



OIL & GAS DEVELOPMENT COMPANY LIMITED
PROCUREMENT DEPARTMENT (LOCAL), ISLAMABAD
SCHEDULE OF REQUIREMENT

Material : **DESIGN & SUPPLY OF THREE PHASE SEPARATOR FOR
PRODUCED WATER ENHANCEMENT**

Tender Enquiry No: **PROC/LF/PT/16907A/17**

EVALUATION WILL BE CARRIED OUT ON FULL

Due Date:

Bid Bond Value : RS.275,000/-

Attachment(if any) : YES

Sr No	Description	Quantity	Make/Brand offered	Unit	Unit Price (PKR) Inclusive Of All Taxes Except GST	Unit Price (PKR) Inclusive of GST	Total Price (PKR) Inclusive of GST	Delivery Period Offered	deviation from Tender Spec. If Any
1	Separator Tank, Type: Horizontal, Diameter: 2m, Length T/T: 6m, as per Design Code ASMESECTION VIII Div I, U-Stamped, Coated/painted in accordance with specification 2547-SP-0002 & 2547-DOC-001, detailed TOR attached	1		Number					

- Special Note:-** The prospective bidders also download the master set of Tender Document
- The prospective bidders may keep in touch with OGDCL web site for downloading the clarifications/amendments (if any) issued by OGDCL.
 - DELIVERY PERIOD 120 DAYS FROM LPO ISSUE DATE. PAYMENT AFTER DELIVERY & INSPECTION AT QADIRPUR SITE.

Discount (if any) shall only be entertained on Schedule of Requirement of Bidding Document (Financial Proposal). If the discount is mentioned elsewhere in the bid, the same shall not be entertained.



**OIL AND GAS DEVELOPMENT COMPANY
LIMITED**

**SCOPE AND SPECIFICATION
OF
THREE PHASE SEPARATOR**

Project: QADIRPUR GAS FIELD

Client: OIL AND GAS DEVELOPMENT COMPANY

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1.0 INTRODUCTION:

Qadirpur Gas Field is operated by Oil and Gas development Company Ltd (OGDCL).

This specification covers minimum requirements of Three Phase Separator intended to be installed at Qadirpur Gas Field for efficient removal of Oil from Oil water /Vapor

1.1 DEFINITION:

“COMPANY” means “Oil and Gas development Company Ltd (OGDCL)”

“SUPPLIER” means entity with which the company will execute a contract from supply of equipment/material as per this document.

“PROJECT” means “PRODUCED WATER ADEQUACY & CAPACITY ENHANCEMENT AT QADIRPUR GAS FIELD”.

“Separator & Pressure Vessels” means “Three Phase Separator”.

1.2 ERROR OR OMISSION:

The review and comments by Company on Supplier’s or its manufacturers drawings procedures or documents shall only indicate acceptance of general requirement and shall not relieve the supplier of its obligation to comply with the requirements of this specification and other reference documents.

All deviations to this specifications, other referred documents or attachments shall be brought to the knowledge of the company/engineering consultant in the bid. All deviations made during the design procurement, manufacturing, testing and inspection shall be with written approval by the company/engineering consultants prior to execution of work. Such deviations shall be shown by the documentation presented by the supplier.

1.3 CONFLICTING REQUIREMENTS:

In the event of any conflict, inconsistency or ambiguity between these documents, referred documents, codes & standards referenced in the documents the supplier shall refer to the Company / Engineering Consultant whose decision shall prevail.

1.4 LANGUAGE AND UNITS OF MEASUREMENT:

The governing language shall be English language.

All other referred quantities (temperature, pressure and flow rate) shall be expressed as per datasheet.

1.5 ORDER OF PRECEDENCE:

In case of conflict among this document, the referenced documents and the International Codes and Standards, the Supplier shall bring the matter to the Company/ Engineering Consultant attention for resolution and approval in writing.

The order of precedence shall be as follows:

1. Schedule of Requirement
2. This specification document and the referenced Documents
3. Referenced International Codes and Standards

In the event of any conflict of data or requirements in any of above documents, it is the Supplier's responsibility to resolve these conflicts and obtain Company /approval before proceeding with design, manufacture or purchase. In any case the most stringent requirement shall prevail. However, Company / Engineering Consultant interpretation shall be final.

1.6 SUPPLIER'S RESPONSIBILITY

The Supplier shall do the detailed mechanical design, prepare detailed fabrication drawings, get the same approved from Company / Engineering

Consultant, arrange materials, fabricate and transport it after completion.

2.0 CODES & STANDARDS:

Separator (Pressure Vessels) shall be designed and constructed in accordance with the latest approved edition of the following:

- API Specification 12J
- ASME Boiler and Pressure Vessel Code, Section VIII, Division I.
- American Society for Testing and Materials (ASTM).
- ASME IX, Welding and Brazing Qualifications.
- ASME V, Non-Destructive Testing.
- ASME II, Material Specifications.
- ASME B16.5 - Pipe Flanges and Flanged Fittings.
- ASME B31.8 Natural Gas Piping
- ASME B31.3 Liquid Piping
- ASME B16.20, Ring Joint Gaskets and Grooves for Steel Pipe Flanges.
- N.A.C.E. Standard MR-0175 / ISO Standard 15156.
- BS 4232 for Painting Works

2.1 ENVIRONMENTAL DESIGN CRITERIA:

General

Unless otherwise stated on the data sheets, Separator will be located in an open exposed area.

Area Classification

All instrumentation and electrical equipment shall be explosion proof Ex'd' type suitable for use in Class I, Zone I & Zone II, Gas Group IIA & IIB, with temperature classification T3.

Site, Environmental & Utility Design Data:

Separators shall be designed for outdoor location with utility & site conditions as given in Site, Environment & Utility Design Data.

Noise:

The noise level from Pressure Vessel shall not exceed 85 dBA at 1m unless stated otherwise on the data sheets, or separately approved by the Company.

3.0 SCOPE OF WORK

3.1 This specification, in conjunction with applicable codes and standards, pertains to the design, fabrication, materials, testing, inspection, identification and documentation of separator vessel (Class 150) for use as a Condensate/Water separator at Qadirpur Gas Field to handle condensate, gas and water.

3.2 Separator shall be designed, constructed and tested in accordance with the datasheet and the requirements of ASME Section VIII, Division 1 and API 12-J (API specifications for Oil and Gas Separators). The vessel shall be U stamped by the authorized ASME inspector. In case of contradictions, the Company/shall be notified, preferably at the bidding stage. No deviations from bid documents are allowed unless approved previously by the Company. In case of deviation between various standards most stringent requirement will prevail.

3.3 Separators shall be designed, fabricated, inspected, cladded and coated (where specified) and tested in accordance with Separator & Pressure Vessel Datasheet, this document, Specification for Unfired Pressure Vessel referenced specifications and ASME Boiler and Pressure Vessel Code, Section VIII and other codes and standards referenced in these specifications.

3.4 Supplier shall do the detailed mechanical design, arrange materials, fabricate, paint, inspect, test and supply the Separators.

3.5 Supplier shall submit detailed fabrication drawings, weld procedures, detailed calculations, quality plan and other required documents for approval to the Company / Engineering Consultant. Shop work shall not start until the Supplier has received drawings and weld procedure approved by the Company / Engineering Consultant.

No subsequent revision may be issued unless it is approved by the Company / Engineering Consultant. Weld procedures shall be accompanied by a weld procedure index and weld map for each Separator.

3.5.1 Supplier should arrange visit for inspection of material at their location. Hydro test will be witnessed by the OGDCL Engineer at manufacturing facility. Supplier should provide the free access at their manufacturing facility at any time.

3.6 Supplier shall carry the sole responsibility for the performance of Separator internals and mechanical correctness of Separators & Pressure Vessel.

4.0 SCOPE OF SUPPLY

The Package shall be completed mechanically (without instrumentation and skid) in all respect and furnished for foundation. All mechanical works including fabrication of vessel, nozzles, Manways, saddles and upper structural platform for instrumentation /ladder shall be in supplier scope. (Instrumentation is not included except at para 4.12 and no skid required) Process design calculations should be submitted with the bid for review of OGDCL

4.1 Supplier's scope of supply for Separators & Pressure Vessel, Spares and tools is as follows.

4.2 Demister Pad/ other internals shall be provided.

4.3 Separators & Pressure Vessel shall be provided with all their internals like inlet baffles, vortex breaker, and weir plate etc. along with complete internal support structures where required and as mentioned in the data sheets of Separators.

4.4 Man-way for Separators & Pressure Vessel shall be provided with davit arms, blind flanges, gaskets and bolting.

4.5 Separator shall be furnished with internal cladding of SS316L.

4.6 Separators shall be provided with necessary platforms with cage access Ladders. This requirement shall be further finalized during detail engineering by supplier with respect to vessel orientation and connections.

4.7 Separators shall be provided with necessary Spare Parts and Special Tools.

4.8 WRC Bulletin No. 107 "Local Stresses in Spherical and Cylindrical Shells due to External Loadings" shall be used in analysis methods of nozzles connecting to shells or heads.

4.9 Nozzles on shell for instrument connection shall be properly braced

and nozzles direction will be finalized after final approval of design.

4.10 If supplier supplies any loose items, he shall provide all the required necessary equipment's and hook-up material and drawings to mount the item.

4.11 The Supplier shall provide two M-12 earthling bosses complete with studs, nuts and washers etc., with Separator and Vessel in order to provide earth connection points.

4.12 Complete Gauge glasses including Bridle for water & condensate should be provided (complete with isolation valves, gaskets, stud bolts instrumentation not required).

4.13 Manual drain shall also be provided. Water & Condensate drains should separately terminate at the end of the Separator.

4.14 Level bridle bottom connections and vortex breaker for the produced water outlet to have an internal up stand to minimize danger of obstruction and minimize sand carry over.

4.15 All the Nozzles are as per provided data sheet and shall terminate at the end of separator, should be flanged along with supply of blind flanges, gaskets and Stud / Washers / Bolts.

4.16 All flanges should be as per nozzles details.

4.17 Upper platform Floor shall be full grated.

4.18 Refer data sheet & P&ID # 2547-PID-001 of vessel for acceptable inlet & Outlet gas nozzles only.

4.19 Acceptable piping size for inlet & Outlet liquid drains should be equivalent to 2 inches or more.

DESIGN REQUIREMENTS

Three Phase Separator must be capable of separating flash gas from a liquid feed stream. Separator internals should be suitable for most effective separation.

OPERATING DATA

<u>Parameter</u>	<u>Design</u>	<u>Operating</u>
Fluid Handled	Condensate, Gas & Water	
Class	150 #	
Pressure (psig)	150	80 - 100
Temperature		
Maximum	180 °F	
Minimum	40 °F	
Gas Flow Rate	0.5 MMSCFD @	0.047MMSCFD
Water Flow Rate	6000 BPD	
Oil Flow Rate	750 BPD	
Specific Gravity (Gas)	0.65 – 0.75	
Service	Sour	
Molecular weight:	20-22 (approx. 80 mol% C1, 11.96 mol% N 2)	
CO ₂	6 mole %	
Corrosion Allowance	3mm	
H ₂ S	75 ppm	
NACE MR 01 75	Yes (Applicable for all material / Coatings)	

Process design calculations should be submitted with the bid for review of OGDCL

4.1 MAINTAINABILITY

Separators & Pressure Vessels shall be designed and fabricated to facilitate maintenance, repairs, and replacement of the internals.

Man ways, hand holes, and inspection openings shall be accessible from the ground or maintenance platforms and shall permit the maintenance and removal of all internal components.

4.2 SEPARATOR INTERNALS

Supplier shall furnish and install all supporting rings, internal piping and all other internals components where required and as mentioned in the data sheets and drawings of the Separators & Pressure Vessels.

All internals (i.e. inlet baffles, vortex breaker etc) shall be designed and fabricated so as to pass through the Separator & Pressure Vessel man-ways. Requirement of internals are mentioned in the data sheets & drawings of Separators & Pressure Vessels.

4.3 MATERIALS

Materials of construction for Separators & Pressure Vessels shall conform to ASME Section II; Part 'A' Latest Edition. Non pressure parts may be in accordance with ASTM Specifications. ASME Specification numbers are prefixed by SA and the corresponding ASTM Specification numbers are prefixed by A.

Materials of construction for pressure parts shall be in accordance with Data sheets and General Arrangement drawings for Separators & Pressure Vessels. Alternative material may be used if advantages with the approval of the Company / Engineering Consultant. Proposed substitutions must be clearly defined. All material of construction for Separators only will be NACE compliance and N.A.C.E. Standard MR-0175/ ISO 15156 (Latest Rev.) will be followed.

4.4 LIFTING

Supplier shall provide lifting lugs with full penetration welds on lifting attachments and it shall be subjected to 100 % UT & 100 % MPI/DPT as appropriate. All welds directly associated with lifting Separators & Pressure Vessels shall be subject to 100 % MPI/DPT after load test.

Separators & Pressure Vessels should be suitable for handling with mobile crane and or other mode of lift, using a single point lift at the construction site, where it is necessary to use special lifting beams, spreader bars, slings, shackles, etc. these shall be provided by Supplier.

4.5 INTERNAL COATING & CLADDING

4.5.1 CLADDING

Separator shall be furnished with internal cladding (Explosion or Roll Bonded) with SS316L material. Cladding thickness shall be selected by the Supplier. Internal cladding (Explosion or Roll Bonded) will be done on all internal surfaces of the shell and head along with nozzle necks. Separator internals shall of SS316L. Thickness of internal cladding for Pressure Vessels should be in accordance with feed gas contains 6 mol % CO₂ with 75 ppmv H₂S.

Material and thickness of the internal coating of Separators & Pressure Vessels shall be approved by the Company/Engineering Consultant prior to fabrication. Clad plate shall be bond shear tested. Codes & Standards used for the internal coating and cladding shall be mentioned and provided by the supplier.

All calculation and specification for the selection of Material and thickness of the internal coating for the separators & Pressure Vessels shall be furnished by the Supplier.

4.5.2 COATING

Pressure Vessel shall be furnished with internal coating with epoxy material. Internal coating will be done on all internal surfaces of the shell and head along with nozzle necks. Separator & Pressure Vessel internals shall also be coated with the epoxy material.

Material and thickness of internal coating for Pressure Vessels will be selected by the supplier with full justification in relation to design parameters.

Material and thickness of the internal coating of separators & Pressure Vessels shall be approved by the Company/Engineering Consultant prior to fabrication. Codes & Standards used for the internal coating and cladding shall be mentioned and provided by the supplier. All calculation and specification for the selection of Material and thickness of the internal coating for the separators & Pressure Vessels shall be furnished by the Supplier.

4.6 CORROSION ALLOWANCE

Separator & Pressure Vessels (except Air and Nitrogen receivers) and their internals shall have minimum 3 mm corrosion allowance applied to all pressure retaining parts and all surfaces of non-removable internals exposed to the process fluid. Removable internals shall also have the specified corrosion allowance on all surfaces exposed to process fluid. No corrosion allowance is required on stainless steel materials or materials protected by stainless steel unless otherwise specified.

Those parts of separators & Pressure Vessels which are subjected to erosion e.g. due to impingement by the process stream, shall be protected with weir plates, or impingement baffles.

4.7 U-STAMPING

Separators and Pressure Vessels shall be design on ASME Sec. VIII Div. 1 and shall be provided with "U" stamp. ASME Inspector will visit the manufacturer

facility during various stages from material receipt to completion of vessel. All the reports generated by ASME inspector will also be shared with OGDCL/Engineering Consultant during stage inspection. Email contact of U Stamp inspector with inspection plan to be provided immediately after award of contract to OGDCL.

4.8 MINIMUM THICKNESS

Minimum thickness of materials other than carbon steel shall be based on the structural stability of the separators & Pressure Vessels in addition to the requirements of pressure and other mechanical loading. Wall thicknesses of carbon steel nozzle necks for separators & Pressure Vessels, including corrosion allowance, shall be in accordance with Drawings. Supplier shall check thicknesses in accordance with ASME Code. Minimum thickness of internal carbon steel attachments shall not be less than 6 mm excluding corrosion allowance. (Specify other thickness if required)

4.9 SUPPORT

Horizontal Separators & Pressure vessels shall be supported on two steel saddles only. Saddles shall be furnished by Supplier.

4.10 CIVIL DESIGN

Designs of the foundation of the separators & Pressure Vessels, is excluded from Supplier's scope. However, the Supplier shall be responsible for the provision of necessary foundation design data including but not limited to size and location of all anchor bolts, static and dynamic loading conditions for foundation design. Supplier shall also indicate on his drawings required elevation of foundations from ground level.

4.11 CLEANING

Prior to shipment and after hydro-testing, Separators & Pressure Vessels shall be subject to thorough cleaning by the Supplier. The Supplier shall give recommendation for the Separators cleaning. The cleaning program shall be agreed with the Company / Engineering Consultant. As a general rule, the Supplier shall clean the Separators & Pressure Vessels and Pumps in the workshop prior to preparation for shipping. Supplier shall ensure that the Separators & Pumps are free from any foreign material, dirt, etc. and hydro-test water is drained and Separators & Pumps are cleaned internally.

4.12 INSTALLATION / ERECTION WORKS

Installation / Erection works are excluded from the Supplier's Scope. However, the Supplier will provide detailed description of the site activities including complete drawings related to the installation and erection / assembly of all the loose items.

4.13 DESIGN LOADINGS

Separators & Pressure Vessels shall be self-supporting and designed to withstand a wind loading based on the projected area of curved surfaces. The area of ladders, platforms and pipe work shall be assumed as equivalent to one and one half times of the projected area. Wind speeds are specified in Site and Environmental Data.

Separators & Pressure Vessels components, their supports and anchorages, shall be designed to withstand the results of the following combinations of loads and forces within the limits of stress and deflections set by the code:

- Erection Condition (The empty weight plus the weight of any internals present during erection)
- Initial Site Test Condition (The empty weight plus weight of water to fill the vessel).

- Operating and Design Conditions (The empty weight plus the weight of all internals packing, insulation and operating liquid).
- Hot Shut down Condition (As for the Operating and Design Condition, but excluding the operating liquid).
- Transportation / Dynamic Loading Condition. Separator shall withstand acceleration forces of 0.5g applied at any time in any direction.
- Periodic Site Test Condition.
- Earthquake design.
- Any other condition which would affect the safety of the Separator e.g. cyclic loading.

Supplier shall submit detailed calculations of Nozzle Loading for Separators & Pressure Vessels for establishing the compliance of design and all with the requirements of this specification, the certifying authority if applicable and all statutory regulations.

Methods of calculations which are not in accordance with the relevant code or established procedures shall be subject to approval by the Company/Engineering Consultant for its applicability to the design.

4.14 LADDERS & PLATFORMS

Separators & Pressure Vessels shall be provided with necessary platforms with cage Access Ladders. Supplier shall submit the strength calculation for cleats and attachments to the Separators & Pressure Vessels. The supplier shall follow the Specification for Steel structures (2547-SP-0002) for the supply of the ladders and platforms.

5.0 GUARANTEE:

5.1 PERFORMANCE GUARANTEE

Supplier shall guarantee the performance and design of supplied internals like Demister Pad etc. of Separators & Pressure Vessels and the performance of whole Separator & Pressure Vessel when operated at the condition specified in their respective datasheets.

5.2 MECHANICAL GUARANTEE

The Supplier shall guarantee that supplied Separators & Pressure Vessels with all internals and externals are free from any manufacturing defect and if any part of the Separator & Pressure Vessel are found defective in any manner during installation or after installation but within guarantee period shall be replaced by the Supplier with no extra cost to Company.

6.0 INSPECTION & TESTING

6.1 INSPECTION

The Supplier shall provide free access to his works and that of Sub-suppliers for the authorized representative of the Company / Engineering Consultant. All necessary certification on materials, shop test data etc., shall be made available to verify that the requirements of the purchase order are being met. No surface shall be painted until all inspection is completed.

6.2 FABRICATION & WELDING

The Supplier shall submit WPS, PQR and WQT for approval by Company/ Engineering Consultant. The approval shall be sought in a manner not disturbing the overall delivery schedule of the package. The Supplier shall notify Company/ Engineering Consultant at least fifteen (15) working days prior to the start of fabrication and scheduled time of testing, etc.

6.3 INSPECTION METHODS & ACCEPTANCE CRITERIA

All examination methods shall be as per ASME Code, Section VIII, Division I, as relevant to the equipment. Supplier's Quality Plan shall be reviewed By Company/ Engineering Consultant.

6.3.1 HYDROSTATIC TESTS

Separators & Pressure Vessels shall be hydro-tested in accordance with the appropriate code requirements. The water for hydro testing shall be of suitable quality not to harm any component of the Separator & Pressure Vessel in any

manner.

Pressure testing shall be maintained long enough to permit complete inspection but shall not be less than 60 minutes. A shop hydrostatic test for Separators & Pressure Vessels shall be applied as per Paragraph UG -99C, ASME Code, Section VIII, Division I.

6.3.2 IMPACT TEST REQUIREMENTS

Charpy V-notch impact testing shall be required for the Separators & Pressure Vessels in accordance with the code, if it is applicable by the Codes & Standards.

Impact Test shall be performed in accordance with the requirements of ASME Section II Part A, SA20 and Clause UG-84 of ASME VIII, Division1.

7.0 PAINTING AND PREPARATION FOR SHIPMENT

7.1 PAINTING & PROTECTIVE COATINGS

Painting, protective coatings and the procedures used for the preparation of surfaces shall be as specified in the Specification for Painting. Where painting is specified, the entire Separator & Pressure Vessel shall be painted. Nozzles shall be painted to the flange edges, inside bolt holes, and up to the gasket surface. Fire proofed or insulated surfaces shall be shot blasted and given one coat of primer only.

7.2 PREPARATION FOR SHIPMENT

After the final test, Separators & Pressure Vessels shall be dried and cleaned thoroughly of all grease, loose scale, rust, flux and weld spatter, both internally and externally. All machined surfaces and threaded connections shall be protected by coating them with rust preventative.

Flanged openings shall be protected with steel plate covers attached by proper bolting or strapping and sealed with a plastic compound. Screwed connections shall be protected with threaded, forged steel plugs. The Supplier shall be responsible for loading and anchoring the Separators & Pressure Vessels to

prevent any damage during shipment.

7.3 PACKING, PRESERVATION & TRANSPORTATION OF MATERIAL & EQUIP.

Packing and Preservation shall be suitable for handling during inland transportation, shipment through sea or by air and storage at site for upto 4 months in an uncovered, very hot and humid climate. Packing shall account for the fragility and physicochemical/ mechanical damages of items.

8.0 SPARES

General

The Supplier shall provide commissioning spares of the Separators & Pressure Vessels. These are the spares parts and other materials needed to adequately cover the requirement of installation, day to day maintenance for the Separators & Pressure Vessels during the Construction phase and Commissioning stages, including start up and testing.

Any delay due to wrong or insufficient supply of commissioning spares will be at Supplier part for the immediate replacement/provision within two (02) working days.

8.1 SPECIAL TOOLS

Special tools (if any) that are required for the installation, adjustment commissioning, operation and maintenance of the equipment shall be provided by the Supplier.

9.0 QA/QC & CERTIFICATION

9.1 QUALITY ASSURANCE & CONTROL

9.1.1 QUALITY MANAGEMENT SYSTEM

The Supplier shall show that an effective system of Quality Assurance is in operation, for both products and services, which generally complies with ISO 9001 or equivalent. The Supplier and his Sub-Suppliers shall be ISO 9001

certified. The Supplier shall submit, with his Proposal, a copy of his Quality Manual for review by Company / Engineering Consultant. The Quality Manual should contain but not be limited to the following:

1. A signed policy statement on commitment to quality by the head of the Supplier's company.
2. An organization matrix of the Supplier's company indicating reporting responsibilities.
3. An index of the Supplier quality procedures.
4. A brief outline of each procedure indicating individual responsibilities for maintaining quality.

9.2 QUALITY CERTIFICATES

Company / Engineering Consultant reserves the right to require the Supplier to implement additional controls, where a satisfactory level of competence cannot be demonstrated in this regard, and/or exercise additional controls not detailed in this document.

9.3 QUALITY CONTROL

It is the intention of Company / Engineering Consultant to determine its involvement in the inspection of materials and activities at the Supplier's work dependant on the equipment complexity/criticality and the effectiveness of the Supplier's QA/QC procedures. The Supplier shall provide their standard format Quality Control Plan, relating to the scope of work for review at the bid submission. This should include those activities, which have been sub-contracted and provision made for Company / Engineering Consultant design review/inspection.

Regular visits by Company / Engineering Consultant for the purposes of surveillance and documentation review will not be carried out as a matter of course. However, should it become apparent that the Supplier's agreed Manufacturing Quality Control Plan is either inadequate or not being implemented, Company / Engineering Consultant reserves the right to increase the level or frequency of his Quality Control activities or request the Supplier to revise its working practices, as necessary.

To assist the Supplier in evaluating the expected level of Company / Engineering

Consultant Involvement applicable to this document, the following activities in Quality Control Level by Company / Engineering Consultant have been identified:

- QC Plan review/markup
- Surveillance of major Sub-Suppliers
- Certification and manufacturing data review
- Hold Points for inspection by Company / Engineering Consultant.

9.4 MATERIAL TRACEABILITY & CERTIFICATION

The Supplier shall advise their proposed material traceability system by which material are assured to be fit-for-purpose and identified throughout the manufacturing process, as part of the bid submission. The Supplier should note that material certification is to be provided for all pressure containing and load bearing components.

9.5 CERTIFICATION & MANUFACTURING RECORDS

9.5.1 INSPECTION & CERTIFICATION RECORDS

The Supplier shall ensure that all inspection, test and certification records for equipment and materials, procured by the Company, and test and inspection records for the Supplier's assemblies and fabrications, required by legislation, codes, standards and specifications, or otherwise required are provided, safely stored and available on request.

9.6 CERTIFICATION & MANUFACTURING DATA REQUIREMENTS

Certification and manufacturing data requirements consist of a collection of original and type test certification, inspection and test records and final release documentation generated during the approval, manufacture and testing of the equipment or material. All Certification and Manufacturing Data four (04) sets are to be issued to Company /Engineering Consultant as one dossier at the time of delivery of equipment.

10.0 DELIVERY OF SEPARATORS & PRESSURE VESSELS

Supplier shall deliver all the Separators and Pressure Vessels. The maximum

acceptable delivery time shall be within Four (04) months at CFR Karachi Port basis (applicable for foreign bidders) or at Qadirpur gas field Sindh site basis (applicable for local bidder) from the date of establishment of letter of credit by OGDCL.

11.0 DOCUMENTATION REQUIREMENT FOR SUPPLIER

11.1 DOCUMENTS TO BE SUBMITTED WITH BID FOR TECHNICAL EVALUATION

A fully detailed written bid is required together with all data requirements listed below:

Technical Documents:

1. Table of compliance / exception and deviations, if any
2. Name of Separator and Pressure Vessels Supplier and country of manufacturing.
3. Name of Plates manufacturer / Country of Origin.
4. Guarantee statement.
5. Material of Construction of Separator and Vessels (including Internals etc).
6. A preliminary production schedule of the Separators and Vessels including design, engineering, fabrication, factory testing etc. Also indicate delivery dates for all Sub-Supplier's items.
7. Document submission schedule.
8. Details of Sub-Suppliers with quality certificates
09. Detail scope of supply including the detailed material list.
10. General Arrangement drawing for Separators & Pressure Vessel including, parts list, materials and equipment description, weights, space required for maintenance.
11. Spare parts (Commissioning i.e Gaskets Stud Bolts etc) and Special tool.
12. **Bidder should have experience of 10 years (2006~2016) for fabrication of high pressure vessels and must submit last ten (10Nos) U stamped Pressure vessel supplied list (including Project duration, completion date, etc) in last 07 years in Oil and Gas/ Process Industry/ Refineries. It should clearly mentioned the detail of product / equipment**

Name Capacity, Client Details, Cost of Equipment & year of supply with verifiable document.

13. Previous Experience of (Cladded Vessel) for supply of similar nature of equipment last ten years.

14. Quality Manual and Quality Control Plan.

15. Typical Inspection and Test Plan.

17. Proposed Cladding, surface treatment and painting/coating procedure.

18. Preliminary design calculations of Separators & vessels.

19. Packaging and shipment procedures

20. Process Design calculations

21. Valid U Stamp Certificate (Latest & Last five years).

22. Quality Certificate

23. Environmental Certifications

24. Performance certificates from Oil & gas companies.

25. Separator Complete Plan on PRIMAVERA

Financial Documents:

1. Price breakup of all the items
2. Performance Bank Guarantee(s)
3. Schedule of Deliveries
4. Comments or exceptions/contractual deviations to ITB.

Documents to be submitted after Purchase Order (for Approval)

1. Finalized Production Schedule.
2. Data required for foundation design.
3. Material test certificates.
4. Mechanical design calculations.

5. Finalized General Arrangement Drawings with Nozzle details (elevation, ratings, projection etc.).

6. Detail fabrication drawings (prior to execution of fabrication works).

7. Internals details/drawings.

8. Welding procedure specifications and Weld Maps.

9. Details of ASME inspector.

10. Procedure Qualification Records.

11. Welding qualification Test Procedure.

12. Hydro-testing Procedures.

13. NDT / Painting inspection Procedures.

14. Complete detail of Sub-suppliers, Material Test Certificates etc.

15. Installation Drawings and Procedures.

16. FAT & SAT Procedures.

11.2 FINAL DOCUMENTATION

A fabrication dossier shall be compiled concurrently with fabrication such that a full record of the fabrication, materials, inspection and testing is available. All items in the dossier shall be numbered and bound in an A4 four post binder contents shall include but not be limited to the following (as applicable)

1. Front cover sheet detailing

- P.O. No.
- Project Title.
- Equipment Title
- Equipment Item No.

2. Index

3. Company/ Engineering Consultant Release Note

4. Purchase Order or extract thereof
5. A list of all applicable codes, standards and specifications
6. All drawings "As-built" - wherever legibility can be preserved reduced to A3 and folded, where legibility cannot be preserved drawings to be folded to A4 size and inserted into pre-punched plastic wallets.
7. Approved weld procedures and NDT procedures.
8. Summary of approved welders and NDT technician's qualifications.
9. All NDT/PWHT/ Hydrostatic/ Performance test reports.
10. All reports checked and approved by ASME Inspector.
11. Photocopy of Nameplate.
12. Material chemical analysis and mechanical test certification.
13. Final signed quality plan.
14. Operating manuals shall also be assembled into bound volumes and shall contain following:
 - Operating and maintenance procedures.
 - Commissioning instructions.
 - All "As-built" drawings.
 - Schedules of commissioning and operating spare parts for two years service.
 - Any other documents not specified above, but essential to make the Separators operational and maintainable.

All above documents four (04) sets shall be submitted in clearly labeled 4 ring white hard cover binders. All documents smaller and larger than A4 shall be inserted into A4 pre-punched, top-opening plastic wallets with the project document number/title block clearly visible to the front.

11.3 TRANSMITALLS

All documents submitted to the Company/ Engineering Consultant after the

award of Contract shall be accompanied by a transmittal completed by the Supplier. All transmittals will be sequentially numbered.

11.4 DRAWING SIZES

- Sizes A1, A2, A3, and A4 shall be used.
- NB. A0 size drawings are NOT acceptable.

11.5 SCALE RATIOS

Except where stated, all drawings will be supplied in metric units using one of the following scales 1:1, 1:2, 1:5, 1:10, 1:20, 1:25, 1:50, 1:100, 1:250, 1:500, 1:1000.

11.6 ELECTRONIC DATA

Supplier shall also submit electronic/soft copies of all design data, documents, drawing, etc. This also includes design details by Supplier's Sub-Suppliers. All drawings shall be provided in AutoCAD 2004 format. All documentation shall be prepared in MS Office 2003.

12.0 NAME PLATE

Separator & Vessels shall be provided with a type 316 stainless steel nameplate securely attached to the Separator & Vessel shell and located so that it is clearly visible after installation. Nameplates shall be riveted to a bracket welded onto the Separator & Vessels.

The following information shall be stamped on the nameplate:

1. Manufacturer's Name.
2. Manufacturer's Serial No.
3. Equipment Tag No.
4. Equipment Title.
5. Purchase Order No.
6. Year of Manufacture

7. Maximum allowable working pressure (psig) at (°F)
8. Minimum design metal temperature (OF) at (psig)
9. Size I.D. /O.D. x T to T in mm.
10. Shell Thickness mm
11. Corrosion Allowance in mm.
12. Design Code.
13. Test Pressure (psig)
14. Weight empty/operating/ Hydro test in kg.
15. Inspection authority and date of inspection.
16. Code 'U' stamp.

17. Plus appropriate symbols for:

- a. Type of construction
- b. Non-destructive testing c.
- Heat treatment

Letters and figures shall be 5mm high and clearly stamped.

QUALITY PLAN

<u>Activity</u>	<u>Purchaser Inspection</u>
Preproduction Meeting	H Material
Procurement	R
Heat Treatment Certificates	R Mill
Test Reports	R
Welding Procedure Qualification	H

Welder Qualifications	R
Fabrication	H, on-site
Radiographic Testing	H, on-site
Hydrostatic Testing	H, on-site
Welding Repairs	M
Painting and Coating	M
Prepare for Shipment	H, on-site

Note: These inspections/tests are considered to hold points at the beginning of production and may be changed to monitor points based on production performance, if notified in writing by the purchaser.

H - Hold point, inspection or testing shall not proceed without the presence of the purchaser's representative.

M - Monitor point, notification to the purchaser's representative of impending inspection or test activity is required.

R - Review documentation, presentation of the specified.

13.0 REFERENCED DOCUMENTS

1. 2547-DOC-001 PIPING & INSTRUMENTATION DIAGRAM
2. 2547-DOC-002 DATA SHEETS
3. 2547-DOC-003 ENVIRONMENTAL DATA
4. 2547-SP-0004-01 SPECIFICATION PRESSURE VESSEL
5. 2547-SP-0005-01 SPECIFICATION WELDING
6. 2547-SP-0002-01 SPECIFICATION PAINTING



OIL & GAS DEVELOPMENT COMPANY LIMITED

**(PIPING & INSTRUMENTATION DIAGRAM)
DOCUMENT NO. : 2547-DOC-001**

NOTES

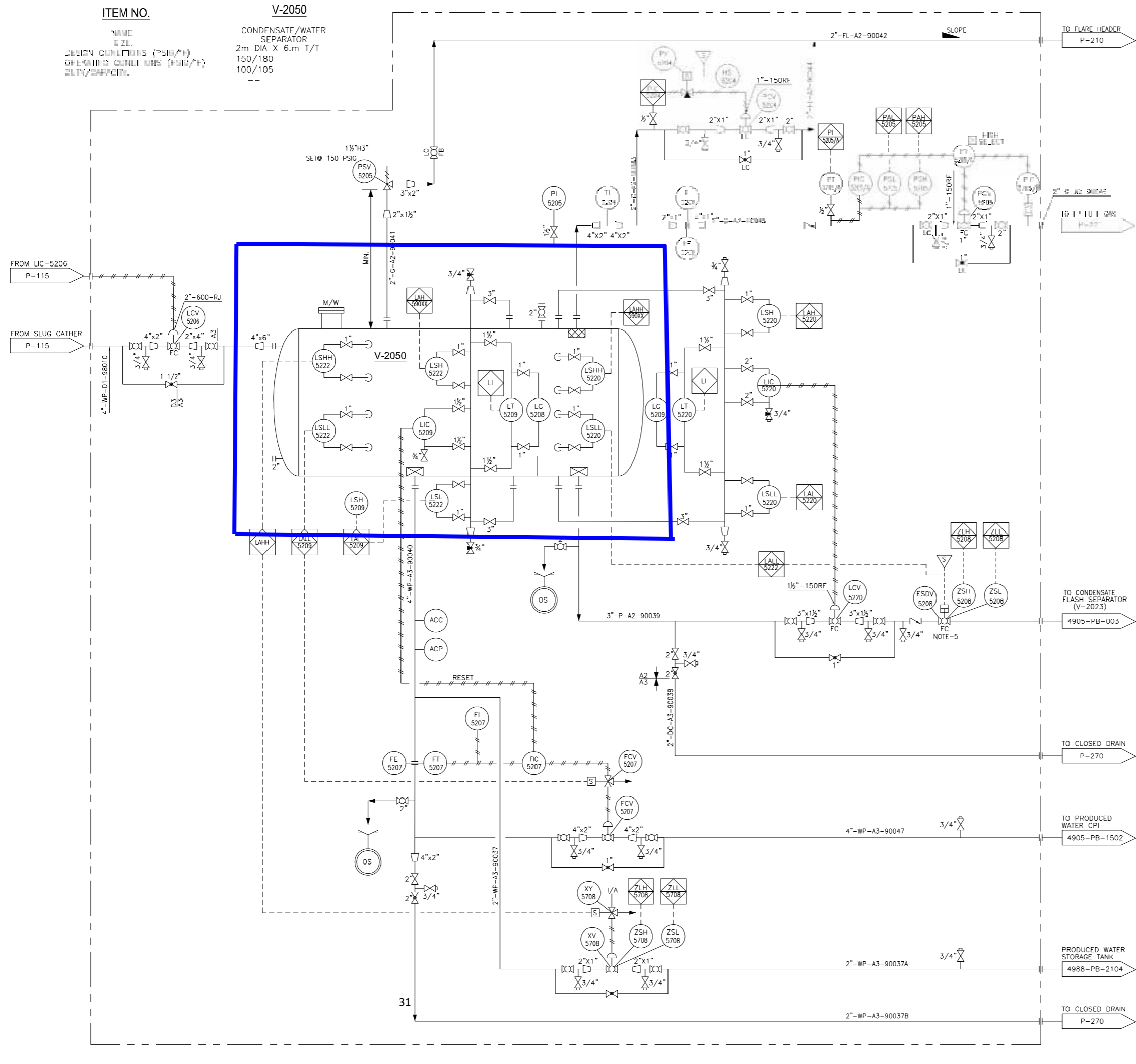
1. PIPING TO ENSURE OFFICE WATER UPSTREAM & DOWNSTREAM STRAIGHT RUN (500 CM).
2. PER CONDENSATE/WATER SEPARATOR (V-2050) & INSTRUMENTATION TO BE 500 CM.
3. VENDOR SHALL PROVIDE PROVISION FOR VENTS AND DRAIN DETACH FOR PROPER FUNCTION & DRAINING OPERATOR JARING COMMISSIONING & START UP.
4. VENDOR SHALL PROVIDE THE AD-ON/AT 500 CM NUMBER OF MARCH AS PER STANDARD.
5. EVERY PART SHALL BE OPERATED FROM INSTRUMENTATION OPERATOR & INTERLOCK SHUTDOWNS. ALSO IT CONTACT WITH DCS FOR LEVEL 1 & LEVEL 2 SHUTDOWN.

ITEM NO.

V-2050

NAME
SIZE
DESIGN CONDITIONS (PSIG/°F)
OPERATING CONDITIONS (PSIG/°F)
DUTY/APP'D

CONDENSATE/WATER
SEPARATOR
2m DIA X 6.m T/T
150/180
100/105



0	05-10-15	ISSUED	SHAH	NWS		
REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
<p>PC PETROCHEMICAL ENGINEERING CONSULTANTS C-2, BLOCK NO. 17, DULSI-AN-E-QBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN. TEL: +92 (21) 34822763, 34891088, FAX: +92 21 34901089, E-Mail: pc@petco.com.pk web site: www.petco.com.pk</p>						
<p>CLIENT OIL & GAS DEVELOPMENT COMPANY LIMITED</p>						
<p>PROJECT LIQUID HANDLING OF PRODUCED WATER</p>						
<p>TITLE PIPING & INSTRUMENTATION DIAGRAM CONDENSATE / WATER SEPARATOR</p>						
JOB No.	DRAWING NO.	SHEET	SCALE	REV.		
2547	2547-PID-001	NO. OF	N.T.S			
		1	1	A3	0	



OIL AND GAS DEVELOPMENT COMPANY LIMITED

Document Title DATA SHEET OF CONDENSATE/WATER SEPARATOR

Document No 2547 -PDS-011 **Rev-0**

PROCESS DATA SHEET

CONDENSATE / WATER SEPARATOR

V - 2050

Rev.	Date	Description	Prepared	Checked	Approved
0	5/10/2015	Issued For Tender	RK	NWS	SMS



OIL AND GAS DEVELOPMENT COMPANY LIMITED

Document Title DATA SHEET OF CONDENSATE/WATER SEPARATOR

Document No 2547-PDS-011

Rev-0

Design Data			Nozzle Schedule				
Design Code	ASME SECTION VIII Div I		Mark No.	Size inch	No.	Rating & Facing	Service
Item no	V-2050						
Orientation	Horizontal		N-1	6	1	1	Inlet
Vessel Diameter	mm	2000	N-2	3	1	1	Light Liquid Outlet
Height - Tan - Tan	mm	6000	N-3	2	1	1	Vapour Outlet
Design Pressure	Psig	150	N-4	4	1	1	Heavy Liquid Outlet
Operating Pressure	Psig	100	N-5	2	1	1	Vent
Design Temperature	°F	180	N-6	2	1	1	Pressure Relief Valve
Operating Temperature	°F	110	N-7	2	1	1	Drain
Hydro Test Pressure	Psig	225	M1	24	1	1	Man Hole
Corrosion Allowance	mm	3	K-1a/b	1	1	1	Level Switch Low low Connection light Liquid
Thickness Shell/Head	mm	12 Minimum (Note-1)	K-2a/b	3	1	1	Bridal Connection for Light Liquid
Head Type	2:1 Elliptical		K-3a/b	3	1	1	Bridal Connection for Heavy Liquid
Support Type	saddle		K-4a/b	1	1	1	Level Switch High High Connection light Liquid
Code Stamp / Category	Yes / U-Stamp		K-5a/b	1	1	1	Level Switch Low low Connection light Liquid
	NACE MR-0175						
Stress Relief (PWHT)	Yes						
Radiography	RT-1						
Joint Efficiency	1						
Nat Board Registration	Yes		Connections				
Basic Wind Speed	100 MPH (Design)		Shell Body Flange			NA	
Wind Design Specification	UBC'97 Exp C; I=1.0		Branch Flange			ASME B16.5	
Seismic Design Specification	Note-3		Specification / Rating			150 # RF WN	
Fireproofing	No		Gasket Face Finish			125/250 AARH	
Painting	Note-6						
Lifting Lugs/Trunnions	Yes						
Earthing Lugs	Yes						

Construction Materials		Vessel Schematic	
Shell	CS	Refer to Sheet 3	
Heads	CS		
Lining	internal Cladding		
Jacket Shell	NA		
Jacket Head	NA		
Shell Body Flange	NA		
Body Blind Flange	NA		
Body Flange Gasket	NA		
Nozzle Neck Pipe	CS-ASME SA106-B Seamless		
Nozzle Neck Forged	CS- ASME SA105		
Nozzle Flanges	CS- ASME SA105		
Fittings	CS - ASME SA234 WPB		
Nozzle Flange Gaskets	316 SS SPW/Graphite/I.R.316/O.R.316		
External Stiffness	NA		
Vessel Support	CS ~ ASME SA36		
Support Attachments	NA		
Insulation Support	NA		
Internals- Fixed	CS ~ ASME SA36		
Internals- Removable	NA		
Bolting - External	NA		
Bolting - Internal	NA		
Int / Ext Attachments	Internal shall S.S 316 L materials		

Notes					
1) Vessel thickness should be minimum 12 mm without internal cladding thickness					
2) Vendor is required to complete the data sheet.					
3) Seismic Design Specification : Moderate Earthquake Zone to UBC 1997 Seismic Coefficient Ca=0.155 Cv=0.13, Importance Factor I=1.0					
4) Vendor to provide full details of vessel internals					
5) As a minimum, surface examination of all nozzle and attachment welds shall be carried out by MT & PT.					
6) External carbon steel surfaces of equipment shall be prepared and painted in accordance with specification 2547-SP-0002					
0	5/10/2015	Issued For Tender	R	NWS	AJ
Rev.	Date	Description	Prepared	Checked	Approved



OIL & GAS DEVELOPMENT COMPANY LIMITED

Document Title

DATA SHEET OF SEPARATOR

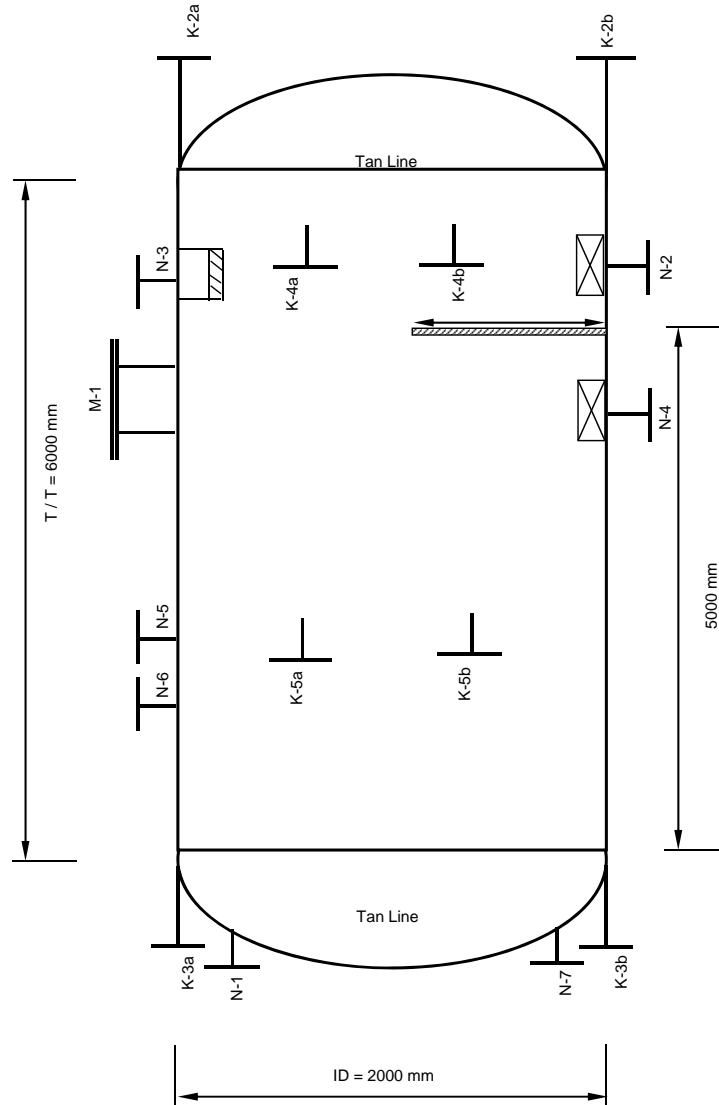
Document No

2547-PDS-011

Rev-0



Vessel Schematic



Rev.	Date	Description	Prepared	Checked	Approved
0	5/10/2015	Issued for Review	RK	NWS	AJ



OIL & GAS DEVELOPMENT COMPANY LIMITED

(SITE ENVIRONMENTAL DATA)
DOCUMENT NO. : 2547-DOC-003



1.1 **ENVIRONMENTAL DESIGN CRITERIA**

1.2 **Scope**

This specification cover minimum, site environmental data.

1.3 **Site Environmental Data**

The following table gives the site and environmental conditions applicable to the location and specific to design and sizing of equipment:

Description	Data	Unit
Ambient Temperature (min.)	41	°F
Ambient Temperature (max.)	131	°F
North / East	30° 17' 0"/71° 40'	
Average Monthly rainfall	0 to 50	mm
Maximum wind velocity	100	Miles / hr
Dry bulb temperature (max)	124	°F
Dry bulb temperature (min)	25	°F
Relative Humidity (Summer)	20-70	%
Relative Humidity (Winter)	45-55	%
Wet Bulb Temperature	82	°F
Area Classification	Class-1,Zone 1 & 2, Gas Group A & B with temperature classification T4	



**OIL & GAS DEVELOPMENT COMPANY
LIMITED**

**SPECIFICATION
FOR
PRESSURE VESSELS**

DOCUMENT NO. : 2547-SP-0004-01





 <p>OIL & GAS DEVELOPMENT COMPANY PAKISTAN</p>	<p>PRODUCED WATER ADEQUACY & CAPACITY ENHANCEMENT AT QADIRPUR GAS FIELD</p>	
<p>Doc. No. : 2547-SP-0004-01</p>	<p>SPECIFICATION FOR PRESSURE VESSEL</p>	<p>Revision No.0</p>

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<p>Doc. No. : 2547-SP-0004-01</p>	<p>SPECIFICATION FOR PRESSURE VESSEL</p>	<p>Revision No.0</p>

1.0 SCOPE

This specification is a general guide establishing the minimum requirements for pressure vessels. Specific design data such as actual design pressure/ temperature and volume, dimensions, locations, installation, type of connection and Equipment and the function etc. of the pressure vessels will be given in separate specifications or in the tender documents.

2.0 REFERENCES

The pressure vessels shall be designed, manufactured and tested in accordance with the following documents to the extent stated in this specification.

Codes and Standards

In this specification reference is made to the following codes and standards:

ASME VIII Div.-1, Boiler and Pressure Vessel Code

ASTM A435

API 5L

ASME B16.5

Specifications



Specification for Painting 2547-SP-0002-01.

3.0 DESIGN AND MANUFACTURING REQUIREMENT

Design

In addition to the codes and standards referred above, the pressure vessels shall comply with the following:

- high and low point - depending on the final installation- shall be equipped with 1" flanged vent and drain connections. The drain opening shall be at least 500 mm above foundation level'

 <p>OIL & GAS DEVELOPMENT COMPANY PAKISTAN</p>	<p>PRODUCED WATER ADEQUACY & CAPACITY ENHANCEMENT AT QADIRPUR GAS FIELD</p>	
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- each compartment of each pressure vessel shall have an inspection opening as required by ASME BPV-VII-1;
- all nozzles shall be “set in” type.
- all nozzles on ASME 300 class vessels shall be self reinforcing type.
- gaskets and sealing material shall be resistant to natural gas, gas condensates, oil, glycol and methanol
- the weld joint factor E of all welds in each pressure vessel shall be at least 0.85;
- each pressure vessel shall be equipped with lifting lugs.

Manufacture

Only fully killed steel in accordance with the applicable material standard shall be used for the manufacture of pressure vessels.

The specific minimum yield strength of the steel used for pressure vessels shall not be higher than 415 N/mm².



Steel castings shall not be used for pressure vessel components.

Welding

Welding shall be carried out in accordance with section IX of the ASME BPV Code. All welding work shall be performed in accordance with suitable welding procedure specifications. All welding procedure specifications shall be submitted to the Employer / Owner’s Engineer for approval in a written form in accordance with the form recommended in section IX of the ASME Boiler and Pressure Vessel Code.

Welding procedure qualification and welder’s performance tests shall be carried out and recorded in accordance with section IX of the ASME BPV Code and shall be certified. All joints shall be welded both from the inside and from the outside, where space allows. Plate offset and any welded joint shall not exceed 10% of the smallest plate/wall thickness of the joint or 1.5 mm, whichever is less.

Minor surface imperfection in the parent material may be removed by grinding, provided that the minimum wall thickness is not reduced to less than the calculated

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minimum wall thickness. Grinding may take place over a length not exceeding $1.0 \times D$ (where D is the Diameter of the component in question) or 300 mm, whichever is less, and shall leave a smooth contour.

Repair welding of the parent material is not permitted. Welds shall only be repaired under the following conditions:

- repair welding shall be performed only according to approved procedures and by qualified welder;
- only manual arc-welding with suitable electrodes shall be used for repair welds;
- the defect shall be removed in such a way that the repair weld can be carried out with at least two passes;
- items with repaired weld seam shall be completely stress-relieved after the completion of the repair work;
- non-destructive tests according to ASME BPV Code VII div. 1 & ASME section IX shall be performed on all repair welds.

4.0 INSPECTION AND TESTS

General



Inspection and test certificates shall be submitted as specified on data sheets or, otherwise for pressure retaining parts, as recommended in the ASME BPV Code.

Inspection of Semi-Finished Products

Plate Material

Each plate to be used for the manufacture of pressure vessels shall be inspected for laminations by ultrasonic methods in accordance with ASTM A435. Acceptance or rejection of such plates shall be governed by the acceptability standards stated in ASTM A435.

The Contractor / Vendor / Sub contractor shall propose a method for such ultrasonic inspection, which shall be subject to approval by the Employer / Owner's Engineer.

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<p>Doc. No. : 2547-SP-0004-01</p>	<p>SPECIFICATTION FOR PRESSURE VESSEL</p>	<p>Revision No.0</p>

Tubular Material

All tubular material to be used for the manufacture of pressure vessels shall be of the seamless or longitudinal double submerged arc-welded type. All such material shall be non-destructively tested in accordance with the requirements of API 5L, including

	Parent material		Weld Metal and HAZ	
Specimen taken	Mean value from 3 tests	Lowest single value	Mean value from 3 tests	Lowest single value
Longitudinal	47 Joules	38 Joules	27 Joules	22 Joules
Transverse	37 Joules	22 Joules	27 Joules	22 Joules

supplementary requirements SR4, before use.

Forging and Bars



Forging and bars used for the manufacture of pressure vessel's shall be subjected to ultrasonic inspection before machining, in accordance with ASTM A388. The standard of acceptability shall be approved by the Employer / Owner's Engineer.

Other ultrasonic inspection methods/procedures and acceptance standards may also be used subject to the approval by the Employer / Owner's Engineer.

Mechanical properties (destructive testing)

After the last post-weld heat treatment, a control of the mechanical properties shall be carried out. The test shall be performed in accordance with the latest edition of ASTM A370. The minimum acceptable values of impact resistance with Charpy-V Notch specimen at 0 °C are given below and in accordance with ASME VIII:

When sub size specimens are used the average of the three reading is divided by the fractional specimen size and compared with the full size acceptance criteria.

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Inspection of Complete Pressure Vessels

Non-Destructive Tests

All pressure retaining stressed and repair welds of each pressure vessel shall be non-destructively tested in accordance with the requirements of the ASME Boiler and Pressure Vessel Code.

All radiographs shall be evaluated by the manufacturer's quality assurance inspection and shall be submitted for evaluation. Welds which do not permit interpretable radiographs shall be inspected by ultrasonic methods in accordance with the requirements of the ASME Boiler and Pressure Vessel Code.

Radiograph inspection shall satisfy the requirements of the International Institute of Welding "IIW Collection of Reference Radiographs of Welds" level bleu.



Other NDT acceptance criteria shall be as mentioned in ASME B31.3 "Chemical Plant and Petroleum Refinery Piping", par. 327, table 372.4.1.A and 327.4.1.B.

All surfaces of the pressure vessels shall be visually inspected and shall be free of notches, dents, pits, laminations, electrode burns and other imperfections. In the case of hot-extruded outlets the surface of the extruded area shall be inspected for cracks by magnetic particle or Liquid penentrant methods. Any evidence of cracks will lead to rejection.

The examination shall be performed and results evaluated by ASNT level II or equivalent.

Hydrostatic Test and Inspection for Conformity

Each completed pressure vessel shall be inspected for conformity with the requirements of this specification and the order, including marking/stamping of the materials, marking of welds, heat treatment performed, dimensions and tolerances and compliance with the drawings. Each pressure vessel shall be hydrostatically

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tested. The test pressure shall be 1.5 times the design pressure and shall be maintained for at least 15 minutes.

5.0 QUALITY ASSURANCE

Under all circumstances, the Contractor / manufacturer shall be responsible for ensuring that the pressure vessels ordered and manufactured in compliance with this specification and shall provide proof thereof to the Employer / Owner's Engineer.

During work on the pressure vessel, the Employer / Owner's Engineer shall have free access to those parts of the manufacturer's premises where the pressure vessels ordered are manufactured and tested. The Contractor / Vendor / Sub contractor shall, without charge, provide the Employer / Owner's Engineer with all reasonable facilities which they may require to satisfy themselves that the pressure vessels are being manufactured and tested in compliance with this specification.

6.0 CERTIFICATION



In respect of the inspection for conformity and hydrostatic tests in accordance with above, inspection certificates in accordance with the ASME Boiler and Pressure Vessel Code shall be submitted to the Employer / Owner's Engineer. Such inspection certificates shall be submitted to the Employer / Owner's Engineer together with NDT records and test reports.

7.0 DOCUMENTATION

All documentation shall be presented in the English language and SI units shall be used. Operation and maintenance instructions and/or manuals shall be in the English language. The documentation listed below shall be submitted at the times indicated below.

With the bid :

- drawing showing main dimensions, indication general arrangements, location of

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<p>Doc. No. : 2547-SP-0004-01</p>	<p>SPECIFICATTION FOR PRESSURE VESSEL</p>	<p>Revision No.0</p>

equipment and size and types of outlets;

- list of materials with standards and grades;
- estimated weight.

After 15 days of award of Contract:

- detailed documentation-drawings with all details (dimensions, welding, testing), calculations, welding documentation, inspection & test documentation, documents concerning materials used with chemical analyses and mechanical characteristics, auxiliary equipment;
- Foundation drawing indication dimensions and loads where applicable.
- Calculations necessary for design evaluation;
- List of materials and certification levels;
- Welding procedure specification;
- Heat treatment procedure;
- NDT procedure;
- Hydrostatic test procedure;
- Manufacturing & delivery schedule.



This documentation shall be submitted in six copies, one of which will be returned after approval by the Employer / Owner's Engineer.

During production:

- Progress reports;
- Inspection plan of critical items/processes
- List of spare parts recommended (for two years operation).

By the latest of delivery:

- All test certificates and reports duly certified.
- Comprehensive installation, operating, maintenance and repair manuals;
- Reproducible "as built" drawings (Hard and soft copies)

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<p>Doc. No. : 2547-SP-0004-01</p>	<p>SPECIFICATION FOR PRESSURE VESSEL</p>	<p>Revision No.0</p>

8.0 IDENTIFICATION

Before the hydrostatic test laid down in section 4.0 under heading 'Hydrostatic test and Inspection of Conformity' of this specification, each pressure vessel shall be fitted with a stainless steel identification plate.

9.0 EXTERNAL SURFACE TREATMENT

Unless otherwise specified in the specification, each pressure vessel shall be delivered externally sandblasted and primed in accordance with the bid specification for "painting" 2547-SP-0002-01.



**OIL & GAS DEVELOPMENT COMPANY
LIMITED**

**SPECIFICATION
FOR WELDING**

DOCUMENT NO. : 2547-SP-0005-01





 Transasia Refinery Ltd.	PRODUCED WATER ADEQUACY & CAPACITY ENHANCEMENT AT QADIRPUR GAS FIELD	 Petrochemical Consultants
Doc. No. : 2547-SP-0005-01	WELDING SPECIFICATION	Revision No.0

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1 GENERAL

1.1 Scope

This specification shall govern the electric arc welding processes permitted for use in the fabrication of all pressure piping.



This specification shall apply to all suppliers, sub contractors, vendors, manufacturers, and fabricators of welded pipes. The Contractor is responsible for all and shall ensure that all components to be incorporated into the work meeting this specification.

No supplier, sub contractors, vendor, manufacturer or fabricator shall subcontract the welding fabrication of any item without written approval from the Employer / Owner's Engineer, and the Employer / Owner's Engineer will not issue such an approval unless the proposed welding fabricator has received prior Employer / Owner's Engineer approval for the type of welding to be carried out.

1.2 Codes, Standards And Regulations

All welding performed under this Specification shall meet or exceed the requirements specified by the latest revisions of the following applicable Codes and Regulations

- a) AWS - (American Welding Society)
 - 1. A2.4 (Symbols for Welding and Nondestructive Testing)
 - 2. A3.0 (Standard Welding Terms and Their Definitions)
 - 3. A5.1 (Specification for Mild Steel Covered Arc Welding Electrodes).
 - 4. A5.5 (Specification for Low-Alloy Steel Covered Arc Welding Electrodes).
 - 5. A5.17 (Specification for Bare Carbon Steel Covered Electrodes).
 - 6. A5.18 (Specification for Carbon Steel Filler Metals for Gas Shielded Arc Welding).

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7. A5.20 (Specification for Mild Steel Electrodes for Flux Cored Arc Welding Electrodes).
- b) Applicable Local Boilers and Pressure Vessels Act and Regulations.
- c) ASME B31.3 Chemical Plant and Petroleum Refinery Piping.
- d) ASME Sec. VIII Div. 1 - Pressure Vessels.
- e) ASME Sec. IX - Welding.
- f) ASME B31.4 - Pipeline transportation systems for liquid hydrocarbons and other liquids.
- g) API STD 1104 Standard for Welding Pipelines and Related Facilities.
- h) AWS D1.1

All welding procedures used by Contractor / fabricator shall have been established and qualified in accordance with the appropriate sections of one or more of the codes and standards listed above and approved by the Employer / Owner's Engineer.

These Specifications apply to materials found in the P-1 grouping of Section IX of the ASME Codes and the equivalent material in the API Standards. The Employer / Owner's Engineer, on an individual basis, shall review all other "P" groupings.



Where a conflict occurs between these specifications and / or any of the above codes or Standards the more stringent shall apply.

2 WELDING PROCEDURES

2.1 General

The Contractor / Sub Contractor / Vendor as applicable shall submit to the Employer / Owner's Engineer for review and approval all welding procedures.

The Contractor / Sub Contractor / Vendor as applicable shall have a separate



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welding procedure for each method of welding he intends to employ.

A procedure qualification record (PQR) shall be included for each WPS. The PQR shall be witnessed and shall be supported with the lab report from the pre approved testing laboratory, if so previously agreed to by the Employer / Owner's Engineer.

All testing shall be performed by Contractor / Sub Contractor / Vendor as the case may be and certified by an Employer / Owner's Engineer approved testing laboratory, agency or equivalent. The minimum acceptable written procedure shall detail information on the following parameters.

1. The scope of work performed under the procedures.
2. The base metals and applicable specifications.
3. The welding process.
4. Type, size, classification, and composition of filler metals. (The specific brand name(s) of the flux-wire shall become an essential variable of the procedure qualification).
5. Type and range of current and voltage.
6. Width of electrode weave or oscillation.
7. Joint preparation and cleaning procedures.
8. Tack welding procedures. Method of marking the location of tack welds to facilitate post weld inspection shall also be included.
9. Electrode polarity.
10. Applicable welding positions.
11. Preheat and inter pass temperatures. (Control method)
12. Welding travel speed.
13. Root preparation prior to welding from second side, (where applicable).
14. Wire feed speed, rate of travel (GMAW & SAW)
15. Removal methods for weld defects and stray arc strikes.
16. Inter pass-cleaning method.
17. Repair welding,
18. Post welding heat treatments (if required).

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19. Type of (GMAW & GTAW) shielding gas, and flow rates
20. Type of (GTAW) electrode, size and tip angle.
21. Welders qualified and deployed in production welds shall always bear an identity card in the manner so approved by Employer / Owner's Engineer.

The Contractor / Vendor shall only employ welders who have a valid welding certificate for the procedures being used.

The Contractor shall have all welders tested in accordance with the applicable code or standard. Testing shall be at the Contractor's / Vendor's expense including test pieces. Irrespective of pre-qualification all welders proposed to be deployed in the work shall be tested and qualified afresh.

No welder shall be allowed to make any weld for which he is not qualified.

2.2 WELDING METHODS



The following welding processes are permitted, provided satisfactory evidence is submitted that the procedure has been qualified in accordance with the applicable Codes:

1. Shielded Metal-Arc Welding (SMAW).
2. Gas tungsten Arc Welding (GTAW).
3. Submerged Arc Welding (SAW).
4. Gas metal arc welding (GMAW)

The following processes are acceptable for the fabrication of piping by welding with limitations as noted.

Shielded metal arc welding (SMAW): may be used on all ferrous P1 & P8 materials with the following restrictions:

1. For low-hydrogen electrodes: 4.0 mm (5/32 inch) for out-of-position welding 2G, 3G, and 4G and 5.0 mm (3/16 inch) for flat welding 1G.

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2. For other non-low-hydrogen electrodes: 5.0 mm (3/16 inch) for out-of-position welding 2G, 3G, and 4G) and 6.0 mm (7/32 inch) for flat welding 1G.
3. Welding with larger-size electrodes for specific applications may be allowed only if each welder qualifies with the largest-size electrode to be used in production. This option is strictly at the Employer / Owner's Engineer discretion. The Employer / Owner's Engineer shall specify the details of the welder qualification tests if required.

Gas tungsten arc welding (GTAW) may be used on all ferrous P1 & P8 materials.

1. GTAW is required for the butt joint root pass of P-8 material.
2. SAW of carbon steel (P-1) materials shall not utilize active (Mn-Si) fluxes.
3. As-deposited weld metal for carbon steel (P-1) materials shall meet A-1 weld metal analysis.
4. For carbon steel (P-1) material; flux / wire combinations shall be chosen such that the deposited hardness of the cap pass shall not exceed 240 BHN. For low-temperature materials and other materials heat input shall be minimized and comply with the WPS parameters.
5. The carbon arc gouging process may be used. All carbon arc gouged surface areas shall be ground to clean bright metal prior to subsequent welding.
6. The Contractor may propose alternate process in addition to those listed. Any proposed process shall require written Employer / Owner's Engineer approval and qualification prior to implementation. Contractor and Employer / Owner's Engineer shall agree on tests, results, and other criteria before Employer / Owner's Engineer approval is granted.

Gas metal arc welding (GMAW) may be used on all P1 & P8 materials with the following restrictions:

1. GMAW in the short-circuiting transfer mode is limited to 10.0 mm (3/8-inch) maximum material thickness.

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2. GMAW in the spray transfer mode shall be used in the flat position 1G only.
3. GMAW in the globular transfer mode is not acceptable.
4. GMAW in the vertical position 3G shall be uphill, except for the root pass on butt joints, which may be downhill.
5. GMAW welds that require radiography shall be Radio graphed with extra fine grain film.
6. The Employer / Owner's Engineer reserves the right to utilize ultrasonic inspection to confirm any GMAW welds interpreted to have lack of fusion defects (sidewall or inter pass).
7. If the as deposited weld exceeds 1.60 percent Mn, then all such welds shall not exceed 200 BHN. If these welds exceed 240 BHN, then they shall be removed.

All fillet welds, including weldolets, threadolets, and socket welds, shall be made as below:



The root and hot with two subsequent pass by GTAW and rest are by Shielded Metal Arc Welding (SMAW) process.

All butt welds in pipe smaller than 60.3 mm O/D (NPS 2" inch) Schedule 40 shall be made by GTAW and shielded metal arc process. Root pass by gas metal arc is acceptable for pipe larger than 60.3 mm O/D NPS (2") inch.

All welds in pressure equipment must be qualified for Charpy impact testing when the code requirements indicate that the parent material requires impact testing.

When impact tests are required, tests shall be taken from the weld and heat affected zone.

The Contractor shall give special attention to welding of dissimilar base metals (different P numbers). Choice of electrodes / filler metals preheats, and the Contractor shall propose post weld heat treatment to Employer / Owner's Engineer for approval. Welds between carbon steel (P-1) and austenitic stainless steel (P-8)

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shall utilize ENiCrFe-2, ENiCrFe-3, ERNiCr-3, E309L, ER309L or equivalent filler metal approved by the Employer / Owner's Engineer.

Permanently installed backing rings shall not be used.

All butt welds in pressure equipment shall have the same chemical and mechanical properties as the parent metal.

All welding procedures must be qualified for Charpy impact testing when the Code requirements indicate that the parent material requires impact testing.

2.3 Materials And Equipment

2.3.1 The work under this section covers welding on materials listed under Material Group P-1, Section IX, Welding Qualifications, ASME Boiler and Pressure Vessel Code, latest edition.



Welding electrodes shall conform to the appropriate of ASME Boiler and Pressure Vessel Code II Part C and / or the appropriate section of - Welding Electrodes as follows:

- a) SMAW to SFA 5.1 covered carbon steel arc welding electrodes Class E7016, E7018, or E7018-1.
- b) GTAW to SFA 5.18 carbon steel filler metals for gas shielded arc-welding class ER70-S2
- c) SAW to SFA 5.17 carbon steel electrodes and fluxes for submerged arc welding, wire / flux classification EM 12K with a suitable neutral flux.

2.3.2 Welding Consumables.

The use of all welding consumables shall be subject to the Employer / Owner's Engineer's approval.

All coated metal arc-welding electrodes shall comply with AWS specification A 5.5, A 5.1. Submerged arc wire and flux shall comply with AWS A 5.17. Flux shall be of

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the non-active type unless approved otherwise by the Employer / Owner's Engineer.

All welding consumables, including fluxes shall be supplied in sealed containers and stored in a dry location at a minimum temperature of 68°F, and a maximum relative humidity of 60%. Low-hydrogen electrodes, after removal from factory seal containers, shall be baked at 250° C for 2 hours and then stored / handled in portable ovens at a minimum temperature of 150°F prior to use.

The welding filler metals shall have a chemical composition as near as possible to the parent metals to be welded. The finished weld as deposited, or after post weld heat treatment (PWHT) when required, shall be at least equal to the parent metal as to unit strength, ductile, and other physical properties and in resistance to corrosion, hydrogen attack, or other operating environment factors as required. Permission to change filler metals to those other than the ONES QUALIFIED IN ACCORDANCE WITH THIS SPECIFICATION must be obtained in writing, from the Employer / Owner's Engineer.



Electrode and rod diameters shall conform to the parameters of the weld procedure.

The Contractor / Vendor shall provide adequate drying ovens and take proper precautions in the storage and handling of low-hydrogen electrodes.

The Contractor / Sub Contractor / Vendor shall provide suitable wind guards, welder's platforms or bell holes when conditions warrant their use.

Electrodes and filler rods shall be protected from mechanical damage or deterioration. All unidentified, damaged or deteriorated electrodes or filler wires shall be removed from the working area and rejected. Any low hydrogen type SMAW electrodes not contained in heated quivers shall be removed from the site. Electrodes shall not be exposed to wet or high humid conditions.

Care of welding consumables is the responsibility of the Contractor; however, the following are minimum requirements:

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Low-hydrogen SMAW electrodes shall be kept in commercial electrode ovens after the factory container has been opened. The electrode holding oven temperature shall be maintained between 175°F (79°C) and 250°F (121°C). Any low-hydrogen SMAW electrodes that have been exposed for more than 4 hours prior to restocking into the holding oven or any SMAW low-hydrogen electrodes that have become wet or have damaged coatings shall not be used and the same shall be rejected and removed from site.

Other (non-low-hydrogen) SMAW electrodes shall be kept in a dry and dust-free enclosure after opening of the factory container. These non-low-hydrogen electrodes shall be held at a temperature below 150°F (66°C).

SAW fluxes and FCAW electrodes shall be stored in the factory containers in a dry and relatively dust-free area. Un-fused SAW fluxes may not be recycled for high strength, low alloy, or high alloy materials unless recycle procedures are Employer / Owner's Engineer approved.



Bare wire (SAW and GMAW) and bare filler rod (GTAW and FGW) filler metals shall be stored in a dry and relatively dust-free area.

Extreme care shall be taken to ensure that electrode separation by classification is maintained in the Contractor's inventory. All storage bins and ovens for welding consumables shall be clearly labeled. In addition, all GTAW bare rod filler metals shall be tagged with the AWS designation of the filler metal. Any welding consumables, which are not readily identifiable, shall not be used.

All pressure containing welds shall be of a minimum of two passes with overlap of starts and stops. This shall include socket welds and seal welds of threaded connections.

Weld stops and starts shall be staggered so that adjacent weld passes do not contain stops / starts within 25mm (1 inch) of each other.

The electrodes shall be purchased from the list of approved manufacturer's OR well known & reliable manufacturer and the same shall be supplied with proper

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certificates and batch certificates.

The width of weave during production welding shall be within the acceptable limit of the Employer / Owner's Engineer approved and qualified welding procedure, qualification certificates, and production welding operating sheets. As a norm this will be limited to a maximum of 3 times the core diameter of SMAW electrodes, whichever is the lesser.

Each weld pass / layer shall be completed in one full cycle / circumference before proceeding with the next. Blocking out or segmental welding is not permitted.

All tools and equipment used in the welding operations shall be in first class operating condition and shall be of sufficient capacity to ensure welds of the specified quality are achieved throughout the work. It shall be the right of the Employer / Owner's Engineer to request at any times the re-calibration of gauges and meters, etc. to ensure compliance with welding procedure operating sheets / WPS.

2.4 Joint Preparation



The surface of the pipe at the weld area shall be free from dirt, grease, scale, paint, grit or any other foreign material, which may adversely affect the final weld quality.

Bevels shall be $37\frac{1}{2}^{\circ}$ and all field cuts shall be normal to the axis of the pipe.

Miter welds are prohibited. All pipes shall be beveled for welding with an approved mechanical beveling machine.

Damage to bevels, which could possibly affect the quality of the weld shall be rectified prior to welding. If beyond repair the pipe shall be cut and the pipe end re beveled.

Where welding a pipe to a flange or another pipe or component, there must be a band of at least 25.0 mm (1" inch) wide around the internal / external joint weld preparation that is ground to bright metal, and is free of all foreign matter.

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To assure proper spacing and alignment in accordance with the applicable Code, an approved lineup clamp shall be used.

All welded joints shall conform to the straightness and alignment specified herein. Correction of improperly fitted parts shall be accomplished by disassembly and refitting. Reworking by hammering or flame straightening shall not be permitted.

The ends of piping components to be joined shall be aligned as accurately as is practicable within existing commercial tolerance on diameters, wall thickness, and out of roundness. Maximum bore mismatch shall not exceed 1/16 inch (1.6 mm). Alignment shall be preserved during welding.

When joints of unequal thickness are joined, the internal offset shall not exceed 1.6 mm (1/16"). If this value is exceeded, the excess thickness of the heavier end shall be machined or ground back from the bevel on a one-to-four (1:4) taper.

Maximum bore mismatch shall not exceed 0.8mm (1/32 inch). Where ends are to be joined and the internal misalignment due to difference in wall thickness, etc. exceeds 1.6 mm (1/6 inch), the wall extending internally shall be internally trimmed. Internal machining shall be performed so that the inside diameters of the components coincide.



When cutting pipe to length, it should be cut by mechanical means, if practical. Ends that are to have flanges attached either in the shop or field must be cut true and square.

2.5 Preheating

Preheat for pressure piping and furnace tubes shall be in accordance with ASME B31.3 and B31.4.

All pipe joints having a wall thickness greater than 9.5 mm (0.375") shall be preheated to 100°C (212°F) prior to welding.

Preheating shall be carried out with an approved torch system or with electrical induction coils, which will provide uniform heating.

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The preheat area shall be at least 200 mm (8") wide centered about the weld and shall extend around the entire circumference of the pipe.

Preheat temperatures shall be checked with temperature sensitive crayons (such as "Tempilstick") or by other approved methods.



If a joint requires preheating, the same temperature requirements shall be maintained for each succeeding pass.

2.6 WELDING DETAILS

- 2.6.1 All pressure welding shall be performed in accordance with approved and qualified welding procedures as required per code.
- 2.6.2 Each weld shall be uniform in width and size throughout its full length.
- 2.6.3 Each layer of welding shall be smooth and free of slag, cracks, pinholes, undercuts (internal and external), porosity and excessive bead shall be completely fused to the adjacent weld beads and base metal.
- 2.6.4 The cover pass shall be free of coarse ripples, irregular surface, non-uniform pattern, high crown, deep ridges or valleys undercut, arc strikes, porosity, undercut, slag, or spatter.
- 2.6.5 Butt welds shall be slightly convex, of uniform height, and have full penetration, unless otherwise approved.
- 2.6.6 For piping, limitations on weld reinforcement shall apply to the internal surfaces as well as to the external.
- 2.6.7 Fillet welds shall be of a specified size with full throat and the legs of uniform length.

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- 2.6.8 Arcs shall only be struck in the weld groove. A controlled arc must be maintained while welding. Should an arc strike occur, it shall be removed by grinding and the area shall be etched (10% Nital) to confirm heat affected area removal, and MPT examined to ensure absence of any surface cracking?
- 2.6.9 After each pass, the layer of weld metal must be cleaned to remove all slag, scale, dirt, etc. Wire brushes, grinder, or chipping hammer shall be used as needed to prepare proper surface for each succeeding weld pass.
- 2.6.10 Repair, chipping or grinding of welds shall be done in such a manner as not to gouge, groove, or reduce the base metal thickness.
- 2.6.11 No welding shall be done if the temperature of the base metal is below 50°F. Nor shall there be any welding done if there is moisture, grease, or any foreign material on the joint to be welded.
- 2.6.12 An ASME qualified welder shall make tack welds. Cracked tack welds shall be completely ground out and NDE by MPT / DPT prior to re-welded.
- 2.6.13 The Contractor shall make no substitution of materials or modifications to details without the prior written approval of the Employer / Owner's Engineer.
- 2.6.14 Welders and welding operators shall not be qualified on production welds.
- 2.6.15 The Contractor shall ensure that welders and welding operators are only employed on those parts of the work for which they are qualified.
- 2.6.16 Each welder and welding operator shall possess an appropriate temperature-measuring device. All supervision shall possess a copy of the approved welding procedures.

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2.6.17 Alternatively, welding procedures may be clearly displayed at each welding location. Welders shall be familiar with the requirements of the appropriate approved welding procedures. Any welder found not complying with the approved welding procedures during production welding shall be removed from the work and the non-conforming weld(s) may be completely rejected, at the discretion of the Employer / Owner's Engineer.

Welder having repairs more than 3% in his production weld shall be given a warning and if no improvement after first warning shall be removed from the project or requalified, at the discretion of the Employer / Owner's Engineer.

2.6.18 No welding shall be undertaken without approved WPS and qualification of welding procedure.

2.6.19 The Employer / Owner's Engineer will not provide any WPS for the Contractor.

2.7 Welding Techniques



2.7.1 General

- a) All welding shall be performed in accordance with an approved and qualified welding procedure.
- b) Each weld shall be uniform in width and size throughout its full length.
- c) The cover pass shall be free of coarse ripples, irregular surface, non-uniform bead pattern, high crown, and deep ridges or valleys between beads.

Butt welds shall be slightly convex, of uniform height, and have full penetration.

2.7.2 Horizontal Roll Welds

When Shielded Metal Arc Welds are made in the horizontal (1G) rolled position, the root pass shall be deposited by the "down hill" method of welding while the pipe

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remains in a horizontally fixed position. For all remaining passes, the pipe may be horizontally rotated as the weld metal is deposited in the approximate top quadrant in the "uphill" progression method.

2.7.3 Horizontal Fixed Welds

- a) When Shielded Metal Arc welds are made with the pipe in the horizontal fixed position, all passes shall be deposited by the "up hill" method of welding.

2.7.4 Vertical Welds

When Shielded Metal Arc welds are made with the pipe in a vertical position, (2G) , the deposition of the weld metal shall be multiple beads in a horizontal plane.

2.7.5 Fillet Welds

- a) All fillet welds shall be slightly concave and the length of each leg nearly equal.
- b) Socket welds shall have a minimum of 2 weld beads – root+3 pass by GTAW remainder by SMAW. The length of each leg of the fillet weld shall be equal.

The width of the weld shall extend to the outer rim of the fitting where practical.



2.7.6 Treatment of Underside of Weld

- a) The use of backing rings for butt welds is prohibited.
- b) Excessive burn through shall be removed.

2.7.7 Cleaning

- a) All weld impurities shall be removed between passes. Cleaning may be done with either hand or power tools.
- b) All rough irregularities in the cover pass and weld spatter shall be removed.

2.7.8 Weld Identification

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Each finished weld shall be clearly marked to identify the portion made by each welder.

2.8 Defects And Repairs

Welds containing defects not exceeding an aggregate of five (5) percent of the length of the root bead may be removed by grinding, chipping or arc gouging and re-welded in accordance with an approved procedure. Welds containing defects exceeding that amount shall be cutout and replaced.

When defects are ground out the entire weld shall be preheated to a temperature of 150 °C (300 °F) prior to welding.

All repaired welds shall be radio graphed or by the same method of original defect detection.

2.9 Post Weld Heat Treatment (PWHT)



2.9.1 Contractor / Sub Contractor / Vendor is responsible for all PWHT requirements, which shall be performed as specified in accordance with ASME B31.3.

2.9.2 PWHT of pressure piping and furnace tubes shall be in accordance with ASME B31.3, B31.4 and the specification for Post Weld Heat Treating.

2.9.3 Controlled atmosphere furnaces are preferred for heat treatment. Procedures using electric resistance, induction, or flame burner rings are acceptable for shop or field heat treatment. The Contractor must take an approval from Employer / Owner's Engineer prior to go for heat treatment.



2.9.4 Contractor / Sub Contractor / Vendor must notify the Employer / Owner's Engineer prior to starting PWHT operations.

2.9.5 Following Employer / Owner's Engineer approval, Contractor / Sub Contractor shall permanently stamp each weld receiving PWHT with "HT" on two locations of the

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weld. If piping orientation is known, the stamping shall be on the top and north sides.

- 2.9.6 The Contractor / Sub Contractor shall furnish a PWHT record chart. The chart must be dated, numbered, and labeled with job identification, Contractor / Sub Contractor name, and person responsible for the PWHT. Heat-treated line, welds and spool numbers shall be identified on the chart.
- 2.9.7 The completed PWHT record chart shall be submitted for Employer / Owner's Engineer approval following completion of heat treatment.
- 2.9.8 Stress relieving of piping shall be performed as per ASME B31.3 / ASME B31.4, as applicable.
- 2.9.9 Stress relieving may be performed by electrical induction or by electric resistance heating devices, or by furnace that has a large enough capacity to accommodate the entire piece being heat-treated.
- 2.9.10 The stress relieving temperature to be attained shall be 1100°F minimum, 1150°F maximum. The soak period at this temperature shall be one hour per 25.0 mm (1 inch) of pipe wall thickness and in no case shall the soak period be less than one hour.
- 2.9.11 Rate of heating and cooling shall be in accordance with the requirements for thermal stress relief presented in Section VIII of the ASME Boiler and Pressure Vessel Code. In any event, the rate of heating above 600°F may not be more than 400°F per hour, nor the rate of cooling more than 500°F per hour when above 600°F.
- 2.9.12 For field stress relieving, a continuous temperature record Log shall be furnished of the program from heating, soaking and cooling to 600°F. A minimum of two

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thermocouples shall be installed at each weld so that continuous readings can be assured in the event of thermocouple failure.



2.9.13 Local heat treatment of welds shall consist of heating 1D pipe length completely around the circumference of the pipe welds or pipes as required to eliminate thermally induced stresses. A continuous record of time and temperature shall be maintained for at least two points on each weld during the course of heat treatment with methods other than exothermic kits.

2.9.14 During heat treatment, the ends of the pipe shall be temporarily plugged to minimize air-cooling. Sufficient insulation shall be applied to maintain the required heat treatment temperature. The full thickness of 75mm (3"-inch) insulation shall be continued for a minimum distance of 610 mm (2 feet) on each side of the heating elements, and shall be left in place until the weld has cooled to below 100°F.

2.9.15 When local heat treatment is used, care shall be exercised with restrained piping so that no upsetting will be caused by thermal expansion.

2.9.16 A minimum 10% of all locally (field) heat-treated welds shall require Brinell hardness testing.

2.9.17 Unless otherwise indicated by Employer / Owner's Engineer, Brinell hardness limits apply to welds after PWHT. The hardness of the weld shall be determined by the average value of three tests (of 3 indentations) taken per 120 degrees quadrant around the weld. The test areas of the weld shall be ground or filed to provide a suitable surface for testing. If a Telebrineller is used to measure the hardness, the bar shall be as close as practical to the anticipated weld hardness. If a poor indentation is obtained on an individual test, a retest shall be made on an adjacent area.

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2.9.18 Hardness tests other than Brinell may be used if the values obtained can be equated to the Brinell hardness numbers, and the proposed equipment and procedures have received prior Employer / Owner's Engineer approval.

2.9.19 Flange facing and threaded connections must be adequately protected against oxidation during stress relieving and must be cleaned and free of defects after stress relieving.



2.9.20 No heating or welding may be applied to any piping or weld joint after stress relieving is complete.

2.9.21 All stress relieving equipment and execution shall be supplied at Contractor's expense.

2.10 INSPECTION

2.10.1 The Contractor / Sub Contractor / Vendor shall extend all facilities, assistance and co-operate fully in all aspects of inspection and NDE and shall give adequate notice of any required fabrication inspection stages, together with sufficient time for thorough inspection. The Employer / Owner's Engineer shall have the right to establish hold points at any point in the fabrication sequence.

2.10.2 Although it is the Contractor's primary responsibility to perform weld examination, the Employer / Owner's Engineer shall have the right to observe the examination of all welds by non-destructive means. The inspection may be at any time before, during, and after fabrication. The Contractor shall conduct daily NDE percentage of welds to assess weld quality. Up to- date examinations are required to identify and prevent the re-occurrence of weld defects on subsequent welds. Records and evidence of all weld examinations shall be available at all times for the Employer / Owner's Engineer to review and approve.

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2.10.3 Employer / Owner's Engineer may use any method of inspection necessary to establish quality control and ensure adherence to welding procedures. Employer / Owner's Engineer shall have the right to accept or reject any weld not meeting the requirements of this specification, or if Employer / Owner's Engineer terms a weld unacceptable to the service for which it is intended.

2.10.4 Repair rates in excess of 5% by joint basis may result in stoppage of work by Employer / Owner's Engineer until the Contractor demonstrates that the welding problem has been resolved.



2.10.5 The Employer / Owner's Engineer reserves the right to perform additional inspection of production welds made using GMAW in the short-circuiting transfer mode. The Employer / Owner's Engineer may:

- a) Perform ultrasonic inspection for the purpose of detecting lack of fusion. This inspection shall not replace any radiographic or other non-destructive examination requirement.
- b) Perform a shop inspection to evaluate the capability of shop procedures and personnel to make acceptable welds.
- c) Require re-qualification of procedures and / or personnel. This option will be exercised only in the presence of a significant number of weld repairs.

2.10.6 Any discrepancies between the approved WPS and the production welds noted by the Employer / Owner's Engineer, any or all of the work made under these conditions is subject to rejection.

2.10.7 Welds made by unqualified welders shall be rejected and shall be completely removed by the Contractor.

2.10.8 Welds that are not welder-identified shall be rejected.

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2.10.9 The completed weld shall be presented in a uniform and workman like appearance and shall be symmetrical to the centerline of the weld.

2.10.10 The Contractor shall submit a daily production weld count report, itemized by ISO drawing number, diameter, weld number, and welder I.D. in addition to a weekly defect classified repair percentage report based on joint count.

2.10.11 The weld quality of branch connections shall meet the acceptance standards of this specification.

2.10.12 Welds between dissimilar materials shall be examined by the method and to the extent required for the material requiring the more stringent examination.

2.10.13 When examination of welds requiring random NDE (RT, UT, MT) reveals defects requiring repair, then two additional welds of the offending welder production shall be examined. For each rejected weld of the two welds, two more additional welds made by that welder shall be examined. If any of these welds are rejected, then the welder shall be re-tested or removed from the fabrication at the Employer / Owner's Engineer's option, and all welds (represented by the original group) made by the welder shall be 100 percent NDE (RT, UT, MT).



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SPECIFICATION FOR PAINTING

DOCUMENT NO. : 2547-SP-0002-01





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1.0 PAINT WORK

1.1 GENERAL

1.1.1. This specification defines the requirements for surface preparation, selection and application of paints on external surfaces of equipment, piping, etc.

When a particular part of work is being carried out. the painting system should be chosen in accordance with the environment in which the material to be painted will be located. Indeed, the degree of aggressiveness of the atmosphere that will be encountered in the environment of the work can range from an environment, which is not very aggressive to an extremely aggressive environment, depending on whether the location is in a rural area. a non-industrial built-up area, ventilated workshops, in the vicinity of the sea, at chemical plants, in humid rooms or in the vicinity of sources of cold or heat.

1.2 CODES & STANDARDS



The following codes and standards shall be followed for the work covered by this contract.

BS 4232	: Specification for Painting requirement, surface preparation
SSPC –Pittsburg. U.S.A.	: Good Painting Practice and Surface specification SP 1 to 10 Manual volume-1
DIN Standard 55928	: Specification for paint requirement for field painting work
BS 4593 sec.4	: Specification for Inspection of finished painting.

1.3 CONDITIONS OF DELIVERY

a) Packaging

Every recipient will be fitted with a hermetically-sealed lid with an opening that is sufficiently large to allow the contents to be stirred: the outside and inside are

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protected against oxidation, and, like the lid, are marked with a strip of colour identical to the contents.

1.4 COMPOSITION OF THE PAINT PRODUCTS USED

a) Quality

The composition and quality of the products may not differ from batch to batch. A batch is all of the products of a specified manufacture. If the analyses of products bring to light that the composition does not conform to the specifications of the paint manufacturer, the Employer / Owner's Engineer may refuse to use this batch of products. The paint products must comply with the following conditions:



- They must have the viscosity necessary for the described use and the established condition ; use of the brush – paint roller (spray gun for special cases and in the workshop)

b) Quality control - Sampling

While the works are in progress on the construction site, the Employer / Owner's Engineer may carry out sampling on the paint being used for the purpose of checking conformity. The paint products must be made available free of charge to the laboratory or the approved supervisory body in sufficient quantities so that all the tests can be carried out on the same batch.

If the analyses reveal a non-conformity in the composition of the products used (tolerance of +3 % of the dosage of every component), the Employer / Owner's Engineer may refuse application of the product under consideration, halt the work / and have the non-conforming product already applied removed.

Before proceeding with the work a product data sheet with its test certificates & batch certificate is to be submitted to Employer / Owner's Engineer's approval stating that products offered is conform to the required specification. The only Purpose of the analyses is to reveal any nonconformity of the composition of the products. Their purpose is therefore not to assess the quality of the different components. The

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analyses concerned are not acceptance tests of the products supplied and in no way affect the obligations of the Contractor specified in the contract towards the Employer / Owner's Engineer.

1.5 IDENTIFICATION

Every recipient will bear the following information:

- Name of the manufacturer;
- Date and number of manufacturer;
- Name of the product type;
- Batch no. with Test certificate
- Net weight of the product or the contents of the recipient;
- Date of the expiry.

At the time of delivery, this packaging must be bear labels in conformity with the legal stipulations in force.

After completion of a job a general clean up shall be carried out by the Contractor to remove all debris, materials or irregularities that his work has brought to the site so that it is left tidy.



The restoration work includes among other things:

- the removal of abrasives;
- the removal of the different protective coverings;
- the Contractor will make the required repairs to any damage after refitting the supports;
- the removal of paint and cleaning of the stains on the floor.

1.6 SURFACE PREPARATION STANDARDS

Following standards shall be followed for surface preparations. :

- 1 Swedish Standard Institution- SIS-05 5900-1967

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- 2 Steel Structures Painting Council, U.S.A. (Surface Preparation Specifications (SSPC-SP)
 - 3 British Standards Institution (Surface Finish of Blast-cleaned for Painting) BS- 4232.
 - 4 National Association of Corrosion Engineers, U.S.A. (NACE).
- a) The contractor shall arrange, at his own cost to keep a set of latest edition of above standards and codes at site.
 - b) The paint manufacturer's instruction shall be followed as far as practicable at all times. Particular attention shall be paid to the following:
 - Proper storage to avoid exposure as well as extremes of temperature.
 - Surface preparation prior to painting.
 - Mixing and thinning.
 - Application of paints and the recommended limit on time intervals between coats.
 - c) Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for taking up painting work is given by the Employer / Owner's Engineer, who may, however, at his discretion authorize in writing, the taking up of surface preparation or painting work in any specific location, even prior to completion of system test.



1.7 PREPARATION OF THE SURFACES

1.7.1 General Specifications

The cases that occur in practice on building sites, with regard to painted surfaces, can be broken down as follows:

- material of which the oxide content disappears by natural oxidation;
- material that has already been covered with a layer of paint in the workshop;
- material that is covered with old paint layers that show different degrees of weathering.

Good preparation of the surface is the best guarantee for good anti-corrosion protection.

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Paintwork shall never begin until the surface to be treated is dry and is independent of the base coat and cleared of dirt, dust, rust, scale, grease, salt attack, cement powder, cement mud-scale, sand, oil, etc.

The method of preparation of the surface will be implemented in accordance with the preparation methods described below:

- cleaning (bright blast-cleaning):
- mechanical cleaning;
- manual de-rusting.



The Contractor should have the required material at his disposal to clean the surfaces to be coated thoroughly in accordance with the preparation methods. regardless of the form or the condition of such surfaces. The cleaning devices that might be damaged during the surface preparation shall be screened off by the Contractor.

1.7.2 Sandblasting

The blasting grits or sand to be used for blasting operation shall be tested for chloride content or the Contractor / manufacturer shall issue the certificate showing there is no chloride content in the product.

Before beginning cleaning by blasting. the person carrying out the work will take the following measures:

- clear the steel surface of oil and/or grease;
- ensure that each flange collar (section where the sealing is applied) is properly screened off against the blasting and the subsequent works;
- check that no blasting grains can get into the pipes during this process. Any openings not sealed off must be screened off;
- where there are valves, regulators and other devices, the manufacturer's identification plate will be dismantled so that all surfaces can be treated. The plate will then be put back again or if removal of above is not possible then

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these items shall be covered & protect so that application of paint on main unit doesn't spoil above said parts.



- screen off all non-metal structures such as rubber where there is a filter;
- with valves operators and other devices care should be taken to ensure that no metal filings or paint get into the apparatus:

To prevent rust forming quickly as the result of humidity on the blasted surface, cleaning by blasting may only be carried out when the temperature of the steel surface is at least 3°C higher than the dew point of the ambient air.

Blasting may not be carried out if the relative degree of humidity exceeds 80%. The choice of the type of blasting medium used depends on local circumstances such as the possible presence of gas and the material to be blasted - e.g. INOX (stainless steel)., The abrasive to be used must conform to the local law i.e. it may contain no carbon and less than 1% free silicon dioxide. The Sa 3 will always be requested and must at least reach Sa 2½ during the initial stage of the paintwork. For blasting followed by metallization, the surface preparation degree to be achieved is always Sa 3. The degree of cleanliness to be obtained will be inspected in accordance with the Swedish standard SVENSK STANDARD ISO 8501-1-1988 SS 05.5900.

- Sa 3: surface blasted down to the bare metal; when the surface is inspected with a magnifying glass, scale, rust and foreign bodies must be completely removed and it should be possible to raise a metallic -shine on the treated surface, the surface roughness shall be at least 75 µ.
- Sa 2 1/2: blasted very carefully. Scale, rust and foreign bodies must be removed in such a way that anything left behind will only be visible as nuances (shading) or strips.

The blast-cleaning will be carried out by means of compressed air free of water and oil. After the blasting and before painting, the surface should be completely cleaned of blasting material and so forth with a soft brush, a dry cloth or dry compressed air.

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1.7.3 Mechanical cleaning

If sandblasting is not permitted or if the metal structures are not easily accessible for blasting or blasting for one reason or another is technically unfeasible, mechanical de-rusting can be used instead. With mechanical cleaning by means of chipping, rotating steel brushes and sanding discs, a degree of cleanliness St 3 should be reached.

- St.3 : removal of the old paint layers of which the adhesion leaves something to be desired and / or of which the paint layer no longer fulfils the requirements.

If parts are present that are so corroded that St 3 is difficult to achieve, this should be notified to the Employer / Owner's Engineer prior to the start of the works.

N. B :

St 3 : means removal of every old paint layer. Retouching means local polishing with St 3 or Sa 3 followed by application of the desired painting system.

After mechanical cleaning, the surface should be made dust-free with a cloth or a soft brush. washed with an organic solvent and thoroughly dried off with a dry cloth (e.g. with 1.1.1. Trichloroethane such as Solvethane, Chlorothene NU).



1.7.4 Manual de-rusting

Manual de-rusting with the aid of scrapers, steel brushes; sandpaper etc. shall only be permitted in exceptional cases for local repairs. Any deviation there from must be requested from the Employer / Owner's Engineer.

With manual de-rusting, a surface preparation degree St 3 must be obtained. The length of the handles of the equipment used may not exceed 50 cm.

1.7.5 Preparation of a surface covered with a layer of paint in the workshop.

This layer is in general applied by the manufacturer for example on valves, Regulators etc. Layers of this kind will be checked for their proper adhesion in accordance with ASTM D3359, method A. The adhesion should be at least 4A.

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If the paint layer shows less adhesion or is incompatible with the rest of the system it should be completely removed. If the paint layer is not removed, the Contractor accepts, it in the state in which the coating is found and the guarantee remains in force.

The Contractor, who must provide for the protection on the construction site. Must therefore obtain the information regarding the treatment of the surface and the quality of the paint that was used and must, moreover, examine the adhesion of the layer on the construction site, the percentage of damage and weathering as well as the value of the preparation of the surface in the workshop together with the thickness thereof that must be supplemented if necessary.

a) Galvanized surfaces

Galvanized surfaces, both old and new will be carefully roughened up. Every foreign body (concrete splatters, chalk marks, grease and oil stains, etc.) will be removed. Thereafter, rub the surfaces with abundant water and, if necessary, with cleaning products.



To this end, nylon brushes will be used for every kind of dirt as well as for removing zinc salt residue. Thereafter, the surfaces will be treated in accordance with system 21. Where the zinc layer is lacking, it will be de-rusted manually to a degree of cleanliness St 3, after which a Primer coat will be applied in accordance with system 22.

b) Metalized surfaces treated with an impregnation layer

- Degrease with the desired degreasing product:
- Clean under high pressure or with a product prescribed by the paint supplier.

If the paint layer adheres well and is applied on a clean base, the painting system described may be continued. If the percentage of damage and weathering does not exceed 5 % / m. retouching may be considered. These partial repairs will be carried out.

If on the other hand, the percentage of damage does exceed 5 %/m or if the layer

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applied in the workshop comes loose, the Contractor must draw the attention of the Employer / Owner's Engineer to this and carry out the complete application system.

1.7.6 Preparation of surfaces covered with earlier paint layers that show different degrees of weathering.

If the surfaces do not show deep weathering limited to the spread of rust by small pitted areas or non-penetrative rust in spots, it will very often be sufficient to clean the surfaces with abrasives or with an abrasive disc. Then to rub them down with steel wool, remove the dust and wash off. If thick rust appears, in spots scale rust and active rust canker, this should be removed with needle hammers or stripped away directly by blasting, removing the dust and washing off.



1.7.7 Preparation of concrete or cement plaster surfaces

Remove unsound paint layers and loose components with scrapers, blades or rotating steel brushes, Thoroughly clean the entire surface with water containing ammonia. Thoroughly remove moss, algae and fungal growths. Where these growths have been removed, treat the area with a fungicide in accordance with the instructions for use.

Once the entire area is completely dry, brush off the dead residue of moss, algae and fungus with a hard brush. In the case of reinforcement steel that has been laid bare, remove as rust. dust and grease as possible and treat with a primer coat. When painting concrete surfaces. they must first be checked for cracks. Cracks larger than 0.3 mm Must be repaired with an appropriate system in accordance with the type and extent of the repairs (e.g. injection with epoxy mortar). Repair damage such as cracks and bursts to concrete parts with a two-component mortar or preferably with micro-mortars. Finally, check the alkalinity of the surface with the aid of litmus paper and neutralize it if necessary.

1.7.8 Use of solvents

It is sometimes necessary to use solvents when the surfaces to be painted are streaked with grease or oil. In this case a suitable organic solvent should be applied.

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The operation should be carried out with the aid of clean brushes or rags and clean solvent.

All the legal specifications in connection with solvents etc. must be adhered to. The Employer / Owner's Engineer shall be informed in advance of any toxicity or flammability. All measures must be taken to prevent any risk of fire and to rule out any Possibility of poisoning (ventilation). The Contractor will provide drip collectors to keep the environment free of pollution.

1.7.9 Condition of the metal after stripping

The Contractor must call in Employer / Owner's Engineer for checking the condition of the metal during stripping and inform Employer / Owner's Engineer immediately of any damage that he might have noticed.

- Deep corrosion of the plates – rivets – bolts
- Faulty welding
- Fittings that appear to be dangerous because of their age.

1.7.10 Removing coating from surface pipelines

The Contractor must have the equipment necessary for the removal of asphalt from the pipe without damaging the latter (scratching, impact, etc.). The Contractor undertakes to carry out the work in accordance with an approved procedure.



1.8 CARRYING OUT THE PAINTWORK

1.8.1 Conditions for carrying out paintwork

Painting may not be carried out in unsuitable conditions.

All preparatory work and painting may only be carried out in dry weather and at a minimum temperature of 10°C, except for special cases requested by the Employer / Owner's Engineer.

Unless otherwise stipulated in the specifications of the paint supplier, application of the paint is forbidden if it is forecast that the temperature will fall to below 0°C before

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the paint is dry. The temperature of the surface to be painted must be at least 3°C higher than the dew point of the ambient air. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

The work must be stopped:

- If the temperature of the surface to be painted is higher than that described by the supplier:
- If it is raining, snow, mist or fog or when the relative humidity is higher than 80 %.

Coats that have not yet dried and have been exposed to frost, mist, snow or rain and might thereby be damaged must be removed after drying and the surfaces must be repainted at the expense of the Contractor.

Working in direct sunlight or in hot weather must be avoided.



The first coat of paint must be applied maximum 3, hours after the preparation of the surface if the relative humidity of the air is between 50 % and 80 %. This time span may be increased to 6 hours if the relative humidity is less than 50 % in all cases, the preparation of the surface must exhibit degree Sa 3 and at the very least the appearance of degree Sa 2½ at the time of painting.

The coats of paint may only be applied on carefully cleaned surfaces that must be dry and free of grease and dust.

1.8.2 Special conditions

Painting may be carried out when the Contractor can be sure that the instructions of the paint supplier have been scrupulously followed with regard to the parameters in the following (non-exhaustive) list:

- Ambient temperature
- Surface temperature
- Relative humidity
- Dew point

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- Drying times

The Contractor must in this respect be able to produce the instructions for the paint on the site.

In addition, the paintwork may only be carried out to a minimum ambient temperature of 5°C and / or to a maximum relative degree of humidity of 85 %. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

Hand mixing of the paint shall be permitted for up to 5 liters only, the large quantity shall mixed by mechanical agitators and shall be maintained continuously during paint work to avoid quick pigment separation.

1.8.3 Paint Materials

Manufacturers shall furnish the characteristics of all paints indicating the suitability for the required service conditions. Paint material should withstand lower up to -10°C. Primer and finish coats shall be of class-I quality and shall conform to the following:

a) Primer (P-1)

Redoxide Zinc Chromate Primer

Type and Composition: Single pack. Modified phenolic alkyd medium pigmented with redoxide and zinc chromate.



Volume solids	30 – 35%
DFT	25 microns/coat (min)

b) Covering capacity Primer (P-2)

High build chlorinated rubber zinc phosphate primer

Type and Composition: Single pack, Chlorinated rubber medium plasticized with unsaponifiable plasticiser pigmented with zinc phosphate

Volume solids	35- 40%
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DFT 50 MICRONS/COAT (MIN)
Covering capacity 7-8 M2/Lit/Coat

c) Primer (P-3)

High build zinc phosphate primer

Type and Composition: Single Pack, Synthetic medium. pigmented with zinc phosphate.

Volume solids 40-45%
DFT 35-50 microns/coat
Covering capacity 10-12 M2/LIT/coat
Heat resistance Upto 100 C (dry)

d) Primer (P-4)

Etch Primer/ Wash Primer

Type and Composition: Two pack Poly vinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate.



Volume solids 7-8%
DFT 8-10 microns/coat
Covering capacity 7-8 M/lit/coat

e) Primer (P-5)



Epoxy Zinc Chromate Primer

Type and Composition: Two pack, Polyamide cured epoxy resin medium pigmented with zinc chromate.

Volume solids 40%(min)
DFT 35 microns/coat(min)
Covering capacity 11-12 M/lit/Coat

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- f) Primer (P-6)
Epoxy Zinc Phosphate Primer
- Type and Composition: Two pack, Polyamide cured Epoxy resin medium pigmented with zinc phosphate.
- | | |
|-------------------|-----------------------|
| Volume solids | 40% |
| DFT | 35 microns/coat (min) |
| Covering capacity | 11-12 M / lit/coat |
- g) Primer (P-7)
Epoxy high build M10 Paint (Intermediate Coat)
- Type and composition: Two pack. Poly Polyamide cured epoxy resin medium pigmented with micaceous iron oxide.
- | | |
|---------------|------------------------|
| Volume solids | 7- 8% |
| Volume Solids | 50% |
| DFT | 100 microns/coat (min) |
- Covering capacity 5.0 M/lit/coat
- h) Primer (P-8)
Epoxy Red Oxide zinc phosphate primer
- Type and Composition: Two pack, Polyamine cured epoxy resin pigmented with Red oxide and Zinc phosphate.
- | | |
|-------------------|-----------------------|
| Volume solids | 42% |
| DFT | 30 microns/coat (min) |
| Covering capacity | 13-14 M/lit/coat |
- i) Primer (P-9)
Epoxy based tie coat (suitable for conventional alkyd based coating prior to

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application of acrylic polyurethane epoxy finishing coat)

Type and Composition: Two pack , Polyamide cured epoxy resin medium suitably pigmented.

Volume solids	50-60%
DFT	50 microns/coat (min)
Covering capacity	10-12 M/lit/coat

j) Finish Coats (F-1)

Synthetic Enamel

Type and Composition: Single pack, Alkyd medium pigmented with superior quality water & weather resistant pigments.

Volume solids	30-40%
DFT	20-25 microns/coat
Covering capacity	16-18 M/lit/coat

k) Finish coat (F-2)

Acrylic Polyurethane paint



Type and Composition: Two pack , Acrylic resin and isocyanate hardener suitably pigmented.

Volume solids	40% (min)
DFT	30-40 microns/coat
Covering capacity	10-12 M / lit / coat

l) Finish Coat (F-3)

Chlorinated Rubber Paint

Type and Composition: Single pack, Plasticized chlorinated rubber medium with chemical & weather resistant pigments.

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Volume solids	30%
DFT	30 microns / coat (min)
Covering capacity	1 0.0 M / lit /coat

m) Finish Coat (F-4)

High build chlorinated rubber M10 paint.

Type and Composition: Single pack Chlorinated rubber based high build pigmented with micaceous iron oxide.

Volume solids	40-50%
DFT	65-75 microns/coat
Covering capacity	6.0-7.0 M / lit / coat

n) Finish coat (F-5)

Chemical Resistant Phenolic based Enamel

Type and Composition: Single pack phenolic medium suitably pigmented.

Volume solids	35-40%
DFT	25 microns/ coat
Covering capacity	15.0 M /lit/ coat



o) Finish Coat(F-6)

Epoxy High Building Coating

Type and Composition: Two pack. Polyamide cured epoxy resin medium suitably pigmented.

Volume solids	60-65%
DFT	100 microns/coat (min)
Covering capacity	6.0-6.5 M / lit / coat

p) Finish Coat (F-7)

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High build Coal Tar Epoxy

Type and Composition: Two pack, Polyamine cured epoxy resin blended with Coal Tar.

Volume solids	65% (min)
DFT	100-125 microns/coat
Covering capacity	6.0-6.5 m / lit / coat

q) Finish Coat (F-8)

Self priming epoxy high build coating (complete rust control coating)

Type and Composition: Two pack. Polyamide-amine cured epoxy resin suitably pigmented. Capable of adhering to manually prepared surface and old coatings.

Volume solids	65-80%
DFT	125-150 microns/coat
Covering capacity	4-5 M / lit / coat

r) Finish Coat (F-9)



Inorganic Zinc Silicate coating

Type and Composition: Two pack , Self cured Ethyl silicate solvent based Inorganic Zinc coating.

Volume solids	60% (min)
DFT	65-75 microns/coat
Covering capacity	8-9 M / lit / coat

s) Finish coat (F-10) High build Black

Type and Composition: Single pack. Reinforced bituminous composition phenol based resin.

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Volume solids	55-60%
DFT	100 microns/coat (min)
Covering capacity	5.50-6.0 M / lit / coat

t) Finish Coat (F-11)

Heat Resistant Aluminum Paint Suitable up to 250°C.

Type and Composition: Dual container (paste & medium). Heat resistant spec varnish medium combined with aluminum flakes.

Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M / lit/ coat

u) Finish Coat (F-12)

Heat Resistant Silicon Paint suitable up to 400° C.

Type and Composition: Single pack Silicone resin based with aluminum flakes.



Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M/lit/coat

v) Finish Coat (F-13)

Synthetic Rubber Based Aluminum Paint Suitable up to 150° C.

Type and Composition: Single Pack, Synthetic medium rubber medium combined with leafing Aluminum,

DFT	25 microns/coat
Covering capacity	9.5 M /lit/ coat

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Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above are theoretical. Allowing the losses during application, min specified DFT should be maintained.
2. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation quality and workmanship should be ensured.
3. Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine environment,
4. All primers and finish coats should be cold cured and air-drying unless otherwise specified.
5. Technical data sheets for all paints shall be supplied at the time of submission of quotations.
6. In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat (P-9) alternate system may be used taking into the service requirement of the system.
7. In case of F-6, F-9, F-11 & F-12 Finish Coats, No Primer is required.

The paints shall conform to the specifications given above and Class-I quality

Painting material

Type	Designation
1. Inorganic zinc, silicate	Ameron Dimetcote 11 or approved equivalent
Thinner	Ameron A65 or approved equivalent
2. High-build polyamide epoxy	Ameron A383HS or approved equivalent
Thinner	Ameron A65 or approved equivalent
3. Acrylic silicone	Ameron 1999 or approved equivalent
Thinner	Ameron 65 or approved equivalent
4. Silicone aluminium	Ameron A878 or approved equivalent

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Thinner	Ameron A65 or approved equivalent
5. Epoxy primer-1	Ameron 71Tc or approved equivalent
Thinner	Ameron A65 or approved equivalent
6. Epoxy finish aluminium	Ameron 72 or approved equivalent
Thinner	Ameron 9HF or approved equivalent

Notes:



- (a) Amercoat 65 or an approved equivalent thinner shall be used for cleaning stainless steel surfaces prior to printing.
- (b) Amercoat 12 or an approved equivalent thinner shall be used for cleaning tools and equipment used for painting in accordance with this specification.

STORAGE

All paints and painting material shall be stored only in rooms to be provided by contractor and approved by Employer / Owner's Engineer for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent, building. A signboard bearing the words ' PAINT STORAGE No NAKED LIGHT highly -inflammable shall be clearly displayed outside.

COLOUR CODE FOR PIPING

- i) For identification of pipelines, the colour code as per Table -1 shall be used.
- ii) The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it
- iii) Colours (Ground) as given in Table-2 shall be applied throughout the entire length of un-insulated pipes, on the metal cladding & on surfaces, ground colour coating of minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied as per approved procedure.

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IDENTIFICATION SIGN

- i) Colours of arrows shall be black or white and in contrast to the colour on which they are superimposed.
- ii) Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Employer / Owner's Engineer.
- iii) Size of arrow shall be either of the following.
 - a) Colour Bands

Minimum width of colour band shall be as per approved procedure.
 - b) Whenever it is required by the Employer / Owner's Engineer to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of black and golden yellow as per IS:2379 shall be painted on the ground colour.



IDENTIFICATION OF EQUIPMENT

All equipment shall be stenciled in black or white on each verses, column, equipment after painting as per approved procedure.

INSPECTION AND TESTING

- i) All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable.
- ii) The painting work shall be subject to inspection at all times. In particular, following stage wise inspection will be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage.

In addition to above, record should include type of shop primer already applied on equipment e.g. Red oxide zinc chromate or zinc chromate or Red lead primer etc.

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Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Employer / Owner's Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, Contractor shall be responsible for making good any defects found during final inspection / guarantee Period / defect liability period as defined in general condition of contract. Dry film' thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to Employer.

PRIMER APPLICATION

- i. The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.
Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detector and protector whenever required for checking in case of immerse conditions.
- ii. At the discretion of Employer / Owner's Engineer, contractor has to provide the paint manufacturer's expert technical service at site as and when required. For this service, there should not be any extra cost to the Employer.
- iii. Final Inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points / locations as decided by Employer / Owner's Engineer and shall be within + 10% of the dry film thickness.
- iv. The contractor shall produce test reports from manufacturer regarding the quality of the particular batch of paint supplied. The Employer / Owner's Engineer shall have the right to test wet samples of paint at random for quality. Batch test reports of the manufacturer's, for each batch of paints supplied shall be made available by the contractor.

PAINT SYSTEMS

- i. The paint system should vary with type of environment envisaged in and around the plants. The types of environment as given below are considered for selection of paint

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system. The paint system is also given for specific requirements.



- a) Normal Industrial Environment, Table 2.
- b) Corrosive Industrial Environment, Table 3
- c) Coastal & Marine Environment, Table 4

Notes 1. Primers and finish coats for any particular paint systems shall be from same manufacturer in order to ensure compatibility

Table – 1 (Colors of Top Coats)



The colors of top coats in accordance with this specification shall be as follows:

Transmission line block valve accessories		
1.	Above ground valves	:Off White / Blue
2.	Above ground pipes	:Off white
3.	Valve handle	:black
Metering and regulating stations		
1.	Ball valves	:Off white / Blue
2.	Bypass valves	:white enamel (epoxy)
3.	ESD valves / Off take	: Red
4.	Gate valve / Plug valves	:Blue / Grey
5.	Relief valves	:Red / Green
6.	3 way Valve	:Red / blue
7.	Valve actuators	:Red
8.	Valve wheels	:Black
9.	Pipes (A/G)	:Grey
10.	Meter run(including regulator)	:Grey
11.	Vessels(scrubber/heater)	:Aluminium
12.	Insulating Joint.	: Yellow
13.	K.O.Drum / Filter	: Grey
14.	Pig Launcher / Receiver / flange	: Off White
15.	Fencing	: Aluminium

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**Table 2
Normal Industrial Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of equipment's and piping.						
1.1	- do -	-10° C to 20°C	SSPC-SP-3	One coat P-2 50 microns/ coat (min.)	One coat F-4 65 Microns/Coat (Min.) Two coats F-3, 30 Microns/coat (min.)	175	Primer and Finish coat can applied at Ambient temp.
1.2	- do -	21°C to 60°C	SSPC-SP-6	Two coats P-1, 25 Microns/ coat (Min.)	Two coats of F-1, 20 Microns/Coat (min.)	90	-
1.3	- do -	61°C to 80°C	SSPC-SP-6	Two coats P-3, 50 microns / coat (Min.)	Two coats of F-13, 25 Microns/Coat (min.)	150	-
1.4	- do -	81°C to 250°C	SSPC-SP-6	Covered in Finish coat	Three coats of F-11, 20 Microns/Coat (min.)	60	Paint application at ambient temp. curing at elevated temp. during start-up.
1.5	- do -	251°C to 400°C	SSPC-SP-10	Covered in Finish coat	Three coats of F-12, 20 Microns/Coat (min.)	60	- do -

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**Table 3
Corrosive Industrial Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of un-insulated and other equipment						
1.1	- do -	- 10°C to 20°C	SSPC-SP-3	Two coat P-2, 50 microns/ coat(Min.)	Two coat F-3 30 microns / coat(min.)	160	Primer and paint application at ambient temp.
1.2	- do -	21°C to 80°C	SSPC-SP-10	Two coats P-5, 35 microns / coat(min.)	Two coats F-6, 100 microns/ coat (min.)	270	Paint application at ambient temp.
1.3	- do -	81°C to 400°C	SSPC-SP-3	Covered in finish coat	Three coats F-12, 20 microns /coat (min.)	60	Paint application at ambient temp. and curing at 250°C for 4 hours,

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**Table 4
Coastal and Marine Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of equipment's and piping.						
1.1	- do -	-10°C to 60°C	SSPC-SP-3	Two coats P-2, 50 microns/ coat (min.)	Two coats F-3, 30 Microns/coat (min.)	160	Primer and Finish coat application at Ambient temp.
1.2	- do -	61°C to 80°C	SSPC-SP-10	Two coats P-5, 35 Microns/ coat (Min.)	Two coats of F-6, 100 Microns/Coat (min.)	270	-do-
1.3	- do -	81°C to 400°C	SSPC-SP-10	One coat F-9, 85 microns / coat (Min.)	-	85	Paint application at Ambient temp. Primer is acting as primer cum finish coat.
1.4	- do -	i) Upto 80°C	SSPC-SP-10	One coat F-9, 65 microns / coat (Min.)	One coat of F-2, 30 Microns/Coat (min.)	95	Paint application at ambient temp.
		ii) 81°C to 400°C	SSPC-SP-10	-do-		85	Paint application at ambient temp. Primer is acting as primer cum finish coat.

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1.8.4 Precautions to be taken

Neither (the environment of the site, nor the marking labels of devices) may be covered with paint and they must be kept free of paint splashes. To this end it is advisable to use removable masking tape.

Paint splashes, leaks. etc. on any adjacent installations such as measuring apparatus, valves, pipes, sources of light, insulation, heat insulators, walls, concrete, etc. must immediately be wiped up and the damage repaired before the paint is dry.

Otherwise, the Employer / Owner's Engineer will be obliged to have the cleaning carried out at the expense of the Contractor. The paint recipient will only be opened at the time of use (unless otherwise specified by the manufacturer).



The product will be mixed in the recipient with the aid of suitable tools and thus homogenized.

1.8.5 Method of application

Normally, three methods of application will be used on the construction site for the paint products - i.e., with a brush, with a roller or with a spray gun.

- The brush method makes it possible to obtain good penetration of the paint over irregularities in the metal.
- Only (this method will be used for application of the base coats, for retouching and for protrusions, welded areas, riveted joints or bolted joints:
- The roller method may be used on large flat surfaces for (the intermediate and topcoats.
- The spray gun method must be used in accordance with the instructions of the manufacturer and carried out by qualified personnel.
- The final / finish coat shall be applied with airless spray gun to achieve smooth and glossy finish.

The Contractor must guarantee that all safety measures have been taken for such work. The spray gun method may only be used on site for places that are difficult to

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reach with the brush. In this case, a request must be made to the Employer / Owner's Engineer for a deviation.

All paint work will be carried out with good brushes or rollers that are suitable for the type of paint being used and for (the form of the material to be painted and fitted with short handles. The maximum length of the brush and roller handles will be 50 cm; longer handles may only be used for places that are absolutely inaccessible. The maximum width of a brush will be 13 cm.

1.8.6 Application of the coating



Application of the paint shall be carried out in accordance with best practice in order to obtain a homogeneous and continuous layer. The Employer / Owner's Engineer demands that painting of a layer will only be started after acceptance by them of the surface preparation or of the previous layer of paint.

The layers of paint must have a uniform thickness. They must be spread in such a way that all concave parts are dried out and that the surface is completely covered and has a glossy appearance without leaving brush marks and without exhibiting bubbles, foam, wrinkles, drips, craters, skins or gums that arise from weathered paint.

Each layer must have the colour stipulated in the tables of the present specifications, which clearly differs from the previous layer, taking account of the colour of the top layer. All of which for the purpose of being able to identify the number of coats and their order of sequence. If the colour of the coats is not mentioned in the tables the colour difference in consecutive coats must, if possible, be at least 100 RAL. The colour of the top layer is given in the table.

The coating power should be such that the underlying layer is not visible. Only 1 layer per day may be applied, unless otherwise specified by the Employer / Owner's Engineer.

The drying times prescribed by the paint manufacturer must be strictly observed in relation to the environmental conditions before proceeding with the application of the

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next layer.

The dry coating thickness indicated in the description of the paint systems, are minimum thickness. In this connection, the Contractor is obliged to contact the paint manufacturer and conform to his guidelines. The Contractor must respect the thickness specified by the supplier.

1.8.7 Transporting treated items



In the case of works being carried out in a workshop, the metal structures will be surrounded by ventilated contraction film that prevents damage during transportation. This film may only be applied after complete polymerisation of the paint.

1.9 GROUND-LEVEL TRANSITION POINT

1.9.1 Polyester protection system

The Contractor will provide system 02 over the entire length of the pipes above ground and below ground and up to a height of 30 cm and a depth of 40 cm. perpendicular to the ground level mark. In each case, he must ensure that the jointing below the asphalt is in good condition and assures' faultless adhesion. He will apply the following products over the entire surface area, prepared in accordance with Sa 3:

- 1) The primer of system 01A
- 2) Reinforced polyester \pm 20 cm above the ground level marker and \pm 5 cm on the asphalt cleaned beforehand. (application of reinforced polyester is carried out in accordance with the work method prescribed by the manufacturer). Moreover, in the case of PE, in contrast to asphalt, he will apply a polyken primer to PE immediately before applying the reinforced polyester.
- 3) He will then apply the other coats of system 01a to the surface section and thus cover the reinforced polyester with about 5 cm.
- 4) For new constructions, the polyken primer will be applied to PE and then subsequently processed as described under point 2.

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1.10 QUALITY CONTROLS AND GUARANTEE

1.10.1 The Contractor is responsible for checking the weather conditions to ascertain whether the paint work can be carried out within the technical specifications.

The Contractor should have the required calibrated monitoring apparatus for this purpose on site (with calibration certificates). The personnel who will have to use this apparatus should have the training for this purpose.

The Employer / Owner's Engineer may maintain supervision during the works and inspect the works with random checks. A daily report shall be drawn up in relation to the department that maintains supervision of these works.



The supplementary inspection and the supervision by the Employer / Owner's Engineer do not diminish in any way the liability of the Contractor. The proper execution of the work and the materials used may be checked at any time.

1.10.2 Reference Surfaces

At the start of the works, the Employer / Owner's Engineer will indicate a few surfaces that the Contractor will prepare and cover in accordance with the recognized method of operation under the inspection and to the satisfaction of all parties; the Employer / Owner's Engineer or his representative, the approved supervisory body, the contractor and possibly the paint manufacturer. These reference surfaces will serve as a point of comparison for the good adhesion of the paint on the installations as a whole. The parties will together work out a system for the identification of these surfaces in order to be able to monitor the condition of the coatings over time. If the paintwork on a section of the installations is in a worse condition than the reference surfaces, the Contractor may be obliged to treat these parts again.

1.10.3 The Employer / Owner's Engineer will use the following standard as a base of assessment of quality

- The Swedish standards ISO 8501-1 1988 SS 05.5900 concerning the degree of

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cleanliness of the areas de-rusted by blasting, by machine or by hand.

- The wet film thickness of the paint will be measured in accordance with ISO 2808 or ASTM D1212
- The dry layer thickness of the film will be measured electronically, will complete statistical information, in accordance with ISO 2808 or ASTM D 1186
- The thickness of each layer will be measured in accordance with ISO 2808, ASTM 4138 or DIN 50986
- Adhesion tests will be carried out in accordance with ISO 2409, ASTM 3359 or DIN 53151
- Traction tests will be carried out in conformity with ISO 4624 or ASTM D 4541
- The rugosity will be measured electronically in accordance with DIN 4768;
- The non-porosity will be measured with a test tension depending on the type of coating, the layer thickness and after consultation with the Paint manufacturer;
- Any defects in the paint film may be inspected visually by means of a magnifying glass or microscope. If necessary a photographic report may be drawn up in accordance with ASTM Standard D 4121-82.

The final judgment of Employer / Owner's Engineer is irrevocable and binding for the Contractor. In the event of non-conformity of the works with the criteria of these specifications, all costs arising from the inspection by Employer / Owner's Engineer shall be borne by the Contractor.

1.10.4 Guarantee



a) General Principles

The Contractor declares that he is aware of:

- The maximum operating temperature of the surfaces to be covered;
- The maximum permitted degree of humidity of the bearing surface;
- The properties of the environment to which the surfaces to be covered are subject.

b) Summary of the Guarantee

The contractor fully guarantees the following without reservation:

 <p>OIL & GAS DEVELOPMENT COMPANY PAKISTAN</p>	<p>PRODUCED WATER ADEQUACY & CAPACITY ENHANCEMENT AT QADIRPUR GAS FIELD</p>	
<p>Doc. No. : 2547-SP-0002-01</p>	<p>SPECIFICATION FOR PAINTING</p>	<p>Revision No.0</p>

- The observance of all stipulations of the specifications for paint work regarding, among other things ;
- The preparation of the surfaces;
- The thickness of each layer
- The total thickness of the covering.
- The uniformity of the materials used;
- The repair of all defects before delivery of the works.

The Contractor will carry out the requested repair work as promptly as possible