEANING 28 SYSTEM
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
TAJA, TAJB MODULE LINE CLEANING 133PKGS
CHEMICAL CLEANING
WATER FLUSHING
AIR BLOWING - QOV (Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
GACA MODULE 2 BUNDLE 1 BEY
JACA MODULE 4 BUNDLE 2 BEY
78500062-SI-1686, 1690
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
TAJA MODULE PNEUMATIC PRESSURE TEST
TAJB MODULE PNEUMATIC PRESSURE TEST
Client : HHI CO.,LTD.(UL SAN)
Main Contractor : HALLIBUTON

2012 10

H1190 SWIRE PACIFIC AHTS SUPPLY VESSEL
STRUCTURE INSTALLATION
WORK AREA : SGT CO.,LTD.(GEO JE)
Client : SGT CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
UACA MODULE 6 BUNDLE 3 BEY
GADA MODULE 12 BUNDLE 6 BEY
GAEA MODULE 12 BUNDLE 6 BEY
78500062-SI-2229
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
TAJB MODULE 2 BUNDLE 1 BEY
TAJC MODULE 40 BUNDLE 20 BEY
TAJD MODULE 42 BUNDLE 21 BEY
78500062-SI-2407
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PRE-INSTALLATION INSPECTION OF AIR FIN COOLERS
- Remove flanges of coolers
- Clean Flanges of Coolers
- Inspect Flanges of Coolers and provide a Detail Report of Findings
- Replace flanges after internal inspection of Coolers
- Do a bore scope inspection of Cooler internals provide a Detail Report of Findings

78500062-SI-2392
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
GREASE SAMPLE ANALYSIS
FIN FAN DRIVE SHAFT TOP BEARING
- PROVIDE 20 SAMPLE CONTAINERS
- CARRY OUT ANALYSIS OF 3 ONLY GREASE SAMPLES PROVIDED
- PROVIDE COMPANY WITH GREASE SAMPLE ANALYSIS REPORT

78500062-SI-2384
Client : HHI CO.,LTD.(UL SAN)

2012 12

GORGON PROJECT BARROW ISLAND LNG PLANT
MODULE TAJA,TAJB,GADA,GAEA,UACA,TAAA,TABA
PIPES KEEP THE SURFACE TEMPERATURE OF 7.2 DEGREES
- PNEUMATIC TEST
- HE & N2 LEAK TEST
- MITT (Module Integration Tightening Test)

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

H1190 SWIRE PACIFIC AHTS SUPPLY VESSEL
ALL PIPING SYSTEM PRESSURE TEST
- PNEUMATIC TEST
- WATER HYDRO TEST
- OIL HYDRO TEST

PIPING CHEMICAL CLEANING
- DIESEL FUEL SYSTEM
- LUBE OIL SYSTEM
- HYDRAULIC SYSTEM

WORK AREA : SGT CO.,LTD.(GEO JE)
Client : SGT CO.,LTD.(UL SAN)

2013 01

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
TAJC MODULE 2 BUNDLE 1 BEY
78500062-SI-3099
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF AIR FIN COOLER
CAAA MODULE 20 BUNDLE 10 BEY
SADA MODULE 6 BUNDLE 3 BEY
78500062-SI-3036
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

H1190 SWIRE PACIFIC AHTS SUPPLY VESSEL
PIPING HOT OIL FLUSHING
- LUBE OIL SYSTEM
- HYDRAULIC OIL SYSTEM
- DIESEL FUEL OIL SYSTEM

WORK AREA : SGT CO.,LTD.(GEO JE)
Client : SGT CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
2nd SHIPMENT GROSS AIR LEAK TEST
TAJA MODULE GALT TEST
TAJB MODULE GALT TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
3rd SHIPMENT LINE CLEANING
GADA,GAEA,UACA MODULE
CHEMICAL CLEANING
WATER FLUSHING
AIR BLOWING - QOV (Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

2013 02

GORGON PROJECT BARROW ISLAND LNG PLANT
3rd SHIPMENT PNEUMATIC TEST
GADA MODULE PNEUMATIC PRESSURE TEST
GAEA MODULE PNEUMATIC PRESSURE TEST
UACA MODULE PNEUMATIC PRESSURE TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
3rd SHIPMENT GROSS AIR LEAK TEST
GADA MODULE GALT TEST
GAEA MODULE GALT TEST
UACA MODULE GALT TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

MEXICO CCGT POWER PROJECT
PROVISION OF TUBE FITTING & TUBE PIPE
SWAGELOK TUBE FITTING
PARKER TUBE PIPE & O-RING, FITTING
Client : SAMSUNG ENGINEERING CO.,LTD.(MEXICO)

CHEVRON NIGERIA AGBAMI FPSO PROJECT
PROVISION OF FORKLIFT PART 20 ITEMS
REQUISITION No. MPR10862908
Client : CHEVRON
AREA : CHEVRON (NIGERIA)

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
RECYCLE GAS COMPRESSOR
UACA MODULE
78500062-SI-2628
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CLEANING OF VASSELS
TOTAL 9 SETS
WATER JET BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-2952,2960,2965
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

RASGAS BARZAN OFFSHORE PROJECT
HYDRAULIC OIL FLUSHING
WELL HEAD CONTROL PANEL TUBE & PIPE
TOTAL LENGTH 7,505 m
NAS 1638 CLASS 6
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 03

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF GENERATOR
25KVA 3Phase 415V 50Hz 1SET
78500062-SI-3532
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
INTERNAL CLEANING OF VESSELS
TAAA MODULE 2SETS
AIR BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-2927
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
HOT WATER FLUSHING OF AIR FIN COOLERS
TBJB MODULE 14 BUNDLE 7 BEY
78500062-SI-3533
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
INTERNAL CLEANING OF VESSELS
AAAA MODULE 6SETS
AIR BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-3237
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF FMS & REPAIR ENGINEERS
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 04

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF HELIUM GAS
1,080 BOTTLES & BOTTLE RACK 15SET
PROVIDE 6,000 M3 HELIUM GAS
78500062-SI-2519
Client : HHI CO.,LTD.(UL SAN)

OFON Q486 PROJECT
PIPE LINE CHEMICAL CLEANING
PIPING VOLUME : 122 M3
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 05

OFON Q486 PROJECT
PIPE LINE 768 PACKAGE (ALL SYSTEM)
PRESSURE TEST
- WATER HYDRO TEST
- PNEUMETIC TEST

FLUSHING & DRY
- WATER FLUSHING
- WATER JET FLUSHING

- AIR BLOWING

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
4th & 5th SHIPMENT PNEUMATIC TEST
- TAAA MODULE PNEUMATIC PRESSURE TEST
- TABA MODULE PNEUMATIC PRESSURE TEST
- AAAA MODULE PNEUMATIC PRESSURE TEST
- AAAB MODULE PNEUMATIC PRESSURE TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
4th & 5th SHIPMENT LINE CLEANING
- TAAA MODULE LINE CLEANING
- TABA MODULE LINE CLEANING
- AAAA MODULE LINE CLEANING
- AAAB MODULE LINE CLEANING

WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV (Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
4th & 5th SHIPMENT GROSS AIR LEAK TEST
- TAAA MODULE GALT TEST
- TABA MODULE GALT TEST
- AAAA MODULE GALT TEST
- AAAB MODULE GALT TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CHEMICAL CLEANING OF COOLERS
UAEA MODULE (0K-4801A/B-EK1)
- 1st NITROGEN COOLER
- 2nd NITROGEN COOLERS & WATER COOLER

78500062-SI-3842
WORK AREA : HHT YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CLEANING OF LUBE OIL COOLERS
AAAA MODULE (LEAN AMINE PUMP)
- 1P-1101A-E2
- 1P-1101B-E2
- 1P-1101C-E2

78500062-SI-3931
WORK AREA : HHT YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CLEANING OF AIR FIN COOLERS
ABAB MODULE
(HOT WATER FLUSHING & DRYING)
- 2E-1104-A1
- 2E-1104-A2
- 2E-1104-A3
- 2E-1104-A4
- 2E-1104-A5
- 2E-1104-A6

78500062-SI-3948
WORK AREA : YUM-PO WHARF ULSAN
Client : HHI CO.,LTD.(UL SAN)

CHEVRON NIGERIA AGBAMI FPSO PROJECT
PROVISION OF ELECTRONIC BALLAST
UV39W2L-HO : 12SETS
REQUISITION No. PSV12752727
Client : CHEVRON
AREA : CHEVRON (NIGERIA)

2013 06

GORGON PROJECT BARROW ISLAND LNG PLANT
6th & 7th SHIPMENT PNEUMATIC TEST
• TACB MODULE PNEUMATIC PRESSURE TEST
• TAJC MODULE PNEUMATIC PRESSURE TEST
• TAJD MODULE PNEUMATIC PRESSURE TEST
• TACA MODULE PNEUMATIC PRESSURE TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
6th & 7th SHIPMENT GROSS AIR LEAK TEST
• TACB MODULE GALT TEST
• TAJC MODULE GALT TEST
• TAJD MODULE GALT TEST
• TACA MODULE GALT TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
6th & 7th SHIPMENT LINE CLEANING
• TACB MODULE LINE CLEANING
• TAJC MODULE LINE CLEANING
• TAJB MODULE LINE CLEANING
• TACA MODULE LINE CLEANING
WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV
(Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

HN2030 SHELL FLNG PROJECT
DRY & CHARGING OF VESSELS (2SETS)
1.DRY : DEW POINT -40℃
2.CHARGING : 0.2BARG 300M3
WORK AREA : U&S CO.,LTD.(PO HANG)
Client : SHI CO.,LTD.(GEO JE)

2013 07

OFON Q486 PROJECT
PIPE LINE GROSS AIR LEAK TEST
GALT OF ALL SYSTEM (184PKGS)
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
VENDOR SKIDS
• CAAA MODULE
• SADA MODULE
78500062-SI-3056,57,58,59,60
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
8,9,10,11,12,13th SHIPMENT PNEUMATIC TEST
• UAEA MODULE PNEUMATIC PRESSURE TEST
• TAHA MODULE PNEUMATIC PRESSURE TEST
• GACA MODULE PNEUMATIC PRESSURE TEST
• GAGA MODULE PNEUMATIC PRESSURE TEST
• JACA MODULE PNEUMATIC PRESSURE TEST
• JADA MODULE PNEUMATIC PRESSURE TEST
• CAAA MODULE PNEUMATIC PRESSURE TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
8,9,10,11,12,13th SHIPMENT LINE CLEANING
• UAEA MODULE LINE CLEANING
• TAHA MODULE LINE CLEANING
• GACA MODULE LINE CLEANING
• GAGA MODULE LINE CLEANING
• JACA MODULE LINE CLEANING
• JADA MODULE LINE CLEANING
• CAAA MODULE LINE CLEANING
WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV
(Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

2013 08

GORGON PROJECT BARROW ISLAND LNG PLANT
10th & 12th SHIPMENT PNEUMATIC TEST
• SADA MODULE PNEUMATIC PRESSURE TEST
• TBJA MODULE PNEUMATIC PRESSURE TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
10th & 12th SHIPMENT LINE CLEANING
• SADA MODULE LINE CLEANING
• TBJA MODULE LINE CLEANING
WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV
(Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
7,8,9,10,11,12th SHIPMENT GROSS AIR LEAK TEST
• JACA MODULE GALT TEST
• JADA MODULE GALT TEST
• GACA MODULE GALT TEST
• GAGA MODULE GALT TEST
• TAHA MODULE GALT TEST
• UAEA MODULE GALT TEST
• CAAA MODULE GALT TEST
• SADA MODULE GALT TEST
• TBJA MODULE GALT TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 09

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
DOMGAS EXPORT COMPRESSORS
• DAAA MODULE
1.OK-2420 A
2.OK-2420 B
78500062-SI-4155
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
VESSEL PRE-INSPECTION
CLEANING EQUIPMENT AND CONSUMABLE SUPPLY
78500062-SI-4927
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
INTERNAL CLEANING OF VESSEL
TBAA MODULE
DEHYDRATION FEED SEPARATOR 2V-1201
AIR BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-4816
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 10

GORGON PROJECT BARROW ISLAND LNG PLANT
DEMINERALISED WATER FLUSHING OF COMPRESSOR
UAEA MODULE
N2 COMPREEOR 0K-4801A
DRYING DEW POINT -40℃
78500062-SI-4950
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
VENDOR SKIDS
• TAHA MODULE
1K-1450,1K-1450-A1,1K-1450-T1
78500062-SI-4947
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 11

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 14th SHIPMENT PNEUMATIC TEST
• TBJB MODULE PNEUMATIC PRESSURE TEST
• TBDA MODULE PNEUMATIC PRESSURE TEST
• ABAB MODULE PNEUMATIC PRESSURE TEST
• ABAA MODULE PNEUMATIC PRESSURE TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 14th SHIPMENT LINE CLEANING
• TBJB MODULE LINE CLEANING
• TBDA MODULE LINE CLEANING
• ABAB MODULE LINE CLEANING
• ABAA MODULE LINE CLEANING
WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV (Quick Open Valve) remote control
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 14th SHIPMENT GROSS AIR LEAK TEST
• TBJB MODULE GALT TEST
• TBDA MODULE GALT TEST
• ABAB MODULE GALT TEST
• ABAA MODULE GALT TEST
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
VENDOR SKIDS
• JACA MODULE
• GACA MODULE
• CBAA MODULE
• TBHA MODULE
• CCAA MODULE
• TCHA MODULE
78500062-KJV-2920
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
MAINTENANCE OF INGERSOLL RAND COMPRESSOR
78500062-SI-5281
78500062-SI-5505
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2013 12

GORGON PROJECT BARROW ISLAND LNG PLANT
PIPES KEEP THE SURFACE TEMPERATURE OF 7.2 DEGREES
- PNEUMATIC TEST(7MODULES)
- HE & N2 LEAK TEST(11MODULES)
- MITT (Module Integration Tightening Test)

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
INTERNAL CLEANING OF VESSELS
TBCA MODULE 4SETS
AIR BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-4436
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
CLEANING OF LUBE OIL COOLERS
CAAA MODULE
- INTERNAL CLEANING OF 18SETS
- CHEMICAL CLEANING OF PIPING
- LEAK TEST OF 2COOLERS

78500062-SI-5412
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
INTERNAL CLEANING OF VESSELS
DAAA MODULE 2SETS
AIR BLASTING
DRYING DEW POINT -40℃
PASSIVATION VpCI-649
78500062-SI-4480
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

OFON Q486 OFFSHORE PROJECT
CHEMICAL CLEANING OF PIPE SPOOLS
PRESSURE TEST OF PIPE SPOOLS
WORK AREA : DB HOLDINGS FACTORY
Client : HHI CO.,LTD.(UL SAN)

2014 01

Clair Ridge Project
Hydro test for Glycol Contactor Unit
- Test Unit : GLYCOL CONTRACTOR (V-34102)
- Hydro Test Volume & Pressure : 10.8 ㎥ / 140.14barg
- Test shall be carry out at pier 6 in UL-SAN

WORK AREA : YUM-PO WHARF ULSAN
Client : ENERMECH CO.,LTD.

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 16th SHIPMENT PNEUMATIC TEST
- TBAA MODULE PNEUMATIC PRESSURE TEST
- TBBA MODULE PNEUMATIC PRESSURE TEST
- DAAA MODULE PNEUMATIC PRESSURE TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 16th SHIPMENT LINE CLEANING
- TBAA MODULE LINE CLEANING
- TBBA MODULE LINE CLEANING
- DAAA MODULE LINE CLEANING

WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV
(Quick Open Valve remote control)
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
12th & 16th SHIPMENT GROSS AIR LEAK TEST
- TBAA MODULE GALT TEST
- TBBA MODULE GALT TEST
- DAAA MODULE GALT TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2014 02

CHEVRON NIGERIA ESCRAVOS PROJECT
PROVISION OF FLANGE PART 14 ITEMS
REQUISITION No. PSV485942
Client : PLATINUM SAMANDY VENTURES
AREA : CHEVRON NIGERIA

CHEVRON NIGERIA AGBAMI FPSO PROJECT
PROVISION OF FORKLIFT PART 14 ITEMS
REQUISITION No. PSV491198
Client : PLATINUM SAMANDY VENTURES
AREA : CHEVRON NIGERIA

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF GENERATOR
25KVA 3Phase 415V 50Hz 3SETS
78500062-SI-5857
WORK AREA : HHI YARD
Client : CHEVRON KJVG (UL SAN)

BP QUED 204 FPSO PROJECT
Hot Oil Flushing
- Turret Connector Folding System

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2014 03

GORGON PROJECT BARROW ISLAND LNG PLANT
18th & 20th SHIPMENT PNEUMATIC TEST
- TBCA MODULE PNEUMATIC PRESSURE TEST
- TBDA MODULE PNEUMATIC PRESSURE TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
18th & 20th SHIPMENT LINE CLEANING
- TBCA MODULE LINE CLEANING
- TBDA MODULE LINE CLEANING

WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV
(Quick Open Valve remote control)
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
18th & 20th SHIPMENT GROSS AIR LEAK TEST
- TBCA MODULE GALT TEST
- TBDA MODULE GALT TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

2014 04

GORGON PROJECT BARROW ISLAND LNG PLANT
HELIUM LEAK TEST
- TADA MODULE
- TBJA MODULE
- TBJB MODULE

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
LUBE OIL FLUSHING
- CAAA MODULE
- SI-6867
- SI-6927

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
STORAGE OF REMOVED FLANGES FOR
DESTRUCTIVE TESTING
- TOTAL REMOVED FLANGES:1,083eA
- CLEAMING
- PACKING FOR TRANSPORTATION AND STORAGE
- PRESERVATION
- SI-6702

WORK AREA : DB HOLDINGS FACTORY
Client : HHI CO.,LTD.(UL SAN)

2014 05

GORGON PROJECT BARROW ISLAND LNG PLANT
16th & 21th SHIPMENT PNEUMATIC TEST
- TBJC MODULE PNEUMATIC PRESSURE TEST
- TBJD MODULE PNEUMATIC PRESSURE TEST
- TBCB MODULE PNEUMATIC PRESSURE TEST
- TCJA MODULE PNEUMATIC PRESSURE TEST
- TCJB MODULE PNEUMATIC PRESSURE TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
16th & 21th SHIPMENT LINE CLEANING
- TBJC MODULE LINE CLEANING
- TBJD MODULE LINE CLEANING
- TBCB MODULE LINE CLEANING
- TCJA MODULE LINE CLEANING
- TCJB MODULE LINE CLEANING

WATER & JET FLUSHING
AIR SHOCK BLOWING - QOV (Quick Open Valve remote control)
WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
16th & 21th SHIPMENT GROSS AIR LEAK TEST
- TBJC MODULE GALT TEST
- TBJD MODULE GALT TEST
- TBCB MODULE GALT TEST
- TCJA MODULE GALT TEST
- TCJB MODULE GALT TEST

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
VESSEL PRE-INSPECTION CLEANING MATERIALS
- SI-6751

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
VARIOUS WORKS ON FUEL GAS SPOOLS
- FMS & HYDRO TEST
- CUTTING AND BEVELING
- PRESERVATION & PACKING
- TRANSPORTATION

WORK AREA : DB HOLDINGS FACTORY
Client : HHI CO.,LTD.(UL SAN)

2014 06

BP QUED 204 FPSO PROJECT
HULL & TOPSIDE, TURRET
- CHEMICAL CLEANING 477.8㎥
- HOT OIL FLUSHING 1.7㎥

WORK AREA : HHI YARD
Client : HHI CO.,LTD.(UL SAN)

GORGON PROJECT BARROW ISLAND LNG PLANT
PROVISION OF GENERATOR
25KVA 3Phase 415V 50Hz 1SET
78500062-SI-7255
Client : HHI CO.,LTD.(UL SAN)



www.dbholdings.asia
E-mail ceo@dbholdings.asia



DBHOLDINGS
DB Holdings Co., Ltd.
2F, 171-7 Samsan-dong, nam-gu, Ulsan, Korea
TEL. +82.52.227.2017
FAX. +82.52.227.2018
Factory. 49-11, Deoksin-ri, Onsan-eup, Ulju-gun, Ulsan, Korea
Corporate R&D Center. 49-4, Decksin-ri, Onsan-eup, Ulju-gun, Ulsan, Korea