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

Material :**PARTICLE & CHARCOAL FILTERS ASSEMBLY ALONG WITH SPARES**

Due Date:

Tender Enquiry No: **PROC/LF/PT/17946A/20**

Bid Bond Value : RS.1,900,000.00

Attachment(if any) : YES

EVALUATION WILL BE CARRIED OUT ON MAIN ITEM

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	PARTICLE FILTER ASSEMBLY, DETAILS SPECIFICATION AS PER ANNEXURE "A" AND DOCS. "0504214-SOW-001" FOR TANDO ALAM FIELD.	6		Number					
2	CHARCOAL FILTER ASSEMBLY DETAIL SPECIFICATIONS AS PER "ANNEXURE-A" AND DOCS. "0504214-SOW-001" FOR TANDO ALAM FIELD.	6		Number					
3	PARTICLE FILTER ASSEMBLY, DETAIL SPECIFICATION AS PER ANNEXURE "A" AND DOCS "0504215-SOW-001" FOR SINJHORO GAS FIELD.	2		Number					
4	CHARCOAL FILTER ASSEMBLY, DETAIL SPECIFICATION AS PER ANNEXURE "A" AND DOCS "0504215-SOW-001" FOR SINJHORO GAS FIELD.	1		Number					
5	COMMISSIONING SPARES FOR EACH PACKAGE ITEMS (LIST TO BE PROVIDED).	1		Sets					
6	TWO YEARS OPERATIONAL SPARES FOR EACH PACKAGE ITEMS (LIST TO BE PROVIDED).	1		Sets					

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.
- BID VALIDITY 150 DAYS FROM TECHNICAL BID OPENING.DELIVERY TERMS AS PER CLAUSE NO.4 OF ANNEXURE A ON FOR SINJHORO & TANDO ALAM SITES. PAYMENT TERMS AS PER CLAUSE NO.3 (IX) OF ANNEXURE A.

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.

Vetted 5/5/20

IRFAN ZOUQUE BUTT
Dy Chief (Mech-iv)
Ext: 4162

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

Mandatory Checklist

Please confirm the compliance of the following mandatory information along with the bid(s) (failing which bids(s) will not be accepted)

Documents	To be Attached with the Technical/Financial Bids	Compliance	
Original Bid Bond	Technical Bid	Yes ☐	No ☐
Copy of NTN Certificate	Technical Bid	Yes ☐	No ☐
Copy of GST Certificate	Technical Bid	Yes ☐	No ☐
Confirmation that the Firm is appearing on FBR's Active Taxpayer List	Technical Bid	Yes ☐	No ☐
Duly signed and stamped **Annexure–A (Un–priced)**	Technical Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–B**	Technical Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–D**	Technical Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–L** on Company's Letterhead	Technical Bid	Yes ☐	No ☐
Duly signed and stamped **Annexure–M** on Company's Letterhead	Technical Bid	Yes ☐	No ☐
Duly signed and stamped **Annexure–N** on Non–Judicial Stamp Paper duly attested by Notary Public	Technical Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–A (Priced)**	Financial Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–C**	Financial Bid	Yes ☐	No ☐
Duly filled, signed and stamped **Annexure–E**	Financial Bid	Yes ☐	No ☐

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

For the Vendors/Contractors who opt to submit Bank Draft/Call Deposit/Pay order against Bid Bond/Performance Bond, our Accounts Department has finalized an arrangement for online payment to such Vendors/Contractors, which will be processed through (IBFT & LFT) for which following information is required:

i.	IBAN No. (International Bank Account Number 24 Digits)	
ii.	Vendor Name as per Title of their Bank Account	
iii.	Contact No.of Company's CEO/ Owner (Mobile & Landline)	
iv.	Bank Name.	
v.	Bank Branch Name and Code	

Name, Sign and Stamp of the authorized official of the Bidder(s) _____

1. Introduction:

OGDCL requires skid mounted Particle and Charcoal Filter packages for its following Field Location situated in SIND Province.

Sr. Nos.	Type of Packages	Quantity	Delivery Location	Province
1	Particle/Charcoal Filters Package as per Sr. # 01 & 02 of SOR	12	Tando Alam, Approx. 30 Kms. From Hyderabad	Sind
2	Particle/Charcoal Filters Package as per Sr. # 03 & 04 of SOR	03	Sinjohoro, Near Distt. Sanghar	

These filters packages shall be the part of the water disposal system of concerned Production Fields which shall handle produced water to be injected further into the water disposal wells. The Skid Mounted Packages shall be fabricated in accordance to the attached Mechanical Design Package. All the material required for the complete package shall be arranged and fabricated by the bidder in accordance to the technical specifications mentioned in drawings. In case of any ambiguity, international code and standard of API, ASTM, ANSI etc., shall be applicable in mutual consent of bidder and OGDCL professionals.

2. Scope of work:

Bidder has to comply all the following in its technical proposal and is liable to provide the same.

i. Skid mounted particle and charcoal filter packages shall be constructed in accordance to attached drawing in all respect. All the fitting and pipe line material and valves etc shall be in accordance to ASME/ANSI Standards and all material shall be in accordance to ASTM Standard.

ii. Supply of all the material including, sheets, pipe line, fittings, valves, instrument gauges and structural material etc required for the construction of Filter packages as per attached drawings in compliance to vendor list.

iii. All the material shall be inspected by OGDCL or its nominated TPI (If any) prior to fabrication/installation. Bidder shall confirm 01 week before inspection to be planned by OGDCL for compliance (If required).

iv. Bidder to arrange the provision of the MTCs (Material Test Certificates) of all the material like metal sheets, pipe line, and structural material etc during inspection prior to construction. Inspection of material shall be carried out by OGDCL/TPI (if required) after availability of material at bidder's site

v. All vessel internals including supports shall be Duplex Steel and lined internally to all the surfaces (bottom, side walls and ceiling etc) of DFT 80 microns of ceramic coating.

vi. All the nozzle connections of the package shall be terminated at skid edge having flanged end and equipped with companion flange, gasket and stud bolts of the same size and Pressure Class Rating etc..

vii. Bidder must arrange ASME Certified inspector for U-stamping of filter vessel. Its verified U-Stamped certificate shall be provided with dossier of each package at the time of delivery.

viii. OGDCL shall arrange Third Party Inspection (if required) at its own cost and bidder shall facilitate regarding provision of documents to TPI during manufacturing at any stage.

ix. Bidder to arrange the hydro-testing of the vessel and complete package prior to delivery. Hydro-test certificate duly signed and stamped shall be provided along with each package. Bidder will inform prior to 01 week to OGDCL for witnessing of hydro-testing.

x. Bidder to specify the service life of cartridge filters and charcoal bed in technical proposal for each item.

xi. Bidder to quote the separately commissioning and 02 years operational spares for each package. The cost must not be increased 10% of the contractual value. The cost of spares shall not be the part of financial evaluation. Following spares must be the part of the spare list along with each package.

- Filter cartridges as per design. 02 sets for each Filter package.
- Charcoal Bed as per design, 02 Set for each filter package.

3. Terms and Conditions

The prospective bidder has to fulfill following requirements and accordingly provide the requisite documents/certificates along with the technical proposal. Compliance is mandatory.

i. Bidder must have minimum 10 years experience of construction of pressure vessels. Bidder has to submit last 05 years supply record of same type of projects as per following formats.
   a. Name of company
   b. Type of pressure vessels
   c. Size and Pressure Class Rating
   d. Address and contact # of the company

ii. Bidder must have its own manufacturing Facility. Outsourcing of whole job would not be allowed Bidder to submit details of its manufacturing facility mentioning address, contact No. and Person name.

iii. Bidder must have the valid U-Stamped Certificates of its manufacturing Facilities. In this regards last 05 years U-stamp certificates from Year 2016 to 2020 has to be provided.

iv. In case bidder quote the manufacturer of accessories (Annexure-I) other than Preferred Vendor List. Than bidder to provide the all the documents /information for each manufacturer as per attached Annexure-J.

v. Bidder should be Tax Registered firm and provision of NTN certificate is mandatory.

vi. Bidder to provide valid ISO 9001-2008, ISO 140001and OHSAS 18001:2007 valid certificate along with technical bid.

vii. Only PEC C-4 and above registered firms are acceptable. Bidder has to submit copy of valid PEC certificates.

viii. Bidder shall provide last 03 years audit reports of years 2016-17, 2017-18 and 2018-19 to be submitted along with technical bid.

ix. Bidder has to confirm acceptance that payment shall be made after delivery and successful inspection of material at OGDCL site. Part Delivery part payment shall be acceptable.

x. Bidder has to confirm that OGDCL has the right to visit its facilities at any working day with prior information to check the status of the consignment.

xi. Bidder has to confirm that manufacturing faults OR non-compliance to OGDCL Tender clauses pointed out by OGDCL at any stage before, during commissioning or after commissioning during warranty period will be rectified by the contractor at its own cost.

xii. Bidder should not be black-listed by any Governmental, Semi-Governmental Organization.

xiii. All kind of Loading, Transportation and Off-loading to OGDCL Site would be responsibility of Supplier as per Para -01.

xiv. In case of joint venture, copy of contract on judiciary stamp paper should be provided in technical bid clearly mentioning the lead partner. The lead partner should fulfill "Requirements for bid submission" and from Para 3.i to 3.xii.

4. Delivery Period.

Delivery period shall be 04 Months after issuance of LPO. Bidder has to arrange to deliver all the packages at its own transport to the mentioned locations as per requirements mentioned at Para-01

5. Bidder Evaluation Crieteria

Prospective bidder's shall be evaluated on the following quantitative Evaluation criteria. Min. qualifications marks are 85%.

Sr. #	OGDCL Requirement	Total Nos.	Marks Obtained	%age acquired
i	Manufacturing experience of last 10 years of same type of vessels			

	as per clause # 3(i). a-For 20+ vessels b-For 10-19 vessels c- Less Than 10 Vessels	 **30** **15** **0**		
ii	Details of bidder's manufacturing facility a-Company having all the in-house facilities for fabrications. b- Outsourcing	 **20** **0**		
iii	Provision of Valid U-Stamp Certificate since Last 05 Years a- Provided last 05 years b- Less Than 05 years	 **15** **0**		
iV	PEC registration for C-4 category along with provision of valid PEC certificates a- PEC C-4 and above registered firms b- PEC C-5 and below registered firms	 **10** **0**		
V	Provision of valid following certification as per clause # 3(v). i-ISO 9001-2008, ii-ISO 140001 iii-OHSAS 18001:2007 a-Provided all certificates b-Provided any 01 or 02 c-No certificate provided	 **15** **05** **0**		
Vi	Provision of 03 years audit report having turn over more than 80 Million a- 03 years and above b- 02 years and below	 **10** **0**		
	Marks obtained:	**100**		

Note:

Bid shall be considered Non-Responsive if the bidder acquired zero marks in any one of the above points of bidder evaluation criteria (Point # i to vi).

Oil and Gas Development Company Limited

DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

SCOPE OF SUPPLY & SPECIFICATIONS FOR FILTRATION PACKAGE (0504214-SOW-001)

Petrochemical Engineering Consultants

C-2, Block No. 17, Gulshan-E-Iqbal, Near National Stadium, Karachi-75300, Pakistan. Tel: +92 (21) 34827780, +92(21) 34961088, Fax: +92 (21) 34961089. E-mail: contact@pcec.com.pk web: www.pcec.com.pk

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1 INTRODUCTION

Oil & Gas Development Co. Ltd. (OGDCL), hereinafter referred as Company owns and operates Kunnar Gas Field.Kunnar gas/condensate field is located in the Hyderabad District at a distance of about 26 km from Hyderabad city.

Currently, condensate from Kunnar Plant is conveyed to Condensate storage tanks where it is allowed to settle down due to which produced water is separated from condensate by gravity which is then drained manually into drain channel that carries the flow towards evaporation pond.

OGDCL acquired the services of Petrochemical Engineering Consultants (PEC) to carry out detailed engineering for treatment of produced water from Kunnar Plant and its safe disposal into injection well located at a distance of approximately 0.5 km from Kunnar Plant.

All associated engineering is in the phase of implementation. However filters are yet to be fabricated.The intent of this document is to outline the scope of services required from perspective Bidders for the construction of Treatment Filters.

2 DEFINITION

Company:	Oil & Gas Development Company Limited (OGDCL).
Consultant	Petrochemical Engineering Consultants (PEC).
Contractor:	“Contractor" means the person or persons, firm or Proprietor whose proposal has been accepted by the Company for construction, commissioning, performance testing and includes the Contractor's representative(s), successors and permitted assignees.
Vendor/Supplier	The organization, firm or agency order for the supply of equipment and or material has been placed.

3 PACKAGE OVERVIEW

3.1 General

This requisition defines the requirements of Filtration vessel skids to be installed at Kunnar Plant. However, filter skids shall be supplied separately to be installed at suitable location in plant.

3.2 Scope

This specification defines the requirements for Package including filtration vessels and their internals. The supplier shall provide all the equipments shown on the attached skid-marked P&IDs attached as ANNEXURE-C and shown in the G.A Drawings attached as ANNEXURE-D. Any internal item, besides the mentioned required for the safe and continuous operation of the unit shall also be in the scope of the Supplier and supplier to incorporate if any additional equipment in the P&ID's. The list of equipments required for Filtration Package are mentioned below:

CharcoalFilter	(FT-1001)
Particle Filter	(FT-1002)

3.3 Company's Intention

It is the intention of Company to Fabricate, Manufacture and Procure the package based on Specifications, Data Sheets, P&IDs, G.A Drawings, Piping Arrangement Drawings & Skid Drawingsattached with this document. The Supplier shall preparethe detailed fabrication drawings for the mentioned vessel internals and get the same approved from Company before taking up the fabrication, procurement of material, performing painting, testing and preparing for shipment, shall also be included in Supplier's scope.

The Supplier shall ensure that all the components of the package are NEW.

4 SUPPLIER'S RESPONSIBILITY

The Supplier shall do the detailed design, prepare detailed drawings for the mentioned davit arm and internals in the G.A Drawings attached as ANNEXURE-D and also mentioned in the datasheets for Charcoal &Particle Filters attached as ANNEXURE-A and get the same approved from Company / Engineering Consultant.

Internal items for Charcoal Filter (FT-1001) such as Activated Charcoal, Support screen for charcoal bed and internal distributor shall be designed and supplied by the Supplier.

Similarly, Internal items for Particle Filters (FT-1002) such as cartridges, support plate for catridges and internal distributor shall be designed and supplied by the Supplier.

4.1 Codes, Standards & Specifications Requirements

The Supplier shall ensure that the Package Items will comply with this document, attached data sheets, specifications and below mentioned Codes and Standards:

ASME VIII Div 1	Pressure Vessels.
ASME V	Non Destructive Examination.
ASME IX	Welding and Brazing Qualifications.
ANSI B16.5	Steel Pipe, Flanges and Flanged Fittings
AWS D1.1	Structural welding code-Steel

The Supplier shall list other codes and standards to which his proposed design complies.

4.2 Error or Omission

The review and comments by Company / Engineering Consultant on Supplier's or its manufacturer's drawings procedures or documents during review & approval duration (this to be confirmed by supplier prior to bid submission) shall only indicate acceptance of general requirements and shall not relieve the Supplier of its obligations to comply with the requirements of this document and other referred documents.

All deviations to this document, other referred document or attachments shall be brought to the knowledge of the Company / Engineering Consultant in the technical bid. No deviations during the procurement, manufacturing, testing and inspection shall be entertained.

4.3 Conflicting Requirements

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

4.4 Language and Units of Measurement

The governing language shall be English language.

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

4.5 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. Data Sheet & P&IDs
2. This scope & 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/ Engineering Consultant's approval before proceeding with design, manufacture or purchase. Such conflicting issues shall be clearly stated in deviation/exception list submitted at the time

of bid. In any case the most stringent requirement shall prevail. However, Company/ Engineering Consultant's interpretation shall be final.

5 ENVIRONMENTAL DESIGN CRITERIA

5.1 General

Unless otherwise stated on the data sheet, Filtervessels will be installed in an open area.

5.2 Area Classification

AREA CLASSIFICATION
Zone 2, Group IIA & Temperature Class T6

5.3 Site, Environmental & Utility Design Data

Package Items shall be designed for outdoor location with utility & site conditions as given;

DESIGN AND AMBIENT CONDITIONS	
Design Maximum Ambient Temperature (°C)	44
Design Minimum Ambient Temperature (°C)	17
CLIMATIC CONDITIONS	
Relative Humidity (minimum monthly average)	22
Relative Humidity (maximum monthly average)	61

6 SCOPE OF SUPPLY

The scope of supply oshall include, but not necessarily be limited to, the following:

- Filter Vessels.
- Charcoal bed (properties of activated charcoal are mentioned in the datasheet #0404177-PRO-DT-003attached in ANNEXURE-A)
- Support Screen for Charcoal bed.
- Filter Cartridges(properties of cartridges are mentioned in the datasheet #0404177-PRO-DT-004attached in ANNEXURE-A)
- All documentation as required & mentioned in this document.
- Inspection and testing.
- All necessary start-up and commissioning spares.
- List of Two year Operational and maintenance spares/tools. All special tools required for installation and maintenance. Third party inspection and Commissioning Assistance

The Package Items to be supplied shall be suitable for continuous operation and for installation outdoors in extremely hot and humid environment.

7 DESIGN REQUIREMENT

7.1 General

Package will be designed and constructed to meet service conditions specified in the data sheetsof particle and charcoal filters (0404177-PRO-DT-004) & (0404177-PRO-DT-003) attached in ANNEXURE-A.

7.2 Material

Materials of construction for Package items shall conform to ASME Section II, Part A, and Latest Edition.

All materials and parts included in the construction of the Package items shall be new, unused and of the highest grade being free from all defects or imperfections likely to affect their performance.

7.3 Fabrication

No fabrication shall commence until Supplier has received the approval from the Company / Engineering Consultant. The Supplier shall submit detailed fabrication drawings of metioned vessel parts to the Company / Engineering Consultant for approval prior to fabrication.

Welding shall be carried out with procedures and operators qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

Each weld procedure shall be accompanied by a suitable procedure qualification record, tested in accordance with the requirements of ASME IX.

Acceptance standards for radiography and ultrasonic testing shall be in accordance with Section VIII Div I of the ASME Boiler and Pressure Vessel Code by Qualified Third party agency.

When post-weld heat treatment is required, radiograph examination shall be performed upon completion of heat treatment.

Stitch welding is not permissible on any part of the vessel.

7.4 Name plate

Hot oil package items shall be provided with a type 316 stainless steel nameplate securely attached to the unit, and located so that it is clearly visible after installation. Nameplates shall be riveted to a bracket welded onto the equipment.

The following information shall be stamped on the name plate:

- Manufacturer's Name
- Manufacturer's Serial No.

- Equipment Item No.
- Equipment Title
- Purchase Order No.
- Year of Manufacture
- Design Code - API 560/ASME Section VIII etc.
- Design Pressure (p.s.i.g.)
- Design Temperature (°C).
- Weight - Empty (kg)
- Weight-Hydrostatic (kg)

Any other data according to the nature of equipment. Letters and figures shall be 5mm high and clearly stamped.

7.5 Third Party Inspection

Supplier shall provide free access to his works and that of sub-Suppliers for the authorized representative of the Company / Engineering Consultant and the certifying authority for Third party inspection.

7.6 Commissioning and Startup Assistance

The Supplier shall provide the startup and commissioning assistance of package items as per OGDCL requirement without any price addition. This shall be the part of contract.

7.7 Site Performance Test

A site performance test will be conducted on mutually agreed dates after successful installation / commissioning. Performance test procedure will be submitted by the supplier for review and approval of Company.

8 GUARANTEE & WARRANTY

The Supplier shall guarantee & warranty that supplied Package Items are free from any manufacturing defect and if any part of the Package is 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 / Engineering Consultant. Bidder to confirm Guarantee/Warranty for a period of 1 year after installation or 18 months after shipment, whichever completes earlier.

8.1 General

Inspection and testing shall generally comply with the requirements as detailed in this document.

8.2 Hydrostatic Tests

All hydrostatic tests (if required at supplier/ manufacturer site) shall be made in the presence of an authorized inspector and with his approval.

After the final accepted hydrostatic test, the vessel shall be flushed, dried and cleaned thoroughly of all grease, loose scale, rust and weld spatter, both internally and externally.

8.3 Material Testing and Certification

The Supplier shall obtain the necessary approvals from the qualified certifying authority.

The Supplier shall maintain a Package Items Data Book containing, as a minimum, the following documents:

- Correspondence between Company / Engineering Consultant, Supplier and/or Certifying Authority (if applicable).
- Mill Certificates referenced by a parts list giving heat numbers, material, etc.
- Inspection & Test plan.
- Welding procedures and qualifications referenced by a weld map giving weld number, welder, etc.
- NDE results and certificates referenced by an appropriate list.

- Visual & dimensional inspection reports.
- Hydro-test results referenced by a line sketch.
- For Pressure vessels, manufacturer's data report shall be furnished and shall contain the same information as required by form U-1 of ASME Code, Section VIII, Division 1.

9 PAINTING AND PREPARATION FOR SHIPMENT

9.1 Painting

The Supplier must ensure that vessels and supports shall be adequately protected from the prevailing atmosphere by means of correct material selection, painting or coating to prevent galvanic corrosion.

SSPC (Steel Structures Painting Council) manuals shall be followed for the preparation of surface before painting and application of paint.

DFT (Dry Film Thickness) of the painting system shall be checked by Elko meters, which shall be as per specification. Surface preparation, prior to application of paintingshall be subjected to inspection.

In general Company / Engineering Consultant's attached Specification for Painting & Surface Preparation (0404177-PRO-SP-014)attached in ANNEXURE-B shall be followed. Color coating for equipment shall be finalized after approval by Company / Engineering Consultant.

9.2 Preparation for shipment

All openings such as nozzles, vents and field connections shall be properly sealed to avoid entrance of foreign particles and protected during shipment.

All fragile items shall be removed and crated in rigid packing crates with sufficient padding to prevent damage during shipment and shall be properly tagged for ease of field installation.

The Supplier shall provide corrosion protection for all internal and external machine parts for sea shipment and six months outdoor storage and which can be easily removable at site.

9.3 Packing, Preservation and Transportation of Material & Equipment

Packing and Preservation shall be suitable for handling during inland transportation, shipment through sea or by air and storage at site for upto 6 months in an uncovered, very hot and humid climate. Packing shall account for the fragility and physico-chemical/ mechanical damages of items. Detailed requirements for Packing & Protection of Material and Equipment are indicated in attached Specification for Export Packing & Crafting (0404177-PRO-SP-013) attached in ANNEXURE-B.

10 SPARES

The supply of Package Items shall include the commissioning spare and list of recommended two years operational spares, special tools and consumables.

10.1 Commissioning Spares

The Supplier shall provide commissioning spares. List of commissioning spare parts shall be provided at bidding stage.

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.

10.2 Two Years Operational Spares

Supplier shall recommend and provide list of spare parts needed for two (02) years of operation at bidding stage. The cost of Operational spares shall be provided in spares list submitted with the bid.

The spares should be in accordance with recommendation by OEM of the supplied components. Recommended spares should take into account related factors of item's reliability, effect to equipment downtime upon production or safety, costs of parts, and availability of equipment service facilities.

All spare parts furnished by Supplier shall be wrapped and packaged so that they will be preserved in original as-new conditions of storage and shall be properly tagged and coded so that later identification for intended equipment usage would be facilitated. They shall be packaged separately, clearly marked as "Spare Parts", and shipped along with the package. Packing lists shall be furnished so that the parts can be handled without uncrating if desired.

10.3 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.

11 QA/QC & CERTIFICATION

11.1 Quality Assurance & Control

11.1.1 Quality Management System

The Supplier shall operate an independently verified Quality Management System that satisfies the applicable provisions of ISO 9000 (series), or agreed equivalent standard, commensurate with the goods and services to be provided. Current details of registration, approval of other demonstration of the status and efficient operation of the Quality System shall be provided with the bid submission. Further information may be requested at the PO stage.

The Supplier, as part of their own Quality Management System, will be expected to demonstrate the QA competence of any Sub-supplier. The Company / Engineering Consultant reserves the right to require the Supplier to implement addition controls, where a satisfactory level of competence cannot be demonstrated in this regard, and/or exercise additional controls not detailed in this document.

The Company / Engineering Consultant reserves that right to visit the premises of the Supplier and any Sub-supplier for the purpose of undertaking Quality Audits relating to the equipment and services covered by this document, the extent of which will be discussed with the Supplier before, PO award.

11.1.2 Quality Control

It is the Company / Engineering Consultant's intention to determine his involvement in the inspection of materials and activities at the Supplier's and Sub-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 inspection visits by the 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 or Sub-suppliers' agreed Manufacturing Quality Control Plan is either inadequate or not being implemented, the Company / Engineering Consultant reserves the right to increase the level or frequency of his Quality Control activities or request the supplier to revise his 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 main Supplier
- Surveillance of major Sub-suppliers
- Certification and manufacturing data review

11.1.3 Material Traceability & Certification

The Supplier shall advise their proposed material tracability 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.

11.1.4 Inspection & Testing

Vessels shall be tested and inspected as per ASME Section VIII, Division 1.

11.2 Certification & Manufacturing Records

11.2.1 Inspection and Certification Records

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

11.2.2 Certification and 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.

12 DOCUMENTATION REQUIREMENT FOR SUPPLIER

12.1 Use of the English Language

All documents shall be written in the English Language.

12.2 Documents to be submitted with the Bid

Technical Documents:

Supplier must provide following listed documents with the Bid. Failure to submit these documents may lead to technical disqualification:

1. Name of Package Item Supplier and country of manufacturing
2. Authority letter in favor of local agent.
3. Table of compliance / exception and deviations, if any
4. Signed & stamped copy of whole tender document.

5. Details of equipment internals and Davit Arm.
6. Document submission schedule.
7. Commissioning spare parts, Special tools and List of 02 years operational spares and Consumables.
8. Quality Manual and Quality Control Plan.
9. Typical Inspection and Test Plan.
10. Proposed surface treatment and painting.
11. Details of Sub-Suppliers with quality certificates
12. Detail scope of supply including the detailed material list.
13. Design Calculation, Specification and Code & Standard

Financial Documents:

1. Price breakup of all the items included in the Package along with spare parts.
2. Performance Bank Guarantee(s) After issuance of LOI.

12.3 Final Documentation

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.
5. A list of all applicable codes, standards and specifications.
6. Photocopy of nameplate.
7. Mechanical test certification.
8. Final signed quality plan.
9. Commissioning instructions.
10. Schedules of commissioning spare parts and list of spare parts for 02 years.
11. All approved drawings and document.

All above documents two (02) 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.

ANNEXURE-A

DATASHEETS

DATASHEET FOR CHARCOAL FILTER

OIL AND GAS DEVELOPMENT COMPANY LTD.
OGDCL House, Plot No.3, Jinnah Avenue, Blue Area, Islamabad, Pakistan.
Telephone: +92-51-9209811-18 + 92-51-2623101-02, 04-06
Fax: +92-51-2623113-18; Website: www.ogdcl.com

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM KARACHI-75300, PAKISTAN
TEL: +92 21 34961088 & 34827780, 'FAX : +92 21 34961089
E-MAIL: contact@pcec.com.pk WEBSITE : www.pcec.com.pk

PEC PROJECT NO. 0504214

PROJECT	DETAILED ENGINEERING DESIGN OF KUNNAR PRODUCED WATER DISPOSAL SYSTEM
TITLE	DATASHEET FOR CHARCOAL FILTER
DOCUMENT No.	0504214-PRO-DT-003

PREPARED	CHECKED	APPROVED	DATE	REV.	DESCRIPTION
SHR	BA	AJ	07-May-2020	2	Re-Issued for Review
SHR	BA	AJ	13-Dec-2019	1	Issued for Review
SHR	ASK	AJ	19-Mar-19	0	Interdisciplinary Check

CLIENT	DETAILED ENGINEERING DESIGN OF KUNNAR PRODUCED WATER DISPOSAL SYSTEM			CONSULTANT
	DATASHEET FOR CHARCOAL FILTER			
	DOCUMENT NUMBER	0504214-PRO-DT-003	Rev-2	SHEET 2 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	Injection Well Area
Plant:	Kunnar Gas Field	Order No.:	-
Req. No.:	1	Job No. :	0504214
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	2 of 3

1	Item No.	FT-1001	Item Name	Activated Charcoal Filter
2	No. of Units	1	Application	Produced water oil content removal

	FLUID HANDLED			
4	Fluid	Produced water+condensate		
5	Service	**Max. Oper.**	**Min. Oper.**	**Design**
6	Temperature, ºF	120	60	130
7	Pressure, psig	1380	600	1400

	FILTER	
10	Type	Activated Charcoal Filter
11	Charcoal Bed Diameter, mm	753 **(NOTE-10)**
12	Charcoal Bed Length, mm	1350 **(NOTE-10)**
13	Activated Charcoal Type	Granular Activated Carbon (GAC) **(NOTE-8)**

	SHELL		NOZZLES & MANHOLES				
16	☐ Horizontal ✓ Vertical		**Label**	**Size**	**Rating**	**Face**	**Service**
17	Tangent/Tangent Length/Height, mm	2200 **(NOTE-10)**	N-1	4"	600#	RF	Inlet
18	Inside Diameter, mm	753 **(NOTE-10)**	N-2	4"	600#	RF	Outlet
19	Head Details		N-3	2"	600#	RF	Drain
20			N-4	3"	600#	RF	Bed Removal
21	Tangent/Grade Distance, mm/in		N-5	32"	600#	RF	Manway
22	Code:		N-6	1"	600#	RF	Vent
23	Radiographed ☐ Spot ✓ Fully						
24	Hydrotest ✓ Yes ☐ No						
25	✓ Stamp Required						

	INTERNALS		
27	**Item**	**No.**	**Description**
28	Support	-	**Note - 2,3**
29	Diffuser	-	
30	Redistrib.	-	
31	Vortex Brk.	-	
32	Hold Down	-	
33	Demister	-	
34	Tray	-	
35	Packing	-	
36	Baffles	-	
37	Scr. Support	1	Clog screen support **(Note-9)**

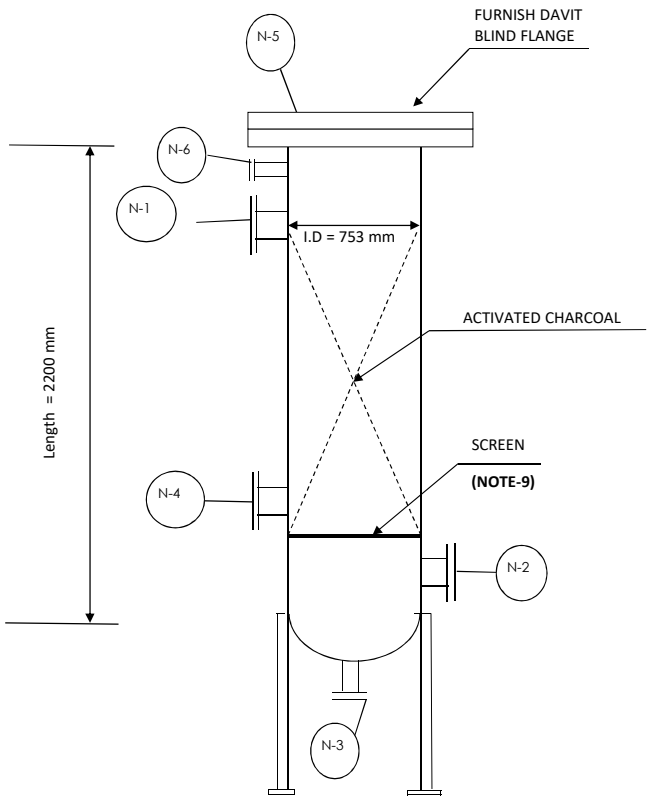
Vessel Detail
See Sheet 3 of 3

	MATERIALS	
40	Corrosion Allowance	1.5 mm
41	Shell/Heads	SA 516 Gr 70
42	Nozzle Necks/Flanges	ASTM A 105
43	Pipes	ASTM A-106 Gr.B
44	Gaskets External	SW 316SS-Graphite Filled
45	Gaskets Internal	Non Asbestos
46	Insulation	N.A
47	Paint	Refer Specification (0504214-SP-014)
48	Internals	Duplex

CLIENT	DETAILED ENGINEERING DESIGN OF KUNNAR PRODUCED WATER DISPOSAL SYSTEM			CONSULTANT
	DATASHEET FOR CHARCOAL FILTER			
	DOCUMENT NUMBER	0504214-PRO-DT-003	Rev-2	SHEET 3 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	Injection Well Area
Plant:	Kunnar Gas Field	Order No.:	-
Req. No.:	1	Job No. :	0504214
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	3 of 3

VESSEL DETAIL



FOR FURTHER DETAILS, PLEASE REFER TO ATTACHED GENERAL ARRANGEMENT DRAWING # 0504214-GA-001.

NOTES

1. VENDOR TO SPECIFY.
2. VENDOR TO CONFIRM.
3. VENDOR SHALL SUBMIT COMPLETE DETAILS OF VESSEL INTERNALS.
4. ALL NECESSARY REQUIRED VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
5. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
6. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
7. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
8. VENDOR TO SHARE MSDS OF PROPOSED CHARCOAL POWDER .
9. INTERNAL SUPPORT FOR CHARCOAL BED SHALL BE ABLE TO WITHSTAND ITS WEIGHT AS SPECIFIED BY VENDOR.
10. VENDOR IS REQUIRED TO QUOTE CHARCOAL FILTER AS PER DIMENSIONS AND DETAILS SPECIFIED IN DATA SHEET (0504214-PRO-DT-003)
11. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
12. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
13. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DULPEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA. AND FILLER METAL AS PER STANDARDS.
14. VENDOR IS REQUIRED TO PROVIDE MAX VOUME OF CHARCOAL THAT CAN BE FILL IN WITHIN SPECIFIED VOLUME OF CHARCOAL FILTER VESSEL.
15. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

DATASHEET FOR PARTICLE FILTER

OIL AND GAS DEVELOPMENT COMPANY LTD.
OGDCL House, Plot No.3, Jinnah Avenue, Blue Area, Islamabad, Pakistan.
Telephone: +92-51-9209811-18 + 92-51-2623101-02, 04-06
Fax: +92-51-2623113-18; Website: www.ogdcl.com

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM KARACHI-75300, PAKISTAN
TEL: +92 21 34961088 & 34827780, 'FAX : +92 21 34961089
E-MAIL: contact@pcec.com.pk WEBSITE : www.pcec.com.pk

PEC PROJECT NO. 0504214

PROJECT	DETAILED ENGINEERING DESIGN OF KUNNAR PRODUCED WATER DISPOSAL SYSTEM
TITLE	DATASHEET FOR PARTICLE FILTER
DOCUMENT No.	0504214-PRO-DT-004

PREPARED	CHECKED	APPROVED	DATE	REV.	DESCRIPTION
SHR	BA	AJ	07-May-2020	2	Re-Issued for Review
SHR	BA	AJ	13-Dec-2019	1	Issued for Review
SHR	ASK	AJ	19-Mar-19	0	Interdisciplinary Check

CLIENT	DETAILED ENGINEERING DESIGN OF KUNNAR PRODUCED WATER DISPOSAL SYSTEM			CONSULTANT
	DATASHEET FOR PARTICLE FILTER			
	DOCUMENT NUMBER	0504214-PRO-DT-004	Rev-2	SHEET 2 OF 3

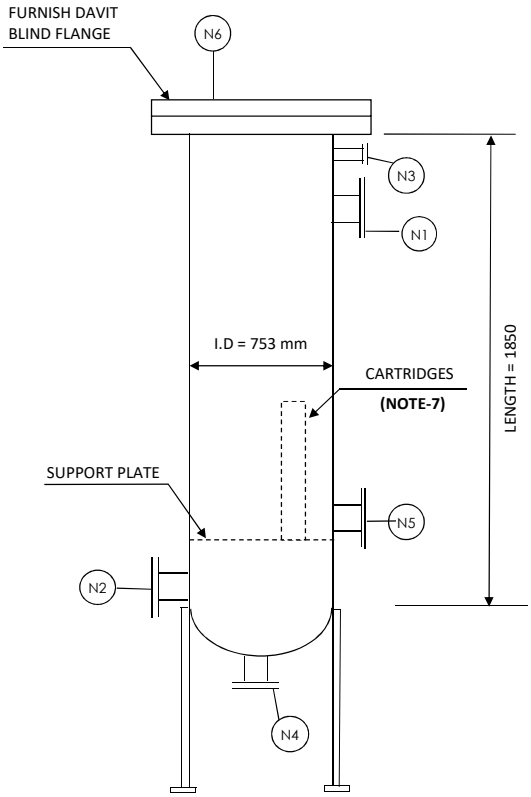
Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	Injection Well Area
Plant:	Kunnar Gas Field	Order No.:	-
Req. No.:	1	Job No. :	0504214
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	2 OF 3

1	Item No.	FT-1002	Item Name	PARTICLE FILTER				
2	No. of Units	1	Application	Produced water Particle removal				
3	**FLUID HANDLED**							
4	Fluid	Produced water+condensate						
5	Service	**Max. Oper.**	**Min. Oper.**	**Design**				
6	Temperature, ºF	120	60	130				
7	Pressure, psig	1380	600	1400				
8								
9	**FILTER**							
10	Type	Cartridge Filter						
11	Number of Cartridges	**(NOTE-7)**						
12	Outlet Particle Size	5 micron						
13	**SHELL**			**NOZZLES & MANHOLES**				
14	☐ Horizontal ✓ Vertical			**Label**	**Size**	**Rating**	**Type**	**Service**
15	Length/Height, mm	1850 **(NOTE-12)**		N1	4"	600#	RF	Inlet
16	Inside Diameter, mm	753 **(NOTE-12)**		N2	4"	600#	RF	Outlet
17	Head Details			N3	1"	600#	RF	Vent
18	Tangent/Grade Distance, mm/in			N4	2"	600#	RF	Drain
19	Code:			N5	3"	600#	RF	Tube sheet Drain
20	✓ Stamp Required			N6	32"	600#	RF	Manway
21	Radiographed ☐ Spot ✓ Fully			Vessel Detail See Sheet 3 of 3				
22	Hydrotest ✓ Yes ☐ No							
23								
24	**INTERNALS**							
25	**Item**	**No.**	**Description**					
26	Support	**Note-1, 2**						
27	Diffuser							
28	Redistrib.							
29	Vortex Brk.							
30	Hold Down							
31	Demister							
32	Tray							
33	Packing							
34	Baffles							
35	Scr. Support							
36								
37	**MATERIALS**							
38				**Corrosion Allowance**				
39	Shell/Heads	SA 516 Gr 70		1.5 mm				
40	Nozzle Necks/Flanges	ASTM A 105						
41	Pipes	ASTM A-106 Gr.B						
42	Gaskets External	SW 316SS-Graphite Filled						
43	Gaskets Internal	Non Asbestos						
44	Insulation	NA						
45	Paint	Refer Specification (0504214-SP-014)						
46	Internals	Duplex						

CLIENT	DETAILED ENGINEERING DESIGN FOR KUNNAR GAS FIELD PRODUCED WATER DISPOSAL SYSTEM			CONSULTANT
	DATASHEET FOR PARTICLE FILTER			
	DOCUMENT NUMBER	0504214-PRO-DT-004	Rev-2	SHEET 3 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	Injection Well Area
Plant:	Kunnar Gas Field	Order No.:	-
Req. No.:	1	Job No. :	0504214
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	3 OF 3

VESSEL DETAILS



FOR FURTHER DETAILS, PLEASE REFER TO ATTACHED GENERAL ARRANGEMENT DRAWING # 0504214-GA-002.

NOTES

VTS = VENDOR TO SPECIFY

1. ALL VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
2. VENDOR TO PROVIDE FULL DETAILS OF VESSEL INTERNALS.
3. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
4. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
5. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
6. PROCESS DATA CONTAINED IN THESE DATA SHEETS, REPRESENTS OPERATING & DESIGN CONDITIONS.
7. VENDOR IS REQUIRED TO PROVIDE MAXIMUM NUMBER OF CARTRIDGES THAT CAN BE FIT IN WITHIN SPECIFIED PARTICLE FILTER VES
   WITHOUT ANY IMPACT OVER PEFORMANCE OF FILTER SEPARATOR
8. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
9. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
10. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DULPEX STEEL) DETAIL OF VESSEL INTERNALS.
    SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A
    NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA.
    AND FILLER METAL AS PER STANDARDS.
11. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO
    OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY
    OWNER'S INSPECTOR.
12. VENDOR TO ADVISE MAXIMUM VOLUME OF PRODUCED WATER THAT CAN BE PROCESS USING MAX NUMBER OF CARTRIDGES
    ALLOWABLE PRESSURE DROP VALUE OF 10 PSI.

CONSULTANT		DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504214-IDS-020	
			REV.	DATE.
			0	27/02/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY LIMITED		DIFFERENTIAL PRESSURE INDICATOR	JAK	SAG
		P&ID NO. 0504214-PID-006	SHEET	1 OF 1

GENERAL	1	Tag Number		PDI-001							
	2	Service		PRODUCED WATER CHARCOAL FILTER (FT-1001)							
	3	Line Size		4"							
	4	P & ID Drawing Number		0504214-PID-006							
	5										
PROCESS CONDITION	6	Fluid		Produced Water							
	7	MIn. Temperature	Max. Temperature	60	°F			120	°F		
	8	Min. Pressure	Max. Pressure	600	psi-g			1380	psi-g		
		Design Temperature		130				°F			
		Design Pressure		1400				psig			
	9	Pulsation	Vibration	NO				NO			
	10										
	11										
GAUGE	12	Type		INDICATOR							
	13	Differential Range	Min / Max.	0	psi	-g		20	psi	-g	
	14	Figure Interval		Manufacturer Standard							
	15	Minor Graduation		Yes							
	16	Dial Size		160	mm						
	17	Dial Color		White Aluminium with Black Numerals							
	18	Case Material		304 St. Stl							
	19	Ring Construction	Ring Material	Bayonet				St. Stl			
	20	Blow-Out Protection		Yes							
	21	Lens Material		Solid Front Full Safety Pattern With Laminated Safety Glass							
	22	Pressure Eelement Type		DP Cell							
	23	Pressure Eelement Material		316 St. Stl							
	24	Socket Material		316 St. Stl							
	25	Connection Size		3/4" NPT-M							
	26	Connection Location		Bottom							
	27	Movement Material		St. Stl. Rack & Pinion							
	28	Nominal Accuracy		+/- 1%							
	29	Micrometer Material		Yes							
	30	Ingress Protection		IP 65							
DIAPHRAGM SEAL	31	Type		N/A							
	32	Process Connection		N/A							
	33	Diaphragm Material		N/A							
	34	Bottom Housing Material		N/A							
	35	Fill Fluid		N/A							
	36	Capillary Length		N/A							
	37	Capillary Material		N/A							
	38	Flushing Connection		No							
	39	Top Housing Material		N/A							
	40	Connection to Instrument		N/A							
	41										
OPTIONS	42	Syphon :	Type	Material	N/A			N/A			
	43	Syphon :	Type	Material	N/A			N/A			
	44	Movement Damping		N/A							
	45	Valve Manifold		Yes 5 Valve Manifold Required							
	46										
	47										
PURCHASE	48	Manufacturer									
	49	Model									
	50	Purchase Order Number									
	51	Price	Item Number					N/A			
	52	Serial Number		N/A							

NOTES :

1	Vendor shall provide a SS tag with embeded tag no. , permanently attached with the instrument.
2	
3	
4	

CONSULTANT		DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504214-IDS-021	
			REV.	DATE.
			0	27/02/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY LIMITED		DIFFERENTIAL PRESSURE INDICATOR	JAK	SAG
		P&ID NO. 0504214-PID-007	SHEET	1 OF 1

GENERAL	1	Tag Number		PDI-002							
	2	Service		PRODUCED WATER PARTICULATE FILTER (FT-1002)							
	3	Line Size		4"							
	4	P & ID Drawing Number		0504214-PID-007							
	5										
PROCESS CONDITION	6	Fluid		Produced Water							
	7	MIn. Temperature	Max. Temperature	60	°F			120	°F		
	8	Min. Pressure	Max. Pressure	600	psi-g			1350	psi-g		
		Design Temperature		130				°F			
		Design Pressure		1400				psig			
	9	Pulsation	Vibration	NO				NO			
	10										
	11										
GAUGE	12	Type		INDICATOR							
	13	Differential Range	Min / Max.	0	psi	-g		20	psi	-g	
	14	Figure Interval		Manufacturer Standard							
	15	Minor Graduation		Yes							
	16	Dial Size		160	mm						
	17	Dial Color		White Aluminium with Black Numerals							
	18	Case Material		304 St. Stl							
	19	Ring Construction	Ring Material	Bayonet				St. Stl			
	20	Blow-Out Protection		Yes							
	21	Lens Material		Solid Front Full Safety Pattern With Laminated Safety Glass							
	22	Pressure Eelement Type		DP Cell							
	23	Pressure Eelement Material		316 St. Stl							
	24	Socket Material		316 St. Stl							
	25	Connection Size		3/4" NPT-M							
	26	Connection Location		Bottom							
	27	Movement Material		St. Stl. Rack & Pinion							
	28	Nominal Accuracy		+/- 1%							
	29	Micrometer Material		Yes							
	30	Ingress Protection		IP 65							
DIAPHRAGM SEAL	31	Type		N/A							
	32	Process Connection		N/A							
	33	Diaphragm Material		N/A							
	34	Bottom Housing Material		N/A							
	35	Fill Fluid		N/A							
	36	Capillary Length		N/A							
	37	Capillary Material		N/A							
	38	Flushing Connection		No							
	39	Top Housing Material		N/A							
	40	Connection to Instrument		N/A							
	41										
OPTIONS	42	Syphon :	Type	Material	N/A			N/A			
	43	Syphon :	Type	Material	N/A			N/A			
	44	Movement Damping		N/A							
	45	Valve Manifold		Yes 5 Valve Manifold Required							
	46										
	47										
PURCHASE	48	Manufacturer									
	49	Model									
	50	Purchase Order Number									
	51	Price	Item Number					N/A			
	52	Serial Number		N/A							

NOTES :

1	Vendor shall provide a SS tag with embeded tag no. , permanently attached with the instrument.
2	
3	
4	

CONSULTANT		DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504214-INS-005	
			REV.	DATE.
			1	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY Ltd.		PRESSURE GAUGE AT FT-1002 DISCHARGE	ZUA	SAG
		0504214-PID-007	SHEET	1 OF 1

GENERAL	1	Tag Number		PI-001B							
	2	Service		FT-1002 DISCHARGE TO PW INJECTION WELLHEAD							
	3	Line Size		4"							
	4	P & ID Drawing Number		0504214-PID-007							
	5										
PROCESS CONDITION	6	Fluid		Produced Water							
	7	MIn. Temperature	Max. Temperature	60	°F			120	°F		
	8	Min. Pressure	Max. Pressure	600	psi-g			1350	psi-g		
	9	Design Temperature		130				°F			
	10	Design Pressure		1400				psig			
	11	Pulsation	Vibration	NO				1			
	12										
	13										
GAUGE	14	Type		INDICATOR							
	15	Calibration Range Min	Max	0	psi	-g		2000	psi	-g	
	16	Figure Interval		Manufacturer Standard							
	17	Minor Graduation		Yes							
	18	Mounting		Direct Mounted							
	19	Dial Size		160	mm						
	20	Dial Color		White Aluminium with Black Numerals							
	21	Case Material		304 St. Stl							
	22	Ring Construction	Ring Material	Bayonet				St. Stl			
	23	Blow-Out Protection		Yes							
	24	Lens Material		Solid Front Full Safety Pattern With Laminated Safety Glass							
	25	Pressure Eelement Type		Bourden Tube							
	26	Pressure Eelement Material		316 St. Stl							
	27	Socket Material		316 St. Stl							
	28	Connection Size		3/4" NPT-µ							
	29	Connection Location		Top							
	30	Movement Material		St. Stl. Rack & Pinion							
	31	Nominal Accuracy		+/- 1%							
	32	Micrometer Material		Yes							
	33	Ingress Protection		IP 65							
DIAPHRAGM SEAL	34	Type		N/A							
	35	Process Connection		N/A							
	36	Diaphragm Material		N/A							
	37	Bottom Housing Material		N/A							
	38	Fill Fluid		N/A							
	39	Capillary Length		N/A							
	40	Capillary Material		N/A							
	41	Flushing Connection		No							
	42	Top Housing Material		N/A							
	43	Connection to Instrument		N/A							
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping		N/A							
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price	Item Number					N/A			
	55	Serial Number		N/A							

NOTES :

1	
2	
3	
4	

CONSULTANT	DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS		0504214-INS-005	
		REV.	DATE.
		1	09/12/2019
CLIENT	INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY Ltd.	PRESSURE GAUGE AT FT-1001 DISCHARGE	ZUA	SAG
	0504214-PID-006	SHEET	1 OF 1

GENERAL	1	Tag Number			PI-001						
	2	Service			FT-1001 DISCHARGE TO PARTICLE FILTER						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504214-PID-006						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	MIn. Temperature	Max. Temperature		60	°F		120	°F		
	8	Min. Pressure	Max. Pressure		600	psi-g		1380	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			1400			psig			
	11	Pulsation	Vibration		NO			1			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Calibration Range Min	Max		0	psi	-g	2000	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			3/4" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price	Item Number					N/A			
	55	Serial Number			N/A						

NOTES :

1	
2	
3	
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CONSULTANT		DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504214-IDS-022	
			REV.	DATE.
			0	07/10/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY LIMITED		TEMPERATURE INDICATOR	JAK	SAG
			SHEET	1 OF 1

GENERAL	1	Tag Number		TI-001				
	2	Service		FT-1001 (Inlet to Charcoal Filter)				
	4	Area Classification		Zone II, Gas Group IIA, T6				
	5	P & ID Drawing Number		0504214-PID-006				
	6							
PROCESS CONDITIONS	7	Fluid		Produced Water				
	8	Min. Temperature	Max. Temperature	60	°F	120	°F	
	9	Min. Pressure	Max. Pressure	600	psi-g	1380	psi-g	
	10	Design Temperature		130		°F		
	11	Design Pressure		1400		psig		
	12							
THERMOMETER	13	Type		Indicator				
	14	Calibration Range Min	Max	0	°F	250	°F	
	15	Dial Size	Dial Color	160 mm		WHITE WITH BLACK PRINTING		
	16	Case Material		304 ST.ST.				
	17	Hermetically Sealed Case		NO				
	18	Stem Type		BI-METALLIC				
	19	Stem Material		316SS				
	20	Stem or Union Thread		Union Thread				
	21	Stem Position		ANY ANGLE				
	22	Stem Length	Stem Diameter	TO SUIT WELL mm		8	mm	
	23	External Calibrator		MICRO POINTER				
	24	Ingress Protection		IP-65				
	25	FILLED	Type	Not Required				
	26		Compensation	N/A				
	27		Capillary Legth	N/A				
	28		Capillary Material	N/A				
	29		Armor Material	N/A				
	30	SYSTEM	Bulb Diameter	N/A				
	31		Bulb Length	N/A				
	32		Bulb Type	N/A				
	33		Bulb Connection	N/A				
	34							
WELL	35	Process Connection		2" FLANGED 600#				
	36	Material		316L ST.ST				
	37	Sheating	Coating	N/A		N/A		
	38	Construction Type		DRILLED BARSTOCK (TAPERED) WELDED FLANGE				
	39	Internal Connection		1/2" NPT-F				
	40	Length Below Thread / Flanged		U = 192 mm				
	41	Lagging Extension		T = 50 mm				
	42	Plug & Chain		NO				
	43	Overall Length		242 mm				
	44	Treatments	Finish	100 % DYE PENETRALL WELDS		FLANGE = RTJ		
	45	Stamping		YES				
	46	Union		1/2 " NPT-M ST.ST				
	47	Wetted Part Materials in Accordance With		NACE MR01-75 (2000)				
PURCHASE	48	Manufacturer						
	49	Model						
	50	Purchase Order Number						
	51	Price	Item Number			N/A		
	52	Serial Number		N/A				

NOTES :

1	Vendor shall provide a SS tag with embeded tag no. , permanently attached with the instrument.
2	
3	
4	

ANNEXURE-B

SPECIFICATIONS

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION # 0504214-PRO-SP-013

SPECIFICATION FOR EXPORT PACKING AND CRATING

CONSULTANTS: **Dec. 2019**

PETROCHEMICAL ENGINEERING CONSULTANTS
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Table of Content

1.0 INTRODUCTION

This standard specification defines the minimum requirements for packing of equipment items in preparation for shipment to the Project Site.

2.0 DEFINITIONS

Following definitions apply throughout this document:

Company / Owner	Oil & Gas Development Company Limited (OGDCL)
Contractor	"Contractor" means the person or persons,firm or Proprietor whose proposal has been accepted by the Company for verification of FEED package, engineering design,procurement, inspection, supply of material and equipment, construction/ commissioning,performance testing, one year of defectliability period and training of Company's personnel for the project and includes the Contractor's representative(s), successors and permitted assignees.
Vendor / Supplier	The organization, firm or agency with who order for the supply of equipment and or material has been placed.

3.0 PRIORITY ORDER

Priority order of documents controlling the Work performed shall be as follows:

- Local laws and regulations.
- Project specific engineering specifications as included in scope of work..
- Industry Codes and Standards (API, ASME, etc.).
- CONTRACTOR / SUPPLIER's bid response documents.
- In the event of any conflict between this specification and the requirements of other COMPANY specifications or industry standards and codes, the more stringent requirements shall apply with the written approval of COMPANY.

4.0 GENERAL REQUIREMENTS

- Transportation shall also address packing requirements for single components, partial fabrications and completed items and be suitable for transportation whether by rail, road, plane or ship.

- Where applicable instruments shall be suitably tagged, packaged and crated.

- Package should be enclosed in cellophane and sealed against ingress of air.

- Title and address of the consignee should be printed /marked on at least three side of the crate.

- CONTRACTOR / SUPPLIER shall be responsible to provide the commissioning spares parts in separate crate.

- All Work shall be subject to inspection at any time. The CONTRACTOR / SUPPLIER shall immediately make any items available for inspection at the request of the COMPANY. The inspection or lack of inspection of the work by the COMPANY does not relieve the CONTRACTOR / SUPPLIER from the responsibility of performing the Work in accordance with this specification and shall make any repairs at his cost.

- Work shall not be released for shipment from CONTRACTOR / SUPPLIER's company ship until it has been inspected and approved by the COMPANY or such inspection and approval has been waived in writing from the COMPANY.

- CONTRACTOR / SUPPLIER shall be responsible for load out, packaging, bracing and securing for transportation for the work. CONTRACTOR / SUPPLIER shall provide COMPANY design, specifications, procedures and/or

drawings on CONTRACTOR / SUPPLIER's plan for load out method, transportation securing and bracing, packaging and field installation for COMPANY's approval 30 days before load out.

- Where applicable equipment is concerned the following shall apply:

a) All lifting devices necessary to lift and transport equipment and/or materials shall be fully identified, listed with the specific lift points and for large package items detailed prior to any handling operations. Spreader bar design calculation should be submitted to the COMPANY for review. Sling & shackles with adequate capacity and spreader bar should be provided along with shipped items by the CONTRACTOR / SUPPLIER.

b) All equipment should be empty and dry from test fluid.

c) All items subject to mechanical damage or corrosion shall be properly packed and protected from damage during shipment.

d) Exposed machined and threaded surfaces shall be coated with easily removable rust preventive.

e) Blank off all the nozzles with plastic caps.

f) Rounded shell should be supported with on wooden saddles with adequate numbers.

g) Exchangers shipped over the ocean shall be purged with nitrogen (N2) prior to closing for shipment and provided make-up with a N2 bottle. Exchanger shipped over land shall have a suitable desiccant, such as silica gel placed inside the nozzle.

CONTAINER STUFFING

- Weight should be evenly distributed throughout the container.
- Packages must not be placed on the top of other packages without adequate sub-flooring and bracing.
- All packages must be blocked and braced to prevent lateral, horizontal and vertical movement of the packages.
- All bulk heading, blocking, bracing and tie-down must conform to applicable railroad specifications for material shipped.
- All containers must be sealed with rail type seal numbers recorded for future reference.
- Locks are to be provided upon COMPANY's request.

5.0 COMMERCIAL EXPORT PACKING SPECIFICATIONS

- This specification covers the minimum requirements for CONTRACTOR / SUPPLIER with regard to preparing equipment, materials and spare parts for shipment in wooden boxes overseas.

- Equipment and materials will be protected to withstand extended periods of storage at the jobsite.

- System specified herein contains the minimum requirements. If the CONTRACTOR / SUPPLIER's standard procedures for export packing will provide equal or better protection than specified herein, this information should be brought to the attention of the COMPANY for review and authorization.

- These requirements are minimum and are designed to protect the equipment and materials from the normal hazards associated with inland transportation, port handling, ocean shipping and worksite storage. If certain aspects of aforementioned activities are not addressed explicitly in this Specification then generally accepted handling and shipping practices shall be used by CONTRACTOR / SUPPLIER. CONTRACTOR / SUPPLIER is required to obtain written approval from COMPANY prior to apply any such practice or procedure.

6.0 EXPORT PREPARATION

- All COMPANY's cargo shall be stored in a designated area and not intermingled with other cargoes to the extent possible.

- All wooden boxes, crates and skids shall be suitable for 4-way mechanical handling by forklifts or cranes. All heavy cardboard boxes should be banded to a pallet. All hood boxes shall clearly indicate the "Center of Gravity" and, where applicable, be marked "For Crane Lift Only" in English.

- CONTRACTOR / SUPPLIER shall ensure that every equipment or part of equipment is delivered to COMPANY according to the correct specifications.

7.0 EXPORT PACKING METHODS

7.1 METHODS

It is important that all material arrive at its destination in undamaged condition. The intent of this Specification is to serve as a minimum requirement for "commercial packaging for export", but compliance does not relieve CONTRACTOR / SUPPLIER from responsibility for adequately packing materials, supplies and equipment.

The following methods apply to designated materials and materials not suited for container shipments. The choice of methods to be used will be selected by mutual agreement between CONTRACTOR / SUPPLIER and the COMPANY.

Method I

Preservative coating with greaseproof wrap. Method I requires the use and application of preservative compounds. The coated part or item shall be enclosed in a greaseproof bag or wrap of greaseproof barrier material that shall be loosely applied around the coated part of item and shall be secured by taping, tying or other suitable means. Projections, sharp edges or other features of the part or item, which may damage the barrier, shall be cushioned. The type of barrier material and cushioning used shall be commensurate with the size, weight and irregularities of the preserved part or item.

Method II

Waterproof – Vapor Proof Barrier with Shell VPI–260. Items preserved, wrapped and cushioned shall be enclosed in a sealed bag. Shell VPI-260 (or equivalent when approved in writing by COMPANY) shall be in small porous bags positioned in the package at location such that the metal surfaces to be protected are within 300mm of the bags. Bags shall be secured by tying, by storage in especially provided baskets, by taping or otherwise secured so as to prevent movement, rupture of the bags or

barrier and damage of the parts. Shell VPI-260 shall be in porous bags of standard sizes. Cushioning shall eliminate projections, sharp edges or other features of the item(s) that may damage the water-vapor proof barrier. A sufficient vacuum shall be drawn to cause the flexible bag to cling snugly to the enclosed item. Care shall be exercised to ensure that an excessive amount of vacuum is not drawn which might cause puncture or rupture to the flexible barrier or the equipment itself.

Method III

Packaging for Mechanical and Physical Protection Method III is intended only for items not susceptible to damage or deterioration from corrosion. Un-preserved items shall be bundled; secured by tying, taping or strapping, skin packaged or enclosed with wrapping, bags, cartons, boxes or other containers, as applicable to the extent necessary to provide protection from hazards of contamination and physical damage encountered in handling, storage and issue. When bags, wrap or other flexible barriers are used, cushioning shall be applied as required to protect the enclosing media. Items packaged in rigid containers shall be supported as necessary to prevent free movement. The methods of preservation - packaging, cushioning, blocking, bracing or bolting shall be applied to provide controlled movement within rigid containers to prevent rupture of flexible barriers and physical damage of contents due to transmission shock and vibration. Items such as machines and assemblies having bolt holes in parts of the item which are sturdy enough to resist breakage when roughly handled shall be bolted to one face of the container or to a base which can be secured by use of lock nuts or cotter pins, or by upsetting bolt threads by pricking bolt threads in four places.

8.0 PACKING MATERIAL/PRACTICES

- For wooden boxes lumber shall be sound and well-seasoned, knots are permitted provided they are sound and tight and do not exceed one-third of the board width.

- For heavy cardboard, double wall, and waxed boxes, 227 kg (500 lb) test boxes are to be used.

- Plywood shall be construction and industrial grade and fabricated with exterior glue. It shall give equal strength in both directions of length and width and shall withstand full weather and water exposure.

- Nails shall be cement-coated.

- Metal strapping shall be un-annealed steel and applied to all packages with a stretching tool and secured with crimped steel seals. For heavy cardboard boxes nylon strapping securing the box to a pallet shall be crimped with steel seals.

- In all wooden boxes constructed with lumber or plywood the top shall be lined with waterproof paper where necessary.

- When consolidating material in a box or crate, items shall be packaged or nested reducing volume as much as possible. All items shall be braced and/or cushioned as necessary within the container to prevent damage from shifting.

- Small items and spare parts not secured to main item shall be separately boxed and properly identified as to its main item number.

- All controls and instruments mounted on equipment, including motor starters, shall be protected internally with Ludlow VPI wrap, Daubert VCI paper or porous bags of VPI-260. Exterior doors will be sealed by applying petroleum jelly to the sealing surfaces and closing. The jelly will cause more efficient seal. CONTRACTOR / SUPPLIER may substitute equivalent materials for Ludlow VPI wrap, Daubert VCI paper, or porous bags of Shell VPI-260, if approved in writing by COMPANY.

- It is necessary that all shipping containers be tightly packed. Where voids appear, they will be filled with cushioning material or securely blocked off to prevent any movement of contents.

- Machinery and large equipment shall be skidded, and shall be bolted and strapped to the skids. As required, items shall be cradled within crates for stability purposes. Specific packing instruction, as mutually agreed between COMPANY and CONTRACTOR / SUPPLIER, will be included in the purchase order for crating or boxing of large equipment, if required.

- Heavy items shall be securely blocked and braced to prevent damage to lighter materials packed in the same box. Heavy items, where possible, shall be packed on the bottom with light items on the top.

- Outer packages shall be packed in such a manner to insure an even distribution of weight within the case. All other packages will bear warning signs on the outside denoting the center of balance and sling marks. Top heavy containers will be so marked as "top heavy" or "heavy end". Outer packaging shall be constructed in a manner that will provide protection from pilferage.

9.0 TYPES OF PACKING

9.1 PALLETIZING

Items which are not crated or boxed and are impervious to damage from moisture, seawater, handling and external damage, which can be conveniently secured to a pallet to facilitate handling, shall be palletized.

9.2 BUNDLING&SKIDDING

All items shall be segregated to length and size and bundled or skidded into units not to exceed 1814 kg (4000 lbs) or 12 m (40 feet) in length unless previously approved by purchaser. Apply steel strap with a stretching tool and secure with crimped steel seals spaced up to 1-meter apart (40").

9.3 BOXES AND CRATES

The construction and reinforcing of a wooden box depends upon the weight of the box and its contents. The following are minimum requirements for various boxes.

45 – 1814 kg (100 - 4000 lbs.)

Box shall be made of a minimum of 25.4 mm (1-inch) nominal lumber board, 9.5 mm (3/8") plywood sheathing, completely cleated ends. All boxes over 22 kg shall be skidded. All seams shall be backed with an upright or brace.

1814 kg (4000 lbs) and up Box shall be constructed with a 102 mm (4") by 102 mm (4") nominal skid base. 51 mm (2") nominal floor, 25.4 mm lumber or 13 mm (1/2") plywood sheathing, with cleated ends. Top and sides shall be braced, with corner post, bracing and stiffening members of 51 mm (2") by 102 mm (4") nominal lumber. Load bearing members shall be placed as needed. Top and upper edge members of large or heavy boxes shall be reinforced with 102 mm (4") by 102 mm (4") or 102

mm (4") by 152 mm (6") nominal spreaders to prevent crushing of boxes when lifting-slings are used.

All wooden boxes to be fork lift able - 4 ways. Cardboard boxes to be of double wall waxed construction, 227 kg (500 lb) test and 1118 mm (44") x 1118 mm (44") x 1118 mm (44") OD with pallet. Intended to double stack and fit side by side in a standard 6.1 (20') or 12.2 m (40') shipping container

9.4 STRAPPING

All wooden boxes must be strapped with a minimum of 2 steel bands running parallel to skids. 19mm (3/4") nominal banding may be used on boxes less than 180 kg. For boxes or crates over 2722 kg (6000 lbs) 32 mm (11/4") or 51 mm (2") nominal banding must be used.

9.5 SPECIAL REQUIREMENTS

Electrical switchgear, electrical panels, chromatographs, computers, all material/ equipment which are susceptible to damage or deterioration from moisture, (i.e., humidity or rain), must be warehouse stored upon receipt and vacuum packed immediately, after checking. If the material has a discrepancy, all efforts should be made to quickly clear the discrepancy and pack the material.

Note: The above listed materials are not all inclusive and other possible applications should be noted and brought to the attention of COMPANY.

Special Materials: Any material which might need packaging differently than that which is stated herein shall be reviewed in writing on an individual item/order basis with COMPANY.

10.0 MARKING AND DOCUMENTATION

- All material must be packed within 4 working days after receipt, if automatic pack Purchase Orders, or within 2 working days after release by COMPANY if inspection is required.

- Specific instructions for shipping markings and documentation procedures will be in the order. Color coding of all packages and/or pieces will be required. All packing/documentation shall be segregated according to COMPANY's Job No.

- All markings and tags on wooden boxed equipment, packages, and crates shall be paint-stenciled (not marking pens) and capable of remaining legible after extended periods of storage in bright sunlight and atmospheric conditions encountered enroute to storage at the destination.

- All markings and tags on heavy cardboard boxes may be written on "peel and stick" labels with indelible marking pens, provided writing is neat and legible.

- Combined Commercial Invoice/Packing Lists must be issued for each shipment indicating all material orders export packed per package, with copy attached to package detailing contents of that package prior to delivery to dock. If pricing is in question, Packing List only may be attached to package prior to dock delivery.

- Final Combined Commercial Invoice/Packing List covering all shipments for a particular vessel must be completed and delivered to COMPANY within 48 hours of last dock delivery. Transfer should take place electronically.

11.0 REPORTING

CONTRACTOR / SUPPLIER will provide COMPANY with the following reports within the time intervals and at the frequencies shown:

- Cargo "On Hold" Report (Detailing all cargo "On Hold" pending resolution of problems). Nature of problem to be outlined on Report (e.g., missing Purchase Order No., overages, shortages, damaged materials, incorrect part numbers, etc.) Report shall be issued every Monday morning and transmitted to COMPANY electronically.

- "Packed Out" Report (Detailing all tonnage packed and ready for shipment). Report shall include CONTRACTOR / SUPPLIER's estimate of 12.2 m (40 ft.) Standard Containers needed to move cargo. Report to be issued weekly and transmitted to COMPANY.

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION # 0504214-PRO-SP-014

PAINTING AND SURFACE PREPARATION

CONSULTANTS: **Dec. 2019**

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, Block No. 17, Gulshan-e-Iqbal, Near National Stadium, Karachi-75300. Pakistan. Tel: 92 (21) 34961088
92 (21) 34827780, Fax: +92 21 34961089, E-Mail: contact@pcec.com.pk Web: www.pcec.com.pk

TABLE OF CONTENT

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

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 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

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.
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 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.

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 so brush. washed with an organic solvent and thoroughly dried off with a dry clot (e.g. with 1.1.1. Tricloroethane 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.

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 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. 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 10ºC, 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 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
- 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)
Covering capacity	12-13 M2/Lit/coat

b) 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%
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

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 Polymide 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 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.

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)
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.

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: Duel 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 400º 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 150º 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

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
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.

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 EOUIPMENT

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.

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

a) Normal Industrial Environment, Table 2.

b) Corrosive Industrial Environment, Table3

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 vale / 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

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 -	-10º C to 20ºC	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 -	21ºC to 60ºC	SSPC-SP-6	Two coats P-1, 25 Microns/ coat (Min.)	Two coats of F-1, 20 Microns/Coat (min.)	90	-
1.3	- do -	61ºC to 80ºC	SSPC-SP-6	Two coats P-3, 50 microns / coat (Min.)	Two coats of F-13, 25 Microns/Coat (min.)	150	-
1.4	- do -	81ºC to 250ºC	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 -	251ºC to 400ºC	SSPC-SP-10	Covered in Finish coat	Three coats of F-12, 20 Microns/Coat (min.)	60	- do -

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 -	- 10ºC to 20ºC	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 -	21ºC to 80ºC	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 -	81ºC to 400ºC	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,

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 -	-10ºC to 60ºC	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 -	61ºC to 80ºC	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 -	81ºC	SSPC-SP-	One coat	-	85	Paint application

		to 400ºC	10	F-9, 85 microns / coat (Min.)			at Ambient temp. Primer is acting as primer cum finish coat.
1.4	- do -	i) Upto 80ºC ii) 81ºC to 400ºC	SSPC-SP-10 SSPC-SP-10	One coat F-9, 65 microns / coat (Min.) -do-	One coat of F-2, 30 Microns/Coat (min.)	95 85	Paint application at ambient temp. Paint application at ambient temp. Primer is acting as primer cum finish coat.

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 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 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 ± 20 cm above the ground level marker and ± 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 0la 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.

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 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:

- 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.

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION FOR

UNFIRED PRESSURE VESSEL

(0504214-SP-021)

CONSULTANTS: **Dec. 2019**

PETROCHEMICAL ENGINEERING CONSULTANTS

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TABLE OF CONTENT

1.0 INTRODUCTION

1.1 GENERAL

This specification is a standard specification for Unfired Pressure Vessels and outlines the minimum requirements of the COMPANY.

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1.2 DEFINATION

Following definitions apply throughout this document:

Company / Owner	Oil and Gas Development Company Limited (OGDCL)
Contractor	“Contractor” means the person or persons,firm or Proprietor whose proposal has beenaccepted by the Company for verification of FEED package, engineering design,procurement, inspection, supply of materialand equipment, construction/ commissioning,performance testing, one year of defectliability period and training of Company’spersonnel for the project and includes theContractor's representative(s), successors andpermitted assignees.
Vendor / Supplier	The organization, firm or agency with whom order for the supply of equipment and ormaterial has been placed.

1.3 ERRORS OR OMISSIONS

Review and comment by the COMPANY of any CONTRACTOR / SUPPLIER drawings, procedures or documents shall only indicate acceptance of general requirements and shall not relieve the CONTRACTOR / SUPPLIER of its obligations to comply with the requirements of this specification and other related parts of the Contract Documents.Any errors or omissions noted by the CONTRACTOR /

SUPPLIER in thisSpecification shall be immediately brought to the attention of COMPANY.

1.4 DEVIATION

All deviations to this Specification, other related specifications or attachments shall be brought to the knowledge of the COMPANY in the bid. All deviations made during the procurement, design, manufacturing, testing and inspection of the Works shall be with written approval of the COMPANY prior to execution of work. Such deviations shall be shown in the documentation prepared by the COMPANY.

1.5 CONFLICTING REQUIREMENTS

In the event of any conflict, inconsistency or ambiguity between the Contract scope of work, this Specification, Codes & Standards referenced in this Specification or any other documents, the CONTRACTOR / SUPPLIER shall refer to the COMPANY whose decision shall prevail.

1.6 REPORTING PROCEDURE

A reporting and documentation system shall be agreed between the COMPANY and the CONTRACTOR / SUPPLIER for the status of procurement, design, manufacturing, inspection, testing and shipment of the equipment/material to be supplied under this specification. CONTRACTOR / SUPPLIER's manufacturer shall provide reports and summaries for production performance and testing operations in conformance with a manufacturing schedule approved by COMPANY.
Weekly, monthly and run summaries of all major aspects of the production process shall be provided as reports to the COMPANY.

1.7 UUNIT RESPONSIBILITY

The CONTRACTOR / SUPPLIER shall be responsible for the complete design, manufacture supply, fabrication, installation/erection, inspection and testing of the vessels, including full compliance with all applicable design codes, and standards,

including those listed in Section 2.0 of this document and with the requirements of the independent certifying authority, where applicable.

2.0 REFERENCE CODES & STANDARDS (LATEST EDITIONS)

ASME Codes

Section VIII	Division I & Division II (Pressure Vessels)
Section IX	Welding Qualifications
Section V	Non-destructive Examination
Section II	Materials
Section II, (Part C)	Welding Rods, Electrodes and Filler Materials

ANSI Standards (Latest Editions)

B16.5	Steel Pipe Flanges
B.16.20	Metallic Gasket for pipe Flanges
B16.9	Factory Made Wrought Steel Butt-Welding Fittings
B36.10	Wrought Steel Pipes
B36.19	Stainless Steel Pipes
A58.1	Building Code Requirement for Minimum Design Loads in Building and Other Structures.
MSS SP-44 or ANSI B16.47	Steel pipe line flanges for dia> 24"

Steel Structures Painting Council Specification for Surface Preparation and Painting System;

In addition to the requirements of this specification, all requirements of the governing authority, i.e. the country and/or its sub-divisions, where the vessel is to be installed shall be met;

Pressure vessels shall be fabricated in accordance with ASME code by `U' stamp fabricator. Bidder to confirm name of fabricator in the bid and provide his `U' stamp certification from ASME.COMPANY's reference specification ENTS-401 shall also be considered.

3.0 APPLICABLE PROJECT SPECIFICATIONS

- Piping Specification
- Specification for Export Packing & Crating
- Specification for Painting and SurfacePreparation
- Specification for Production Welding
- Specification for Pressure Vessel Internals
- Specification for Equipment with lowTemperature service and their Materials ofConstruction
- Specification for Structure Steel Works
- Specification for Instrumentation for PackagedUnit
- Specification for Electrical requirements for Packaged Equipment

4.0 SITE ENVIRONMENTAL CONDITION

For site environmental condition including range of ambient temperature, rain fall intensity per day or annum and other essential parameters can be found in Annexure of Site Environmental Condition.

5.0 SCOPE OF SUPPLY

5.1 GENERAL

This specification sets forth the minimum acceptable standards governing the design, fabrication, material requirements, inspection, testing, identification and preparation for shipping of unfired pressure vessels.

5.2 MATERIAL, WORKMANSHIPAND SUITABILITY

All materials and parts included in the construction of the specified vessel shall be new, unused and of the highest grade being free from all defects or imperfections likely to affect their performance.

6.0 ENVIRONMENTAL DESIGN CRITERIA

For environmental / site conditions, please refer to “Specification for Site EnvironmentalConditions” in Annexure-H.

7.0 GENERAL REQUIREMENTS

7.1 COMPANY’s Requirements

The design life of equipment shall be 25 years.

Requests for substitutions of any kind shall be complete with all pertinent engineering information required for the COMPANY’s evaluation of the proposed substitution.
Vessel outline drawings and/or data sheet sketches submitted to the CONTRACTOR / SUPPLIER are not intended to cover complete details. The CONTRACTOR / SUPPLIER shall make detailed calculations for the design of the pressure vessels and shall prepare detailed shop drawings.

The CONTRACTOR / SUPPLIER shall concurrently submit to the COMPANY, fabrication drawings, weld procedures and detailed calculations for approval. Shop work shall not start until the CONTRACTOR / SUPPLIER have received drawings and weld procedures approved by the COMPANY. No subsequent revision may be issued to the fabrication shop unless it is approved by the COMPANY.

7.2 EARTHING

Each vessel shall be supplied with a minimum of two earthing bosses suitable for termination of 70 sq. mm earth cable.

7.3 TOLERANCES& DIMENSIONS

CONTRACTOR / SUPPLIER shall comply with the requirements as per ASME VIII.

7.4 NOZZLE PROJECTION

Unless specified otherwise, the nozzle projections shall comply with the requirements as per ASME VIII.

7.5 INSULATION& FIRE PROOFING

See insulation specification attached in tender document.

Fire proofing shall be provided on unfired pressure vessel. Contractor needs to share the detailed specification and drawings to COMPANY for approval.

8.0 DESIGN

8.1 DESIGN CONDITIONS

The design pressure shall be in accordance with the code, but shall be at least 30% above the maximum operating pressure.

Design Temperature shall be $\pm$50 ^{O}F than maximum/minimum allowable operating temperature.

8.2 DESIGN LOADINGS

The Vessel(s) 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 pipework shall be assumed as equivalent to one and one-half times the wind loading of the insulated vessel.

Pressure vessel 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 set by the code, and the deflections set by Section 6.4 of this specification:

- 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;
- Continuous monitoring of vessel conditions by mechanical testing during operation conducted by operating and maintenance team after start-up and handing over;
- Any other condition, which would affect the safety of the vessel e.g. cyclic loading;

8.3 DESIGN STRESS

Allowable Stress

Shall be the maximum stresses permitted by the basic design code.

Test Condition

The allowable general membrane stress shall be the maximum of 90 percent of the minimum specified yield or proof stress of the material of construction.

Anchorages

Foundation bolts for vessels shall have a maximum allowable tensile stress of 110 N/mm^2.

8.4 DEFLECTION LIMITS DUE TO APPLIED LOADS

The static deflection of vertical vessels in the corroded condition due to the full wind load shall be limited to 1 in 200 of the vessel length.The deflection due to applied load and self weight of distributors, gratings, etc. and their supports, in the corroded condition, shall be limited to 1 in 500 of their span.Vertical vessels with a ratio of overall height to diameter exceeding 15 shall be designed for dynamic stability under wind induced vibrations.

8.5 NOZZLE LOADING

Nozzle Size	Resultant Force (N)	Resultant Moment (RN)
2”	1435	380
3”	2930	1140
4”	4100	2080
6”	7000	5230
8”	10190	9800
10”	13950	16510
12”	16500	22820
14”	17500	26110
16”	19350	32310
18”	21000	38310
20”	22450	44260
24” – 30”	24750	54880

The above table gives the resultant forces and moments induced from pipework systems, which are to be allowed. CONTRACTOR / SUPPLIER shall consider the force acting radially together with the moment acting either in a longitudinal or circumferential direction. The above table does not apply to equipment nozzles within packaged units where actual loading conditions should be applied. CONTRACTOR /

SUPPLIER shall ensure that the above nozzle loadings will not induce unacceptable stress levels in the vessel shell or head, in compliance with the relevant vessel design code.

8.6 DRAWINGS & CALCULATIONS

Shop details shall be complete with all dimensions, thicknesses and details of construction, including dimensional location of circumferential and longitudinal seams, and all nozzle locations and orientations. All material thicknesses shall be shown, including spherical radius and knuckle radius of heads. All welds shall be detailed or fully described by notes or weld symbols, and annotated to the relevant weld procedure specification.

The assembly drawings shall contain all pertinent information relating to the standards, codes and specifications used in the design, fabrication, inspection and testing of the vessel, including the materials used, plus the total weight of the vessel empty, operating and full of water.

A detail of the skirt, base ring and chairs for vertical vessels or saddles for horizontal vessels shall be provided, complete with all dimensions and descriptions of material, including number, diameter, and location of anchor bolt holes. If this information is furnished by the COMPANY it shall be checked by the CONTRACTOR / SUPPLIER and so noted on the appropriate drawing. Foundation loading data shall also be provided by the CONTRACTOR /SUPPLIER. CONTRACTOR / SUPPLIER shall submit detailed calculations establishing thecompliance of design 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 for its applicability to the design.

All calculations shall be complete, giving all references and showing all working methods. Computer printouts will not be accepted without the program flow chart, input data and complete printout, and then only by prior written agreement with the COMPANY at the quotation stage.Review of drawings, calculations and other

documents by the COMPANY, does not relieve the CONTRACTOR / SUPPLIER of his responsibility for the correctness of the design to suit the stated conditions.

9.0 MECHANICAL REQUIREMENTS

9.1 MINIMUM THICKNESS

After forming, the minimum thickness of shell and head shall, for carbon steel and low alloy steel vessels, be as follows:

Vessel I.D.	**Min. Thickness with Corrosion Allowance**
1500 mm & below	6 mm
1501 – 2500 mm	8 mm
2501 mm	10 mm

Minimum thickness of materials other than carbon steel shall be based on the structural stability of the vessel in addition to the requirements of pressure and other mechanical loading. However, the minimum thickness of high alloy (austenitic) steel vessels and their components shall not be less than 6mm.Minimum wall thicknesses of carbon steel and low alloy nozzle necks, includingcorrosion allowance, shall be the greater of the code requirement or the following:

- 2" through 6" - Sch. 80.
- 8" through 24" - Std. Wall

Skirts shall be designed for load conditions, but shall not be less than 6mm wall thickness. Minimum thickness of internal carbon steel attachments shall not be less than 6mm excluding corrosion allowance.

9.2 CORROSION ALLOWANCE

Unless otherwise specified on the data sheet, carbon steel vessels and internals shall have 3mm corrosion allowance applied to all pressure retaining parts and all

surfaces of non-removable internals exposed to the process fluid. Removable internals shall have half 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. When corrosion allowance is provided by a corrosion resistant metallic lining, a minimum thickness of 3mm of lining material shall be used or otherwise stated in data sheet.

Vessel parts, which are subjected to erosion e.g. due to impingement by the process stream, shall be protected with wear plates, or impingement baffles. Flaked glass lining may be provided on the inner surface of inlet separator vessels to avoid erosion due to high velocity inlet fluid, which may contain abrasives/solid particles etc. and also to avoid corrosion effect in water boot section.

9.3 HEADS

Vessel heads shall be one-piece semi-ellipsoidal (ratio 2:1) unless otherwise specified. Pressure vessels having design pressure 150 psig & above, shall have one piece hemispherical heads.

Torispherical and hemispherical heads may be used provided all pertinent dimensions and information is submitted to the COMPANY for approval before the heads are ordered.

Heads shall have straight flange of not less than 50mm or two times the thickness, whichever is greater. All heads, which have been formed cold or below final tempering temperature.Heads produced from more than one plate shall have the welds 100% radiographed after forming.

9.4 SUPPORTS

Horizontal vessels shall be supported on two steel saddles only. Saddles shall be furnished by CONTRACTOR / SUPPLIER. There shall be two (2) ½" NPT tapped

tell-tale holes at outer extremities in each saddle pad. Saddle pads shall have rounded corners. Saddles shall provide support for at least 120° arc at the circumference of vessel shell (As per ASME VIII).

Calculations shall be provided for the effect of support saddles on the vessel shell and heads. Vertical vessels shall be supported on steel skirts. Small vertical vessels less than 1200mm Inside Diameter may be supported on structural legs, or lugs, where advantageous to plant layout. Skirts are however mandatory for all vertical vessels with a height to diameter ratio greater than 5.

All vessels shall be designed to be self-supporting without benefit of guys or braces. Vessel skirts shall be of the height required to provide a clearance not less than 480mm between the bottom of the head and the deck/foundation. All vessels provided with skirts shall have a reinforced access opening of 400mm minimum diameter. Skirts for vessels smaller than 920mm nominal diameter shall be provided with at least one 200mm access opening. Desired orientation of openings shall be shown on the vessel drawing, or affixed on CONTRACTOR / SUPPLIER's approval drawings.

Vessel skirts shall be provided with 3" diameter reinforced vent holes at approximately 920mm intervals on the circumference, located as near the vessel head as permitted by insulation or other attachments. No skirts shall have less than two such vent holes. The following joint factors should be applied to vessel skirts:

- Circumferential seams - 0.7
- Skirt to shell joint - 0.55
- Skirt to base ring joint - 1.0

9.5 MANHOLES, NOZZLES& INSPECTION OPENINGS

Manholes, handholes, cleanout openings and end flanges shall be provided as required for operation and maintenance and to meet Code requirements for inspection.

Cleanout openings shall be 4" minimum inside diameter, and shall be complete with blind flanges, bolting and gaskets and hinged, if not accessible to ground or a platform, for ease in maintenance. Where inspection openings are required the minimum size shall be 4" nominal. Trayed or packed towers shall be served by adequate internal and external access openings and shall have at least a top and bottom manhole. Packed towers shall have a manhole above the top level of the packing and below each support grid. A minimum 12" nominal opening shall be provided above each grid to permit removal of packing. Where the centreline of the lowest manhole is more than 1525mm above the vessel bottom, ladder access shall be provided to the interior vessel bottom.

Manholes shall be at least 480mm clear inside diameter, and are to be complete with blind flanges, bolting, gaskets, and davits or hinges. No bolts smaller than M 16 diameter may be used.The minimum connection size welded into a vessel shall be 2" NB, swaged if required to the specific line size and terminating with a flanged connection. Alternatively, an appropriate long welding neck forging may be used for the connection provided it has a 2" or greater diameter hub. The only exception to the above shall be nozzles for vessels in water, air and steam (if applicable) service in which the pressure does not exceed 13.50 barg and the temperature does not exceed 160°C.

Full penetration welds shall be used for all body flange, nozzle and manhole attachments. Other attachment weld details are not acceptable without specific approval of the COMPANY. All flanges for external nozzles and manholes of 24" diameter and smaller shall be in accordance with ANSI B16.5 and shall be raised face unless otherwise shown on the individual vessel data sheets and/or drawings. Pressure-temperature ratings of ANSI B16.5 shall apply for the design condition. Flanges over 24" diameter shall be in accordance with MSS Standard Practice SP-44. Non-standard size flanges shall be calculated in accordance with ASME Code Rules.Raised face flanges for use with spiral wound or soft metal jacketed asbestos gaskets shall have a smooth finish (125 RMS). Raised face flanges for use with compressed asbestos gaskets shall have contact surfaces as follows:

- Nominal size 12" and smaller - A continuous spiral groove generated by a 1.8mm radius round-nose tool at a feed of approximately 0.9mm per revolution.
- Nominal size above 12" - A continuous spiral groove generated by a 3mm radius round-nose tool at a feed of approximately 1.3mm per revolution All nozzles shall be flush with inside of vessel wall unless otherwise indicated on vessel data sheets.

Where two or more openings are provided for installation of equipment, such as gouge glasses, level controls, etc. they shall be set with a Jig to prevent tolerance from being additive. No threaded connections shall be screwed directly into any part of the vessel except for tell-tale holes in reinforcing pads. Minimum nozzle connection size shall be 2” flanged type.

All bolt holes in manholes, handholes and nozzles and anchor bolts on supports shall straddle the normal vessel centreline unless otherwise specified. Pad type nozzles, handholes etc. shall not be used unless written approval is obtained from the COMPANY. Nozzles may be either integral forgings or fabricated from seamless pipe and welding neck flange joined by full penetration welds. Other type built-up nozzles are not acceptable without approval of COMPANY.

Flanges for internal nonpressure piping may be slip-on-type. Set-on type nozzles shall only be used with prior agreement from the COMPANY and provided that 100% Ultrasonic Examination of the shell plate is carried out adjacent to the opening. Examination is to be in accordance with ASTM A-435 to cover a minimum of two times the opening diameter.

9.6 REINFORCEMENT

Reinforcement of nozzles and manholes shall be designed to provide 100% compensation for the as built thickness of the shell/head, in accordance with the specified design code. The reinforcement for openings shall be provided by either self reinforcing type nozzles or built-up, seamless pipe and WN flange with pad reinforcement as necessary.

Reinforcing pads when applied shall have a minimum width of 2" or three times the pad thickness, whichever is greater. Reinforcing pads shall be made in one piece if possible. Large reinforcing pads may be made from two pieces provided that written approval is obtained from the COMPANY. Integral reinforcement of openings shall be provided for vessels in the following categories. Reinforcing pads shall not be used in these instances:

- Vessels in lethal service;
- Vessels designed for temperatures below 0°C;
- Vessels with shell thickness exceeding 50mm;

All rectangular reinforcing pads when used for external or internal attachments shall be radius 25mm minimum.

9.7 INTERNAL ATTACHMENTS

The vessel fabricator shall furnish and install all internal support rings, down comer supports, bars, gratings, grating supports, tray lifting, tray leveling device, vortex breakers, piping and all other internals as and where required by the appropriate drawings. Internals shall be fixed by bolting to cups or rings for ease of maintenance.

Mitred joints shall not be used, unless otherwise specified on drawings and agreed by the COMPANY. Major internal piping shall be flanged for ease of removal through vessel manholes. All removable internals shall be fabricated so as to pass through the vessel manholes.Support and fixed internals welded to shell/head, shall be seal welded to prevent crevice corrosion. Seal and strength welds shall carry the appropriate corrosion allowance.

All internal crevices where supports and fixed internals are welded to the shell/heads shall be seal welded to exclude process fluids. Seal and strength welds shall carry the appropriate corrosion allowance.

9.8 EXTERNAL ATTACHMENTS

Vessel fabricator shall furnish and attach all insulation support rings, external pressure stiffeners, lifting lugs, ladder and platform lugs, and pipe supports unless otherwise specified. Reinforcing pads shall be continuously welded to vessel beneath all attachments where the welding of such attachments would cause excessive concentration of stress on vessel at those points. Each pad shall contain at least one ½" NPT tapped tell-tale hole.

All vessels greater than 3600mm installed height shall be fitted with a full length ladder, Platforms for maintenance shall be provided as necessary for safe access to manholes, relief valves, control valves, controllers, etc. Sample connections, thermometers, thermowells, gauges and control instruments shall be accessible from a platform or a ladder. Tower davits shall be provided as necessary for proper maintenance. All attachments shall be continuously welded.All vessels, vertical or horizontal, shall be furnished with a minimum of two lifting lugs, which shall be designed for a load equal to two times the shipping weight.

9.9 VIBRATION ANALYSIS

A dynamic wind analysis shall be performed for all towers taller than 100 ft (30 m) with a height-to-diameter ratio greater than 15. The following conditions shall be met:

- Vessel diameter (d) shall be the predominant outside shell diameter of the top one-third of the vessel.

- Vessel height (H) shall be the total height of vessel from base of skirt to top of head.

- The maximum single amplitude (deflection) at the top of the vessel due to dynamic wind load, including rotation of the concrete foundation or structure, shall not exceed 0.5 percent of H.

10.0 ADDITIONAL REQUIREMENTS FOR FLANGED GIRTH JOINTS

1. Flanged girth joints shall be designed for through bolting. Proposals for alternative joint design shall be submitted to the COMPANY for approval.

2. Flanges for girth joints shall conform to the following:

   - Flanges shall be according to ASME B16.5, ASME B16.47 Series B, or designed according to ASME SEC VIII D1 with allowable stresses determined according to that code.

   - Welding neck flanges shall be used where the pressure-temperature design conditions require an ASME Class 300 or greater flange.

   - Slip-on flanges shall not be used if any of the following conditions are exceeded:

     - Pressure-temperature design conditions require an ASME Class 300 or greater flange.

     - Design temperature exceeds 750°F (400°C).

     - Specified corrosion allowance for the vessel is greater than 1/8 in. (3 mm).

     - The vessel is in hydrogen service.

   - Girth flanges larger than NPS 24 that are not in accordance with ASME B16.47 Series B shall be designed to meet the flange rigidity recommendations in ASME SEC VIII D1.

   - Unless otherwise specified, gasket contacts surfaces shall have a finish in accordance with reference Codes and Standards.

- Allowable flatness tolerances of gasket contact surfaces for the appropriate service condition shall be as per reference Codes and Standards.

- For confined joint construction (peripheral gasket confined on OD):

  - Nubbins, if provided, shall be located on the female (grooved) flange.

  - The clearance between flanges after assembly shall be not less than 3/16 in. (5 mm). This clearance shall extend from the periphery of the flange to within the bolt circle.

11.0 MATERIALS

11.1 GENERAL SPECIFICATION

Materials of construction for pressure parts shall be in accordance with the design code. Alternative materials may be used if advantageous with the approval of the COMPANY. Proposed substitutions must be clearly defined:

- Vessels having design temperature below 0°C are considered as cold vessels.

- Vessels having design temperature over 0°C considered as warm vessels.

11.2 SHELL / HEADS

Unless otherwise specified in drawings or data sheets, materials for shell/heads shall be as under:

- Material for warm service pressure vessel shell/heads shall be:

  ASTM A-515 for Intermediate & High Temperature Service;

  ASTM A-516 for Moderate & Lower Temperature Service;

- Material for cold service pressure vessel shell/heads shall be:

ASTM A-516 for Pressure Vessel having Design Temperature upto -46°C with impact test.

ASTM A-203 Gr. D for Pressure Vessel having Design Temperature upto -101°C with impact testing corresponding to vessel design temperature.

ASTM A-240 Gr. 304 for Pressure Vessel having Design Temperature upto -178°C without impact testing.

11.3 SUPPORTS & MISCELLANEOUS PARTS

Any material welded directly to the pressure retaining parts shall be of similar quality as the vessel plate, including impact requirements if any, for a length measured from the vessel wall of at least 150mm. The material of such items beyond this point may be structural quality A283 Gr. C, or equal.

ASTM A-203 Gr. D or ASTM A-240 Gr. 304 shall be used for cold vessels.

11.4 BOLTING

Bolts and nuts shall be furnished by the CONTRACTOR / SUPPLIER for all cover plates, manholes, blind flanges and bolted attachments supplied with vessels. Bolts and nuts shall be new.
External bolting shall be alloy steel stud type and selected for maximum and minimum design temperatures.
For warm vessels; all external bolting shall be cadmium plated to ASTM A-193 Gr. B7 c/w ASTM A-194 Gr. 2H nuts.

For cold vessels; all external bolting shall be cadmium plated to ASTM A-320 Gr. L7 c/w ASTM A-194 Gr. 7 nuts.

All internal bolting to be stainless steel;

Flange bolting of nominal size 1½" and above shall be subject to bolt tensioning. CONTRACTOR / SUPPLIER to supply flange stud-bolts over length by one nut thickness and complete with 3 nuts to facilitate bolt tensioning for all flanged connections for which CONTRACTOR / SUPPLIER supplies a mating flange,bolt tensioning will be carried out on site by Contractor.

11.5 FLANGES

Flange material shall be of a similar quality to the vessel shell including impact properties where applicable. Forgings shall be supplied in the normalized condition.

For warm vessels; all flanges material shall be ASTM A-105. For cold vessels; all flanges material shall be ASTM A-182 Gr. 316 for Stainless Steel Vessels or ASTM A-350 Gr. LF2 for Carbon Steel (with impact test) Vessels.

11.6 GASKETS

Gaskets shall be furnished by the CONTRACTOR / SUPPLIER for all bolted attachments i.e. cover-plates, manways, and blind flanges supplied with vessels. Unless otherwise specified, gaskets shall be in accordance with ANSI B16.5 as follows:

- For Flat Face, 150 LB ANSI flange: Full Face, 1.6mm thick compressed non-asbestos.

- For Raised Face, 150 LB ANSI flanges: thick compressed Spiral wound stainless steel, non-asbestos filled with spacer rings.

- For Raised Face, 300 & 600LB ANSI flanges: Spiral wound stainless steel, non-asbestos filled with spacer rings.

- For Ring Joint, 900, 1500 and 2500 LB ANSI flanges: Oval Ring per ANSI B16.20, Armco soft iron or equal. (90 Brinell Max).

Gasket material for nozzles connected to external pipework and valving shall be in accordance with the Project Specification for Piping Design and Materials.

11.7 IMPACT TEST REQUIREMENTS

Charpy V-notch impact testing is required in accordance with the code except that this shall apply to all vessels with a design temperature below 0°C. These vessels shall meet the requirements of ASME Section 11 Part A, SA20 and Clause UG-84 of ASME VIII Division 1.

12.0 FABRICATION

12.1 START OF FABRICATION

No manufacture may begin until CONTRACTOR / SUPPLIER has received written approval of his detailed fabrication drawings from the COMPANY or their authorized representative.

The CONTRACTOR / SUPPLIER shall notify the COMPANY or their authorized representative in reasonable time before actual fabrication begins.

12.2 FORMING

Shell plates shall not be formed until actual head dimensions are known. Plates shall be formed in the same direction as the final roll given in manufacture.

12.3 WELDING

All welding shall be in accordance with the code, standard and welding specification for this project. The CONTRACTOR / SUPPLIER shall submit proposed weld procedures and weld details for the COMPANY'S review and approval prior to commencing any production welding.

Submerged arc welding is preferred on all vessel seams. For materials with yield strength exceeding 330 N/mm2 and/or thickness exceeding 20mm, consumables for manual metallic arc welding shall be of the basic low hydrogen type. CONTRACTOR / SUPPLIER shall establish a procedure for maintaining proper control of welding consumables.

Low hydrogen electrodes shall be dried or baked at the temperature level and times specified by the manufacturer, and shall be used within 8 hours when stored in quivers. Electrodes stored in quivers, but not used within the specified times, shall be restored in ovens.

No electrodes shall be left lying about the site, or in workshops. Electrodes so left shall be scrapped. Submerged arc flux shall be stored in moisture-proof containers in a dry location, at a temperature of above 20°C. Submerged arc consumables shall be withdrawn from store only when required for immediate use. Used consumables shall be returned to store on completion ofthe welding operation.

Submerged arc flux may be recycled but shall be free from fused flux, mill scale, dirt or other foreign matter. The CONTRACTOR / SUPPLIER shall provide proof to the satisfaction of theCOMPANY'S Inspector that the welder has been using the process for which he is qualified within the previous 3 months. If not, then the welder shall be required to re-qualify. Backing rings shall be used only with approval of the COMPANY.

Adjacent longitudinal seams shall be staggered to give between seams a minimum of 60° orientation or 2000mm whichever is greater. Shell seams shall be located to miss long internal attachment welds (trays, downcomers, etc.) and all nozzles and manhole openings and their reinforcing pad.

Longitudinal and circumferential seams in shells and all seams in heads shall be full penetration single or double butt-welds of the 'V' or 'U' type. Lap welds are not permitted.All weld procedure numbers shall be shown on drawings. All welding without subsequent postweld heat treatment is prohibited on the following:

- Materials and thickness criteria defined within the design code.
- Chrome-moly alloy steels containing more than 2% Cr or more than 0.6% Mo.

Production test plates shall be conducted on longitudinal shell seams and head seams (if any) where run-off tabs shall be used. This shall apply to vessels with a design temperature below 0°C and thickness greater than 25mm. One production test plate shall be provided per vessel for each weld procedure and shall be subject to full mechanical testing in accordance with ASME IX. Production control test plates shall be post-weld heat treated with the vessel where applicable.

The weld ligament, i.e. the distance between the edges of weld preparations for any two nozzle welds, or between nozzle welds and seam welds and attachment welds, shall be twice the shell/head thickness plus 25mm. No welding shall be allowed after PWHT. All attachments including ladder and platform clips must be welded before PWHT. All fillet welds shall be continuous.

12.4 WELD REPAIRS

All repairs welding shall be in accordance with procedures previously approved by the COMPANY. The repaired weld shall be subjected, as a minimum requirement, to the same testing and inspection as the original weld. The cost of all repairs and subsequent inspection shall be the responsibility of the CONTRACTOR / SUPPLIER. Weld repairs shall take place before hydrotesting and care shall be taken to ensure that the wall thickness is not reduced below the specified minimum design thickness. Surface defects, and areas of weld resulting from the removal of temporary attachments shall be ground smooth and the area subjected to 100% crack detection.

12.5 WELDING PROCEDURE QUALIFICATION RECORD (WPQR)

Each weld procedure shall be covered by a suitable procedure qualification tested in accordance with the requirements of ASME IX.

12.6 PREHEAT REQUIREMENTS

The minimum preheat for ferritic steels shall be in accordance with Appendix R of ASME VIII DIV I. Calculations of preheat temperature to suit particular combined plate thickness, chemical composition, heat input, consumables and restraint can however be made by reference to the following:

Welding Steels without Hydrogen Cracking, international Institute of Welding 1973;

Note: This guide is primarily suitable for carbon, carbon manganese fine grain and carbon molybdenum steel with less than 0.6% Mo.

The required preheat temperature shall be established before commencing welding, and held until welding is complete. Preheat temperatures shall be controlled by temperature indicating crayons or contact pyrometer.

12.7 POST WELD HEAT TREATMENT REQUIREMENTS

Vessels shall be post-weld heat treated when required by the design code depending on the combination of material, thickness and design temperature. All vessels in lethal service shall be post-weld heat treated. Post-weld heat treatment shall also be considered for vessels subjected to large amounts of welding and where pressure parts have been formed from thick plateinto tight radii.

Field post-weld heat treatment procedures must be reviewed by the COMPANY. The CONTRACTOR / SUPPLIER shall include in his material sub-order(s), how many heat treatments are likely to be carried out during fabrication, and he shall ensure that he receives a guarantee from the mill that the steel supplied can be heat treated as proposed, without detrimental effect on the minimum guaranteed mechanical properties.

The use of manually operated gas torches or gas rings shall not be permitted for PWHT. During PWHT, a minimum of six thermocouples per furnace load shall be

used to ensure that uniform temperature is achieved throughout the heat treatment cycle. The thermocouples shall be used to record metal skin temperature.

If welded repairs are made to a vessel, which has been heat treated, the vessel shall again be heat treated. This treatment shall form part of the repair procedure. All heat treatments shall be recorded and documented by a temperature recording chart. The welding and associated heat treatment of stainless steels shall take into account the ease with which this material can be sensitized and its corrosion resistant properties thereby impaired.

13.0 INSPECTION, TESTING AND CERTIFICATION

13.1 GENERAL

All non-destructive examination shall be carried out in accordance with the design code as a minimum. All personnel involved in non-destructive testing shall be qualified to aninternationally recognized standard.

Inspection and testing shall be carried out at the CONTRACTOR / SUPPLIER'S works and shall be witnessed by the COMPANY'S authorized representativesand/or the certifying authority if applicable.

The responsibility for inspection rests with the COMPANY. However, the COMPANY reserves the right to inspect vessels at any time during fabrication to ensure that materials and workmanship are in accordance with this specification, and/or the approved drawings.

The CONTRACTOR / SUPPLIER shall provide a projected shop schedule with appropriate fabrication stages at the time drawings are submitted for approval, to highlight the inspection activity schedule. The approval of any work by the COMPANY or their authorized representative and the release of a vessel for shipment shall in no way relieve the CONTRACTOR / SUPPLIER of any responsibility for carrying out the provisions of this specification.

The CONTRACTOR / SUPPLIER shall inform the COMPANY at the time of placing the order of any tests, which cannot be adequately performed.

13.2 RADIOGRAPHIC INSPECTION

Except where amplified in this specification the extent of radiography shall be in accordance with the design code. When 100% radiography is specified for all welds, including flange butt welds and nozzle to shell connecting welds, shall be fully radiographed. Where radiography is considered to be impractical ultrasonic inspection may be substituted with prior approval of the COMPANY.

For vessels requiring radiography where heat treatment is required, the radiography must be carried out after heat treatment. The CONTRACTOR / SUPPLIER may at his discretion carry out radiography prior to heat treatment. The COMPANY'S appointed inspector shall see all radiographs and shall be advised of any defects found in any welds.

13.3 ULTRASONIC INSPECTION

Ultrasonic inspection may be substituted for radiography with prior approval of the COMPANY in areas that are inaccessible for radiography.

For vessels requiring U/T examination where heat treatment is required, the examination must be carried out after heat treatment. The CONTRACTOR / SUPPLIER may, at his discretion carry out U/T examination prior to heat treatment.

13.4 MAGNETIC PARTICLE& DYE PENETRANT INSPECTION

All magnetic particle and Dye Penetrant inspection shall be performed in accordance with the design code.

As. a minimum, the following applies at all nozzles, manways, and reinforcing pads:

- Load bearing fillet welds shall be checked at root runs and finished welds by magnetic particle or dye penetrant method.

- All full penetration attachment welds shall be magnetic particle inspected at the bock-chipped surface and on all finished weld surfaces.

Crack detection of finished welds shall be carried out after hydrotest and PWHT (where applicable). Magnetic particle inspection is preferred particularly after post-weld heat treatment. Vessels of low chrome alloy with plates over 50mm thick shall receive this inspection of all weld seams after post-weld heat treatment.

13.5 ACCEPTANCE CRITERIA

The acceptance standard for Non-Destructive examination of welds shall be in accordance with the design code.

13.6 SUPPORT& REINFORCING POD INSPECTION

Welds of reinforcing pads shall be tested to 1 barg with dry air after fabrication (but prior to the hydrostatic test of the vessel) using suitable materials for the detection of leaks.

13.7 HYDROSTATIC TESTS

Hydrostatic tests shall be carried out in presence of the COMPANY appointed inspector and a representative of the certifying authority, when applicable.
Hydrostatic testing shall be in accordance with the design code. Fresh water only shall be used for testing. For vessels manufactured from stainless steel the chloride ion content of the test water shall not exceed 30ppm. During testing the temperature of the vessel and test water shall not be lower than 7°C and not more than 25°C. Adequate support shall be provided for vertical vessels tested in the horizontal position to ensure that they are not subjected to excessive local loadings and bending stresses. Hydrotest pressure shall be held for a minimum of 60 minutes, irrespective of design code requirements.

13.8 TEST BOLTING

After the successful completion of the hydrostatic test, the bolting used during testing shall be replaced. Service bolts; nuts and gaskets furnished by the CONTRACTOR / SUPPLIER shall not be used for testing. The test bolts shall form part of the total equipment supply.

13.9 NAMEPLATE

13.9.1 GENERAL

Each complete vessel shall be provided with a type 316 stainless steel nameplate securely attached to the vessel shell and located so that it is clearly visible after installation. Nameplates shall be rivetted to a bracket welded on the vessel and the inspection authority then overstamps one rivet. Insulated vessels shall have nameplate brackets with enough projection to clear insulation by at least 25mm

13.9.2 STAMPED DATA

The following information shall be stamped on the nameplate:

- Manufacturer's Name;
- Manufacturer's Serial Number;
- Tag Number;
- Purchase Order Number;
- Equipment Title;
- Maximum allowable working pressure (Hot and Corroded) barg at °C;
- Maximum test Pressure (Corroded) in barg;
- Year Built;

- Size I.D./O.D. xT to T in mm;
- Service;
- Corrosion Allowance in mm;
- Design Code/Code Symbol showing degree of radiography and/orstress relieved and type of construction;
- Weight empty/operating/hydrotest in kg;
- Inspection authority and date of inspection;
- Code symbol showing if the unit is x-rayed and stress relieved;
- Design temperature and pressure;
- Operating temperature and pressure;

13.10 REPORT & ACCEPTANCE CERTIFICATES

With regard to witnessed tests the CONTRACTOR / SUPPLIER shall prepare a report on the tests and the results, these shall be included in the 'Certification Data Books'. All Data Books produced shall be complete and copies submitted to the COMPANY for review not later than 4 weeks after the date of completion of the tests.

13.11 CERTIFICATION DOCUMENTS

The COMPANY shall store in good order all material certificates, fully catalogued and indexed NDT test records, mechanical test certificates, welding qualification certificates, heat treatment certificates and hydrostatic test certificates for a minimum of 5 years after acceptance of the complete and fully certified vessel by the COMPANY.

All certificates shall be available for counter signature by the certificationauthority.

14.0 PAINTING AND PREPARATION FOR SHIPMENT

14.1 PAINTING & PROTECTIVE COATINGS

Painting, protective coatings and the procedures used for the preparation of surfaces shall be as specified in the Project Specification for Painting and Protective Coatings.

Where painting is specified, the entire vessel shall be painted, including inside of skirt, outside of bottom head, entire base ring and all skirt attachments. Nozzles shall be painted on the flange edges, inside bolt holes, and up to the gasket surface.

Fireproofed/Insulated surfaces shall be shot blasted and given one coat of primer only. The CONTRACTOR / SUPPLIER shall stencil in a prominent position in 50mm high characters the dry lifting weight of the vessel and for stress relieved vessels the words "NO WELDING PERMITTED".

14.2 PREPARATION OF SHIPMENT

After the final hydrostatic test, the vessel 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 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 CONTRACTOR / SUPPLIER shall be responsible for loading and anchoring vessels to prevent any damage during shipment.

When shipped loose, all instruments, valves, parts, etc., of a vessel shall be tagged with vessel number and purchase order number to facilitate match-up with appropriate vessel in the field. Tags and wire shall be stainless steel. All such items shall be boxed and where possible attached to the inside of the skirt or saddle.

CONTRACTOR / SUPPLIER shall state in the proposal his recommendations for long term storage (up to 12 months) for both indoor and open-air storage in a marine environment.

15.0 SPECIFIC REQUIREMENTS FOR CLAD VESSELS

15.1 DESIGN

Design calculation shall be based on the nominal thickness of the base material i.e. shall not include any allowance for the cladding thickness. The thickness of corrosion resistant linings applied to nozzles shall not be less than the thickness specified for the vessel.

The principle shall be satisfied that the design of a cladding or lining accounts for the effect of differential thermal expansion and has sufficient ductility to accommodate any strain likely to be imposed during service.

15.2 MATERIALS

Pressure vessel parts constructed of integrally clad plate, and vessel parts fully or partially lined by welding after forming, shall satisfy the requirements of ASME Section VIII DIV I Part UCL.

The use of linings other than those obtained by using integrally clad plate or overlay weld deposits shall be avoided and requires special approval of the COMPANY. Integrally clad plate shall be of the homogeneously clad type as obtained by roll cladding or explosive bonding. The clad plates shall conform to ASTM A-263, ASTM A-264 & ASTM A-265, as applicable, irrespective of the design calculation method used. Integrally clad plate shall be ultrasonically tested to check the quality of the bond in accordance with the requirements of ASTM A579, acceptance level S6. The branches in clad vessels shall be cut from tubing or fabricated from clad plate. Alternatively, the branches may be protected by corrosion resistance weld overlays.
Solid alloy nozzles may be offered as on alternative to clad nozzles in the smaller sizes where it is considered to be advantageous. Flange facings on clad vessels

shall be provided with an overlay weld deposit protection unless otherwise specified by the COMPANY. Overlay weld deposits of austenitic stainless steel weld metal on carbon and lowalloy steels shall be applied in a minimum of two layers. For the first layer type 309 weld material shall be used, and the top layer as specified.

15.3 FABRICATION

Weld overlay deposits on clad vessels shall be performed in accordance with procedures qualified to ASME IX. The proposed procedure for relevant application shall be submitted with the bid. The procedure for PWHT shall be submitted to the COMPANY for approval. It shall be demonstrated that no deleterious effects on the corrosion resistance of the cladding or weld overlay will occur during PWHT.

15.4 INSPECTION & TESTING

Clad plate formed into dished ends shall be ultrasonically retested for soundness after forming.Linings applied by overlay weld deposit, shall be ultrasonically examined for gross lack of fusion in accordance with ASTM A578 acceptance level S6. This also applies to clad restoring of welds in clad plate, where a bond of 50mm on each side of the weld shall be examined.

Vessels protected with a cladding or lining of stainless steel, or having stainless steel internals shall be hydrostatically tested as if they were of solid stainless steel, refer to clause No. 6 of this specification.

16.0 DRAWINGS AND DATA REQUIRED

CONTRACTOR / SUPPLIER information shall be supplied in accordance with the COMPANY’s procurement documentation and shall include, as a minimum, the following:

- Completed data sheets;

- General arrangement and cross-sectional drawings, complete with parts list, materials and equipment description;
- Materials and thickness of principal parts, not covered by the data sheet;
- Itemized weights, including maintenance weights, plus withdrawal dimensions;
- Foundation Loading Data;
- CONTRACTOR / SUPPLIER connection drawings complete with detailed nozzle schedule;
- Itemized list of CONTRACTOR / SUPPLIER's deviations from Specification. CONTRACTOR / SUPPLIER shall advise separate prices for the following:
  - Supply & installation of additional nozzles, rated as per data sheet, with and without reinforcement for the following nominal bores:

    2", 3", 4", 6", 8", 10", 12", 14" & 16";

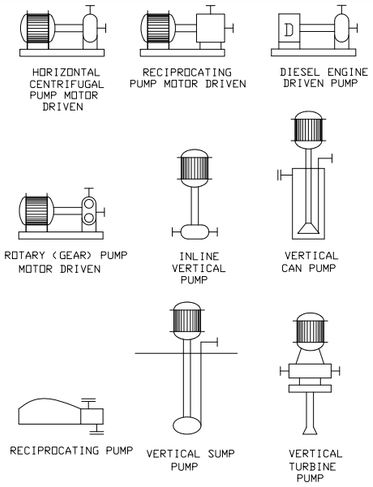
    32” Manways complete with blind flanges, bolting, gasket and davit;

    Per kg of all support clips and lugs;
- Proposed test procedure and erection details;
- Priced list of recommended commissioning spares;
- Priced list of spare parts for two years operation;
- Priced list of special tools;

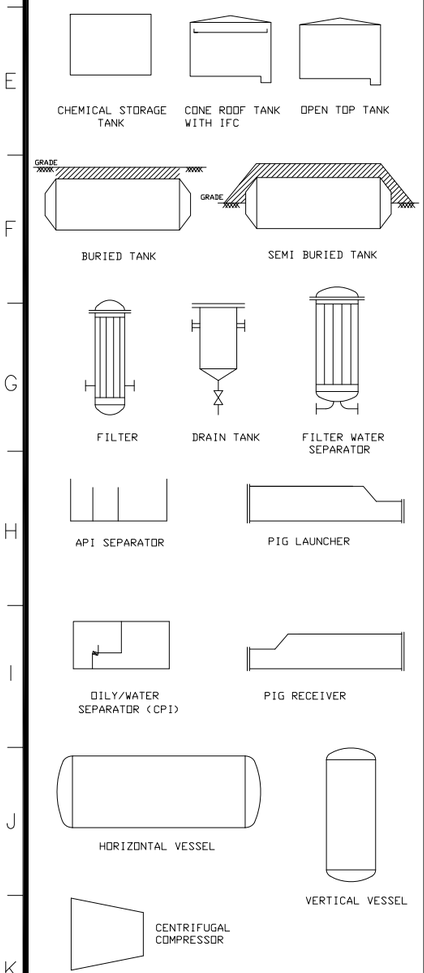
ANNEXURE-C

PIPING & INSTRUMENTATION DIAGRAMS

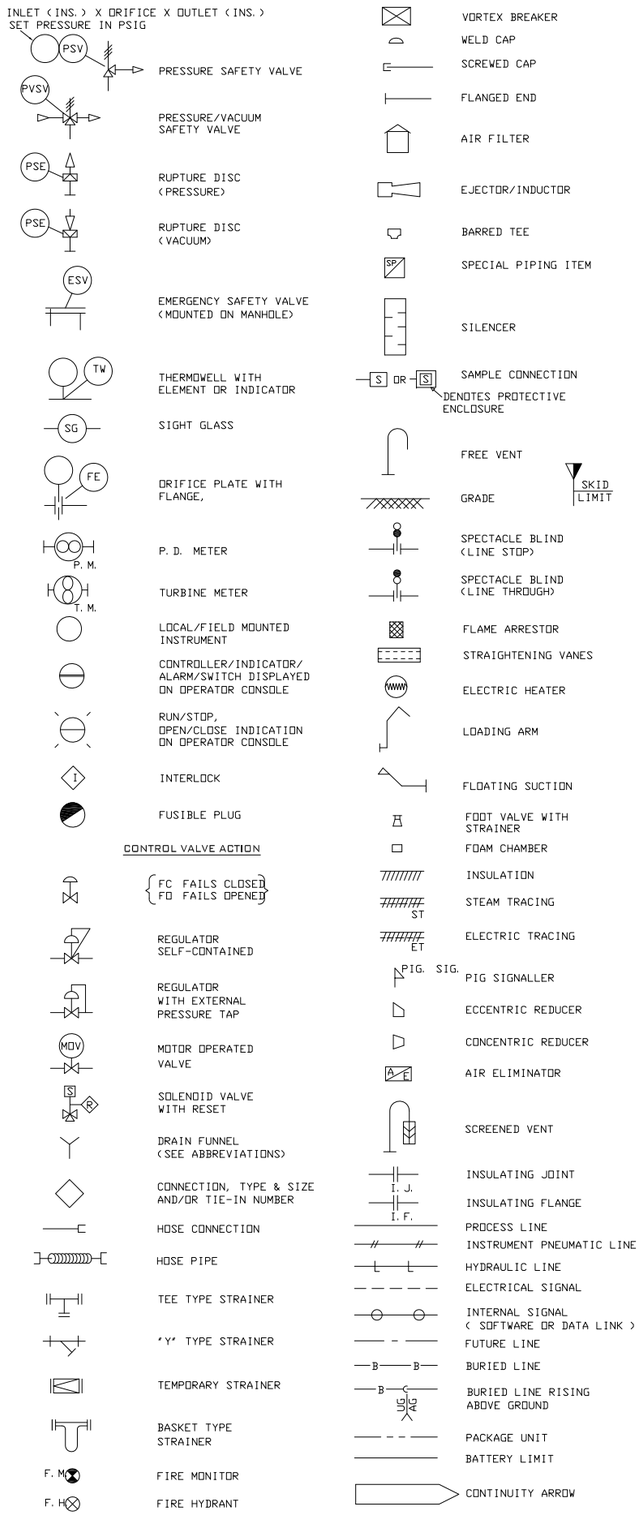
ROTARY EQUIPMENT



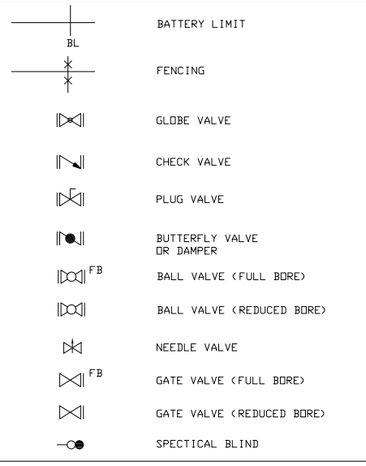
TANKS AND VESSELS



PIPING AND INSTRUMENTATION SYMBOLS



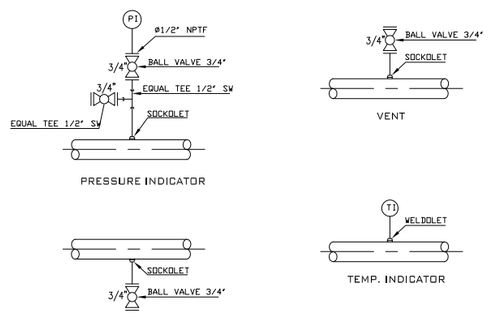
PIPING AND INSTRUMENTATION SYMBOLS



FLOW DIAGRAM IDENTIFICATION LETTERS

LETTER	FIRST LETTER	SUBSEQUENT LETTER
A	ANALYSIS	ALARM
B	BURNER FLAME	BLOCK/BYPASS
C	CONDUCTIVITY (ELECTRICAL)	CONTROLLER/CLOSED
D	DENSITY (SP. GR.)	DIFFERENTIAL
E	VOLTAGE (EMF/ELECTRICAL)	ELEMENT (PRIMARY)
F	FLOW	RATIO (FRACTION)
G	GAUGING (DIMENSIONAL)	GLASS/GAUGE
H	HAND ACTUATED (MANUAL)	HIGH
I	CURRENT (AMPS)	INDICATOR
J	POWER (WATTS)	MILTIPOINT (SCAN)
K	TIME	CONTROL STATION
L	LEVEL	LIGHT/LOW
M	MOISTURE (HUMIDITY)	MIDDLE
N	(UNCLASSIFIED)	(UNCLASSIFIED)
O	(UNCLASSIFIED)	ORIFICE/OPEN
P	PRESSURE/VACUUM	POINT
Q	QUANTITY/NUMBER	TOTALIZER/INTEGRATER
R	RUN/RESTRICTION	RECORDER
S	SPEED/FREQUENCY	SAFETY/SWITCH
T	TEMPERATURE	TRANSMITTER
U	MULTIVARIABLE	MALFUNCTION
V	VIBRATION/VISCOSITY	VALVE
W	WEIGHT/FORCE	WELL/PROBE
X	(UNCLASSIFIED)	UNCLASSIFIED
Y	(UNCLASSIFIED)	RELAY
Z	POSITION	DRIVE/ACTUATE

VENT AND DRAIN DETAILS

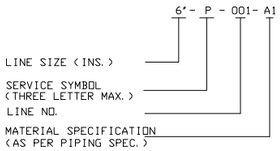


HEADER SIZE	DRAIN SIZE	VENT SIZE
3/4"–4"	3/4"	3/4"
6"–10"	3/4"	3/4"
12"–ABOVE	1 1/2"	3/4"

PIPING ABBREVATIONS

AG	– ABOVE GROUND	IJ	– INSULATING JOINT	TIP	– TIE-IN POINT
ATM	– ATMOSPHERE	HC	– HOSE CONNECTION/ HALF COUPLING HEAT CONSERVATION	T-T	– TANGENT TO TANGENT
BF	– BLIND FLANGE			UG	– UNDERGROUND
BL	– BATTERY LIMIT			V	– VENT
CO	– CHAIN OPERATED	OWS	– OILY WATER SEWER	VB	– VORTEX BREAKER
CSC	– CAR SEAL CLOSED	UC	– UTILITY CONNECTION	RW	– RAW WATER
CSO	– CAR SEAL OPEN	LC	– LOCKED CLOSE	P	– PLUGGED
DR	– DRAIN	LO	– LOCKED OPEN	RO	– RESTRICTION ORIFICE
DPI	– DIFFERENTIAL PRESSURE INDICATOR	LOR	– LOCAL-OFF-REMOTE	TS	– TEMPORARY STRAINER
FB	– FULL BORE	LP	– LOW PRESSURE	TYP	– TYPICAL
FC	– FAIL CLOSED	MOV	– MOTOR OPERATED VALVE	ESD	– EMERGENCY SHUT DOWN
FO	– FAIL OPEN	NC	– NORMALLY CLOSED		
FOB	– FLAT ON BOTTOM	NO	– NORMALLY OPEN		
FOT	– FLAT ON TOP	PP	– PERSONNEL PROTEXCTION		
GOV	– GEAR OPERATED VALVE	SC	– SAMPLE CONNECTION		
HP	– HORSE POWER OR HIGH PRESSURE	S-S	– SEAM TO SEAM		
IFC	– INTERNAL FLOATING COVER	SWS	– STORM WATER SEWER		
F/W	– FILTER WATER				

LINE NUMBER IDENTIFICATION



DRAIN SYSTEM	
DRAIN	D
OILY WATER SEWER	OWS
RECOVERED OIL	RO
FLARE	FL
OIL SYSTEM	
CRUDE OIL	CR
DIESEL FUEL	DF
GAS SYSTEMS	
FUEL GAS	FG
VENT	V
INSTRUMENT AIR	IA
SPECIAL LIQUIDS	
FOAM SOLUTION	FS
FOAM CONCENTRATE	FC
CHEMICAL INJECTION	CI
METHANOL	ME
PROCESS SERVICE	
PROCESS STREAM	P
WATER SYSTEMS	
FIRE WATER	FW
WASTE WATER	WW
RAW WATER	RW
PRODUCED WATER	PW

PIPING SPECIFICATIONS

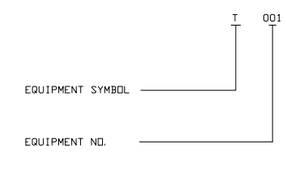
C1 - 600#

B1 - 300#

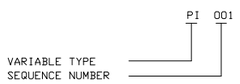
A1 - 150#

EQUIPMENT NUMBER IDENTIFICATION

B= BOILER
E= HEAT EXCHANGER
F= FILTER
G= GENERATOR
J= EDUCTOR, INDUCTOR
M= MOTOR
P= PUMP (CENTRIFUGAL, ROTARY)
S= SEPARATOR
T= ATMOSPHERIC TANK
V= VESSEL
LA= LOADING ARM
MT= METER
PU= PACKAGE UNIT
WCB= WELLHEAD CONTROL PANEL



INSTRUMENT NUMBER IDENTIFICATION



REV.	DATE	DESCRIPTION OF REVISION	PREP'D:	CHECK	APPR.
0	20-02-2019	ISSUED FOR REVIEW	MAH	SHR	
0	19-02-2019	INTERDISCIPLINARY CHECK	MAH	SHR	

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LIMITED

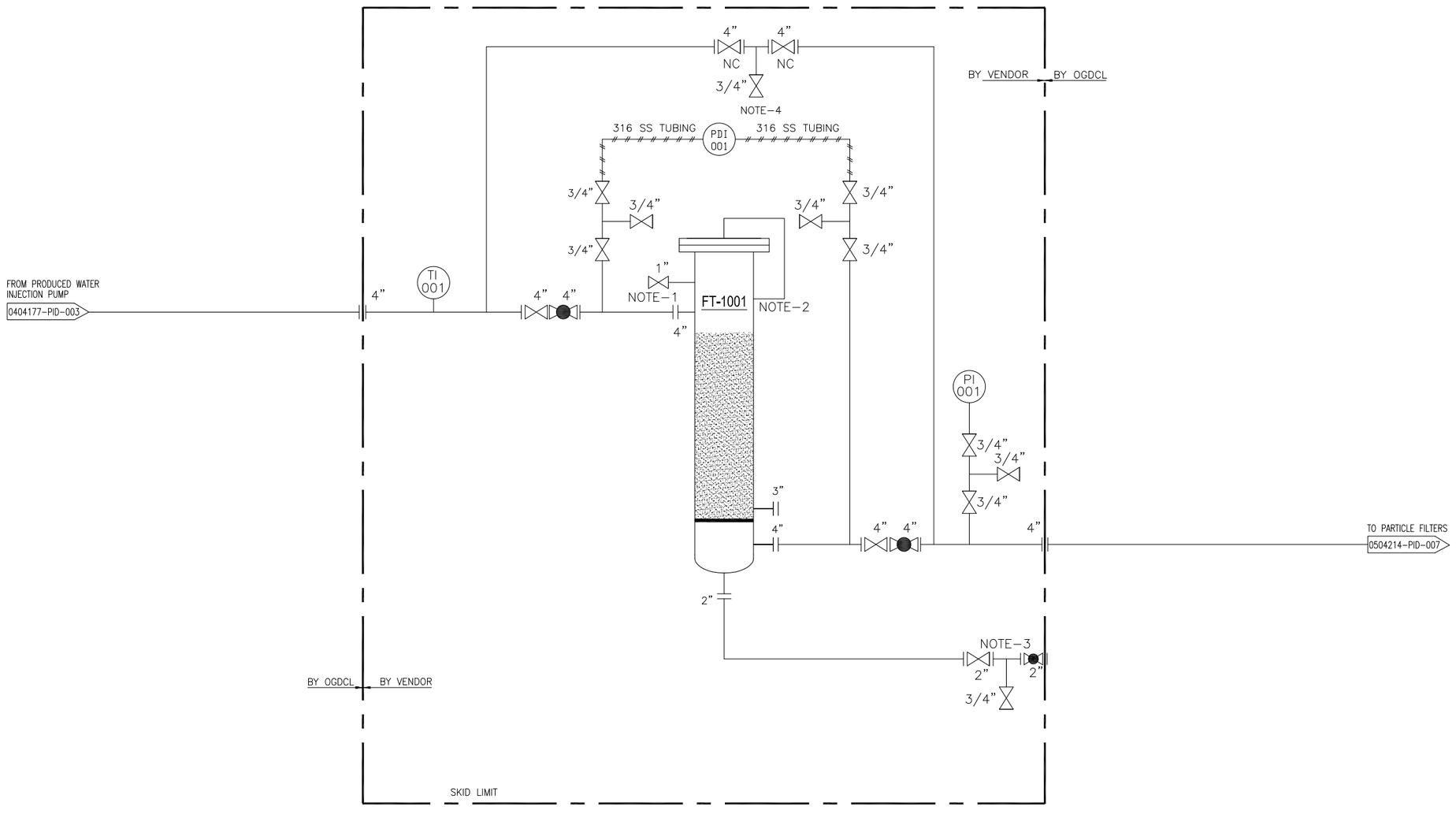
PROJECT : DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM

TITLE : PIPING & INSTRUMENTATION DIAGRAM LEGEND SHEET

JOB NO.	DRAWING NO.	SHEET NO.	SCALE	SHEET SIZE	REV.
0504214	0504214-PID-000	1 OF 1	NTS	A3	0

FT-1001

PRODUCED WATER CHARCOAL FILTER
PRESSURE DROP PSI : 5-10
INTERNAL DIAMETER : 753MM
TAN/TAN LENGTH : 2200MM



NOTES

1. VENT VALVE SHOULD BE AT OPERATOR HEIGHT LEVEL.
2. DAVIT ARM TO BE PROVIDED FOR QUICK CLOSURE OF VESSEL.
3. DRAIN VALVE TO BE PROVIDED AT SKID EDGE.
4. PRESSURE DIFFERENTIAL INDICATOR SHALL BE AT OPERATOR HEIGHT.
5. FOR SYMBOLS REFER TO DWG # 0504214-PID-000.

REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPR
1	07-12-2019	ISSUED FOR REVIEW	NJ	SHR	A. J
0	06-12-2019	INTERDISCIPLINARY CHECK	NJ	SHR	A. J

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

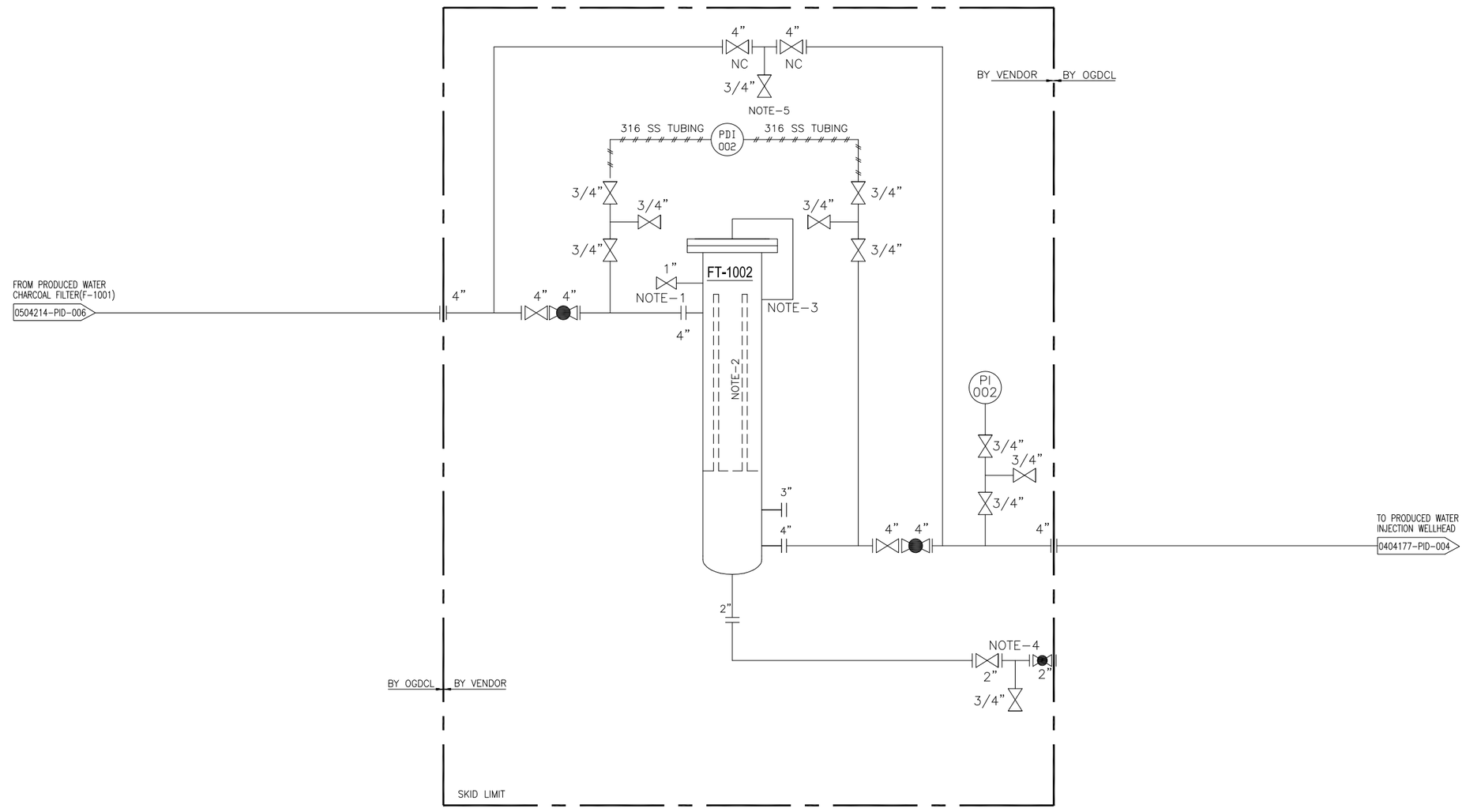
PROJECT : DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM

TITLE : PIPING & INSTRUMENTATION DIAGRAM CHARCOAL FILTER (FT-1001)

JOB NO.	DRAWING NO.	SHEET NO.	SCALE:	SHEET SIZE	REV.
0504214	0504214-PID-006	1 OF 1	NTS	A3	0

FT-1002

PRODUCED WATER PARTICULATE FILTER
PRESSURE DROP PSI : 5-10
INTERNAL DIAMETER : 753MM
TAN/TAN LENGTH : 1850MM



NOTES

1. VENT VALVE SHOULD BE AT OPERATOR HEIGHT LEVEL.
2. VENDOR TO SPECIFY THE NUMBER OF CARTRIDGES AS PER THE VESSEL DIMENSIONS.
3. DAVIT ARM TO BE PROVIDED FOR QUICK CLOSURE OF VESSEL.
4. DRAIN VALVE TO BE PROVIDED AT SKID EDGE.
5. PRESSURE DIFFERENTIAL INDICATOR SHALL BE AT OPERATOR HEIGHT.
6. FOR SYMBOLS REFER TO DWG # 0504214-PID-000.

REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPR.
1	07-12-2019	ISSUED FOR REVIEW	NJ	SHR	A. J
0	06-12-2019	INTERDISCIPLINARY CHECK	NJ	SHR	A. J

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

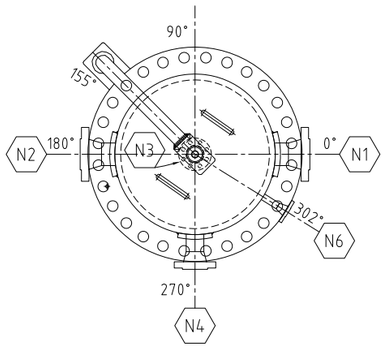
PROJECT : DETAILED ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL SYSTEM

TITLE : PIPING & INSTRUMENTATION DIAGRAM PARTICLE FILTER (FT-1002)

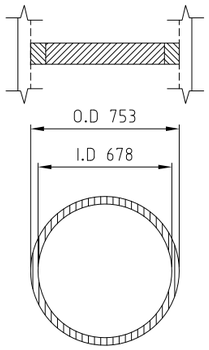
JOB NO.	DRAWING NO.	SHEET NO.	SCALE:	SHEET SIZE	REV.
0504214	0504214-PID-007	1 OF 1	NTS	A3	0

ANNEXURE-D

GENERAL ARRANGEMENT DRAWINGS

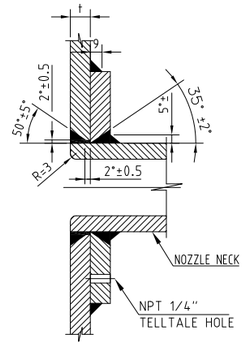


ORIENTATION PLAN

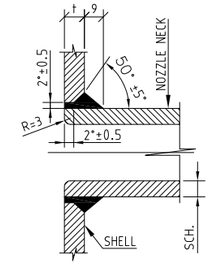


SUPPORT RING PLATE DETAIL

10mm THK.
DETAIL "A"



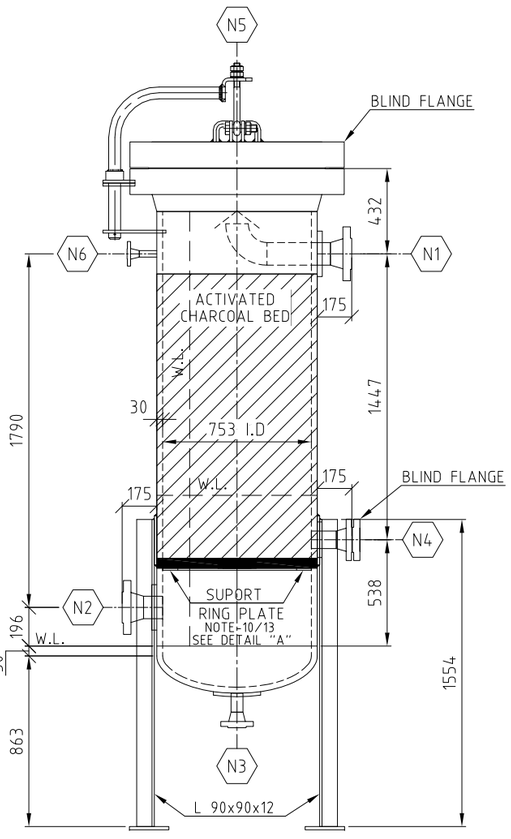
TYPICAL DETAIL OF
NOZZLES NECK WELDING
REINFORCEMENT



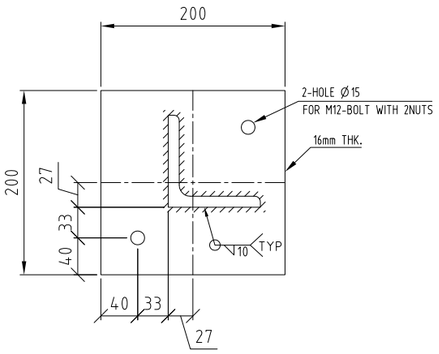
TYPICAL DETAIL OF
NOZZLES NECK WELDING

DESIGN DATA	
DESIGN CODE	ASME SEC. VIII DIV.1
ITEM NO.	CHARCOAL FILTER (F-1001)
QUANTITY (NOS.)	01
SERVICE	PRODUCED WATER/CONDENSATE
DENSITY(Kg/M^3)	1000
NOMINAL CAPACITY M^3	1.07
OPERATING CAPACITY M^3	0.884
DESIGN TEMPERATURE (°F)	130
DESIGN PRESSURE (PSI)	1400
HYDROSTATIC TEST PRESSURE(PSI)	1820
CORROSION ALLOWANCE mm	1.5
U-STAMP	YES
WIND	100 mile/hr
SEISMIC	ZONE 2B
PWHT	NO
JOINT EFFICIENCY	1
RADIOGRAPHY	RT-1 100%
WEIGHT EMPTY (Kg)	3165
OPERATING WEIGHT (Kg)	3934.5
WEIGHT FULL OF WATER (Kg)	4313

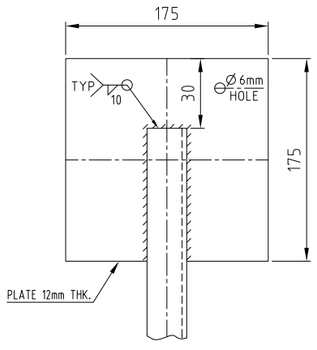
MATERIALS	
SHELL	SA 516 GR. 70
HEADS	SA 516 GR. 70
PIPES	ASTM A-106 Gr.B
FLANGES	ASTM A-105
STIFFENERS / SUPPORTS	ASTM A-36
GASKETS	SPIRAL WOUND 316L S.S, 3mm THICK COMPRESSED GRAPHITE FILLED, AS PER ASME B16.20
STUD BOLT/NUTS	SA-193 Gr.B7/SA-194 Gr. 2H
LEGS	SA-516 GR.70
REINF. PAD	SA-516 GR.70



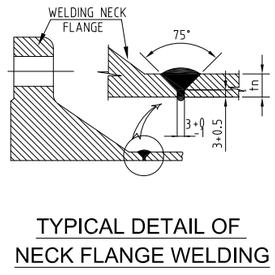
ELEVATION



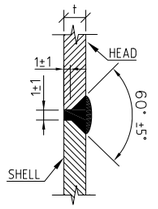
BASE PLATE



LEG REINFORCING DETAIL



TYPICAL DETAIL OF
NECK FLANGE WELDING



TYPICAL DETAIL OF
WELDING SEAM

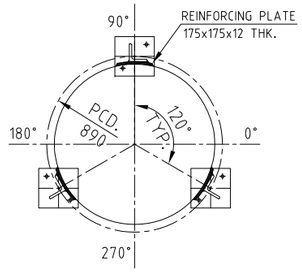


PLATE ORIENTATION PLAN

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. POST WELD HEAT TREATMENT IS NOT REQUIRED.
3. FLANGE BOLT HOLES TO STRADDLE THE NORMAL HORIZONTAL AND VERTICAL CENTERLINES. ALL REINFORCEMENT PADS FOR NOZZLES TO BE PROVIDED WITH 1/4" DIA HOLES. THESE HOLES TO BE FILLED WITH PLASTIC SEALANT OR GREASE AFTER PRESSURE TESTING.
4. ALL INTERNAL SURFACES SHALL BE CLEAN AND SMOOTH (EXCEPT WELDING).
5. THE FINISH OF THE FLANGE FACING SHALL BE SMOOTH FINISH BETWEEN 125-250 MICRO INCH (3.2-6.3 MICRO METER) VESSEL TOLERANCES SHALL BE AS PER ASME SECTION VIII DIV-1.
6. ALL FLANGES TO CONFIRM ASME B16.5 AND MANWAY FLANGE TO CONFIRM ASME B16.47.
7. ALL PARTS WELDED DIRECTLY TO THE VESSELS SHALL BE OF SAME BASE MATERIAL. RE-PADS TO BE PROVIDED FOR EXTERNAL CLIPS/BRACKETS FOR LADDERS AND PLATFORMS.
8. EXTERNAL PAINTING (SEE SPECIFICATION # 0504215-SP-002).
9. THE INTERNAL SHALL BE POSITIONED AT THE CENTRE OF VESSEL FOR PROPER WATER DISTRIBUTION.
10. THE SCREEN SHALL BE POROUS AND ABLE TO WITHSTAND THE LOAD IN OPERATING CONDITION BUT SHALL NOT ALLOW CHARCOAL TO PASS THROUGH IT.
11. VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
12. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
13. INTERNAL SUPPORT RINGS MUST BE EVALUATED BY VENDOR.
14. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
15. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
16. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
17. VENDOR TO SPECIFY THE DETAILS OF CHARCOAL BED.
18. INTERNAL SUPPORT FOR CHARCOAL BED SHALL BE ABLE TO WITHSTAND ITS WEIGHT AS SPECIFIED BY VENDOR.
19. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
20. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DUPLEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA. AND FILLER METAL AS PER STANDARDS.
22. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

NOZZLE DATA

Nozzle #	QTY.	Nominal Size	Schedule/ Thickness	Pressure/ Class	Service	Flange Type	REINF. PAD	
							O.D x I.D	THK.
N1	1	4"	SCH.120	600#	INLET	WN-RF	230x118	26
N2	1	4"	SCH.120	600#	OUTLET	WN-RF	230x118	26
N3	1	2"	SCH.160	600#	DRAIN	WN-RF	120x64	18
N4	1	3"	SCH.160	600#	BED REMOVAL	WN-RF	180x92	24
N5	1	32"	SCH.XS	600#	MANWAY	WN-RF	-	-
N6	1	1"	SCH.160	600#	VENT	WN-RF	-	-

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
1	13-12-19	ISSUED FOR REVIEW	N.U	SAR		
0	07-12-19	INTERDISCIPLINARY CHECK	N.U	SAR		

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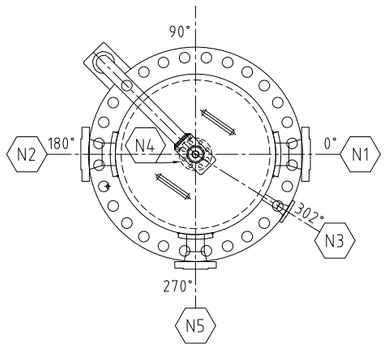
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX. +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT :
OIL & GAS DEVELOPMENT COMPANY LTD.

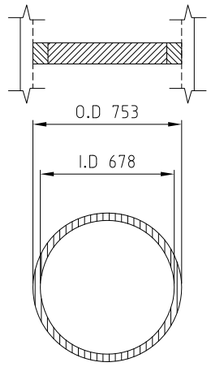
PROJECT :
DETAIL ENGINEERING DESIGN
FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE :
GENERAL ARRANGEMENT DRAWING
FOR CHARCOAL FILTER (FT-1001)

JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504214	0504214-GA-001	1 OF 1	1:30	A3	1



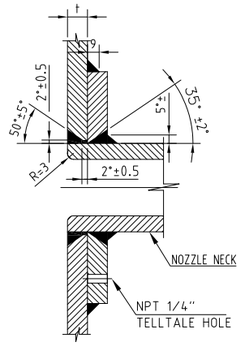
ORIENTATION PLAN



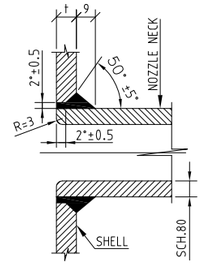
SUPPORT RING PLATE DETAIL

10mm THK.

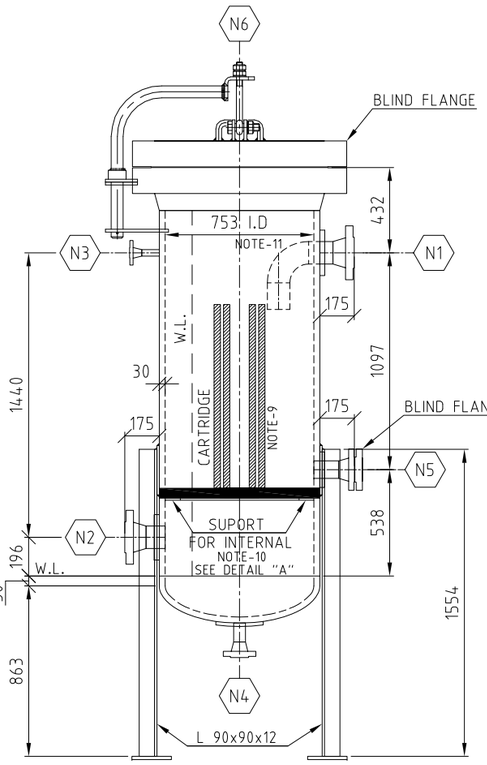
DETAIL "A"



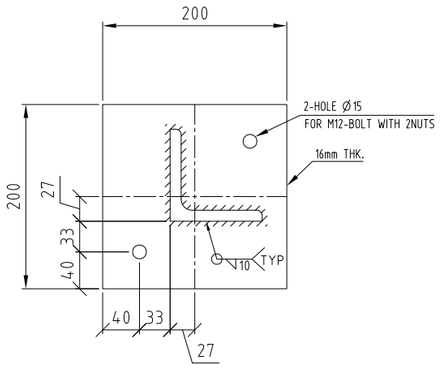
TYPICAL DETAIL OF NOZZLES NECK WELDING REINFORCEMENT



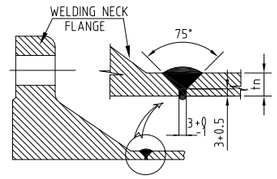
TYPICAL DETAIL OF NOZZLES NECK WELDING



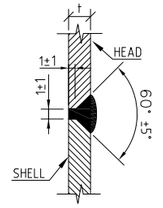
ELEVATION



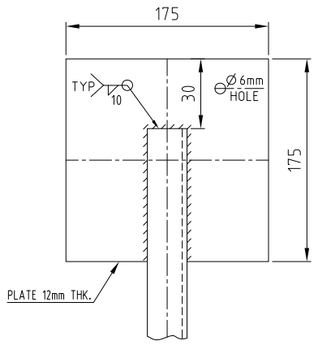
BASE PLATE DETAIL



TYPICAL DETAIL OF NECK FLANGE WELDING



TYPICAL DETAIL OF WELDING SEAM



LEG REINFORCING DETAIL

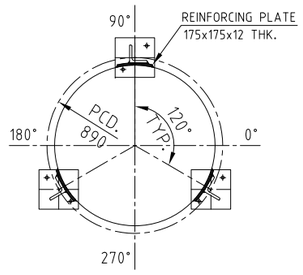


PLATE ORIENTATION PLAN

DESIGN DATA

DESIGN CODE	ASME SEC. VIII DIV.1
ITEM NO.	PARTICLE FILTER (F-1002)
QUANTITY (NOS.)	01
SERVICE	PRODUCED WATER/CONDENSATE
DENSITY(Kg/M^3)	1000
NOMINAL CAPACITY M^3	0.818
OPERATING CAPACITY M^3	0.66
DESIGN TEMPERATURE (°F)	130
DESIGN PRESSURE (PSI)	1400
HYDROSTATIC TEST PRESSURE(PSI)	1820
CORROSION ALLOWANCE mm	1.5
U-STAMP	YES
WIND	100 mile/hr
SEISMIC	ZONE 2B
PWHT	NO
JOINT EFFICIENCY	1
RADIOGRAPHY	RT-1 100%
WEIGHT EMPTY (Kg)	2972
OPERATING WEIGHT (Kg)	3892.5
WEIGHT FULL OF WATER (Kg)	3964

MATERIALS

SHELL	SA 516 GR. 70
HEADS	SA 516 GR. 70
PIPES	ASTM A-106 Gr.B
FLANGES	ASTM A-105
STIFFENERS / SUPPORTS	ASTM A-36
GASKETS	SPIRAL WOUND 316L S.S, 3mm THICK COMPRESSED GRAPHITE FILLED, AS PER ASME B16.20
STUD BOLT/NUTS	SA-193 Gr.B7/SA-194 Gr. 2H
LEGS	SA-36
REINF. PAD	SA-516 GR.70

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. POST WELD HEAT TREATMENT IS NOT REQUIRED.
3. FLANGE BOLT HOLES TO STRADDLE THE NORMAL HORIZONTAL AND VERTICAL CENTERLINES. ALL REINFORCEMENT PADS FOR NOZZLES TO BE PROVIDED WITH 1/4" DIA HOLES. THESE HOLES TO BE FILLED WITH PLASTIC SEALANT OR GREASE AFTER PRESSURE TESTING.
4. ALL INTERNAL SURFACES SHALL BE CLEAN AND SMOOTH (EXCEPT WELDING).
5. THE FINISH OF THE FLANGE FACING SHALL BE SMOOTH FINISH BETWEEN 125-250 MICRO INCH (3.2-6.3 MICRO METER) VESSEL TOLERANCES SHALL BE AS PER ASME SECTION VIII DIV-1.
6. ALL FLANGES TO CONFIRM ASME B16.5 AND MANWAY FLANGE TO CONFIRM ASME B16.47.
7. ALL PARTS WELDED DIRECTLY TO THE VESSELS SHALL BE OF SAME BASE MATERIAL. RE-PADS TO BE PROVIDED FOR EXTERNAL CLIPS/BRACKETS FOR LADDERS AND PLATFORMS.
8. EXTERNAL PAINTING (SEE SPECIFICATION # 0504214-SP-014).
9. VENDOR TO SPECIFY THE NUMBER OF CARTRIDGES AS PER THE VESSEL DIMENSIONS.
10. THE SUPPORT PLATE SHALL BE ABLE TO WITHSTAND THE LOAD IN OPERATING CONDITION.
11. VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
12. VENDOR TO PROVIDE FULL DETAILS OF VESSEL INTERNALS.
13. INTERNAL SUPPORT RINGS MUST BE EVALUATED BY VENDOR.
14. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
15. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
16. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
17. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
18. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
19. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DUPLEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA.AND FILLER METAL AS PER STANDARDS.
20. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

NOZZLE DATA

Nozzle #	QTY.	Nominal Size	Schedule/ Thickness	Pressure/ Class	Service	Flange Type	REINFORCEMENT	REINF. PAD O.D x I.D	REINF. PAD THK.
N1	1	4"	SCH.120	600#	INLET	WN-RF	YES	230x118	26
N2	1	4"	SCH.120	600#	OUTLET	WN-RF	YES	230x118	26
N3	1	1"	SCH.160	600#	VENT	WN-RF	NO	-	-
N4	1	2"	SCH.160	600#	DRAIN	WN-RF	YES	120x64	18
N5	1	3"	SCH.160	600#	TUBESHEET DRAIN	WN-RF	YES	180x92	24
N6	1	32"	SCH.XS	600#	MANWAY	WN-RF	NO	-	-

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
1	13-12-19	ISSUED FOR REVIEW	N.U	SAR		
0	07-12-19	INTERDISCIPLINARY CHECK	N.U	SAR		

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX. +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

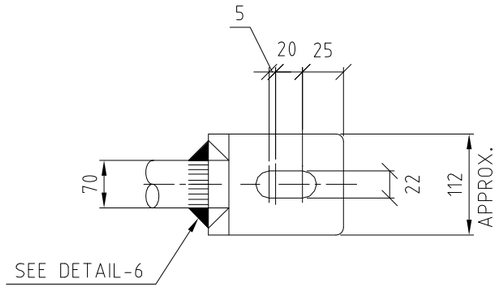
PROJECT : DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE : GENERAL ARRANGEMENT DRAWING FOR PARTICLE FILTER (FT-1002)

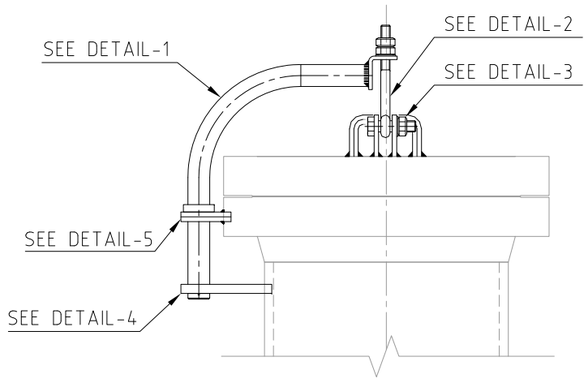
JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504214	0504214-GA-002	1 OF 1	1:30	A3	1

ANNEXURE-E

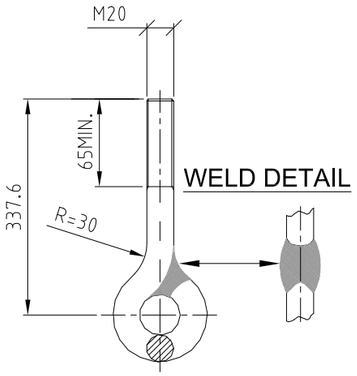
DAVIT ARM DETAILS



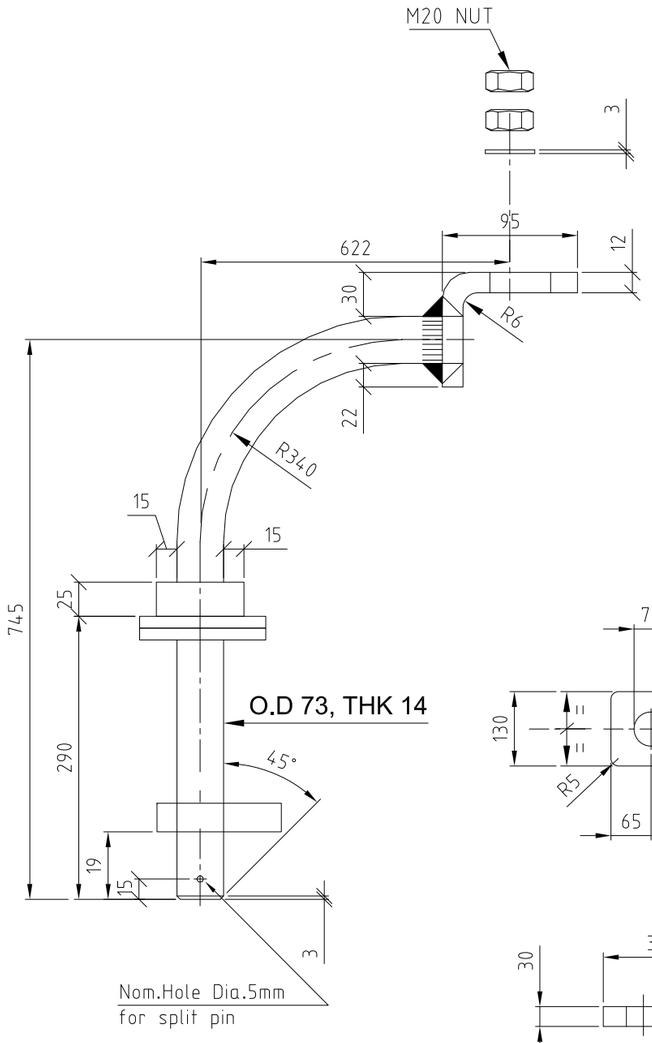
DETAIL-1



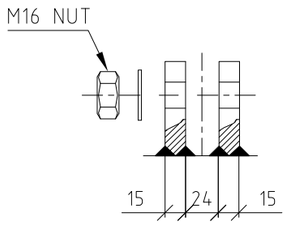
MANHOLE DETAIL
WITH DAVIT ARM

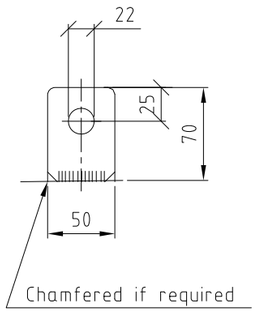


DETAIL-2

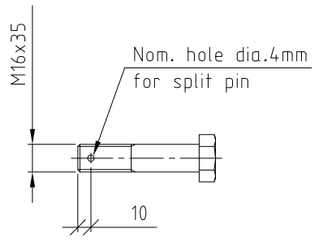


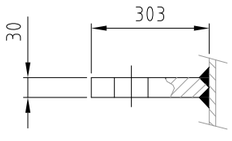
DETAIL-1



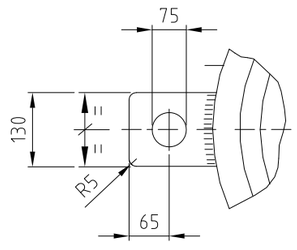


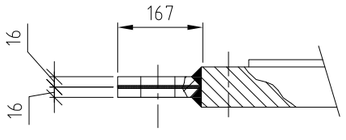
DETAIL-3



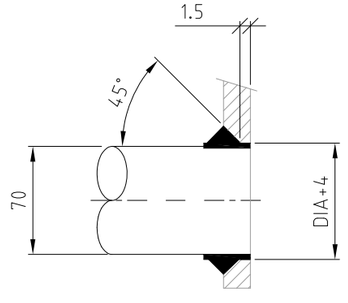


DETAIL-4





DETAIL-5



DETAIL-6

NOTES:

1. Design
   a. Position of davit to be stated on equipment drawing.
   b. Welding shall be in accordance with the applicable design code.
   c. When insert are welded to fill nozzle area davit construction cannot be applied.
2. Finishing
   a. All movable parts of davit assembly to be thoroughly lubricated and coated with grease before dispatch.
   b. Davit assembly must be in true vertical alignment after welding to flange.
   c. No zinc containing coatings to be applied on the stainless steel eye bolt.
3. All dimensions are in millimeters.
4. Materials

Blind Flange:	As specified on requisition and/or equip. drawing
Grips:	Carbon Steel, weldable quality
Davit:	Carbon Steel, weldable quality
Davit bearing ring:	Carbon Steel, weldable quality
Eye bolt acc. To detail 2:	ASTM A 320–B8
Eye bolt acc. To DN 444:	Carbon steel, commercial quality
Davit top–end:	ASTM–283–C or equivalent
Bolt/nut:	ASTM A 193–B7/ ASTM A 194 – GR 2h
Washer:	Carbon Steel, commercial quality
Split pin:	Carbon steel, commercial quality
Lugs:	equivalent to nozzle material
Flanges and nozzle neck:	As per requisition or equipment drawing
Screw thread of fastners:	Metric coarse thr. serie tolerance class 6g/6h to iso 965/2

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
1	08/12/19	ISSUED FOR REVIEW	MK	SAR		
0	07/12/19	INTERDISCIPLINARY CHECK	MK	SAR		

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

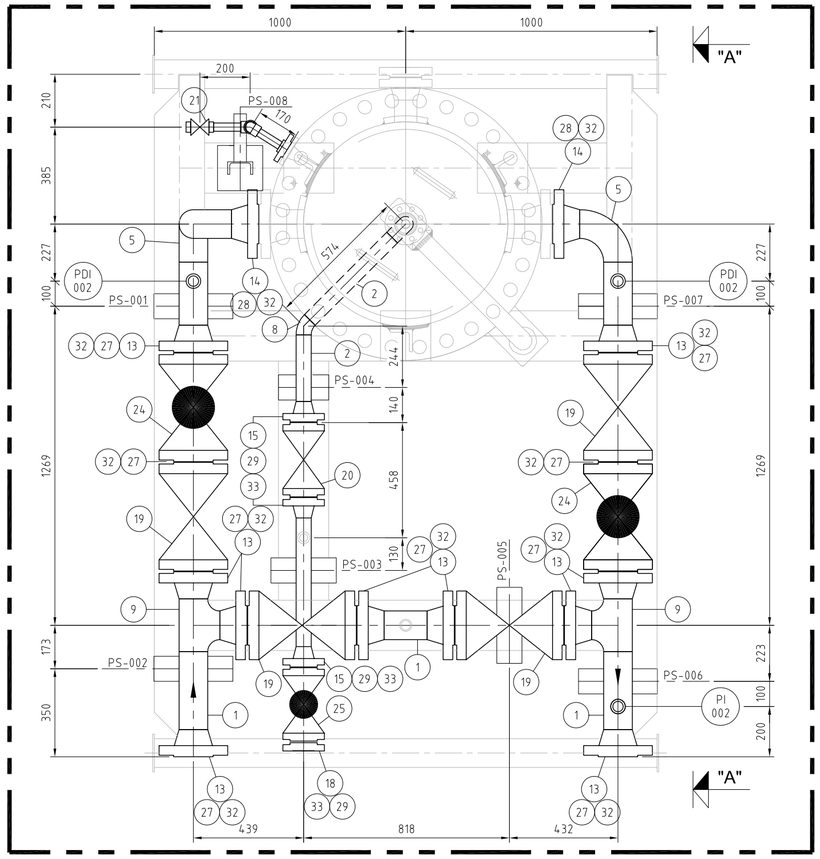
PROJECT : DETAIL ENGINEERING DESIGN
FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE : DAVIT ARM DETAIL

JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504214	0504214–GA–003	1 OF 1	1:50	A3	1

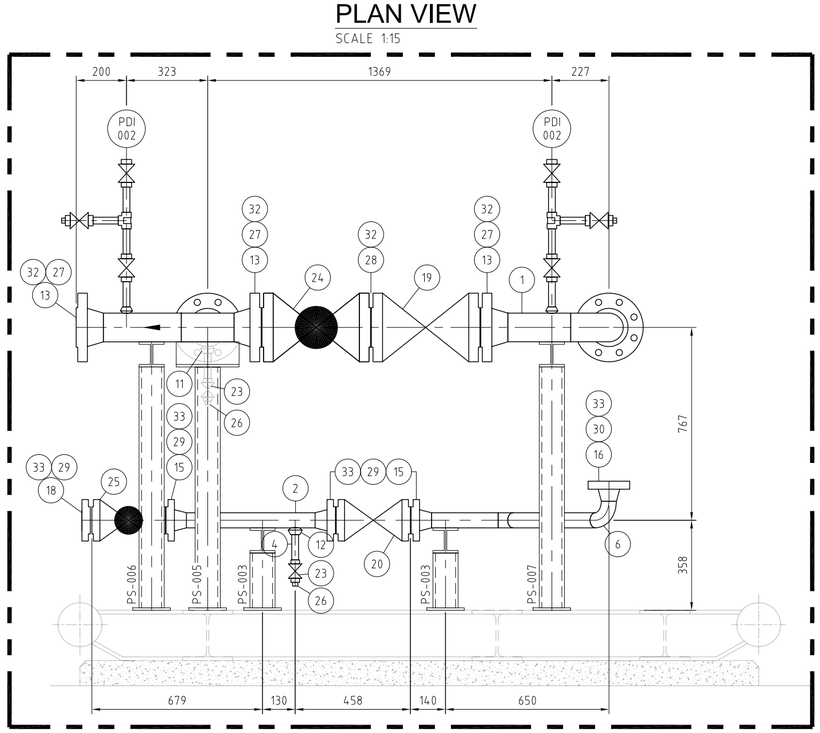
ANNEXURE-F

PIPING ARRANGEMENT DRAWINGS



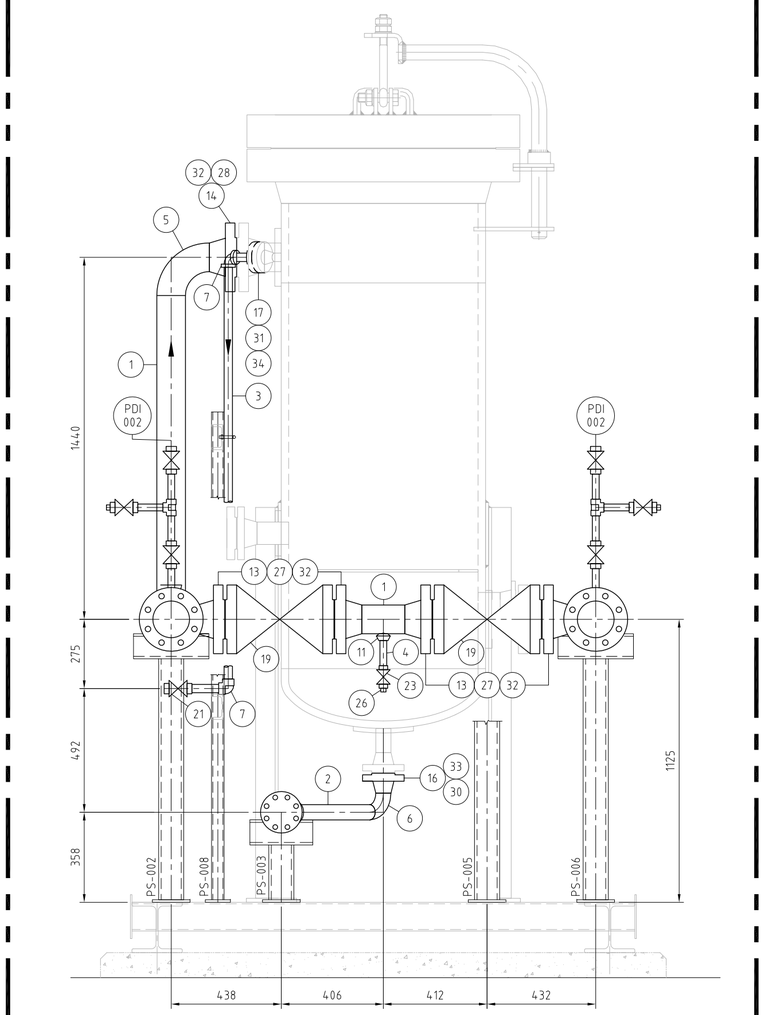
PLAN VIEW

SCALE 1:15



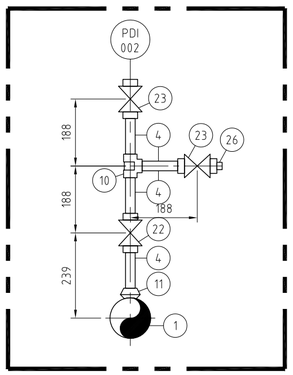
SECTION -A

SCALE 1:15

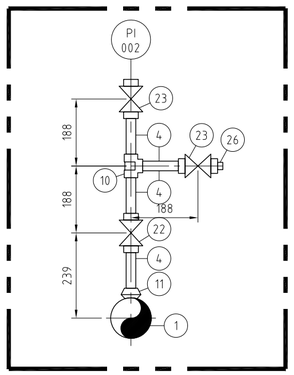


ELEVATION VIEW

SCALE 1:20



PDI DETAIL



PI DETAIL

BILL OF MATERIAL

Sr.NO.	SIZE	DESCRIPTION	QTY.	(MAT. SPEC)	REMARKS
1	4"	PIPE SCH.80 BE SMLS, ASTM A-106 GR.B	2.6M	C1	
2	2"	PIPE SCH.80 BE SMLS, ASTM A-106 GR.B	1.5M	C1	
3	1"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	2.1	C1	
4	3/4"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.6M	C1	
5	4"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	3	C1	
6	2"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	1	C1	
7	1"	ELBOW 90° 3000#, ASTM A-105 S.W	2	C1	
8	2"	ELBOW 45° LR SCH. 80, ASTM A-234 GR.WPB BW	1	C1	
9	4"	EQUAL TEE SCH. 80, ASTM A-234 GR.WPB BW	2	C1	
10	3/4"	EQUAL TEE, 3000#, ASTM A-105 S.W	3	C1	
11	4"x3/4"	SOCKOLET, 3000#, ASTM A-105	4	C1	
12	2"x3/4"	SOCKOLET, 3000#, ASTM A-105	1	C1	
13	4"	FLG, WN 600# RTJ, SCH.80 ASTM A-105	10	C1	
14	4"	FLG, WN 600# RF, SCH.80 ASTM A-105	2	-	
15	2"	FLG, WN 600# RTJ, SCH.80 ASTM A-105	3	C1	
16	2"	FLG, WN 600# RF, SCH.80 ASTM A-105	1	-	
17	1"	FLG, SW 600# RF, SCH.80 ASTM A-105	1	-	
18	2"	FLG, BLIND 600# RTJ, ASTM A-105	1	C1	
19	4"	GATE VALVE RTJ. 600#, SEE TAG NO. VG-103	4	C1	
20	2"	GATE VALVE RTJ. 600#, SEE TAG NO. VG-103	1	C1	
21	1"	GATE VALVE 800# SW, SEE TAG NO. VG-100	1	C1	
22	3/4"	GATE VALVE 800# SW, SEE TAG NO. VG-100	3	C1	
23	3/4"	GATE VALVE 800# SW-NPT, ASTM A-105	8	-	
24	4"	GLOBE VALVE RTJ. 600#, SEE TAG NO. VGL-103	2	C1	
25	2"	GLOBE VALVE RTJ. 600#, SEE TAG NO. VGL-103	1	C1	
26	3/4"	PLUG, ROUND HEAD NPT, ASTM A-105	5	-	
27	4"	OCTAGONAL RING, TYPE 316L S.S. R-37	12	C1	
28	4"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	2	-	
29	2"	OCTAGONAL RING, TYPE 316L S.S. R-23	4	C1	
30	2"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	-	
31	1"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	-	
32	7/8"	LG STUD BOLTS C/W 2 NUTS 145mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	112	C1	
33	5/8"	LG STUD BOLTS C/W 2 NUTS 110mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	40	C1	
34	5/8"	LG STUD BOLTS C/W 2 NUTS 90mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	4	C1	

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	09/12/19	ISSUED FOR REVIEW	MK	SAR		
0	08/12/19	INTERDISCIPLINARY CHECK	MK	SAR		

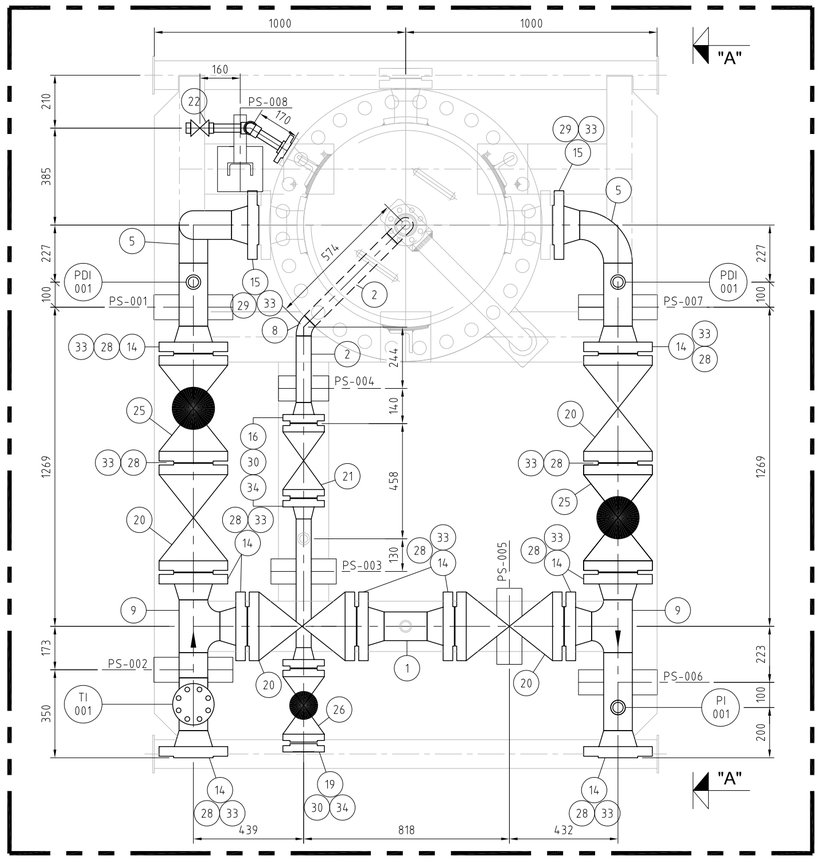
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN.
TEL: +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

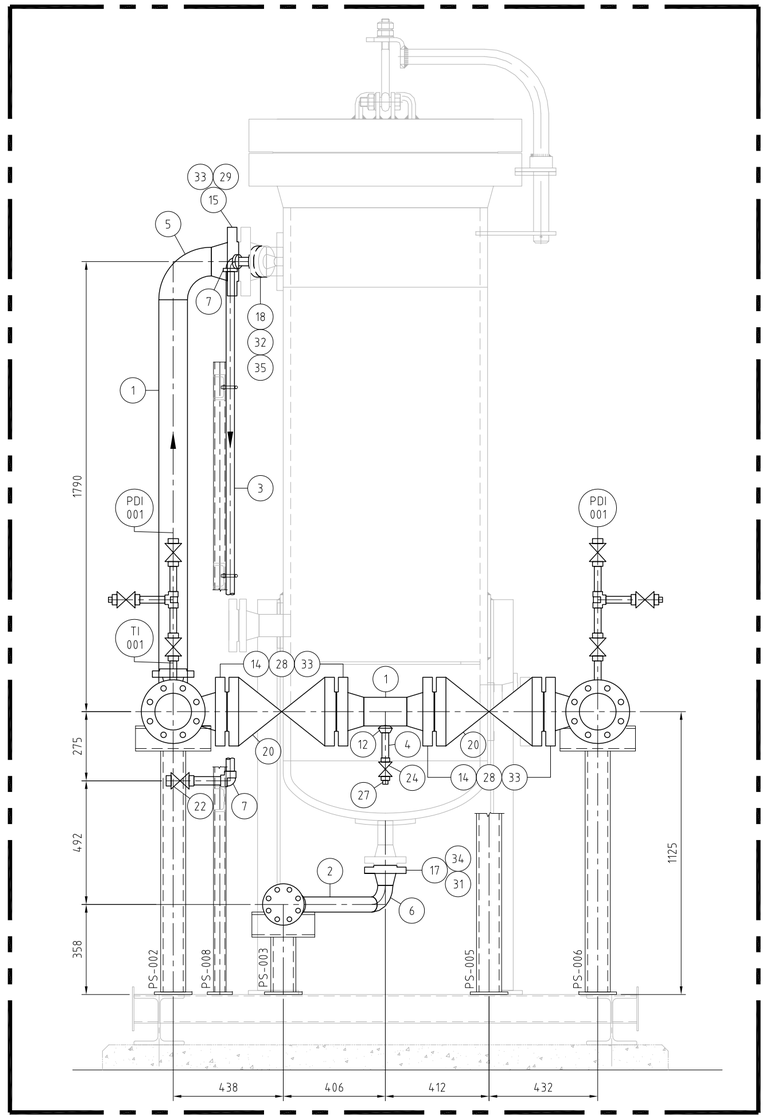
TITLE: PARTICULATE FILTER (FT-1002) PIPING ARRANGEMENT

DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-FT-002	1	1	A3 -	1



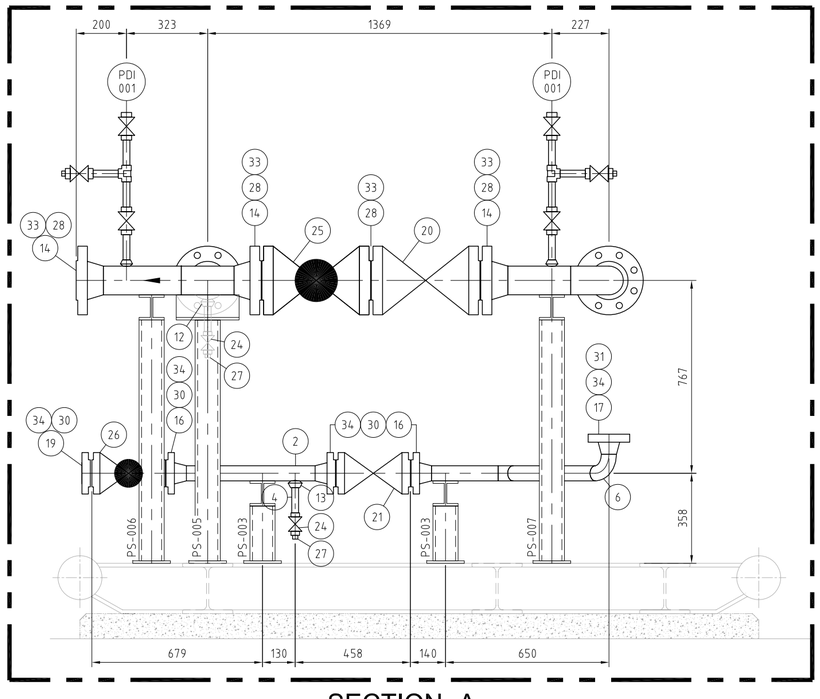
PLAN VIEW

SCALE 1:15



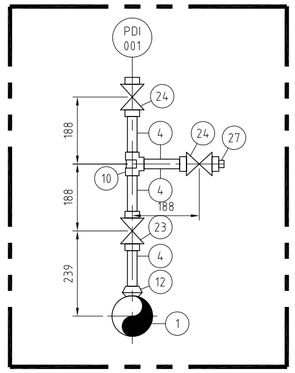
ELEVATION VIEW

SCALE 1:20

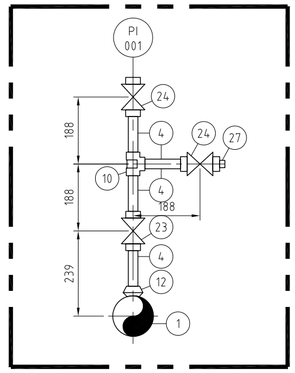


SECTION -A

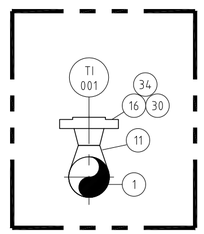
SCALE 1:15



PDI DETAIL



PI DETAIL



TI DETAIL

BILL OF MATERIAL

Sr.NO.	SIZE	DESCRIPTION	QTY.	(MAT. SPEC)	REMARKS
1	4"	PIPE SCH.80 BE SMLS, ASTM A-106 GR.B	2.9M	C1	
2	2"	PIPE SCH.80 BE SMLS, ASTM A-106 GR.B	1.5M	C1	
3	1"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	2.5	C1	
4	3/4"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.6M	C1	
5	4"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	3	C1	
6	2"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	1	C1	
7	1"	ELBOW 90° 3000#, ASTM A-105 S.W	2	C1	
8	2"	ELBOW 45° LR SCH. 80, ASTM A-234 GR.WPB BW	1	C1	
9	4"	EQUAL TEE SCH. 80, ASTM A-234 GR.WPB BW	2	C1	
10	3/4"	EQUAL TEE, 3000#, ASTM A-105 S.W	3	C1	
11	4"x2"	RED. TEE SCH. 80, ASTM A-234 GR.WPB BW	1	C1	
12	4"x3/4"	SOCKOLET, 3000#, ASTM A-105	4	C1	
13	2"x3/4"	SOCKOLET, 3000#, ASTM A-105	1	C1	
14	4"	FLG, WN 600# RTJ, SCH.80 ASTM A-105	10	C1	
15	4"	FLG, WN 600# RF, SCH.80 ASTM A-105	2	-	
16	2"	FLG, WN 600# RTJ, SCH.80 ASTM A-105	4	C1	
17	2"	FLG, WN 600# RF, SCH.80 ASTM A-105	1	-	
18	1"	FLG, SW 600# RF, SCH.80 ASTM A-105	1	-	
19	2"	FLG, BLIND 600# RTJ, ASTM A-105	1	C1	
20	4"	GATE VALVE RTJ. 600#, SEE TAG NO. VG-103	4	C1	
21	2"	GATE VALVE RTJ. 600#, SEE TAG NO. VG-103	1	C1	
22	1"	GATE VALVE 800# SW, SEE TAG NO. VG-100	1	C1	
23	3/4"	GATE VALVE 800# SW, SEE TAG NO. VG-100	3	C1	
24	3/4"	GATE VALVE 800# SW-NPT, ASTM A-105	8	-	
25	4"	GLOBE VALVE RTJ. 600#, SEE TAG NO. VGL-103	2	C1	
26	2"	GLOBE VALVE RTJ. 600#, SEE TAG NO. VGL-103	1	C1	
27	3/4"	PLUG, ROUND HEAD NPT, ASTM A-105	5	-	
28	4"	OCTAGONAL RING, TYPE 316L S.S. R-37	12	C1	
29	4"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	2	-	
30	2"	OCTAGONAL RING, TYPE 316L S.S. R-23	4	C1	
31	2"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	-	
32	1"	GASKET 600# 3mm THICK COMPRESSED GRAPHITE FILLED, SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	-	
33	7/8"	LG STUD BOLTS C/W 2 NUTS 145mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	112	C1	
34	5/8"	LG STUD BOLTS C/W 2 NUTS 110mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	48	C1	
35	5/8"	LG STUD BOLTS C/W 2 NUTS 90mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	4	C1	

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
1	09/12/19	ISSUED FOR REVIEW	MK	SAR		
0	08/12/19	INTERDISCIPLINARY CHECK	MK	SAR		
			CONSULTANT			CLIENT

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL: +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

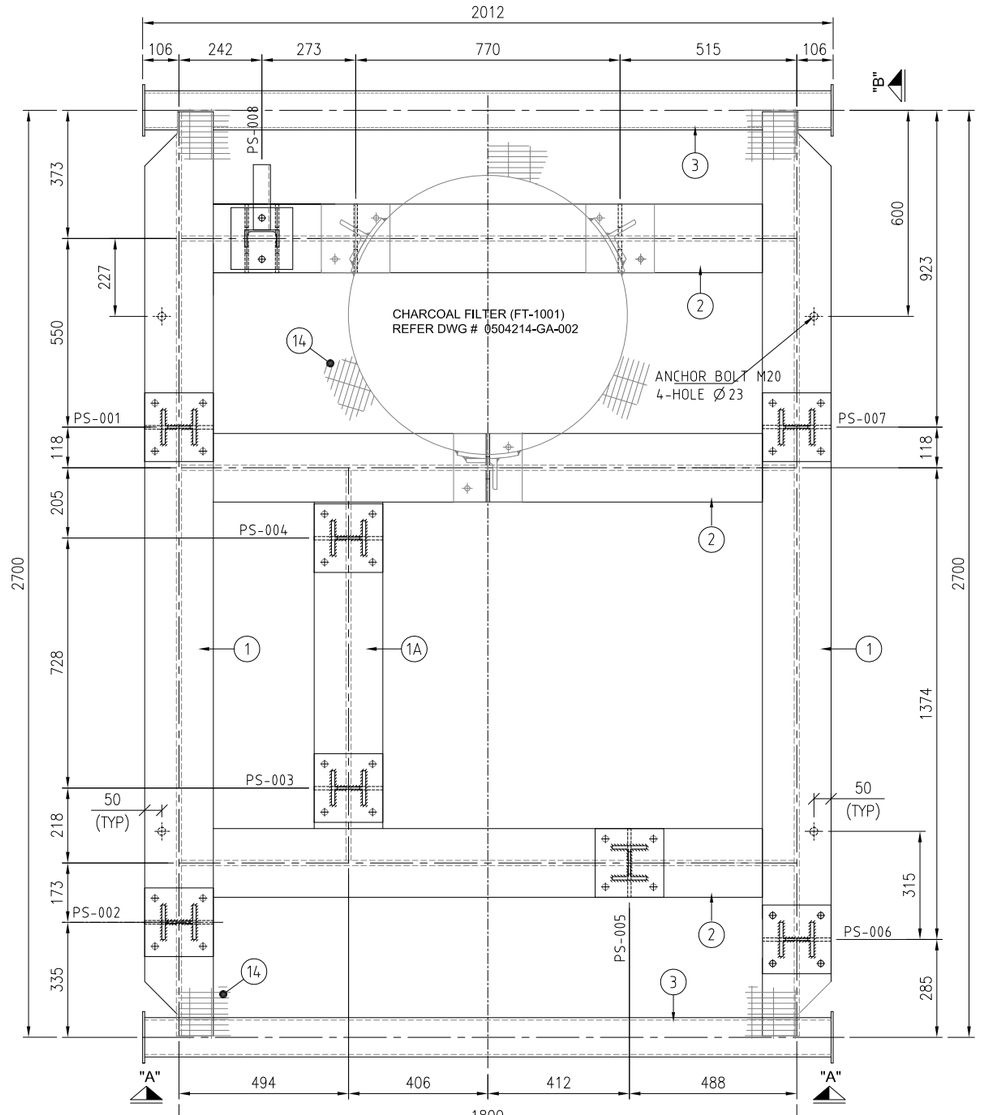
PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE: CHARCOAL FILTER (FT-1001) PIPING ARRANGEMENT

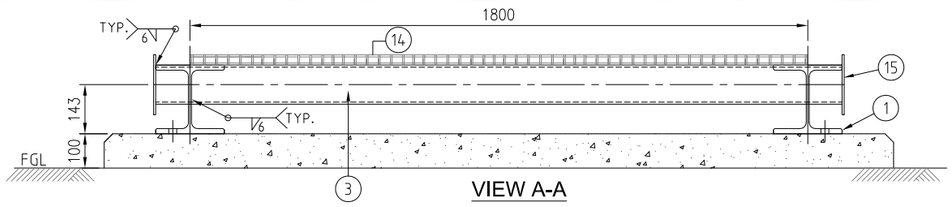
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-FT-001	1	1	A3 -	1

ANNEXURE-G

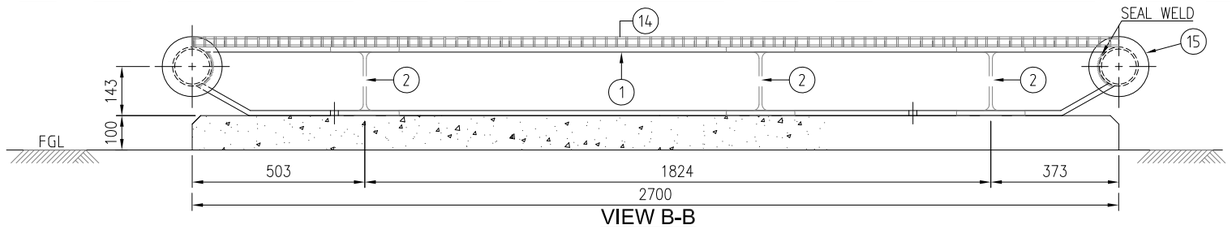
SKID DRAWINGS



PLAN



VIEW A-A



VIEW B-B

16	GUSSET PLATE (AREA=17091mm²) 10mm THK.	24	ASTM A-36	78.5 KG/M²	38
15	COVER PLATE Ø175x6mm THK.	4	ASTM A-36	47.1 KG/M²	5
14	GRATING, LOAD BEARING BAR AREA =4.4 M²	1	ASTM A-36	42.87 Kg/m²	189
13	BOLT M16x85	36	A193 Gr.B7 A194 Gr.2H	-	-
12A	U-BOLT 3/8"Ø WITH 4 NUTS FOR PIPE Ø2"	2	ASTM A-36	-	-
12	U-BOLT 1/4"Ø WITH 4 NUTS FOR PIPE Ø1"	3	ASTM A-36	-	-
11	U-BOLT 1/2"Ø WITH 4 NUTS FOR PIPE Ø4"	4	ASTM A-36	-	-
10	BASE PLATE 180x180x10mm THK.	1	ASTM A-36	78.5 KG/M²	3
9	BASE PLATE 200x200x10mm THK.	7	ASTM A-36	78.5 KG/M²	22
8	CH-100x50x10 200mm LG.	3	ASTM A-36	10.2 KG/M	6
7A	CH-100x50x10 2505mm LG.	1	ASTM A-36	10.2 KG/M	26
7	CH-100x50x10 200mm LG.	1	ASTM A-36	10.2 KG/M	2
6B	HEB-100 (1015mm LG.)	1	ASTM A-36	20.4 KG/M	21
6A	HEB-100 (310mm LG.)	3	ASTM A-36	20.4 KG/M	19
6	HEB-100 (218mm LG.)	2	ASTM A-36	20.4 KG/M	9
5	HEB-100 (310mm LG.)	4	ASTM A-36	20.4 KG/M	26
4	HEB-100 (958mm LG.)	4	ASTM A-36	20.4 KG/M	78
3	PIPE Ø4" SCH.40 (2000 LG.)	2	ASTM A-106 GR.B	16.06 KG/M	64
2	HEB-200 (1785mm LG.)	3	ASTM A-36	61.3 KG/M	328
1A	HEB-200 (1135mm LG.)	1	ASTM A-36	61.3 KG/M	70
1	HEB-200 (2700mm LG.)	2	ASTM A-36	61.3 KG/M	331
PART NO.	DESCRIPTION	QTY.	MATERIAL	UNIT WT.(KG/M) / TOTAL WT.(Kg)	TOTAL WT. (KG) / 1237

BILL OF MATERIAL

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. CONTRACTOR WILL ADD ANY REQUIRED ITEM AS PER SCOPE OF WORKS, DRAWINGS AND SPECIFICATIONS.
3. MENTIONED QUANTITIES ARE ESTIMATED; CONTRACTOR WILL VERIFY AND ESTIMATE THE BILL OF OF QUANTITIES
4. DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		
			CONSULTANT			CLIENT

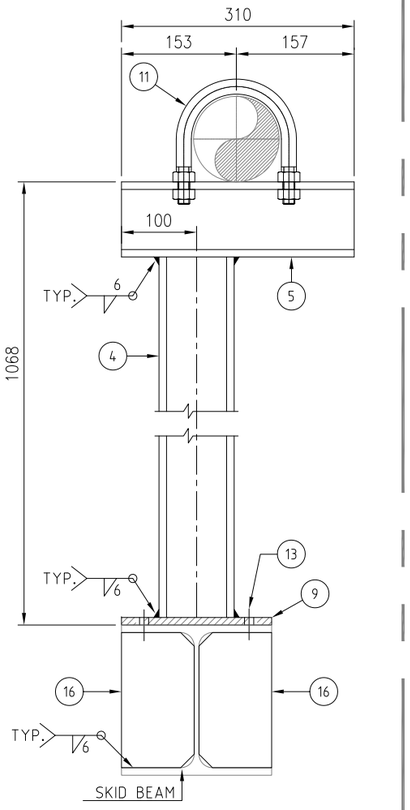
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

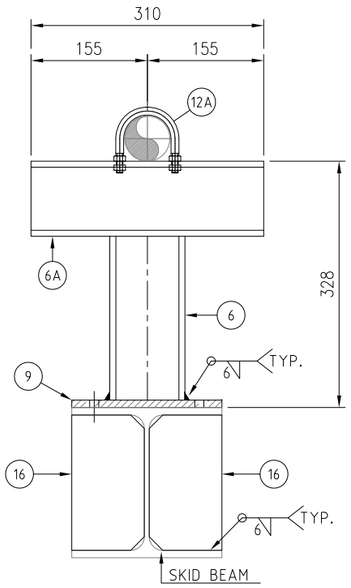
PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE: CHARCOAL FILTER (FT-1001) SKID & PIPE SUPPORT DETAIL

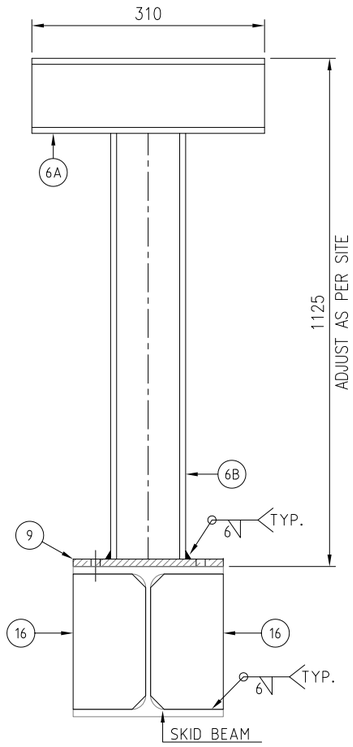
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-CIV-ST-001	1	2	A3	1



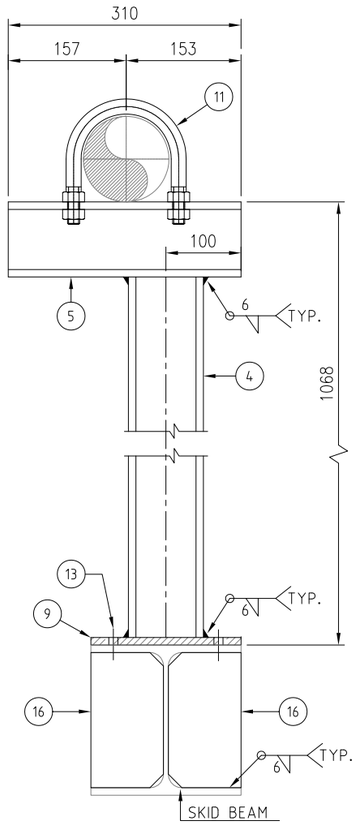
PS-001 & PS-002



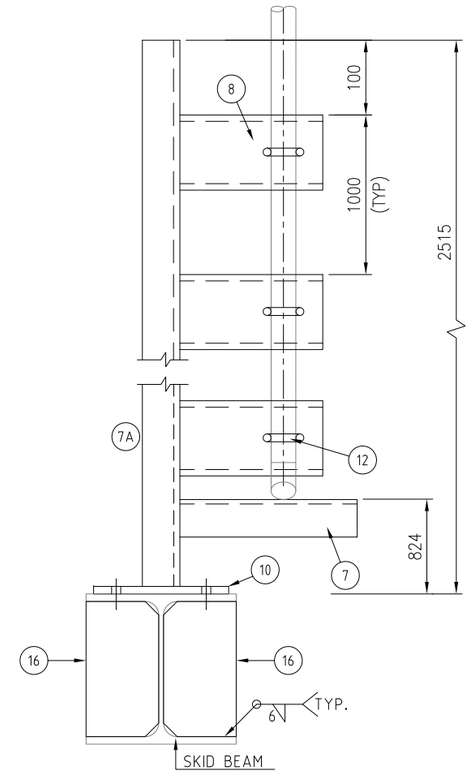
PS-003 & PS-004



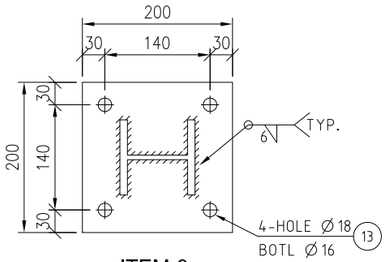
PS-005



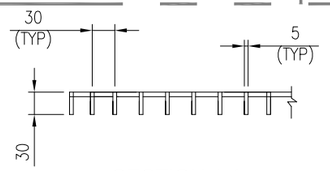
PS-006 & PS-007



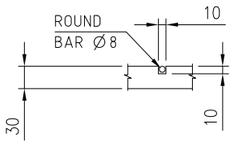
PS-008



ITEM-9



SECTION 1-1



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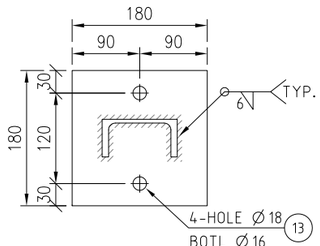
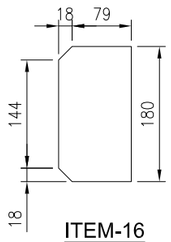
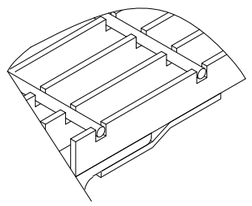


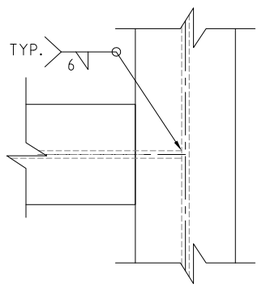
ITEM-10

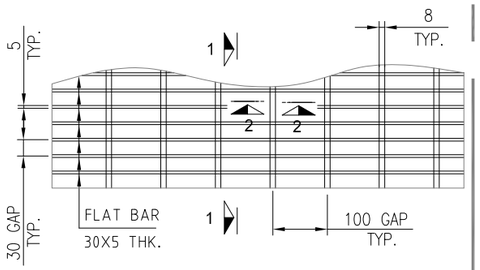


ITEM-16

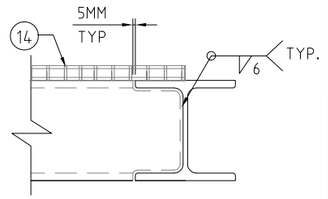


GRATING ATTACHMENT





TYP. GRATING DETAIL



TYP BEAM TO BEAM (HEB-200) CONNECTION DETAIL

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

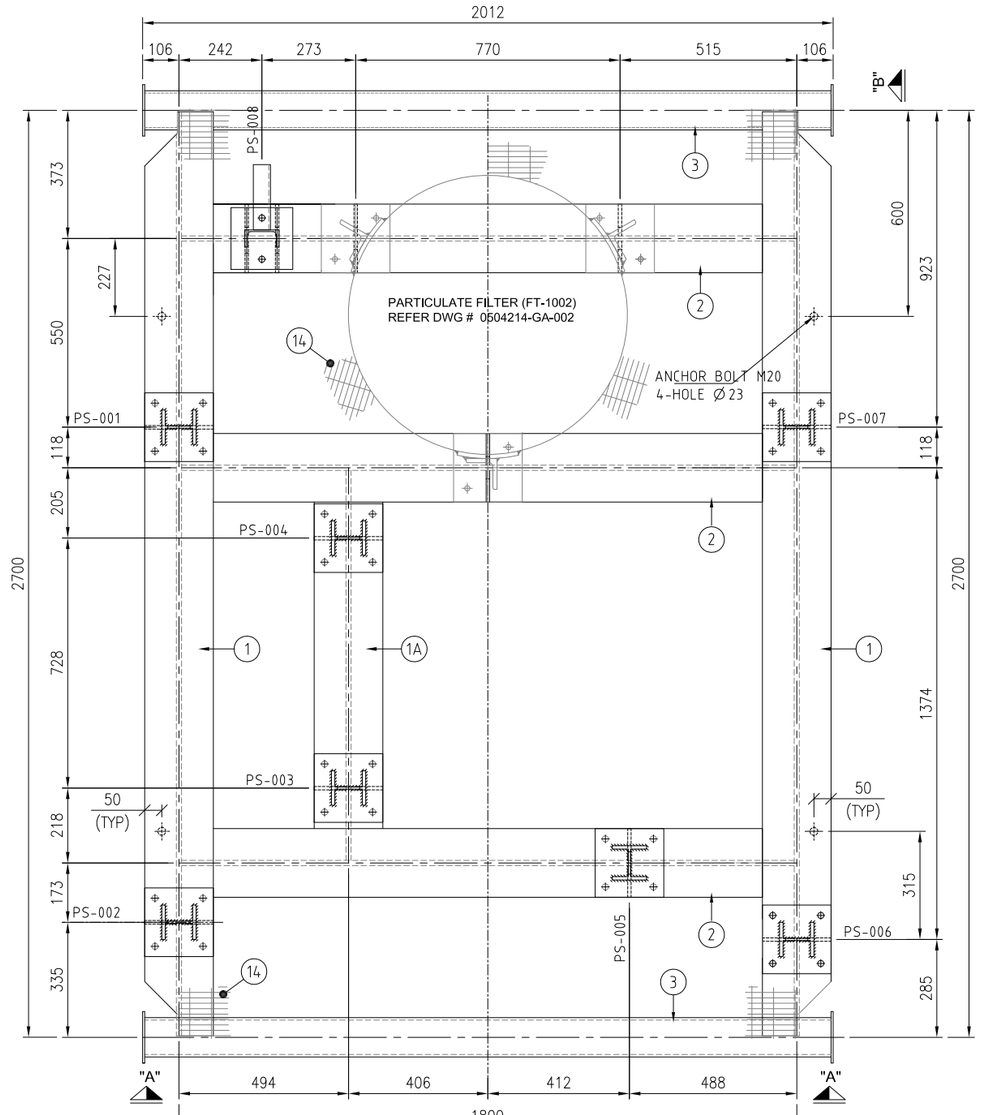
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX. +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

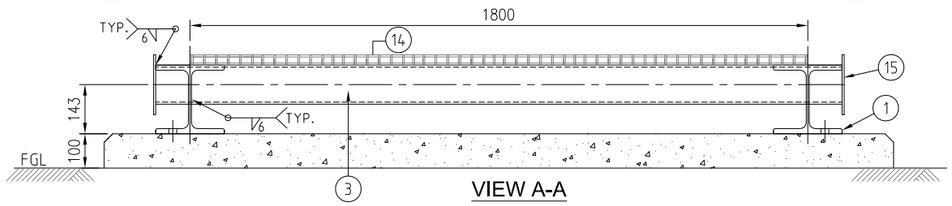
PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE: CHARCOAL FILTER (FT-1001) SKID & PIPE SUPPORT DETAIL

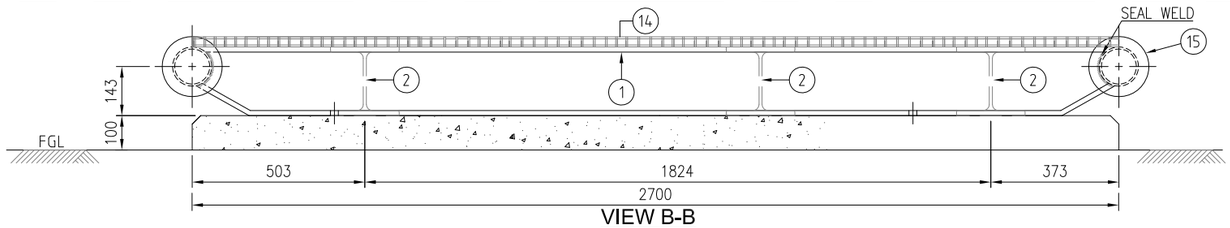
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-CIV-ST-001	2	2	A3	1



PLAN



VIEW A-A



VIEW B-B

16	GUSSET PLATE (AREA=17091mm) 10mm THK.	24	ASTM A-36	78.5 KG/M²	38
15	COVER PLATE Ø175x6mm THK.	4	ASTM A-36	47.1 KG/M²	5
14	GRATING, LOAD BEARING BAR AREA =4.4 M²	1	ASTM A-36	42.87 Kg/m²	189
13	BOLT M16x85	36	A193 Gr.B7 A194 Gr.2H	-	-
12A	U-BOLT 3/8"Ø WITH 4 NUTS FOR PIPE Ø2"	2	ASTM A-36	-	-
12	U-BOLT 1/4"Ø WITH 4 NUTS FOR PIPE Ø1"	3	ASTM A-36	-	-
11	U-BOLT 1/2"Ø WITH 4 NUTS FOR PIPE Ø4"	4	ASTM A-36	-	-
10	BASE PLATE 180x180x10mm THK.	1	ASTM A-36	78.5 KG/M²	3
9	BASE PLATE 200x200x10mm THK.	7	ASTM A-36	78.5 KG/M²	22
8	CH-100x50x10 200mm LG.	3	ASTM A-36	10.2 KG/M	6
7A	CH-100x50x10 2505mm LG.	1	ASTM A-36	10.2 KG/M	26
7	CH-100x50x10 200mm LG.	1	ASTM A-36	10.2 KG/M	2
6B	HEB-100 (1015mm LG.)	1	ASTM A-36	20.4 KG/M	21
6A	HEB-100 (310mm LG.)	3	ASTM A-36	20.4 KG/M	19
6	HEB-100 (218mm LG.)	2	ASTM A-36	20.4 KG/M	9
5	HEB-100 (310mm LG.)	4	ASTM A-36	20.4 KG/M	26
4	HEB-100 (958mm LG.)	4	ASTM A-36	20.4 KG/M	78
3	PIPE Ø4" SCH.40 (2000 LG.)	2	ASTM A-106 GR.B	16.06 KG/M	64
2	HEB-200 (1785mm LG.)	3	ASTM A-36	61.3 KG/M	328
1A	HEB-200 (1135mm LG.)	1	ASTM A-36	61.3 KG/M	70
1	HEB-200 (2700mm LG.)	2	ASTM A-36	61.3 KG/M	331
PART NO.	DESCRIPTION	QTY.	MATERIAL	UNIT WT.(KG/M) / TOTAL WT.(Kg)	TOTAL WT. (KG) / 1237

BILL OF MATERIAL

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. CONTRACTOR WILL ADD ANY REQUIRED ITEM AS PER SCOPE OF WORKS, DRAWINGS AND SPECIFICATIONS.
3. MENTIONED QUANTITIES ARE ESTIMATED; CONTRACTOR WILL VERIFY AND ESTIMATE THE BILL OF OF QUANTITIES
4. DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

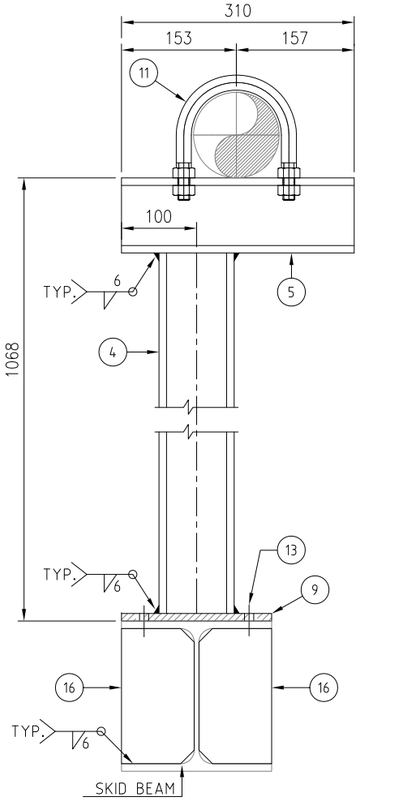
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

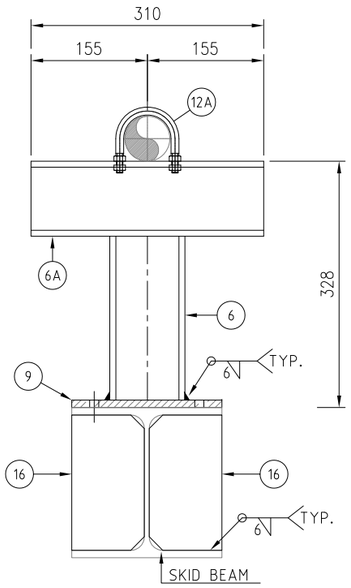
PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE: PARTICULATE FILTER (FT-1002) SKID & PIPE SUPPORT DETAIL

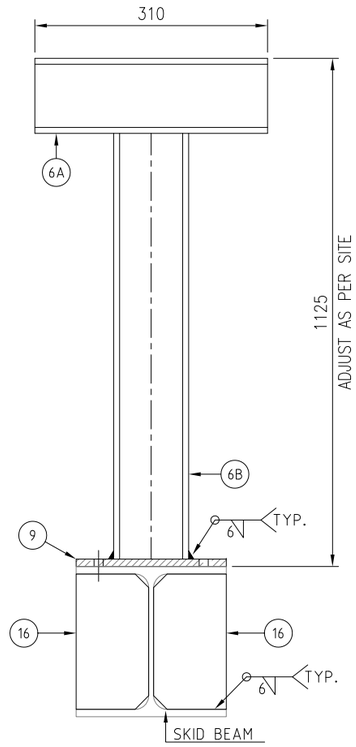
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-CIV-ST-002	1	2	A3	1



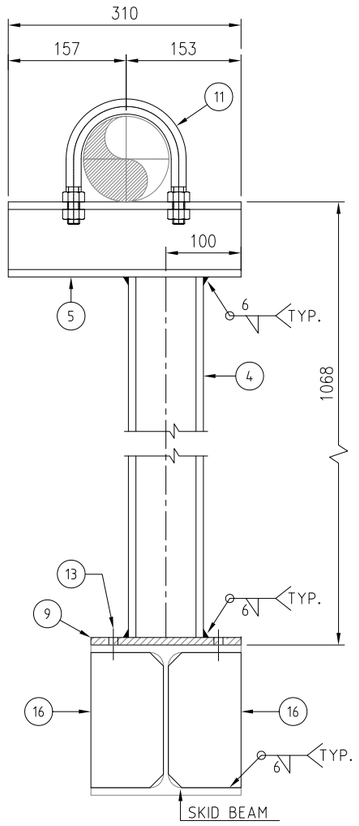
PS-001 & PS-002



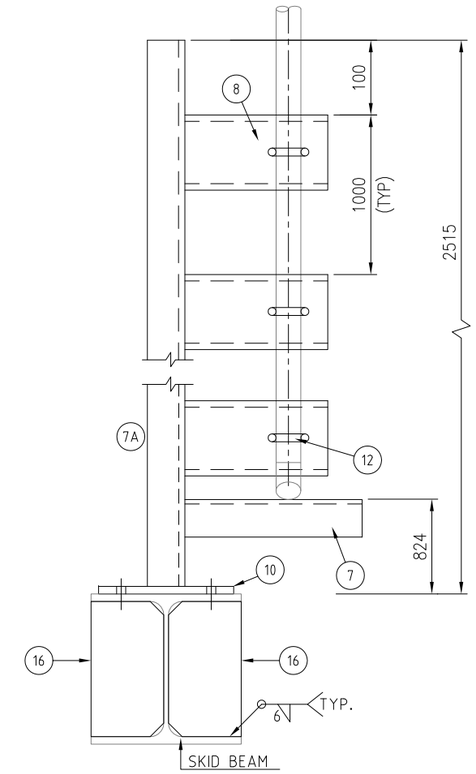
PS-003 & PS-004



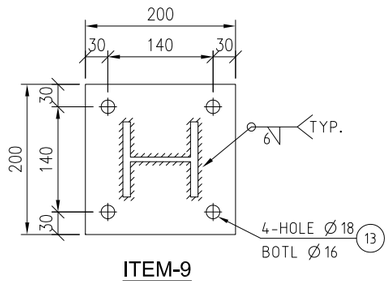
PS-005



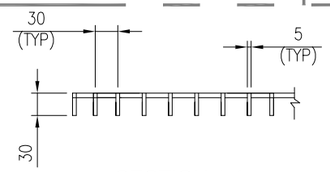
PS-006 & PS-007



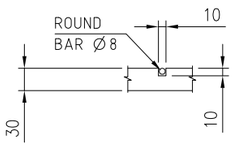
PS-008



ITEM-9



SECTION 1-1



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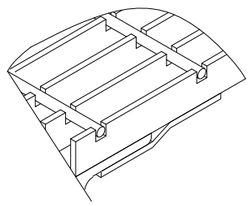
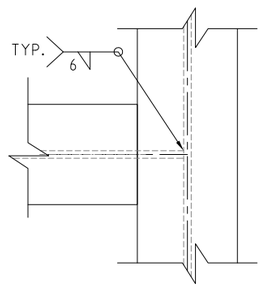
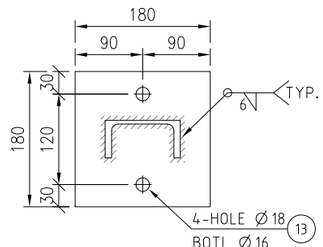
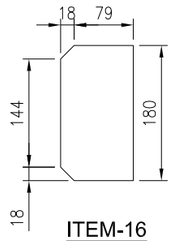


GRATING ATTACHMENT

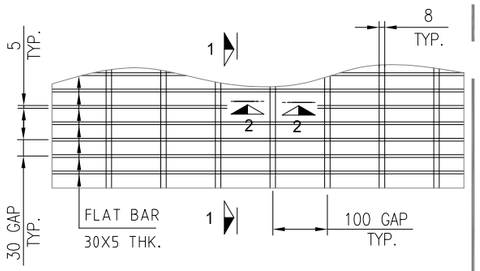




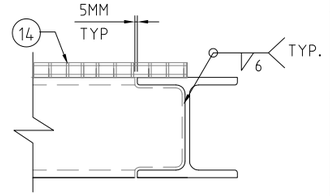
ITEM-10



ITEM-16



TYP. GRATING DETAIL



TYP BEAM TO BEAM (HEB-200) CONNECTION DETAIL

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

PETROCHEMICAL ENGINEERING CONSULTANTS

C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX. +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT: DETAIL ENGINEERING DESIGN FOR KUNNAR PRODUCED WATER DISPOSAL

TITLE: PARTICULATE FILTER (FT-1002) SKID & PIPE SUPPORT DETAIL

DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504214-CIV-ST-002	2	2	A3	1

ANNEXURE-H

PIPING SPECIFICATIONS

OIL & GAS DEVELOPMENT COMPANY LIMITED

PIPING SPECIFICATION

C1 (Plant Piping)

SPEC. NO. : C1-600-SP-003	DATE : 26-11-19	Revision : 1	Prep. By. : SAR

SERVICE	RATING	CORROSION ALLOWANCE	DESIGN CODE
PROCESS GAS	ASME CLASS 600#	1.5 mm	ASME B31.3

PIPES

SIZE	DESIGNATION	DESCRIPTION
3" to 8"	Sch. 80	ASTM A106 Gr. B / API 5L Gr. B (SMLS) B.E.AS PER ASME B36.10
2"	Sch. 80	ASTM A106 Gr. B / API 5L Gr. B (SMLS) B.E.AS PER ASME B36.10
≤ 1 1/2"	Sch. 80	ASTM A106 Gr. B / API 5L Gr. B (SMLS) P.E.AS PER ASME B36.10

FITTINGS

SIZE	DESCRIPTION
2" to 6"	BW, A-234 Gr. WPB AS PER ASME B16.9
≤ 1 1/2"	SW, A-105 AS PER ASME B16.11, 3000#

FLANGES

SIZE	CLASS	DESCRIPTION
2" to 8"	600#	WN, RTJ, ASME B16.5, ASTM A-105
≤ 1 1/2"	600#	SW, RTJ, ASME B16.5, ASTM A-105 (Note-3)

BOLTS & GASKETS

Stud Bolts	ASTM A-193 B7M, Cadmium Plated
Nuts	ASTM A-194 2HM, Cadmium Plated
Gaskets	Octagonal Ring, Type 316L S.S.

VALVES

	SIZE	DESCRIPTION		SIZE	DESCRIPTION		SIZE	DESCRIPTION
GATE	≤ 1 1/2" 2" to 8"	VG-100 VG-103	BALL	≤ 1 1/2" 2" to 4" 6"to 8"	VB-104 / VB-102 VB-105 VB-106	OTHERS		
CHECK	≤ 1 1/2" 2" to 8"	VC-100 VC-103	GLOBE	≤ 1 1/2" 2" to 8"	VGL-100 VGL-103	OTHERS		

DESIGN CONDITIONS	1400 psig @ 130 °F	HYDROSTATIC TEST PRESSURE	1820 psig

BRANCH CONNECTIONS

BRANCH SIZE (INCH) \ RUN SIZE (INCH)	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	3	2	1½	1	¾	½
½					S	S	S	S	S	S	S	S	S	S	S	S	S	RT	RT	RT	ET
¾					S	S	S	S	S	S	S	S	S	S	S	S	S	RT	RT	ET	
1					S	S	S	S	S	S	S	S	S	S	S	S	S	RT	ET		
1½					S	S	S	S	S	S	S	S	S	S	S	S	RT	ET			
2					W	W	W	W	W	W	W	W	W	W	RT	RT	ET				
3					W	W	W	W	W	W	W	W	W	RT	RT	ET					
4					W	W	W	W	W	W	W	RT	RT	RT	ET						
6					W	W	W	W	RT	RT	RT	RT	RT	ET							
8					W	W	RT	RT	RT	RT	RT	RT	ET								
10					RT	RT	RT	RT	RT	RT	RT	ET									
12					RT	RT	RT	RT	RT	RT	ET										
14					RT	RT	RT	RT	RT	ET											
16					RT	RT	RT	RT	ET												
18					RT	RT	RT	ET													
20					RT	RT	ET														
22					RT	ET															
24					ET																

LEGENDS:

ET	=	Equal Tee
RT	=	Reducing Tee
W	=	Weldolet
S	=	Sockolet 3000#

NOTES:

1. Reduced fitting thickness shall match heavier pipe wall thickness, taper to match thinner pipe wall.
2. Instrument connections shall be screwed beyond the first block valve of process piping.
3. Bore to match pipe I.D. for Welding Neck flanges.
4. All materials shall comply with NACE MR-0175
5. Ball valve body seat shall be selected with respect to service / with PTFE seat is allowed from-50 Deg F use metal seats beyond this temperature range.
6. Under ground piping should be coated with Zinc-Rich or Zinc Silicate primer, & apply 3 Layer Polyethylene Coted.

OIL & GAS DEVELOPMENT COMPANY LIMITED

VALVE SPECIFICATION
FOR GATE VALVES

DOC. NO. : GTVS-01-DS-003	DATE : - 15-03-2019	REV. : 1	PREP. BY A.V.

VALVE	SIZE	RATING (lb)	ENDS	STYLE	OPERATOR	DESIGN & TEST	MATERIAL	
							BODY	TRIM
VG-100	≤ 1 1/2"	800	SW	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 602	A-105	316 S.STEEL
VG-101	2" - 12"	150	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 600	A-216 GR. WCB	316 S.STEEL
VG-103	2" - 8"	600	RTJ (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 600	A-216 GR. WCB	316 S.STEEL

OIL & GAS DEVELOPMENT COMPANY LIMITED

VALVE SPECIFICATION
FOR GLOBE VALVES

DOC. NO. : GLVS-01-DS-004	DATE : -15-03-2019	REV. : 1	PREP. BY A.V.

VALVE	SIZE	RATING (lb)	ENDS	STYLE	OPERATOR	DESIGN & TEST	MATERIAL	
							BODY	TRIM
VGL-100	≤1 1/2"	800	SW	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-105	316 S.STEEL
VGL-101	2" - 12"	150	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-216 GR. WCB	316 S.STEEL
VGL-103	2" - 8"	600	RTJ (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-216 GR. WCB	316 S.STEEL

ANNEXURE-I

VENDORS LIST

PREFERRED VENDOR LIST

1.0 VALVES

1.1 Globe Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	AES	International
II.	Crane	International
III.	Newco	International
IV.	Walworth	International
V.	Kitz	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	Velan	International
XI.	Ecoline –KSB	International

1.2 Gate Valves (API 6D)

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Kvaerner Oiltool	International
III.	Control Flow Inc.	International
IV.	Newco	International
V.	FMC	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	KF	International
XI.	Velan	International
XII.	Ecoline –KSB	International

PREFERRED VENDOR LIST

1.3 Ball Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Control Flow	International
III.	Neles Jamesbury	International
IV.	Orbit	International
V.	Valvitalia	International
VI.	LVF	International
VII.	JC Valvulas	International
VIII.	KVC	International
IX.	KF	International
X.	Ecoline –KSB	International
XI.	Force	International
XII.	Quadrant	International
XIII.	Flow-Tek / Bray	International
XIV.	PBV	International

1.4 Needle Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Anderson Greenwood	International
II.	Kenmac	International
III.	KF	International
IV.	Oliver	International
V.	Parker	International
VI.	Precision Valves	International
VII.	Swagelok	International

PREFERRED VENDOR LIST

2.0 Filter Elements

2.1 Particle Filter Cartridges

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Twinfilter	International
II.	Syntech Fibres (Pvt.) Ltd.	International
III.	Yunda Filters	International

2.2 Charcoal Bed

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Calgon Carbon	International
II.	Lenntech	International
III.	CPL	International
IV.	Activated Carbon Technologies (Pvt.) Ltd.	International

OIL & GAS DEVELOPMENT COMPANY LIMITED

DETAILED ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

SCOPE OF SUPPLY & SPECIFICATIONS FOR FILTRATION PACKAGE (0504215-SOW-001)

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ANNEXURES

1 INTRODUCTION

Oil & Gas Development Co. Ltd. (OGDCL), hereinafter referred as Company owns and operates Sinjhoro facility. Currently produced water at Sinjhoro plant is disposed off in evaporation pond but due to continuous increase in produced water production, existing pond reaches its optimum level. Therefore OGDCL planned to safely dispose off PW to Sanghar X-1 Injection well.

OGDCL hired the services of PEC to design the injection system which also includes the designing of Treatment Filters. All associated engineering is in the phase of implementation. However filters are yet to be fabricated.

The intent of this document is to outline the scope of services required from perspective Bidders for the construction of Treatment Filters.

2 DEFINITION

Company:	Oil & Gas Development Company Limited (OGDCL).
Consultant	Petrochemical Engineering Consultants (PEC).
Contractor:	“Contractor" means the person or persons, firm or Proprietor whose proposal has been accepted by the Company for construction, commissioning, performance testing and includes the Contractor's representative(s), successors and permitted assignees.
Vendor/Supplier	The organization, firm or agency order for the supply of equipment and or material has been placed.

3 PACKAGE OVERVIEW

3.1 General

This requisition defines the requirements of Filtrationvessel skids to be installed at SINJHOROPlant. However, filter skids shall be supplied separately to be installed at suitable location in plant.

3.2 Scope

This specification defines the requirements for Package including filtration vessels and their internals. The supplier shall provide all the equipments shown on the attached skid-marked P&IDs attached as ANNEXURE-C and shown in the G.A Drawings attached as ANNEXURE-D. Any internal item, besides the mentioned required for the safe and continuous operation of the unit shall also be in the scope of the Supplier and supplier to incorporate if any additional equipment in the P&ID's. The list of equipments required for Filtration Package are mentioned below:

CharcoalFilter	(F-02)
Particle Filter	(F-01A/B)

3.3 Company's Intention

It is the intention of Company to Fabricate, Manufacture and Procure the package based on Specifications, Data Sheets, P&IDs, G.A Drawings, Piping Arrangement Drawings & Skid Drawings attached with this document. The Supplier shall prepare the detailed fabrication drawings for the mentioned vessel internals and get the same approved from Company before taking up the fabrication, procurement of material, performing painting, testing and preparing for shipment, shall also be included in Supplier's scope.

The Supplier shall ensure that all the components of the package are NEW.

4 SUPPLIER'S RESPONSIBILITY

The Supplier shall do the detailed design, prepare detailed drawings for the mentioned davit arm and internals in the G.A Drawings attached as ANNEXURE-D and also mentioned in the datasheets for Charcoal &Particle Filters attached as ANNEXURE-A and get the same approved from Company / Engineering Consultant.

Internal items for Charcoal Filter (F-02) such as Activated Charcoal, Support screen for charcoal bed and internal distributor shall be designed and supplied by the Supplier.

Similarly, Internal items for Particle Filters (F-01A/B) such as cartridges, support plate for cartridges and internal distributor shall be designed and supplied by the Supplier.

4.1 Codes, Standards & Specifications Requirements

The Supplier shall ensure that the Package Items will comply with this document, attached data sheets, specifications and below mentioned Codes and Standards:

ASME VIII Div 1	Pressure Vessels.
ASME V	Non Destructive Examination.
ASME IX	Welding and Brazing Qualifications.
ANSI B16.5/B16.47	Steel Pipe, Flanges and Flanged Fittings
AWS D1.1	Structural welding code-Steel

The Supplier shall list other codes and standards to which his proposed design complies.

4.2 Error or Omission

The review and comments by Company / Engineering Consultant on Supplier's or its manufacturer's drawings procedures or documents during review & approval duration (this to be confirmed by supplier prior to bid submission) shall only indicate acceptance of general requirements and shall not relieve the Supplier of its obligations to comply with the requirements of this document and other referred documents.

All deviations to this document, other referred document or attachments shall be brought to the knowledge of the Company / Engineering Consultant in the technical bid. No deviations during the procurement, manufacturing, testing and inspection shall be entertained.

4.3 Conflicting Requirements

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

4.4 Language and Units of Measurement

The governing language shall be English language.

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

4.5 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. Data Sheet & P&IDs
2. This scope & 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/ Engineering Consultant's approval before proceeding with design, manufacture or purchase. Such conflicting issues shall be clearly stated in deviation/exception list submitted at the time

of bid. In any case the most stringent requirement shall prevail. However, Company/ Engineering Consultant's interpretation shall be final.

5 ENVIRONMENTAL DESIGN CRITERIA

5.1 General

Unless otherwise stated on the data sheet, Filter vessels will be installed in an open area.

5.2 Area Classification

AREA CLASSIFICATION
Zone 2, Group IIA & Temperature Class T6

5.3 Site, Environmental & Utility Design Data

Package Items shall be designed for outdoor location with utility & site conditions as given;

DESIGN AND AMBIENT CONDITIONS	
Design Maximum Ambient Temperature (°C)	44
Design Minimum Ambient Temperature (°C)	17
CLIMATIC CONDITIONS	
Relative Humidity (minimum monthly average)	22
Relative Humidity (maximum monthly average)	61

6 SCOPE OF SUPPLY

The scope of supply shall include, but not necessarily be limited to, the following:

- Filter Vessels.
- Charcoal bed (properties of activated charcoal are mentioned in the datasheet #0504215-PDS-004 attached in ANNEXURE-A)
- Support Screen for Charcoal bed.
- Filter Cartridges(properties of cartridges are mentioned in the datasheet #0504215-PDS-002 attached in ANNEXURE-A)
- All documentation as required & mentioned in this document.
- Inspection and testing.
- All necessary start-up and commissioning spares.
- List of Two year Operational and maintenance spares/tools. All special tools required for installation and maintenance. Third party inspection and Commissioning Assistance

The Package Items to be supplied shall be suitable for continuous operation and for installation outdoors in extremely hot and humid environment.

7 DESIGN REQUIREMENT

7.1 General

Package will be designed and constructed to meet service conditions specified in the data sheets of particle and charcoal filters (0504215-PDS-002) & (0504215-PDS-004) attached in ANNEXURE-A.

7.2 Material

Materials of construction for Package items shall conform to ASME Section II, Part A, and Latest Edition.

All materials and parts included in the construction of the Package items shall be new, unused and of the highest grade being free from all defects or imperfections likely to affect their performance.

7.3 Fabrication

No fabrication shall commence until Supplier has received the approval from the Company / Engineering Consultant. The Supplier shall submit detailed fabrication drawings of mentioned vessel parts to the Company / Engineering Consultant for approval prior to fabrication.

Welding shall be carried out with procedures and operators qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

Each weld procedure shall be accompanied by a suitable procedure qualification record, tested in accordance with the requirements of ASME IX.

Acceptance standards for radiography and ultrasonic testing shall be in accordance with Section VIII Div I of the ASME Boiler and Pressure Vessel Code by Qualified Third party agency.

When post-weld heat treatment is required, radiograph examination shall be performed upon completion of heat treatment.

Stitch welding is not permissible on any part of the vessel.

7.4 Name plate

Hot oil package items shall be provided with a type 316 stainless steel nameplate securely attached to the unit, and located so that it is clearly visible after installation. Nameplates shall be riveted to a bracket welded onto the equipment.

The following information shall be stamped on the name plate:

- Manufacturer's Name
- Manufacturer's Serial No.

- Equipment Item No.
- Equipment Title
- Purchase Order No.
- Year of Manufacture
- Design Code - API 560/ASME Section VIII etc.
- Design Pressure (p.s.i.g.)
- Design Temperature (°C).
- Weight - Empty (kg)
- Weight-Hydrostatic (kg)

Any other data according to the nature of equipment. Letters and figures shall be 5mm high and clearly stamped.

7.5 Third Party Inspection

Supplier shall provide free access to his works and that of sub-Suppliers for the authorized representative of the Company / Engineering Consultant and the certifying authority for Third party inspection.

7.6 Commissioning and Startup Assistance

The Supplier shall provide the startup and commissioning assistance of package items. As per OGDCL requirement without any price addition. This shall be the part of the contract.

7.7 Site Performance Test

A site performance test will be conducted on mutually agreed dates after successful installation / commissioning. Performance test procedure will be submitted by the supplier for review and approval of Company.

8 GUARANTEE & WARRANTY

The Supplier shall guarantee & warranty that supplied Package Items are free from any manufacturing defect and if any part of the Package is 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 / Engineering Consultant. Bidder to confirm Guarantee/Warranty for a period of 1 year after installation or 18 months after shipment, whichever completes earlier.

8.1 General

Inspection and testing shall generally comply with the requirements as detailed in this document.

8.2 Hydrostatic Tests

All hydrostatic tests (if required at supplier/ manufacturer site) shall be made in the presence of an authorized inspector and with his approval.

After the final accepted hydrostatic test, the vessel shall be flushed, dried and cleaned thoroughly of all grease, loose scale, rust and weld spatter, both internally and externally.

8.3 Material Testing and Certification

The Supplier shall obtain the necessary approvals from the qualified certifying authority.

The Supplier shall maintain a Package Items Data Book containing, as a minimum, the following documents:

- Correspondence between Company / Engineering Consultant, Supplier and/or Certifying Authority (if applicable).
- Mill Certificates referenced by a parts list giving heat numbers, material, etc.
- Inspection & Test plan.
- Welding procedures and qualifications referenced by a weld map giving weld number, welder, etc.

- NDE results and certificates referenced by an appropriate list.
- Visual & dimensional inspection reports.
- Hydro-test results referenced by a line sketch.
- For Pressure vessels, manufacturer's data report shall be furnished and shall contain the same information as required by form U-1 of ASME Code, Section VIII, Division 1.

9 PAINTING AND PREPARATION FOR SHIPMENT

9.1 Painting

The Supplier must ensure that vessels and supports shall be adequately protected from the prevailing atmosphere by means of correct material selection, painting or coating to prevent galvanic corrosion.

SSPC (Steel Structures Painting Council) manuals shall be followed for the preparation of surface before painting and application of paint.

DFT (Dry Film Thickness) of the painting system shall be checked by Elko meters, which shall be as per specification. Surface preparation, prior to application of paintingshall be subjected to inspection.

In general Company / Engineering Consultant's attached Specification for Painting & Surface Preparation (0504215-PRO-SP-014)attached in ANNEXURE-B shall be followed. Color coating for equipment shall be finalized after approval by Company / Engineering Consultant.

9.2 Preparation for shipment

All openings such as nozzles, vents and field connections shall be properly sealed to avoid entrance of foreign particles and protected during shipment.

All fragile items shall be removed and crated in rigid packing crates with sufficient padding to prevent damage during shipment and shall be properly tagged for ease of field installation.

The Supplier shall provide corrosion protection for all internal and external machine parts for sea shipment and six months outdoor storage and which can be easily removable at site.

9.3 Packing, Preservation and Transportation of Material & Equipment

Packing and Preservation shall be suitable for handling during inland transportation, shipment through sea or by air and storage at site for upto 6 months in an uncovered, very hot and humid climate. Packing shall account for the fragility and physico-chemical/ mechanical damages of items. Detailed requirements for Packing & Protection of Material and Equipment are indicated in attached Specification for Export Packing & Crafting (0504215-PRO-SP-013) attached in ANNEXURE-B.

10 SPARES

The supply of Package Items shall include the commissioning spare and list of recommended two years operational spares, special tools and consumables.

10.1 Commissioning Spares

The Supplier shall provide commissioning spares. List of commissioning spare parts shall be provided at bidding stage.

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.

10.2 Two Years Operational Spares

Supplier shall recommend and provide list of spare parts needed for two (02) years of operation at bidding stage. The cost of Operational spares shall be provided in spares list submitted with the bid.

The spares should be in accordance with recommendation by OEM of the supplied components. Recommended spares should take into account related factors of item's reliability, effect to equipment downtime upon production or safety, costs of parts, and availability of equipment service facilities.

All spare parts furnished by Supplier shall be wrapped and packaged so that they will be preserved in original as-new conditions of storage and shall be properly tagged and coded so that later identification for intended equipment usage would be facilitated. They shall be packaged separately, clearly marked as "Spare Parts", and shipped along with the package. Packing lists shall be furnished so that the parts can be handled without uncrating if desired.

10.3 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.

11 QA/QC & CERTIFICATION

11.1 Quality Assurance & Control

11.1.1 Quality Management System

The Supplier shall operate an independently verified Quality Management System that satisfies the applicable provisions of ISO 9000 (series), or agreed equivalent standard, commensurate with the goods and services to be provided. Current details of registration, approval of other demonstration of the status and efficient operation of the Quality System shall be provided with the bid submission. Further information may be requested at the PO stage.

The Supplier, as part of their own Quality Management System, will be expected to demonstrate the QA competence of any Sub-supplier. The Company / Engineering Consultant reserves the right to require the Supplier to implement addition controls, where a satisfactory level of competence cannot be demonstrated in this regard, and/or exercise additional controls not detailed in this document.

The Company / Engineering Consultant reserves that right to visit the premises of the Supplier and any Sub-supplier for the purpose of undertaking Quality Audits relating to the equipment and services covered by this document, the extent of which will be discussed with the Supplier before, PO award.

11.1.2 Quality Control

It is the Company / Engineering Consultant's intention to determine his involvement in the inspection of materials and activities at the Supplier's and Sub-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 inspection visits by the 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 or Sub-suppliers' agreed Manufacturing Quality Control Plan is either inadequate or not being implemented, the Company / Engineering Consultant reserves the right to increase the level or frequency of his Quality Control activities or request the supplier to revise his 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 main Supplier
- Surveillance of major Sub-suppliers
- Certification and manufacturing data review

11.1.3 Material Traceability & Certification

The Supplier shall advise their proposed material tracability 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.

11.1.4 Inspection & Testing

Vessels shall be tested and inspected as per ASME Section VIII, Division 1.

11.2 Certification & Manufacturing Records

11.2.1 Inspection and Certification Records

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

11.2.2 Certification and 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.

12 DOCUMENTATION REQUIREMENT FOR SUPPLIER

12.1 Use of the English Language

All documents shall be written in the English Language.

12.2 Documents to be submitted with the Bid

Technical Documents:

Supplier must provide following listed documents with the Bid. Failure to submit these documents may lead to technical disqualification:

1. Name of Package Item Supplier and country of manufacturing
2. Authority letter in favor of local agent.
3. Table of compliance / exception and deviations, if any
4. Signed & stamped copy of whole tender document.

5. Details of equipment internals and Davit Arm.
6. Document submission schedule.
7. Commissioning spare parts, Special tools and List of 02 years operational spares and Consumables.
8. Quality Manual and Quality Control Plan.
9. Typical Inspection and Test Plan.
10. Proposed surface treatment and painting.
11. Details of Sub-Suppliers with quality certificates
12. Detail scope of supply including the detailed material list.
13. Design Calculation, Specification and Code & Standard

Financial Documents:

1. Price breakup of all the items included in the Package.
2. Performance Bank Guarantee(s) after issuance of LOI.

12.3 Final Documentation

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.
5. A list of all applicable codes, standards and specifications.
6. Photocopy of nameplate.
7. Mechanical test certification.
8. Final signed quality plan.
9. Commissioning instructions.
10. Schedules of commissioning spare parts and list of spare parts for 02 years.
11. All approved drawings and document.

All above documents two (02) 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.

ANNEXURE-A

DATASHEETS

DATASHEET FOR PARTICLE FILTER

OIL AND GAS DEVELOPMENT COMPANY LTD.
OGDCL House, Plot No.3, Jinnah Avenue, Blue Area, Islamabad, Pakistan.
Telephone: +92-51-9209811-18 + 92-51-2623101-02, 04-06
Fax: +92-51-2623113-18; Website: www.ogdcl.com

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PEC PROJECT NO. 0504215

PROJECT	SINJHORO PLANT PRODUCED WATER DISPOSAL
TITLE	DATASHEET FOR PARTICLE FILTER
DOCUMENT No.	0504215-PDS-002

PREPARED	CHECKED	APPROVED	DATE	REV.	DESCRIPTION
SHR	BA	AJ	07-May-2020	1	Re-Issued for Review
SHR	BA	AJ	13-Dec-2019	0	Issued for Review

CLIENT	SINJHORO PLANT PRODUCED WATER DISPOSAL			CONSULTANT
	DATASHEET FOR PARTICLE FILTER			
	DOCUMENT NUMBER	0504215-PDS-002	Rev-1	SHEET 2 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	PW Injection Pump
Plant:	SINJHORO PLANT	Order No.:	-
Req. No.:	2	Job No. :	0504215
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	2 OF 3

1	Item No.	F-01 A/B	Item Name	PARTICLE FILTER				
2	No. of Units	2	Application	Produced water Particle removal				
3	**FLUID HANDLED**							
4	Fluid	Produced water+condensate						
5	Service	**Max. Oper.**	**Min. Oper.**	**Design**				
6	Temperature, ºF	110	70	130				
7	Pressure, psig	700	500	720				
8								
9	**FILTER**							
10	Type	Cartridge Filter						
11	Number of Cartridges	**(NOTE-7)**						
12	Outlet Particle Size	5 micron						
13								

14	**SHELL**		**NOZZLES & MANHOLES**					
15	☐ Horizontal ✓ Vertical		**Label**	**Size**	**Rating**	**Type**	**Service**	
16	Length/Height, mm	1850 **(NOTE-12)**	N1	4"	300#	RF	Inlet	
17	Inside Diameter, mm	781 **(NOTE-12)**	N2	4"	300#	RF	Outlet	
18	Head Details		N3	1"	300#	RF	Vent	
19	Tangent/Grade Distance, mm/in		N4	2"	300#	RF	Drain	
20	Code:		N5	3"	300#	RF	Tubesheet Drain	
21	✓ Stamp Required		N6	32"	300#	RF	Manway	
22	Radiographed ☐ Spot ✓ Fully							
23	Hydrotest ✓ Yes ☐ No							
24								
25	**INTERNALS**							
26	**Item**	**No.**	**Description**					
27	Support							
28	Diffuser							
29	Redistrib.							
30	Vortex Brk.							
31	Hold Down							
32	Demister	**Note-1, 2**						
33	Tray							
34	Packing							
35	Baffles							
36	Scr. Support							
37								

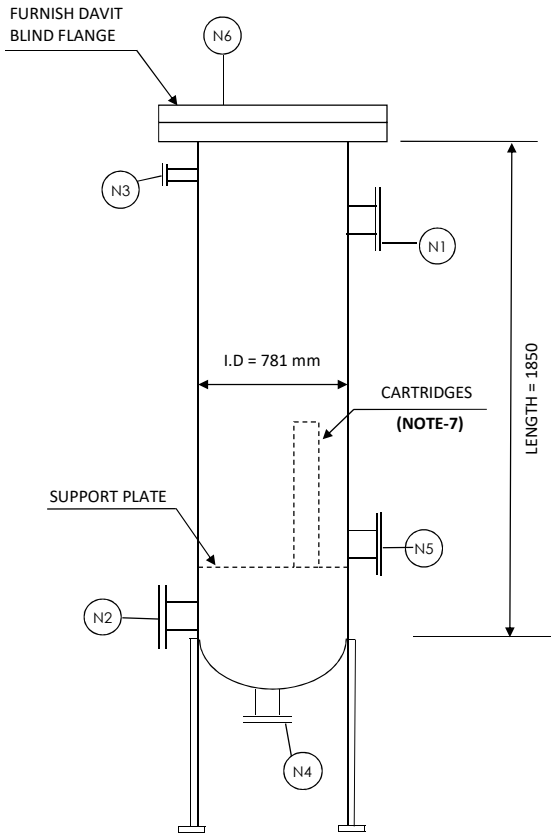
Vessel Detail
See Sheet 3 of 3

38	**MATERIALS**		
39			**Corrosion Allowance**
40	Shell/Heads	SA 516 Gr 70	1.5 mm
41	Nozzle Necks/Flanges	ASTM A 105	
42	Pipes	ASTM A-106 Gr.B	
43	Gaskets External	SW 316SS-Graphite Filled	
44	Gaskets Internal	Non Asbestos	
45	Insulation	NA	
46	Paint	Refer Specification (0504215-PRO-SP-014)	
47	Internals	Duplex	

CLIENT	SINJHORO PLANT PRODUCED WATER DISPOSAL			CONSULTANT
	DATASHEET FOR PARTICLE FILTER			
	DOCUMENT NUMBER	0504215-PDS-002	Rev-1	SHEET 3 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	PW Injection Pump
Plant:	SINJHORO PLANT	Order No.:	-
Req. No.:	2	Job No. :	0504215
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	3 OF 3

VESSEL DETAILS



FOR FURTHER DETAILS, PLEASE REFER TO ATTACHED GENERAL ARRANGEMENT DRAWING # 0504215-GA-002.

NOTES

VTS = VENDOR TO SPECIFY

1. ALL VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
2. VENDOR TO PROVIDE FULL DETAILS OF VESSEL INTERNALS.
3. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
4. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
5. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
6. PROCESS DATA CONTAINED IN THESE DATA SHEETS, REPRESENTS OPERATING & DESIGN CONDITIONS.
7. VENDOR IS REQUIRED TO PROVIDE MAXIMUM NUMBER OF CARTRIDGES THAT CAN BE FIT IN WITHIN SPECIFIED PARTICLE FILTER VESSEL WITHOUT ANY IMPACT OVER PEFORMANCE OF FILTER SEPARATOR
8. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
9. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
10. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DULPEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA. AND FILLER METAL AS PER STANDARDS.
11. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.
12. VENDOR TO ADVISE MAXIMUM VOLUME OF PRODUCED WATER THAT CAN BE PROCESS USING MAX NUMBER OF CARTRIDGES ALLOWABLE PRESSURE DROP VALUE OF 10 PSI.

DATASHEET FOR CHARCOAL FILTER

OIL AND GAS DEVELOPMENT COMPANY LTD.
OGDCL House, Plot No.3, Jinnah Avenue, Blue Area, Islamabad, Pakistan.
Telephone: +92-51-9209811-18 + 92-51-2623101-02, 04-06
Fax: +92-51-2623113-18; Website: www.ogdcl.com

PETROCHEMICAL ENGINEERING CONSULTANTS
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PEC PROJECT NO. 0504215

PROJECT	SINJHORO PRODUCED WATER DISPOSAL
TITLE	DATASHEET FOR CHARCOAL FILTER
DOCUMENT No.	0504215-PDS-004

PREPARED	CHECKED	APPROVED	DATE	REV.	DESCRIPTION
SHR	BA	AJ	07-May-2020	1	Re-Issued for Review
SHR	BA	AJ	13-Dec-2019	0	Issued for Review

CLIENT	SINJHORO PRODUCED WATER DISPOSAL			CONSULTANT
	DATASHEET FOR CHARCOAL FILTER			
	DOCUMENT NUMBER	0504215-PDS-004	Rev-1	SHEET 2 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	PW Injection Pump
Plant:	SINJHORO PLANT	Order No.:	-
Req. No.:	1	Job No. :	0504215
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	2 of 3

1	Item No.	F-02	Item Name	Activated Charcoal Filter
2	No. of Units	1	Application	Produced water oil content removal

3	**FLUID HANDLED**			
4	Fluid	Produced water+condensate		
5	Service	**Max. Oper.**	**Min. Oper.**	**Design**
6	Temperature, ºF	110	70	130
7	Pressure, psig	700	500	720
8				
9	**FILTER**			
10	Type	Activated Charcoal Filter		
11	Charcoal Bed Diameter, mm	781 **(NOTE-10)**		
12	Charcoal Bed Length, mm	1350 **(NOTE-10)**		
13	Activated Charcoal Type	Granular Activated Carbon (GAC) **(NOTE-8)**		
14				

15	**SHELL**			**NOZZLES & MANHOLES**				
16	☐ Horizontal ✓ Vertical			**Label**	**Size**	**Rating**	**Face**	**Service**
17	Tangent/Tangent Length/Height, mm	2200 **(NOTE-10)**		N-1	4"	300#	RF	Inlet
18	Inside Diameter, mm	781 **(NOTE-10)**		N-2	4"	300#	RF	Outlet
19	Head Details			N-3	2"	300#	RF	Drain
20				N-4	3"	300#	RF	Bed Removal
21	Tangent/Grade Distance, mm/in			N-5	32"	300#	RF	Manway
22	Code:			N-6	1"	600#	RF	Vent
23	Radiographed ☐ Spot ✓ Fully							
24	Hydrotest ✓ Yes ☐ No							
25	✓ Stamp Required							

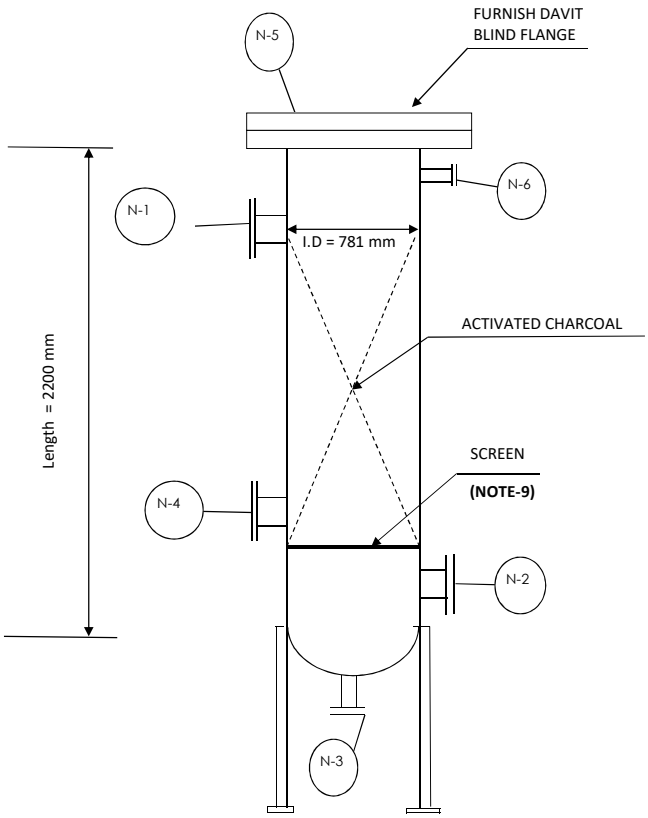
26	**INTERNALS**			
27	**Item**	**No.**	**Description**	
28	Support	-	**Note - 2,3**	Vessel Detail See Sheet 3 of 3
29	Diffuser	-		
30	Redistrib.	-		
31	Vortex Brk.	-		
32	Hold Down	-		
33	Demister	-		
34	Tray	-		
35	Packing	-		
36	Baffles	-		
37	Scr. Support	1	Clog screen support **(Note-9)**	
38				

39	**MATERIALS**	
40	Corrosion Allowance	1.5 mm
41	Shell/Heads	SA 516 Gr 70
42	Nozzle Necks/Flanges	ASTM A 105
43	Pipes	ASTM A-106 Gr.B
44	Gaskets External	SW 316SS-Graphite Filled
45	Gaskets Internal	Non Asbestos
46	Insulation	N.A
47	Paint	Refer Specification (0504215-PRO-SP-014)
48	Internals	Duplex
49		

CLIENT	SINJHORO PRODUCED WATER DISPOSAL			CONSULTANT
	DATASHEET FOR CHARCOAL FILTER			
	DOCUMENT NUMBER	0504215-PDS-004	Rev-1	SHEET 3 OF 3

Client:	OIL AND GAS DEVELOPMENT COMPANY LIMITED	Unit:	PW Injection Pump
Plant:	SINJHORO PLANT	Order No.:	-
Req. No.:	1	Job No. :	0504215
Vendor:	-	Model No.:	-
Vendor Dwg. No.:	-	Sheet:	3 of 3

VESSEL DETAIL



FOR FURTHER DETAILS, PLEASE REFER TO ATTACHED GENERAL ARRANGEMENT DRAWING # 0504215-GA-001.

NOTES

1. VENDOR TO SPECIFY.
2. VENDOR TO CONFIRM.
3. VENDOR SHALL SUBMIT COMPLETE DETAILS OF VESSEL INTERNALS.
4. ALL NECESSARY REQUIRED VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
5. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
6. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
7. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
8. VENDOR TO SHARE MSDS OF PROPOSED CHARCOAL POWDER .
9. INTERNAL SUPPORT FOR CHARCOAL BED SHALL BE ABLE TO WITHSTAND ITS WEIGHT AS SPECIFIED BY VENDOR.
10. VENDOR IS REQUIRED TO QUOTE CHARCOAL FILTER AS PER DIMENSIONS AND DETAILS SPECIFIED IN DATA SHEET (0504215-PDS-004)
11. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
12. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
13. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DULPEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA. AND FILLER METAL AS PER STANDARDS.
14. VENDOR IS REQUIRED TO PROVIDE MAX VOUME OF CHARCOAL THAT CAN BE FILL IN WITHIN SPECIFIED VOLUME OF CHARCOAL FILTER VESSEL.
15. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

CONSULTANT								DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS				SINJHORO PLANT PRODUCE WATER DISPOSAL				0504215-IDS-010	
								REV.	DATE.
								0	09/12/2019
CLIENT				INSTRUMENT DATA SHEET				BY	APPR.
OIL & GAS DEVELOPMENT COMPANY LIMITED				TEMPERATURE INDICATOR				JAK	SAG
								SHEET	1 OF 1

GENERAL	1	Tag Number		TI-001				
	2	Service		F-02 (Inlet to Charcoal Filter)				
	4	Area Classification		Zone II, Gas Group IIA, T6				
	5	P & ID Drawing Number		0504215-PID-005				
	6							
PROCESS CONDITIONS	7	Fluid		Produced Water				
	8	Min. Temperature	Max. Temperature	70	°F	110	°F	
	9	Min. Pressure	Max. Pressure	500	psi-g	700	psi-g	
	10	Design Temperature		130		°F		
	11	Design Pressure		720		psig		
	12							
THERMOMETER	13	Type		Indicator				
	14	Calibration Range Min	Max	0	°F	450	°F	
	15	Dial Size	Dial Color	160 mm		WHITE WITH BLACK PRINTING		
	16	Case Material		304 ST.ST.				
	17	Hermetically Sealed Case		NO				
	18	Stem Type		BI-METALLIC				
	19	Stem Material		316SS				
	20	Stem or Union Thread		Union Thread				
	21	Stem Position		ANY ANGLE				
	22	Stem Length	Stem Diameter	TO SUIT WELL mm		8	mm	
	23	External Calibrator		MICRO POINTER				
	24	Ingress Protection		IP-65				
	25	FILLED	Type	Not Required				
	26		Compensation	N/A				
	27		Capillary Legth	N/A				
	28		Capillary Material	N/A				
	29		Armor Material	N/A				
	30	SYSTEM	Bulb Diameter	N/A				
	31		Bulb Length	N/A				
	32		Bulb Type	N/A				
	33		Bulb Connection	N/A				
	34							
WELL	35	Process Connection		2" FLANGED 300#				
	36	Material		316L ST.ST				
	37	Sheating	Coating	N/A		N/A		
	38	Construction Type		DRILLED BARSTOCK (TAPERED) WELDED FLANGE				
	39	Internal Connection		1/2" NPT-F				
	40	Length Below Thread / Flanged		U =192 mm				
	41	Lagging Extension		T = 50 mm				
	42	Plug & Chain		NO				
	43	Overall Length		312 mm				
	44	Treatments	Finish	100 % DYE PENETRALL WELDS		FLANGE = RF		
	45	Stamping		YES				
	46	Union		1/2 " NPT-M ST.ST				
	47	Wetted Part Materials in Accordance With		NACE MR01-75 (2000)				
PURCHASE	48	Manufacturer						
	49	Model						
	50	Purchase Order Number						
	51	Price	Item Number			N/A		
	52	Serial Number		N/A				

CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-001	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT OF PAKISTAN		DIFFERENTIAL PRESSURE GAUGE	JAK	SAG
		P&ID N. 0504215-PID-006	SHEET	1 OF 1

GENERAL	1	Tag Number			DPI-001A						
	2	Service			PARTICLE FILTER F-01A						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-006						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	Min. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			NO			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Differential Range	Min.	Max.	0	psi	-g	20	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			1/2" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :

1	Vendor shall provide a SS tag with embaded tag no. , permanently attached with the instrument.
2	
3	
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CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-002	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT OF PAKISTAN		DIFFERENTIAL PRESSURE GAUGE	JAK	SAG
		P&ID N. 0504215-PID-005	SHEET	1 OF 1

GENERAL	1	Tag Number			DPI-002						
	2	Service			CHARCOAL FILTER F-02						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-005						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	Min. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			NO			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Differential Range	Min.	Max.	0	psi	-g	20	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			1/2" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :

1	Vendor shall provide a SS tag with embaded tag no. , permanently attached with the instrument.
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3	
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CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-003	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT OF PAKISTAN		DIFFERENTIAL PRESSURE GAUGE	JAK	SAG
		P&ID N. 0504215-PID-007	SHEET	1 OF 1

GENERAL	1	Tag Number			DPI-001B						
	2	Service			PARTICLE FILTER F-01B						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-007						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	Min. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			NO			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Differential Range	Min.	Max.	0	psi	-g	20	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			1/2" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :

1	Vendor shall provide a SS tag with embaded tag no. , permanently attached with the instrument.
2	
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CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-010	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY Ltd.		PRESSURE GAUGE AT F-01A DISCHARGE	ZUA	SAG
		0504215-PID-006	SHEET	1 OF 1

GENERAL	1	Tag Number			PI-001						
	2	Service			F-01A DISCHARGE TO CHARCOAL FILTER (F-02)						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-006						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	Mln. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			1			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Calibration Range Min	Max		0	psi	-g	1000	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			3/4" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :

1	
2	
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CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-011	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY Ltd.		PRESSURE GAUGE AT F-02 DISCHARGE	ZUA	SAG
		0504215-PID-005	SHEET	1 OF 1

GENERAL	1	Tag Number			PI-002						
	2	Service			F-02 DISCHARGE TO PARTICLE FILTER (F-01B)						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-005						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	MIn. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			1			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Calibration Range Min	Max		0	psi	-g	1000	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			3/4" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :	
1	
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CONSULTANT		SINJHORO PLANT PRODUCE WATER DISPOSAL	DOCUMENT NO.	
PETROCHEMICAL ENGINEERING CONSULTANTS			0504215-INS-011	
			REV.	DATE.
			0	09/12/2019
CLIENT		INSTRUMENT DATA SHEET	BY	APPR.
OIL & GAS DEVELOPMENT COMPANY Ltd.		PRESSURE GAUGE AT F-01B DISCHARGE	ZUA	SAG
		0504215-PID-007	SHEET	1 OF 1

GENERAL	1	Tag Number			PI-001						
	2	Service			F-01B DISCHARGE TO SANGHAR INJECTION WELLHEAD						
	3	Line Size			4"						
	4	P & ID Drawing Number			0504215-PID-007						
	5										
PROCESS CONDITION	6	Fluid			Produced Water						
	7	MIn. Temperature	Max. Temperature		70	°F		110	°F		
	8	Min. Pressure	Max. Pressure		500	psi-g		700	psi-g		
	9	Design Temperature			130			°F			
	10	Design Pressure			720			psig			
	11	Pulsation	Vibration		NO			1			
	12										
	13										
GAUGE	14	Type			INDICATOR						
	15	Calibration Range Min	Max		0	psi	-g	1000	psi	-g	
	16	Figure Interval			Manufacturer Standard						
	17	Minor Graduation			Yes						
	18	Mounting			Direct Mounted						
	19	Dial Size			160	mm					
	20	Dial Color			White Aluminium with Black Numerals						
	21	Case Material			304 St. Stl						
	22	Ring Construction	Ring Material		Bayonet			St. Stl			
	23	Blow-Out Protection			Yes						
	24	Lens Material			Solid Front Full Safety Pattern With Laminated Safety Glass						
	25	Pressure Eelement Type			Bourden Tube						
	26	Pressure Eelement Material			316 St. Stl						
	27	Socket Material			316 St. Stl						
	28	Connection Size			3/4" NPT-µ						
	29	Connection Location			Top						
	30	Movement Material			St. Stl. Rack & Pinion						
	31	Nominal Accuracy			+/- 1%						
	32	Micrometer Material			Yes						
	33	Ingress Protection			IP 65						
DIAPHRAGM SEAL	34	Type			N/A						
	35	Process Connection			N/A						
	36	Diaphragm Material			N/A						
	37	Bottom Housing Material			N/A						
	38	Fill Fluid			N/A						
	39	Capillary Length			N/A						
	40	Capillary Material			N/A						
	41	Flushing Connection			No						
	42	Top Housing Material			N/A						
	43	Connection to Instrument			N/A						
	44										
OPTIONS	45	Syphon :	Type	Material	N/A			N/A			
	46	Syphon :	Type	Material	N/A			N/A			
	47	Movement Damping			N/A						
	48										
	49										
	50										
PURCHASE	51	Manufacturer									
	52	Model									
	53	Purchase Order Number									
	54	Price		Item Number				N/A			
	55	Serial Number			N/A						

NOTES :	
1	
2	
3	
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ANNEXURE-B

SPECIFICATIONS

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION # 0504215-PRO-SP-014

PAINTING AND SURFACE PREPARATION

PETROCHEMICAL ENGINEERING CONSULTANTS

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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

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 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

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.
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 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.

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 so brush. washed with an organic solvent and thoroughly dried off with a dry clot (e.g. with 1.1.1. Tricloroethane 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.

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 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. 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 10ºC, 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 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
- 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)
Covering capacity	12-13 M2/Lit/coat

b) 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%
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

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 Polymide 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 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.

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)
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.

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: Duel 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 400º 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 150º 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

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
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.

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 EOUIPMENT

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.

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

a) Normal Industrial Environment, Table 2.

b) Corrosive Industrial Environment, Table3

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 vale / 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

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 -	-10º C to 20ºC	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 -	21ºC to 60ºC	SSPC-SP-6	Two coats P-1, 25 Microns/ coat (Min.)	Two coats of F-1, 20 Microns/Coat (min.)	90	-
1.3	- do -	61ºC to 80ºC	SSPC-SP-6	Two coats P-3, 50 microns / coat (Min.)	Two coats of F-13, 25 Microns/Coat (min.)	150	-
1.4	- do -	81ºC to 250ºC	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 -	251ºC to 400ºC	SSPC-SP-10	Covered in Finish coat	Three coats of F-12, 20 Microns/Coat (min.)	60	- do -

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 -	- 10ºC to 20ºC	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 -	21ºC to 80ºC	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 -	81ºC to 400ºC	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,

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 -	-10ºC to 60ºC	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 -	61ºC to 80ºC	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 -	81ºC	SSPC-SP-	One coat	-	85	Paint application

		to 400ºC	10	F-9, 85 microns / coat (Min.)			at Ambient temp. Primer is acting as primer cum finish coat.
1.4	- do -	i) Upto 80ºC ii) 81ºC to 400ºC	SSPC-SP-10 SSPC-SP-10	One coat F-9, 65 microns / coat (Min.) -do-	One coat of F-2, 30 Microns/Coat (min.)	95 85	Paint application at ambient temp. Paint application at ambient temp. Primer is acting as primer cum finish coat.

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 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 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 ± 20 cm above the ground level marker and ± 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 0la 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.

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 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:

- 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.

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION # 0504215-PRO-SP-013

SPECIFICATION FOR EXPORT PACKING AND CRATING

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Table of Content

1.0 INTRODUCTION

This standard specification defines the minimum requirements for packing of equipment items in preparation for shipment to the Project Site.

2.0 DEFINITIONS

Following definitions apply throughout this document:

Company / Owner	Oil & Gas Development Company Limited (OGDCL)
Contractor	"Contractor" means the person or persons,firm or Proprietor whose proposal has been accepted by the Company for verification of FEED package, engineering design,procurement, inspection, supply of material and equipment, construction/ commissioning,performance testing, one year of defectliability period and training of Company's personnel for the project and includes the Contractor's representative(s), successors and permitted assignees.
Vendor / Supplier	The organization, firm or agency with who order for the supply of equipment and or material has been placed.

3.0 PRIORITY ORDER

Priority order of documents controlling the Work performed shall be as follows:

- Local laws and regulations.
- Project specific engineering specifications as included in scope of work..
- Industry Codes and Standards (API, ASME, etc.).
- CONTRACTOR / SUPPLIER's bid response documents.
- In the event of any conflict between this specification and the requirements of other COMPANY specifications or industry standards and codes, the more stringent requirements shall apply with the written approval of COMPANY.

4.0 GENERAL REQUIREMENTS

- Transportation shall also address packing requirements for single components, partial fabrications and completed items and be suitable for transportation whether by rail, road, plane or ship.

- Where applicable instruments shall be suitably tagged, packaged and crated.

- Package should be enclosed in cellophane and sealed against ingress of air.

- Title and address of the consignee should be printed /marked on at least three side of the crate.

- CONTRACTOR / SUPPLIER shall be responsible to provide the commissioning spares parts in separate crate.

- All Work shall be subject to inspection at any time. The CONTRACTOR / SUPPLIER shall immediately make any items available for inspection at the request of the COMPANY. The inspection or lack of inspection of the work by the COMPANY does not relieve the CONTRACTOR / SUPPLIER from the responsibility of performing the Work in accordance with this specification and shall make any repairs at his cost.

- Work shall not be released for shipment from CONTRACTOR / SUPPLIER's company ship until it has been inspected and approved by the COMPANY or such inspection and approval has been waived in writing from the COMPANY.

- CONTRACTOR / SUPPLIER shall be responsible for load out, packaging, bracing and securing for transportation for the work. CONTRACTOR / SUPPLIER shall provide COMPANY design, specifications, procedures and/or

drawings on CONTRACTOR / SUPPLIER's plan for load out method, transportation securing and bracing, packaging and field installation for COMPANY's approval 30 days before load out.

- Where applicable equipment is concerned the following shall apply:

a) All lifting devices necessary to lift and transport equipment and/or materials shall be fully identified, listed with the specific lift points and for large package items detailed prior to any handling operations. Spreader bar design calculation should be submitted to the COMPANY for review. Sling & shackles with adequate capacity and spreader bar should be provided along with shipped items by the CONTRACTOR / SUPPLIER.

b) All equipment should be empty and dry from test fluid.

c) All items subject to mechanical damage or corrosion shall be properly packed and protected from damage during shipment.

d) Exposed machined and threaded surfaces shall be coated with easily removable rust preventive.

e) Blank off all the nozzles with plastic caps.

f) Rounded shell should be supported with on wooden saddles with adequate numbers.

g) Exchangers shipped over the ocean shall be purged with nitrogen (N2) prior to closing for shipment and provided make-up with a N2 bottle. Exchanger shipped over land shall have a suitable desiccant, such as silica gel placed inside the nozzle.

CONTAINER STUFFING

- Weight should be evenly distributed throughout the container.
- Packages must not be placed on the top of other packages without adequate sub-flooring and bracing.
- All packages must be blocked and braced to prevent lateral, horizontal and vertical movement of the packages.
- All bulk heading, blocking, bracing and tie-down must conform to applicable railroad specifications for material shipped.
- All containers must be sealed with rail type seal numbers recorded for future reference.
- Locks are to be provided upon COMPANY's request.

5.0 COMMERCIAL EXPORT PACKING SPECIFICATIONS

- This specification covers the minimum requirements for CONTRACTOR / SUPPLIER with regard to preparing equipment, materials and spare parts for shipment in wooden boxes overseas.

- Equipment and materials will be protected to withstand extended periods of storage at the jobsite.

- System specified herein contains the minimum requirements. If the CONTRACTOR / SUPPLIER's standard procedures for export packing will provide equal or better protection than specified herein, this information should be brought to the attention of the COMPANY for review and authorization.

- These requirements are minimum and are designed to protect the equipment and materials from the normal hazards associated with inland transportation, port handling, ocean shipping and worksite storage. If certain aspects of aforementioned activities are not addressed explicitly in this Specification then generally accepted handling and shipping practices shall be used by CONTRACTOR / SUPPLIER. CONTRACTOR / SUPPLIER is required to obtain written approval from COMPANY prior to apply any such practice or procedure.

6.0 EXPORT PREPARATION

- All COMPANY's cargo shall be stored in a designated area and not intermingled with other cargoes to the extent possible.

- All wooden boxes, crates and skids shall be suitable for 4-way mechanical handling by forklifts or cranes. All heavy cardboard boxes should be banded to a pallet. All hood boxes shall clearly indicate the "Center of Gravity" and, where applicable, be marked "For Crane Lift Only" in English.

- CONTRACTOR / SUPPLIER shall ensure that every equipment or part of equipment is delivered to COMPANY according to the correct specifications.

7.0 EXPORT PACKING METHODS

7.1 METHODS

It is important that all material arrive at its destination in undamaged condition. The intent of this Specification is to serve as a minimum requirement for "commercial packaging for export", but compliance does not relieve CONTRACTOR / SUPPLIER from responsibility for adequately packing materials, supplies and equipment.

The following methods apply to designated materials and materials not suited for container shipments. The choice of methods to be used will be selected by mutual agreement between CONTRACTOR / SUPPLIER and the COMPANY.

Method I

Preservative coating with greaseproof wrap. Method I requires the use and application of preservative compounds. The coated part or item shall be enclosed in a greaseproof bag or wrap of greaseproof barrier material that shall be loosely applied around the coated part of item and shall be secured by taping, tying or other suitable means. Projections, sharp edges or other features of the part or item, which may damage the barrier, shall be cushioned. The type of barrier material and cushioning used shall be commensurate with the size, weight and irregularities of the preserved part or item.

Method II

Waterproof – Vapor Proof Barrier with Shell VPI–260. Items preserved, wrapped and cushioned shall be enclosed in a sealed bag. Shell VPI-260 (or equivalent when approved in writing by COMPANY) shall be in small porous bags positioned in the package at location such that the metal surfaces to be protected are within 300mm of the bags. Bags shall be secured by tying, by storage in especially provided baskets, by taping or otherwise secured so as to prevent movement, rupture of the bags or

barrier and damage of the parts. Shell VPI-260 shall be in porous bags of standard sizes. Cushioning shall eliminate projections, sharp edges or other features of the item(s) that may damage the water-vapor proof barrier. A sufficient vacuum shall be drawn to cause the flexible bag to cling snugly to the enclosed item. Care shall be exercised to ensure that an excessive amount of vacuum is not drawn which might cause puncture or rupture to the flexible barrier or the equipment itself.

Method III

Packaging for Mechanical and Physical Protection Method III is intended only for items not susceptible to damage or deterioration from corrosion. Un-preserved items shall be bundled; secured by tying, taping or strapping, skin packaged or enclosed with wrapping, bags, cartons, boxes or other containers, as applicable to the extent necessary to provide protection from hazards of contamination and physical damage encountered in handling, storage and issue. When bags, wrap or other flexible barriers are used, cushioning shall be applied as required to protect the enclosing media. Items packaged in rigid containers shall be supported as necessary to prevent free movement. The methods of preservation - packaging, cushioning, blocking, bracing or bolting shall be applied to provide controlled movement within rigid containers to prevent rupture of flexible barriers and physical damage of contents due to transmission shock and vibration. Items such as machines and assemblies having bolt holes in parts of the item which are sturdy enough to resist breakage when roughly handled shall be bolted to one face of the container or to a base which can be secured by use of lock nuts or cotter pins, or by upsetting bolt threads by pricking bolt threads in four places.

8.0 PACKING MATERIAL/PRACTICES

- For wooden boxes lumber shall be sound and well-seasoned, knots are permitted provided they are sound and tight and do not exceed one-third of the board width.

- For heavy cardboard, double wall, and waxed boxes, 227 kg (500 lb) test boxes are to be used.

- Plywood shall be construction and industrial grade and fabricated with exterior glue. It shall give equal strength in both directions of length and width and shall withstand full weather and water exposure.

- Nails shall be cement-coated.

- Metal strapping shall be un-annealed steel and applied to all packages with a stretching tool and secured with crimped steel seals. For heavy cardboard boxes nylon strapping securing the box to a pallet shall be crimped with steel seals.

- In all wooden boxes constructed with lumber or plywood the top shall be lined with waterproof paper where necessary.

- When consolidating material in a box or crate, items shall be packaged or nested reducing volume as much as possible. All items shall be braced and/or cushioned as necessary within the container to prevent damage from shifting.

- Small items and spare parts not secured to main item shall be separately boxed and properly identified as to its main item number.

- All controls and instruments mounted on equipment, including motor starters, shall be protected internally with Ludlow VPI wrap, Daubert VCI paper or porous bags of VPI-260. Exterior doors will be sealed by applying petroleum jelly to the sealing surfaces and closing. The jelly will cause more efficient seal. CONTRACTOR / SUPPLIER may substitute equivalent materials for Ludlow VPI wrap, Daubert VCI paper, or porous bags of Shell VPI-260, if approved in writing by COMPANY.

- It is necessary that all shipping containers be tightly packed. Where voids appear, they will be filled with cushioning material or securely blocked off to prevent any movement of contents.

- Machinery and large equipment shall be skidded, and shall be bolted and strapped to the skids. As required, items shall be cradled within crates for stability purposes. Specific packing instruction, as mutually agreed between COMPANY and CONTRACTOR / SUPPLIER, will be included in the purchase order for crating or boxing of large equipment, if required.

- Heavy items shall be securely blocked and braced to prevent damage to lighter materials packed in the same box. Heavy items, where possible, shall be packed on the bottom with light items on the top.

- Outer packages shall be packed in such a manner to insure an even distribution of weight within the case. All other packages will bear warning signs on the outside denoting the center of balance and sling marks. Top heavy containers will be so marked as "top heavy" or "heavy end". Outer packaging shall be constructed in a manner that will provide protection from pilferage.

9.0 TYPES OF PACKING

9.1 PALLETIZING

Items which are not crated or boxed and are impervious to damage from moisture, seawater, handling and external damage, which can be conveniently secured to a pallet to facilitate handling, shall be palletized.

9.2 BUNDLING&SKIDDING

All items shall be segregated to length and size and bundled or skidded into units not to exceed 1814 kg (4000 lbs) or 12 m (40 feet) in length unless previously approved by purchaser. Apply steel strap with a stretching tool and secure with crimped steel seals spaced up to 1-meter apart (40").

9.3 BOXES AND CRATES

The construction and reinforcing of a wooden box depends upon the weight of the box and its contents. The following are minimum requirements for various boxes.

45 – 1814 kg (100 - 4000 lbs.)

Box shall be made of a minimum of 25.4 mm (1-inch) nominal lumber board, 9.5 mm (3/8") plywood sheathing, completely cleated ends. All boxes over 22 kg shall be skidded. All seams shall be backed with an upright or brace.

1814 kg (4000 lbs) and up Box shall be constructed with a 102 mm (4") by 102 mm (4") nominal skid base. 51 mm (2") nominal floor, 25.4 mm lumber or 13 mm (1/2") plywood sheathing, with cleated ends. Top and sides shall be braced, with corner post, bracing and stiffening members of 51 mm (2") by 102 mm (4") nominal lumber. Load bearing members shall be placed as needed. Top and upper edge members of large or heavy boxes shall be reinforced with 102 mm (4") by 102 mm (4") or 102

mm (4") by 152 mm (6") nominal spreaders to prevent crushing of boxes when lifting-slings are used.

All wooden boxes to be fork lift able - 4 ways. Cardboard boxes to be of double wall waxed construction, 227 kg (500 lb) test and 1118 mm (44") x 1118 mm (44") x 1118 mm (44") OD with pallet. Intended to double stack and fit side by side in a standard 6.1 (20') or 12.2 m (40') shipping container

9.4 STRAPPING

All wooden boxes must be strapped with a minimum of 2 steel bands running parallel to skids. 19mm (3/4") nominal banding may be used on boxes less than 180 kg. For boxes or crates over 2722 kg (6000 lbs) 32 mm (11/4") or 51 mm (2") nominal banding must be used.

9.5 SPECIAL REQUIREMENTS

Electrical switchgear, electrical panels, chromatographs, computers, all material/ equipment which are susceptible to damage or deterioration from moisture, (i.e., humidity or rain), must be warehouse stored upon receipt and vacuum packed immediately, after checking. If the material has a discrepancy, all efforts should be made to quickly clear the discrepancy and pack the material.

Note: The above listed materials are not all inclusive and other possible applications should be noted and brought to the attention of COMPANY.

Special Materials: Any material which might need packaging differently than that which is stated herein shall be reviewed in writing on an individual item/order basis with COMPANY.

10.0 MARKING AND DOCUMENTATION

- All material must be packed within 4 working days after receipt, if automatic pack Purchase Orders, or within 2 working days after release by COMPANY if inspection is required.

- Specific instructions for shipping markings and documentation procedures will be in the order. Color coding of all packages and/or pieces will be required. All packing/documentation shall be segregated according to COMPANY's Job No.

- All markings and tags on wooden boxed equipment, packages, and crates shall be paint-stenciled (not marking pens) and capable of remaining legible after extended periods of storage in bright sunlight and atmospheric conditions encountered enroute to storage at the destination.

- All markings and tags on heavy cardboard boxes may be written on "peel and stick" labels with indelible marking pens, provided writing is neat and legible.

- Combined Commercial Invoice/Packing Lists must be issued for each shipment indicating all material orders export packed per package, with copy attached to package detailing contents of that package prior to delivery to dock. If pricing is in question, Packing List only may be attached to package prior to dock delivery.

- Final Combined Commercial Invoice/Packing List covering all shipments for a particular vessel must be completed and delivered to COMPANY within 48 hours of last dock delivery. Transfer should take place electronically.

11.0 REPORTING

CONTRACTOR / SUPPLIER will provide COMPANY with the following reports within the time intervals and at the frequencies shown:

- Cargo "On Hold" Report (Detailing all cargo "On Hold" pending resolution of problems). Nature of problem to be outlined on Report (e.g., missing Purchase Order No., overages, shortages, damaged materials, incorrect part numbers, etc.) Report shall be issued every Monday morning and transmitted to COMPANY electronically.

- "Packed Out" Report (Detailing all tonnage packed and ready for shipment). Report shall include CONTRACTOR / SUPPLIER's estimate of 12.2 m (40 ft.) Standard Containers needed to move cargo. Report to be issued weekly and transmitted to COMPANY.

OIL & GAS DEVELOPMENT COMPANY LIMITED

SPECIFICATION FOR UNFIRED PRESSURE VESSEL

(0504215-SP-021)

PETROCHEMICAL ENGINEERING CONSULTANTS

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TABLE OF CONTENT

1.0 INTRODUCTION

1.1 GENERAL

This specification is a standard specification for Unfired Pressure Vessels and outlines the minimum requirements of the COMPANY.

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1.2 DEFINATION

Following definitions apply throughout this document:

Company / Owner	Oil and Gas Development Company Limited (OGDCL)
Contractor	“Contractor” means the person or persons,firm or Proprietor whose proposal has beenaccepted by the Company for verification of FEED package, engineering design,procurement, inspection, supply of materialand equipment, construction/ commissioning,performance testing, one year of defectliability period and training of Company’spersonnel for the project and includes theContractor's representative(s), successors andpermitted assignees.
Vendor / Supplier	The organization, firm or agency with whom order for the supply of equipment and ormaterial has been placed.

1.3 ERRORS OR OMISSIONS

Review and comment by the COMPANY of any CONTRACTOR / SUPPLIER drawings, procedures or documents shall only indicate acceptance of general requirements and shall not relieve the CONTRACTOR / SUPPLIER of its obligations to comply with the requirements of this specification and other related parts of the Contract Documents.Any errors or omissions noted by the CONTRACTOR /

SUPPLIER in thisSpecification shall be immediately brought to the attention of COMPANY.

1.4 DEVIATION

All deviations to this Specification, other related specifications or attachments shall be brought to the knowledge of the COMPANY in the bid. All deviations made during the procurement, design, manufacturing, testing and inspection of the Works shall be with written approval of the COMPANY prior to execution of work. Such deviations shall be shown in the documentation prepared by the COMPANY.

1.5 CONFLICTING REQUIREMENTS

In the event of any conflict, inconsistency or ambiguity between the Contract scope of work, this Specification, Codes & Standards referenced in this Specification or any other documents, the CONTRACTOR / SUPPLIER shall refer to the COMPANY whose decision shall prevail.

1.6 REPORTING PROCEDURE

A reporting and documentation system shall be agreed between the COMPANY and the CONTRACTOR / SUPPLIER for the status of procurement, design, manufacturing, inspection, testing and shipment of the equipment/material to be supplied under this specification. CONTRACTOR / SUPPLIER's manufacturer shall provide reports and summaries for production performance and testing operations in conformance with a manufacturing schedule approved by COMPANY.
Weekly, monthly and run summaries of all major aspects of the production process shall be provided as reports to the COMPANY.

1.7 UUNIT RESPONSIBILITY

The CONTRACTOR / SUPPLIER shall be responsible for the complete design, manufacture supply, fabrication, installation/erection, inspection and testing of the vessels, including full compliance with all applicable design codes, and standards,

including those listed in Section 2.0 of this document and with the requirements of the independent certifying authority, where applicable.

2.0 REFERENCE CODES & STANDARDS (LATEST EDITIONS)

ASME Codes

Section VIII	Division I & Division II (Pressure Vessels)
Section IX	Welding Qualifications
Section V	Non-destructive Examination
Section II	Materials
Section II, (Part C)	Welding Rods, Electrodes and Filler Materials

ANSI Standards (Latest Editions)

B16.5	Steel Pipe Flanges
B.16.20	Metallic Gasket for pipe Flanges
B16.9	Factory Made Wrought Steel Butt-Welding Fittings
B36.10	Wrought Steel Pipes
B36.19	Stainless Steel Pipes
A58.1	Building Code Requirement for Minimum Design Loads in Building and Other Structures.
MSS SP-44 or ANSI B16.47	Steel pipe line flanges for dia> 24"

Steel Structures Painting Council Specification for Surface Preparation and Painting System;

In addition to the requirements of this specification, all requirements of the governing authority, i.e. the country and/or its sub-divisions, where the vessel is to be installed shall be met;

Pressure vessels shall be fabricated in accordance with ASME code by `U' stamp fabricator. Bidder to confirm name of fabricator in the bid and provide his `U' stamp certification from ASME.COMPANY's reference specification ENTS-401 shall also be considered.

3.0 APPLICABLE PROJECT SPECIFICATIONS

- Piping Specification
- Specification for Export Packing & Crating
- Specification for Painting and SurfacePreparation
- Specification for Production Welding
- Specification for Pressure Vessel Internals
- Specification for Equipment with lowTemperature service and their Materials ofConstruction
- Specification for Structure Steel Works
- Specification for Instrumentation for PackagedUnit
- Specification for Electrical requirements for Packaged Equipment

4.0 SITE ENVIRONMENTAL CONDITION

For site environmental condition including range of ambient temperature, rain fall intensity per day or annum and other essential parameters can be found in Annexure of Site Environmental Condition.

5.0 SCOPE OF SUPPLY

5.1 GENERAL

This specification sets forth the minimum acceptable standards governing the design, fabrication, material requirements, inspection, testing, identification and preparation for shipping of unfired pressure vessels.

5.2 MATERIAL, WORKMANSHIPAND SUITABILITY

All materials and parts included in the construction of the specified vessel shall be new, unused and of the highest grade being free from all defects or imperfections likely to affect their performance.

6.0 ENVIRONMENTAL DESIGN CRITERIA

For environmental / site conditions, please refer to “Specification for Site EnvironmentalConditions” in Annexure-H.

7.0 GENERAL REQUIREMENTS

7.1 COMPANY’s Requirements

The design life of equipment shall be 25 years.

Requests for substitutions of any kind shall be complete with all pertinent engineering information required for the COMPANY’s evaluation of the proposed substitution.
Vessel outline drawings and/or data sheet sketches submitted to the CONTRACTOR / SUPPLIER are not intended to cover complete details. The CONTRACTOR / SUPPLIER shall make detailed calculations for the design of the pressure vessels and shall prepare detailed shop drawings.

The CONTRACTOR / SUPPLIER shall concurrently submit to the COMPANY, fabrication drawings, weld procedures and detailed calculations for approval. Shop work shall not start until the CONTRACTOR / SUPPLIER have received drawings and weld procedures approved by the COMPANY. No subsequent revision may be issued to the fabrication shop unless it is approved by the COMPANY.

7.2 EARTHING

Each vessel shall be supplied with a minimum of two earthing bosses suitable for termination of 70 sq. mm earth cable.

7.3 TOLERANCES& DIMENSIONS

CONTRACTOR / SUPPLIER shall comply with the requirements as per ASME VIII.

7.4 NOZZLE PROJECTION

Unless specified otherwise, the nozzle projections shall comply with the requirements as per ASME VIII.

7.5 INSULATION& FIRE PROOFING

See insulation specification attached in tender document.

Fire proofing shall be provided on unfired pressure vessel. Contractor needs to share the detailed specification and drawings to COMPANY for approval.

8.0 DESIGN

8.1 DESIGN CONDITIONS

The design pressure shall be in accordance with the code, but shall be at least 30% above the maximum operating pressure.

Design Temperature shall be $\pm$50 ^{O}F than maximum/minimum allowable operating temperature.

8.2 DESIGN LOADINGS

The Vessel(s) 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 pipework shall be assumed as equivalent to one and one-half times the wind loading of the insulated vessel.

Pressure vessel 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 set by the code, and the deflections set by Section 6.4 of this specification:

- 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;
- Continuous monitoring of vessel conditions by mechanical testing during operation conducted by operating and maintenance team after start-up and handing over;
- Any other condition, which would affect the safety of the vessel e.g. cyclic loading;

8.3 DESIGN STRESS

Allowable Stress

Shall be the maximum stresses permitted by the basic design code.

Test Condition

The allowable general membrane stress shall be the maximum of 90 percent of the minimum specified yield or proof stress of the material of construction.

Anchorages

Foundation bolts for vessels shall have a maximum allowable tensile stress of 110 N/mm^2.

8.4 DEFLECTION LIMITS DUE TO APPLIED LOADS

The static deflection of vertical vessels in the corroded condition due to the full wind load shall be limited to 1 in 200 of the vessel length.The deflection due to applied load and self weight of distributors, gratings, etc. and their supports, in the corroded condition, shall be limited to 1 in 500 of their span.Vertical vessels with a ratio of overall height to diameter exceeding 15 shall be designed for dynamic stability under wind induced vibrations.

8.5 NOZZLE LOADING

Nozzle Size	Resultant Force (N)	Resultant Moment (RN)
2”	1435	380
3”	2930	1140
4”	4100	2080
6”	7000	5230
8”	10190	9800
10”	13950	16510
12”	16500	22820
14”	17500	26110
16”	19350	32310
18”	21000	38310
20”	22450	44260
24” – 30”	24750	54880

The above table gives the resultant forces and moments induced from pipework systems, which are to be allowed. CONTRACTOR / SUPPLIER shall consider the force acting radially together with the moment acting either in a longitudinal or circumferential direction. The above table does not apply to equipment nozzles within packaged units where actual loading conditions should be applied. CONTRACTOR /

SUPPLIER shall ensure that the above nozzle loadings will not induce unacceptable stress levels in the vessel shell or head, in compliance with the relevant vessel design code.

8.6 DRAWINGS & CALCULATIONS

Shop details shall be complete with all dimensions, thicknesses and details of construction, including dimensional location of circumferential and longitudinal seams, and all nozzle locations and orientations. All material thicknesses shall be shown, including spherical radius and knuckle radius of heads. All welds shall be detailed or fully described by notes or weld symbols, and annotated to the relevant weld procedure specification.

The assembly drawings shall contain all pertinent information relating to the standards, codes and specifications used in the design, fabrication, inspection and testing of the vessel, including the materials used, plus the total weight of the vessel empty, operating and full of water.

A detail of the skirt, base ring and chairs for vertical vessels or saddles for horizontal vessels shall be provided, complete with all dimensions and descriptions of material, including number, diameter, and location of anchor bolt holes. If this information is furnished by the COMPANY it shall be checked by the CONTRACTOR / SUPPLIER and so noted on the appropriate drawing. Foundation loading data shall also be provided by the CONTRACTOR /SUPPLIER. CONTRACTOR / SUPPLIER shall submit detailed calculations establishing thecompliance of design 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 for its applicability to the design.

All calculations shall be complete, giving all references and showing all working methods. Computer printouts will not be accepted without the program flow chart, input data and complete printout, and then only by prior written agreement with the COMPANY at the quotation stage.Review of drawings, calculations and other

documents by the COMPANY, does not relieve the CONTRACTOR / SUPPLIER of his responsibility for the correctness of the design to suit the stated conditions.

9.0 MECHANICAL REQUIREMENTS

9.1 MINIMUM THICKNESS

After forming, the minimum thickness of shell and head shall, for carbon steel and low alloy steel vessels, be as follows:

Vessel I.D.	**Min. Thickness with Corrosion Allowance**
1500 mm & below	6 mm
1501 – 2500 mm	8 mm
2501 mm	10 mm

Minimum thickness of materials other than carbon steel shall be based on the structural stability of the vessel in addition to the requirements of pressure and other mechanical loading. However, the minimum thickness of high alloy (austenitic) steel vessels and their components shall not be less than 6mm.Minimum wall thicknesses of carbon steel and low alloy nozzle necks, includingcorrosion allowance, shall be the greater of the code requirement or the following:

- 2" through 6" - Sch. 80.
- 8" through 24" - Std. Wall

Skirts shall be designed for load conditions, but shall not be less than 6mm wall thickness. Minimum thickness of internal carbon steel attachments shall not be less than 6mm excluding corrosion allowance.

9.2 CORROSION ALLOWANCE

Unless otherwise specified on the data sheet, carbon steel vessels and internals shall have 3mm corrosion allowance applied to all pressure retaining parts and all

surfaces of non-removable internals exposed to the process fluid. Removable internals shall have half 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. When corrosion allowance is provided by a corrosion resistant metallic lining, a minimum thickness of 3mm of lining material shall be used or otherwise as specified on Data sheet (Annexure A).

Vessel parts, which are subjected to erosion e.g. due to impingement by the process stream, shall be protected with wear plates, or impingement baffles. Flaked glass lining may be provided on the inner surface of inlet separator vessels to avoid erosion due to high velocity inlet fluid, which may contain abrasives/solid particles etc. and also to avoid corrosion effect in water boot section.

9.3 HEADS

Vessel heads shall be one-piece semi-ellipsoidal (ratio 2:1) unless otherwise specified. Pressure vessels having design pressure 150 psig & above, shall have one piece hemispherical heads.

Torispherical and hemispherical heads may be used provided all pertinent dimensions and information is submitted to the COMPANY for approval before the heads are ordered.

Heads shall have straight flange of not less than 50mm or two times the thickness, whichever is greater. All heads, which have been formed cold or below final tempering temperature.Heads produced from more than one plate shall have the welds 100% radiographed after forming.

9.4 SUPPORTS

Horizontal vessels shall be supported on two steel saddles only. Saddles shall be furnished by CONTRACTOR / SUPPLIER. There shall be two (2) ½" NPT tapped

tell-tale holes at outer extremities in each saddle pad. Saddle pads shall have rounded corners. Saddles shall provide support for at least 120° arc at the circumference of vessel shell (As per ASME VIII).

Calculations shall be provided for the effect of support saddles on the vessel shell and heads. Vertical vessels shall be supported on steel skirts. Small vertical vessels less than 1200mm Inside Diameter may be supported on structural legs, or lugs, where advantageous to plant layout. Skirts are however mandatory for all vertical vessels with a height to diameter ratio greater than 5.

All vessels shall be designed to be self-supporting without benefit of guys or braces. Vessel skirts shall be of the height required to provide a clearance not less than 480mm between the bottom of the head and the deck/foundation. All vessels provided with skirts shall have a reinforced access opening of 400mm minimum diameter. Skirts for vessels smaller than 920mm nominal diameter shall be provided with at least one 200mm access opening. Desired orientation of openings shall be shown on the vessel drawing, or affixed on CONTRACTOR / SUPPLIER's approval drawings.

Vessel skirts shall be provided with 3" diameter reinforced vent holes at approximately 920mm intervals on the circumference, located as near the vessel head as permitted by insulation or other attachments. No skirts shall have less than two such vent holes. The following joint factors should be applied to vessel skirts:

- Circumferential seams - 0.7
- Skirt to shell joint - 0.55
- Skirt to base ring joint - 1.0

9.5 MANHOLES, NOZZLES& INSPECTION OPENINGS

Manholes, handholes, cleanout openings and end flanges shall be provided as required for operation and maintenance and to meet Code requirements for inspection.

Cleanout openings shall be 4" minimum inside diameter, and shall be complete with blind flanges, bolting and gaskets and hinged, if not accessible to ground or a platform, for ease in maintenance. Where inspection openings are required the minimum size shall be 4" nominal. Trayed or packed towers shall be served by adequate internal and external access openings and shall have at least a top and bottom manhole. Packed towers shall have a manhole above the top level of the packing and below each support grid. A minimum 12" nominal opening shall be provided above each grid to permit removal of packing. Where the centreline of the lowest manhole is more than 1525mm above the vessel bottom, ladder access shall be provided to the interior vessel bottom.

Manholes shall be at least 480mm clear inside diameter, and are to be complete with blind flanges, bolting, gaskets, and davits or hinges. No bolts smaller than M 16 diameter may be used.The minimum connection size welded into a vessel shall be 2" NB, swaged if required to the specific line size and terminating with a flanged connection. Alternatively, an appropriate long welding neck forging may be used for the connection provided it has a 2" or greater diameter hub. The only exception to the above shall be nozzles for vessels in water, air and steam (if applicable) service in which the pressure does not exceed 13.50 barg and the temperature does not exceed 160°C.

Full penetration welds shall be used for all body flange, nozzle and manhole attachments. Other attachment weld details are not acceptable without specific approval of the COMPANY. All flanges for external nozzles and manholes of 24" diameter and smaller shall be in accordance with ANSI B16.5 and shall be raised face unless otherwise shown on the individual vessel data sheets and/or drawings. Pressure-temperature ratings of ANSI B16.5 shall apply for the design condition. Flanges over 24" diameter shall be in accordance with MSS Standard Practice SP-44. Non-standard size flanges shall be calculated in accordance with ASME Code Rules.Raised face flanges for use with spiral wound or soft metal jacketed asbestos gaskets shall have a smooth finish (125 RMS). Raised face flanges for use with compressed asbestos gaskets shall have contact surfaces as follows:

- Nominal size 12" and smaller - A continuous spiral groove generated by a 1.8mm radius round-nose tool at a feed of approximately 0.9mm per revolution.
- Nominal size above 12" - A continuous spiral groove generated by a 3mm radius round-nose tool at a feed of approximately 1.3mm per revolution All nozzles shall be flush with inside of vessel wall unless otherwise indicated on vessel data sheets.

Where two or more openings are provided for installation of equipment, such as gouge glasses, level controls, etc. they shall be set with a Jig to prevent tolerance from being additive. No threaded connections shall be screwed directly into any part of the vessel except for tell-tale holes in reinforcing pads. Minimum nozzle connection size shall be 2” flanged type.

All bolt holes in manholes, handholes and nozzles and anchor bolts on supports shall straddle the normal vessel centreline unless otherwise specified. Pad type nozzles, handholes etc. shall not be used unless written approval is obtained from the COMPANY. Nozzles may be either integral forgings or fabricated from seamless pipe and welding neck flange joined by full penetration welds. Other type built-up nozzles are not acceptable without approval of COMPANY.

Flanges for internal nonpressure piping may be slip-on-type. Set-on type nozzles shall only be used with prior agreement from the COMPANY and provided that 100% Ultrasonic Examination of the shell plate is carried out adjacent to the opening. Examination is to be in accordance with ASTM A-435 to cover a minimum of two times the opening diameter.

9.6 REINFORCEMENT

Reinforcement of nozzles and manholes shall be designed to provide 100% compensation for the as built thickness of the shell/head, in accordance with the specified design code. The reinforcement for openings shall be provided by either self reinforcing type nozzles or built-up, seamless pipe and WN flange with pad reinforcement as necessary.

Reinforcing pads when applied shall have a minimum width of 2" or three times the pad thickness, whichever is greater. Reinforcing pads shall be made in one piece if possible. Large reinforcing pads may be made from two pieces provided that written approval is obtained from the COMPANY. Integral reinforcement of openings shall be provided for vessels in the following categories. Reinforcing pads shall not be used in these instances:

- Vessels in lethal service;
- Vessels designed for temperatures below 0°C;
- Vessels with shell thickness exceeding 50mm;

All rectangular reinforcing pads when used for external or internal attachments shall be radius 25mm minimum.

9.7 INTERNAL ATTACHMENTS

The vessel fabricator shall furnish and install all internal support rings, down comer supports, bars, gratings, grating supports, tray lifting, tray leveling device, vortex breakers, piping and all other internals as and where required by the appropriate drawings. Internals shall be fixed by bolting to cups or rings for ease of maintenance.

Mitred joints shall not be used, unless otherwise specified on drawings and agreed by the COMPANY. Major internal piping shall be flanged for ease of removal through vessel manholes. All removable internals shall be fabricated so as to pass through the vessel manholes.Support and fixed internals welded to shell/head, shall be seal welded to prevent crevice corrosion. Seal and strength welds shall carry the appropriate corrosion allowance.

All internal crevices where supports and fixed internals are welded to the shell/heads shall be seal welded to exclude process fluids. Seal and strength welds shall carry the appropriate corrosion allowance.

9.8 EXTERNAL ATTACHMENTS

Vessel fabricator shall furnish and attach all insulation support rings, external pressure stiffeners, lifting lugs, ladder and platform lugs, and pipe supports unless otherwise specified. Reinforcing pads shall be continuously welded to vessel beneath all attachments where the welding of such attachments would cause excessive concentration of stress on vessel at those points. Each pad shall contain at least one ½" NPT tapped tell-tale hole.

All vessels greater than 3600mm installed height shall be fitted with a full length ladder, Platforms for maintenance shall be provided as necessary for safe access to manholes, relief valves, control valves, controllers, etc. Sample connections, thermometers, thermowells, gauges and control instruments shall be accessible from a platform or a ladder. Tower davits shall be provided as necessary for proper maintenance. All attachments shall be continuously welded.All vessels, vertical or horizontal, shall be furnished with a minimum of two lifting lugs, which shall be designed for a load equal to two times the shipping weight.

9.9 VIBRATION ANALYSIS

A dynamic wind analysis shall be performed for all towers taller than 100 ft (30 m) with a height-to-diameter ratio greater than 15. The following conditions shall be met:

- Vessel diameter (d) shall be the predominant outside shell diameter of the top one-third of the vessel.

- Vessel height (H) shall be the total height of vessel from base of skirt to top of head.

- The maximum single amplitude (deflection) at the top of the vessel due to dynamic wind load, including rotation of the concrete foundation or structure, shall not exceed 0.5 percent of H.

10.0 ADDITIONAL REQUIREMENTS FOR FLANGED GIRTH JOINTS

1. Flanged girth joints shall be designed for through bolting. Proposals for alternative joint design shall be submitted to the COMPANY for approval.

2. Flanges for girth joints shall conform to the following:

- Flanges shall be according to ASME B16.5, ASME B16.47 Series B, or designed according to ASME SEC VIII D1 with allowable stresses determined according to that code.

- Welding neck flanges shall be used where the pressure-temperature design conditions require an ASME Class 300 or greater flange.

- Slip-on flanges shall not be used if any of the following conditions are exceeded:

  - Pressure-temperature design conditions require an ASME Class 300 or greater flange.

  - Design temperature exceeds 750°F (400°C).

  - Specified corrosion allowance for the vessel is greater than 1/8 in. (3 mm).

  - The vessel is in hydrogen service.

- Girth flanges larger than NPS 24 that are not in accordance with ASME B16.47 Series B shall be designed to meet the flange rigidity recommendations in ASME SEC VIII D1.

- Unless otherwise specified, gasket contacts surfaces shall have a finish in accordance with reference Codes and Standards.

- Allowable flatness tolerances of gasket contact surfaces for the appropriate service condition shall be as per reference Codes and Standards.

- For confined joint construction (peripheral gasket confined on OD):

  - Nubbins, if provided, shall be located on the female (grooved) flange.

  - The clearance between flanges after assembly shall be not less than 3/16 in. (5 mm). This clearance shall extend from the periphery of the flange to within the bolt circle.

11.0 MATERIALS

11.1 GENERAL SPECIFICATION

Materials of construction for pressure parts shall be in accordance with the design code. Alternative materials may be used if advantageous with the approval of the COMPANY. Proposed substitutions must be clearly defined:

- Vessels having design temperature below 0°C are considered as cold vessels.

- Vessels having design temperature over 0°C considered as warm vessels.

11.2 SHELL / HEADS

Unless otherwise specified in drawings or data sheets, materials for shell/heads shall be as under:

- Material for warm service pressure vessel shell/heads shall be:

  ASTM A-515 for Intermediate & High Temperature Service;

  ASTM A-516 for Moderate & Lower Temperature Service;

- Material for cold service pressure vessel shell/heads shall be:

ASTM A-516 for Pressure Vessel having Design Temperature upto -46°C with impact test.

ASTM A-203 Gr. D for Pressure Vessel having Design Temperature upto -101°C with impact testing corresponding to vessel design temperature.

ASTM A-240 Gr. 304 for Pressure Vessel having Design Temperature upto -178°C without impact testing.

11.3 SUPPORTS & MISCELLANEOUS PARTS

Any material welded directly to the pressure retaining parts shall be of similar quality as the vessel plate, including impact requirements if any, for a length measured from the vessel wall of at least 150mm. The material of such items beyond this point may be structural quality A283 Gr. C, or equal.

ASTM A-203 Gr. D or ASTM A-240 Gr. 304 shall be used for cold vessels.

11.4 BOLTING

Bolts and nuts shall be furnished by the CONTRACTOR / SUPPLIER for all cover plates, manholes, blind flanges and bolted attachments supplied with vessels. Bolts and nuts shall be new.
External bolting shall be alloy steel stud type and selected for maximum and minimum design temperatures.
For warm vessels; all external bolting shall be cadmium plated to ASTM A-193 Gr. B7 c/w ASTM A-194 Gr. 2H nuts.

For cold vessels; all external bolting shall be cadmium plated to ASTM A-320 Gr. L7 c/w ASTM A-194 Gr. 7 nuts.

All internal bolting to be stainless steel;

Flange bolting of nominal size 1½" and above shall be subject to bolt tensioning. CONTRACTOR / SUPPLIER to supply flange stud-bolts over length by one nut thickness and complete with 3 nuts to facilitate bolt tensioning for all flanged connections for which CONTRACTOR / SUPPLIER supplies a mating flange,bolt tensioning will be carried out on site by Contractor.

11.5 FLANGES

Flange material shall be of a similar quality to the vessel shell including impact properties where applicable. Forgings shall be supplied in the normalized condition.

For warm vessels; all flanges material shall be ASTM A-105. For cold vessels; all flanges material shall be ASTM A-182 Gr. 316 for Stainless Steel Vessels or ASTM A-350 Gr. LF2 for Carbon Steel (with impact test) Vessels.

11.6 GASKETS

Gaskets shall be furnished by the CONTRACTOR / SUPPLIER for all bolted attachments i.e. cover-plates, manways, and blind flanges supplied with vessels. Unless otherwise specified, gaskets shall be in accordance with ANSI B16.5 as follows:

- For Flat Face, 150 LB ANSI flange: Full Face, 1.6mm thick compressed non-asbestos.

- For Raised Face, 150 LB ANSI flanges: thick compressed Spiral wound stainless steel, non-asbestos filled with spacer rings.

- For Raised Face, 300 & 600LB ANSI flanges: Spiral wound stainless steel, non-asbestos filled with spacer rings.

- For Ring Joint, 900, 1500 and 2500 LB ANSI flanges: Oval Ring per ANSI B16.20, Armco soft iron or equal. (90 Brinell Max).

Gasket material for nozzles connected to external pipework and valving shall be in accordance with the Project Specification for Piping Design and Materials.

11.7 IMPACT TEST REQUIREMENTS

Charpy V-notch impact testing is required in accordance with the code except that this shall apply to all vessels with a design temperature below 0°C. These vessels shall meet the requirements of ASME Section 11 Part A, SA20 and Clause UG-84 of ASME VIII Division 1.

12.0 FABRICATION

12.1 START OF FABRICATION

No manufacture may begin until CONTRACTOR / SUPPLIER has received written approval of his detailed fabrication drawings from the COMPANY or their authorized representative.

The CONTRACTOR / SUPPLIER shall notify the COMPANY or their authorized representative in reasonable time before actual fabrication begins.

12.2 FORMING

Shell plates shall not be formed until actual head dimensions are known. Plates shall be formed in the same direction as the final roll given in manufacture.

12.3 WELDING

All welding shall be in accordance with the code, standard and welding specification for this project. The CONTRACTOR / SUPPLIER shall submit proposed weld procedures and weld details for the COMPANY'S review and approval prior to commencing any production welding.

Submerged arc welding is preferred on all vessel seams. For materials with yield strength exceeding 330 N/mm2 and/or thickness exceeding 20mm, consumables for manual metallic arc welding shall be of the basic low hydrogen type. CONTRACTOR / SUPPLIER shall establish a procedure for maintaining proper control of welding consumables.

Low hydrogen electrodes shall be dried or baked at the temperature level and times specified by the manufacturer, and shall be used within 8 hours when stored in quivers. Electrodes stored in quivers, but not used within the specified times, shall be restored in ovens.

No electrodes shall be left lying about the site, or in workshops. Electrodes so left shall be scrapped. Submerged arc flux shall be stored in moisture-proof containers in a dry location, at a temperature of above 20°C. Submerged arc consumables shall be withdrawn from store only when required for immediate use. Used consumables shall be returned to store on completion ofthe welding operation.

Submerged arc flux may be recycled but shall be free from fused flux, mill scale, dirt or other foreign matter. The CONTRACTOR / SUPPLIER shall provide proof to the satisfaction of theCOMPANY'S Inspector that the welder has been using the process for which he is qualified within the previous 3 months. If not, then the welder shall be required to re-qualify. Backing rings shall be used only with approval of the COMPANY.

Adjacent longitudinal seams shall be staggered to give between seams a minimum of 60° orientation or 2000mm whichever is greater. Shell seams shall be located to miss long internal attachment welds (trays, downcomers, etc.) and all nozzles and manhole openings and their reinforcing pad.

Longitudinal and circumferential seams in shells and all seams in heads shall be full penetration single or double butt-welds of the 'V' or 'U' type. Lap welds are not permitted.All weld procedure numbers shall be shown on drawings. All welding without subsequent postweld heat treatment is prohibited on the following:

- Materials and thickness criteria defined within the design code.
- Chrome-moly alloy steels containing more than 2% Cr or more than 0.6% Mo.

Production test plates shall be conducted on longitudinal shell seams and head seams (if any) where run-off tabs shall be used. This shall apply to vessels with a design temperature below 0°C and thickness greater than 25mm. One production test plate shall be provided per vessel for each weld procedure and shall be subject to full mechanical testing in accordance with ASME IX. Production control test plates shall be post-weld heat treated with the vessel where applicable.

The weld ligament, i.e. the distance between the edges of weld preparations for any two nozzle welds, or between nozzle welds and seam welds and attachment welds, shall be twice the shell/head thickness plus 25mm. No welding shall be allowed after PWHT. All attachments including ladder and platform clips must be welded before PWHT. All fillet welds shall be continuous.

12.4 WELD REPAIRS

All repairs welding shall be in accordance with procedures previously approved by the COMPANY. The repaired weld shall be subjected, as a minimum requirement, to the same testing and inspection as the original weld. The cost of all repairs and subsequent inspection shall be the responsibility of the CONTRACTOR / SUPPLIER. Weld repairs shall take place before hydrotesting and care shall be taken to ensure that the wall thickness is not reduced below the specified minimum design thickness. Surface defects, and areas of weld resulting from the removal of temporary attachments shall be ground smooth and the area subjected to 100% crack detection.

12.5 WELDING PROCEDURE QUALIFICATION RECORD (WPQR)

Each weld procedure shall be covered by a suitable procedure qualification tested in accordance with the requirements of ASME IX.

12.6 PREHEAT REQUIREMENTS

The minimum preheat for ferritic steels shall be in accordance with Appendix R of ASME VIII DIV I. Calculations of preheat temperature to suit particular combined plate thickness, chemical composition, heat input, consumables and restraint can however be made by reference to the following:

Welding Steels without Hydrogen Cracking, international Institute of Welding 1973;

Note: This guide is primarily suitable for carbon, carbon manganese fine grain and carbon molybdenum steel with less than 0.6% Mo.

The required preheat temperature shall be established before commencing welding, and held until welding is complete. Preheat temperatures shall be controlled by temperature indicating crayons or contact pyrometer.

12.7 POST WELD HEAT TREATMENT REQUIREMENTS

Vessels shall be post-weld heat treated when required by the design code depending on the combination of material, thickness and design temperature. All vessels in lethal service shall be post-weld heat treated. Post-weld heat treatment shall also be considered for vessels subjected to large amounts of welding and where pressure parts have been formed from thick plateinto tight radii.

Field post-weld heat treatment procedures must be reviewed by the COMPANY. The CONTRACTOR / SUPPLIER shall include in his material sub-order(s), how many heat treatments are likely to be carried out during fabrication, and he shall ensure that he receives a guarantee from the mill that the steel supplied can be heat treated as proposed, without detrimental effect on the minimum guaranteed mechanical properties.

The use of manually operated gas torches or gas rings shall not be permitted for PWHT. During PWHT, a minimum of six thermocouples per furnace load shall be

used to ensure that uniform temperature is achieved throughout the heat treatment cycle. The thermocouples shall be used to record metal skin temperature.

If welded repairs are made to a vessel, which has been heat treated, the vessel shall again be heat treated. This treatment shall form part of the repair procedure. All heat treatments shall be recorded and documented by a temperature recording chart. The welding and associated heat treatment of stainless steels shall take into account the ease with which this material can be sensitized and its corrosion resistant properties thereby impaired.

13.0 INSPECTION, TESTING AND CERTIFICATION

13.1 GENERAL

All non-destructive examination shall be carried out in accordance with the design code as a minimum. All personnel involved in non-destructive testing shall be qualified to aninternationally recognized standard.

Inspection and testing shall be carried out at the CONTRACTOR / SUPPLIER'S works and shall be witnessed by the COMPANY'S authorized representativesand/or the certifying authority if applicable.

The responsibility for inspection rests with the COMPANY. However, the COMPANY reserves the right to inspect vessels at any time during fabrication to ensure that materials and workmanship are in accordance with this specification, and/or the approved drawings.

The CONTRACTOR / SUPPLIER shall provide a projected shop schedule with appropriate fabrication stages at the time drawings are submitted for approval, to highlight the inspection activity schedule. The approval of any work by the COMPANY or their authorized representative and the release of a vessel for shipment shall in no way relieve the CONTRACTOR / SUPPLIER of any responsibility for carrying out the provisions of this specification.

The CONTRACTOR / SUPPLIER shall inform the COMPANY at the time of placing the order of any tests, which cannot be adequately performed.

13.2 RADIOGRAPHIC INSPECTION

Except where amplified in this specification the extent of radiography shall be in accordance with the design code. When 100% radiography is specified for all welds, including flange butt welds and nozzle to shell connecting welds, shall be fully radiographed. Where radiography is considered to be impractical ultrasonic inspection may be substituted with prior approval of the COMPANY.

For vessels requiring radiography where heat treatment is required, the radiography must be carried out after heat treatment. The CONTRACTOR / SUPPLIER may at his discretion carry out radiography prior to heat treatment. The COMPANY'S appointed inspector shall see all radiographs and shall be advised of any defects found in any welds.

13.3 ULTRASONIC INSPECTION

Ultrasonic inspection may be substituted for radiography with prior approval of the COMPANY in areas that are inaccessible for radiography.

For vessels requiring U/T examination where heat treatment is required, the examination must be carried out after heat treatment. The CONTRACTOR / SUPPLIER may, at his discretion carry out U/T examination prior to heat treatment.

13.4 MAGNETIC PARTICLE& DYE PENETRANT INSPECTION

All magnetic particle and Dye Penetrant inspection shall be performed in accordance with the design code.

As. a minimum, the following applies at all nozzles, manways, and reinforcing pads:

- Load bearing fillet welds shall be checked at root runs and finished welds by magnetic particle or dye penetrant method.

- All full penetration attachment welds shall be magnetic particle inspected at the bock-chipped surface and on all finished weld surfaces.

Crack detection of finished welds shall be carried out after hydrotest and PWHT (where applicable). Magnetic particle inspection is preferred particularly after post-weld heat treatment. Vessels of low chrome alloy with plates over 50mm thick shall receive this inspection of all weld seams after post-weld heat treatment.

13.5 ACCEPTANCE CRITERIA

The acceptance standard for Non-Destructive examination of welds shall be in accordance with the design code.

13.6 SUPPORT& REINFORCING POD INSPECTION

Welds of reinforcing pads shall be tested to 1 barg with dry air after fabrication (but prior to the hydrostatic test of the vessel) using suitable materials for the detection of leaks.

13.7 HYDROSTATIC TESTS

Hydrostatic tests shall be carried out in presence of the COMPANY appointed inspector and a representative of the certifying authority, when applicable.
Hydrostatic testing shall be in accordance with the design code. Fresh water only shall be used for testing. For vessels manufactured from stainless steel the chloride ion content of the test water shall not exceed 30ppm. During testing the temperature of the vessel and test water shall not be lower than 7°C and not more than 25°C. Adequate support shall be provided for vertical vessels tested in the horizontal position to ensure that they are not subjected to excessive local loadings and bending stresses. Hydrotest pressure shall be held for a minimum of 60 minutes, irrespective of design code requirements.

13.8 TEST BOLTING

After the successful completion of the hydrostatic test, the bolting used during testing shall be replaced. Service bolts; nuts and gaskets furnished by the CONTRACTOR / SUPPLIER shall not be used for testing. The test bolts shall form part of the total equipment supply.

13.9 NAMEPLATE

13.9.1 GENERAL

Each complete vessel shall be provided with a type 316 stainless steel nameplate securely attached to the vessel shell and located so that it is clearly visible after installation. Nameplates shall be rivetted to a bracket welded on the vessel and the inspection authority then overstamps one rivet. Insulated vessels shall have nameplate brackets with enough projection to clear insulation by at least 25mm

13.9.2 STAMPED DATA

The following information shall be stamped on the nameplate:

- Manufacturer's Name;
- Manufacturer's Serial Number;
- Tag Number;
- Purchase Order Number;
- Equipment Title;
- Maximum allowable working pressure (Hot and Corroded) barg at °C;
- Maximum test Pressure (Corroded) in barg;
- Year Built;

- Size I.D./O.D. xT to T in mm;
- Service;
- Corrosion Allowance in mm;
- Design Code/Code Symbol showing degree of radiography and/orstress relieved and type of construction;
- Weight empty/operating/hydrotest in kg;
- Inspection authority and date of inspection;
- Code symbol showing if the unit is x-rayed and stress relieved;
- Design temperature and pressure;
- Operating temperature and pressure;

13.10 REPORT & ACCEPTANCE CERTIFICATES

With regard to witnessed tests the CONTRACTOR / SUPPLIER shall prepare a report on the tests and the results, these shall be included in the 'Certification Data Books'. All Data Books produced shall be complete and copies submitted to the COMPANY for review not later than 4 weeks after the date of completion of the tests.

13.11 CERTIFICATION DOCUMENTS

The COMPANY shall store in good order all material certificates, fully catalogued and indexed NDT test records, mechanical test certificates, welding qualification certificates, heat treatment certificates and hydrostatic test certificates for a minimum of 5 years after acceptance of the complete and fully certified vessel by the COMPANY.

All certificates shall be available for counter signature by the certificationauthority.

14.0 PAINTING AND PREPARATION FOR SHIPMENT

14.1 PAINTING & PROTECTIVE COATINGS

Painting, protective coatings and the procedures used for the preparation of surfaces shall be as specified in the Project Specification for Painting and Protective Coatings.

Where painting is specified, the entire vessel shall be painted, including inside of skirt, outside of bottom head, entire base ring and all skirt attachments. Nozzles shall be painted on the flange edges, inside bolt holes, and up to the gasket surface.

Fireproofed/Insulated surfaces shall be shot blasted and given one coat of primer only. The CONTRACTOR / SUPPLIER shall stencil in a prominent position in 50mm high characters the dry lifting weight of the vessel and for stress relieved vessels the words "NO WELDING PERMITTED".

14.2 PREPARATION OF SHIPMENT

After the final hydrostatic test, the vessel 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 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 CONTRACTOR / SUPPLIER shall be responsible for loading and anchoring vessels to prevent any damage during shipment.

When shipped loose, all instruments, valves, parts, etc., of a vessel shall be tagged with vessel number and purchase order number to facilitate match-up with appropriate vessel in the field. Tags and wire shall be stainless steel. All such items shall be boxed and where possible attached to the inside of the skirt or saddle.

CONTRACTOR / SUPPLIER shall state in the proposal his recommendations for long term storage (up to 12 months) for both indoor and open-air storage in a marine environment.

15.0 SPECIFIC REQUIREMENTS FOR CLAD VESSELS

15.1 DESIGN

Design calculation shall be based on the nominal thickness of the base material i.e. shall not include any allowance for the cladding thickness. The thickness of corrosion resistant linings applied to nozzles shall not be less than the thickness specified for the vessel.

The principle shall be satisfied that the design of a cladding or lining accounts for the effect of differential thermal expansion and has sufficient ductility to accommodate any strain likely to be imposed during service.

15.2 MATERIALS

Pressure vessel parts constructed of integrally clad plate, and vessel parts fully or partially lined by welding after forming, shall satisfy the requirements of ASME Section VIII DIV I Part UCL.

The use of linings other than those obtained by using integrally clad plate or overlay weld deposits shall be avoided and requires special approval of the COMPANY. Integrally clad plate shall be of the homogeneously clad type as obtained by roll cladding or explosive bonding. The clad plates shall conform to ASTM A-263, ASTM A-264 & ASTM A-265, as applicable, irrespective of the design calculation method used. Integrally clad plate shall be ultrasonically tested to check the quality of the bond in accordance with the requirements of ASTM A579, acceptance level S6. The branches in clad vessels shall be cut from tubing or fabricated from clad plate. Alternatively, the branches may be protected by corrosion resistance weld overlays.
Solid alloy nozzles may be offered as on alternative to clad nozzles in the smaller sizes where it is considered to be advantageous. Flange facings on clad vessels

shall be provided with an overlay weld deposit protection unless otherwise specified by the COMPANY. Overlay weld deposits of austenitic stainless steel weld metal on carbon and lowalloy steels shall be applied in a minimum of two layers. For the first layer type 309 weld material shall be used, and the top layer as specified.

15.3 FABRICATION

Weld overlay deposits on clad vessels shall be performed in accordance with procedures qualified to ASME IX. The proposed procedure for relevant application shall be submitted with the bid. The procedure for PWHT shall be submitted to the COMPANY for approval. It shall be demonstrated that no deleterious effects on the corrosion resistance of the cladding or weld overlay will occur during PWHT.

15.4 INSPECTION & TESTING

Clad plate formed into dished ends shall be ultrasonically retested for soundness after forming.Linings applied by overlay weld deposit, shall be ultrasonically examined for gross lack of fusion in accordance with ASTM A578 acceptance level S6. This also applies to clad restoring of welds in clad plate, where a bond of 50mm on each side of the weld shall be examined.

Vessels protected with a cladding or lining of stainless steel, or having stainless steel internals shall be hydrostatically tested as if they were of solid stainless steel, refer to clause No. 6 of this specification.

16.0 DRAWINGS AND DATA REQUIRED

CONTRACTOR / SUPPLIER information shall be supplied in accordance with the COMPANY's procurement documentation and shall include, as a minimum, the following:

- Completed data sheets;

- General arrangement and cross-sectional drawings, complete with parts list, materials and equipment description;
- Materials and thickness of principal parts, not covered by the data sheet;
- Itemized weights, including maintenance weights, plus withdrawal dimensions;
- Foundation Loading Data;
- CONTRACTOR / SUPPLIER connection drawings complete with detailed nozzle schedule;
- Itemized list of CONTRACTOR / SUPPLIER's deviations from Specification. CONTRACTOR / SUPPLIER shall advise separate prices for the following:
  - Supply & installation of additional nozzles, rated as per data sheet, with and without reinforcement for the following nominal bores:

    2", 3", 4", 6", 8", 10", 12", 14" & 16";

    32" Manways complete with blind flanges, bolting, gasket and davit;

    Per kg of all support clips and lugs;
- Proposed test procedure and erection details;
- Priced list of recommended commissioning spares;
- Priced list of spare parts for two years operation;
- Priced list of special tools;

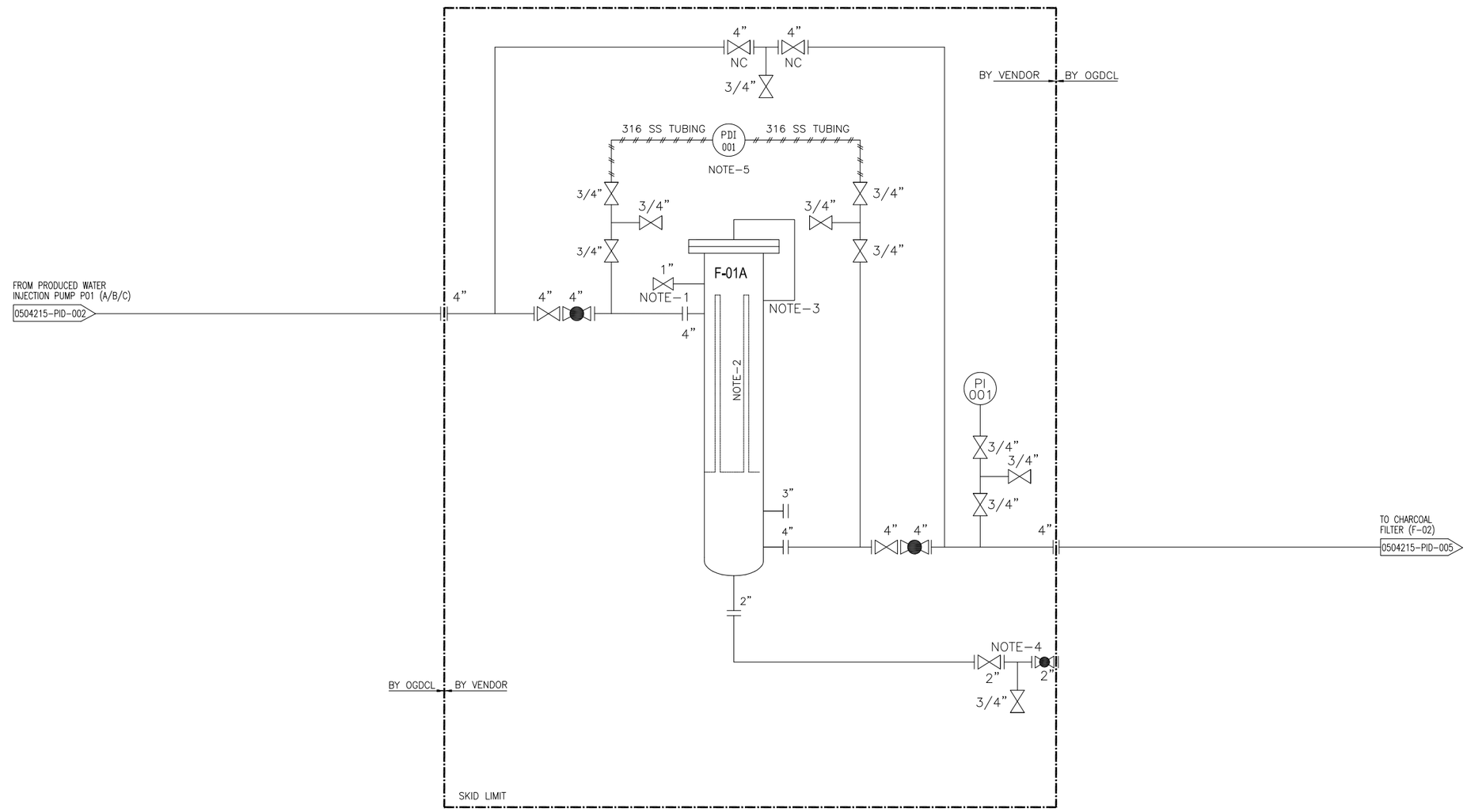
ANNEXURE-C

PIPING & INSTRUMENTATION DIAGRAMS

F-01A

PARTICLE FILTER

DESIGN PRESSURE : 720 psig
DESIGN TEMPERATURE : 130°F
INTERNAL DIAMETER : 781MM
TAN/TAN LENGTH : 1850MM



NOTES

1. VALVE SHOULD BE AT OPERATOR HEIGHT LEVEL.
2. VENDOR TO SPECIFY THE NUMBER OF CARTRIDGES AS PER THE VESSEL DIMENSIONS.
3. DAVIT ARM TO BE PROVIDED FOR QUICK CLOSURE OF VESSEL.
4. DRAIN VALVE TO BE PROVIDED AT SKID EDGE.
5. PRESSURE DIFFERENTIAL INDICATOR SHALL BE AT OPERATOR HEIGHT.
6. FOR SYMBOLS REFER TO DWG # 0504215-PID-000.

REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPR
					AJ
0	09-12-2019	ISSUED FOR REVIEW	NJ	SHR	AJ

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

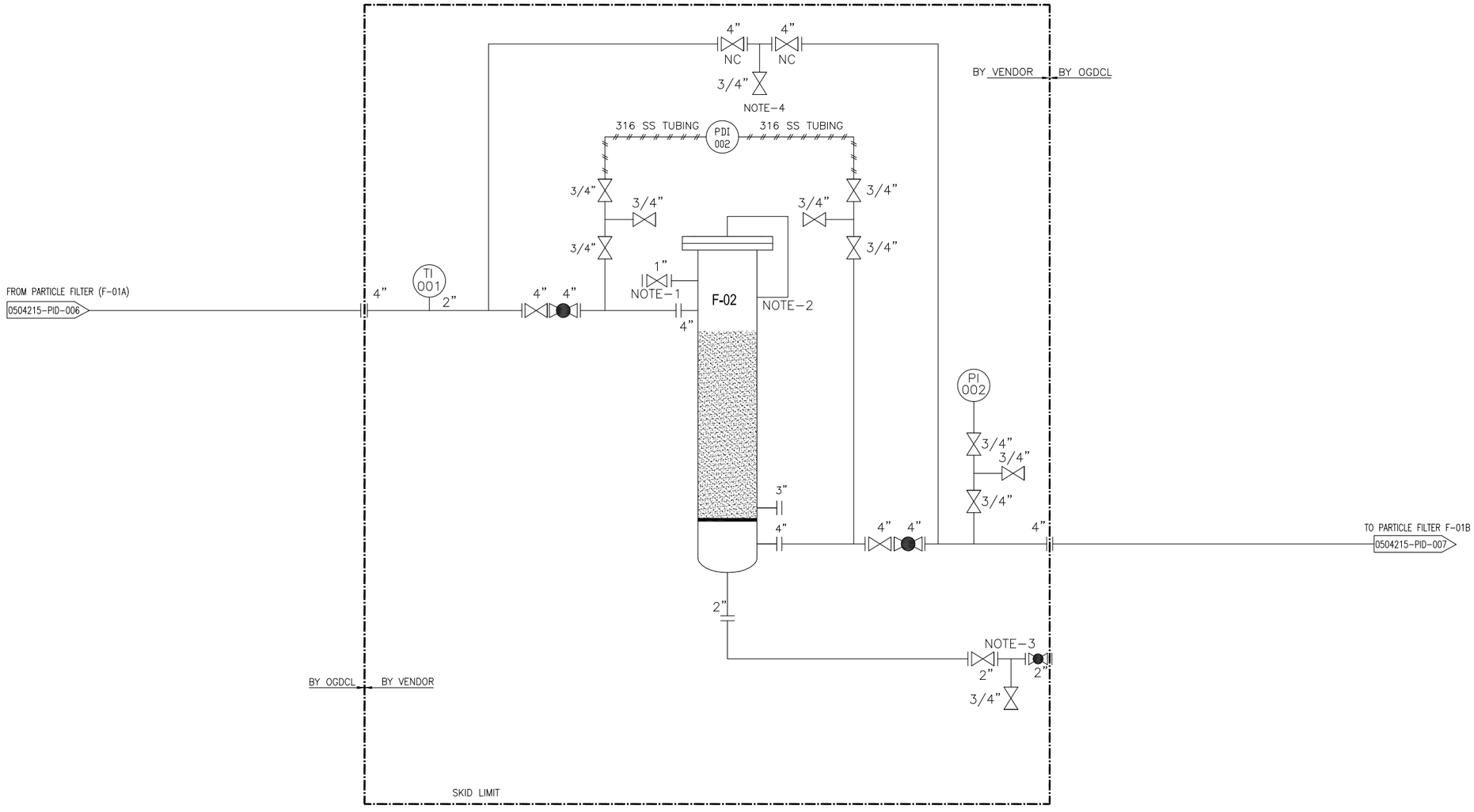
PROJECT : SINJHORO PLANT PRODUCED WATER DISPOSAL

TITLE : PIPING & INSTRUMENTATION DIAGRAM
PARTICLE FILTERS (F-01A)

JOB NO.	DRAWING NO.	SHEET NO.	SCALE	SHEET SIZE	REV.
0504215	0504215-PID-006	1 OF 1	NTS	A3	0

F-02
CHARCOAL FILTER

DESIGN PRESSURE : 720 psig
DESIGN TEMPERATURE : 130°F
INTERNAL DIAMETER : 781MM
TAN/TAN LENGTH : 2200MM



NOTES

1. VALVE SHOULD BE AT OPERATOR HEIGHT LEVEL.
2. DAVIT ARM TO BE PROVIDED FOR QUICK CLOSURE OF VESSEL.
3. DRAIN VALVE TO BE PROVIDED AT SKID EDGE.
4. PRESSURE DIFFERENTIAL INDICATOR SHALL BE AT OPERATOR HEIGHT.
5. FOR SYMBOLS REFER TO DWG # 0504215-PID-000.

REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPR.
0	09-12-2019	ISSUED FOR REVIEW	NJ	SHR	AJ

PETROCHEMICAL ENGINEERING CONSULTANTS
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CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

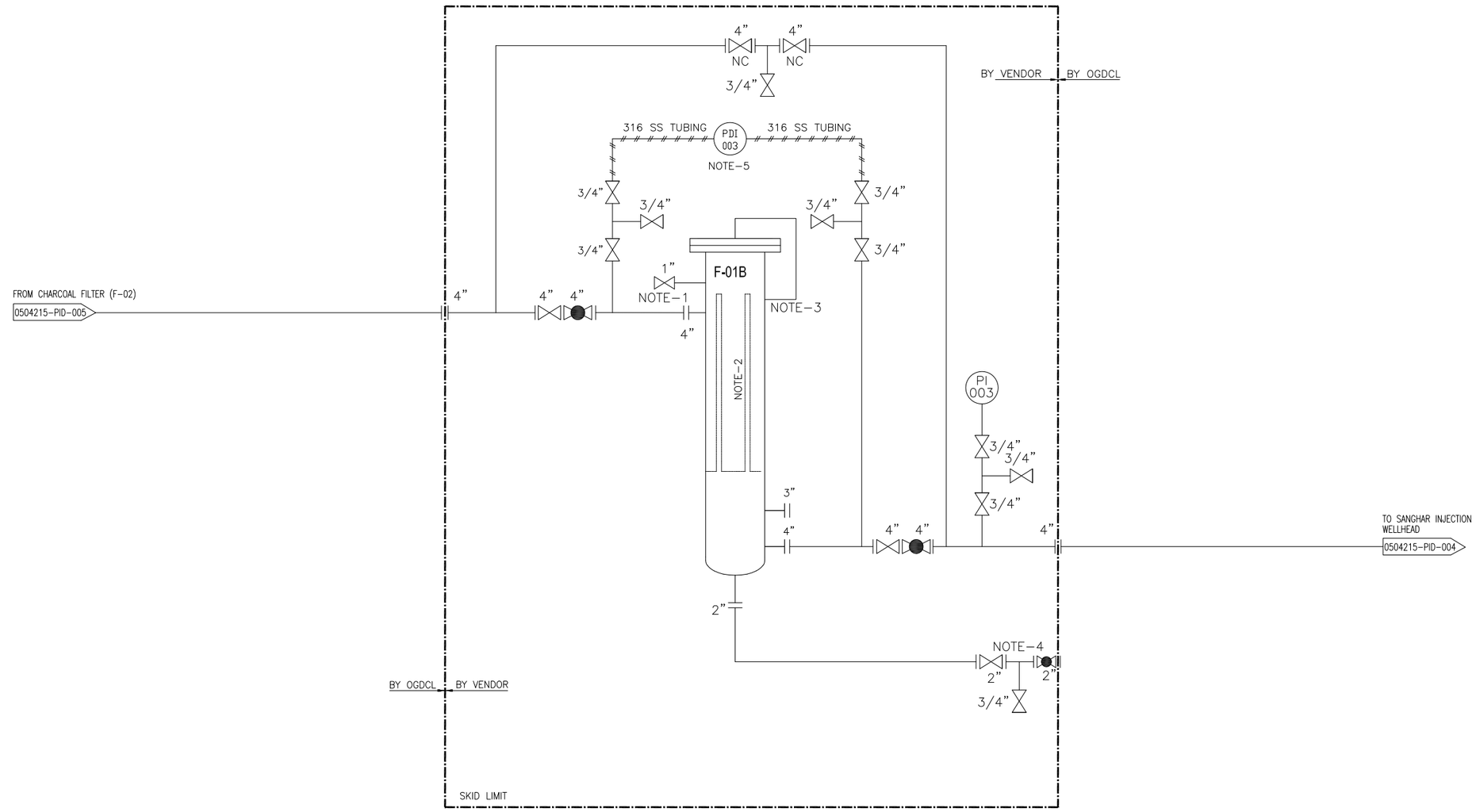
PROJECT : SINJHORO PLANT PRODUCED WATER DISPOSAL

TITLE : PIPING & INSTRUMENTATION DIAGRAM
CHARCOAL FILTER (F-02)

JOB NO.	DRAWING. NO.	SHEET NO.	SCALE:	SHEET SIZE	REV.
0504215	0504215-PID-005	1 OF 1	NTS	A3	0

F-01B
PARTICLE FILTER

DESIGN PRESSURE : 720 psig
DESIGN TEMPERATURE : 130°F
INTERNAL DIAMETER : 781MM
TAN/TAN LENGTH : 1850MM



NOTES

1. VALVE SHOULD BE AT OPERATOR HEIGHT LEVEL.
2. VENDOR TO SPECIFY THE NUMBER OF CARTRIDGES AS PER THE VESSEL DIMENSIONS.
3. DAVIT ARM TO BE PROVIDED FOR QUICK CLOSURE OF VESSEL.
4. DRAIN VALVE TO BE PROVIDED AT SKID EDGE.
5. PRESSURE DIFFERENTIAL INDICATOR SHALL BE AT OPERATOR HEIGHT.
6. FOR SYMBOLS REFER TO DWG # 0504215-PID-000.

REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPR
0	09-12-2019	ISSUED FOR REVIEW	NJ	SHR	AJ

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C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

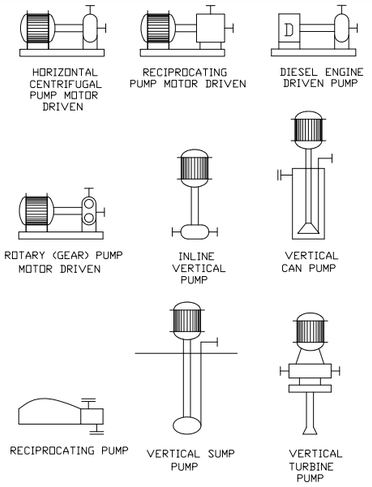
CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT : SINJHORO PLANT PRODUCED WATER DISPOSAL

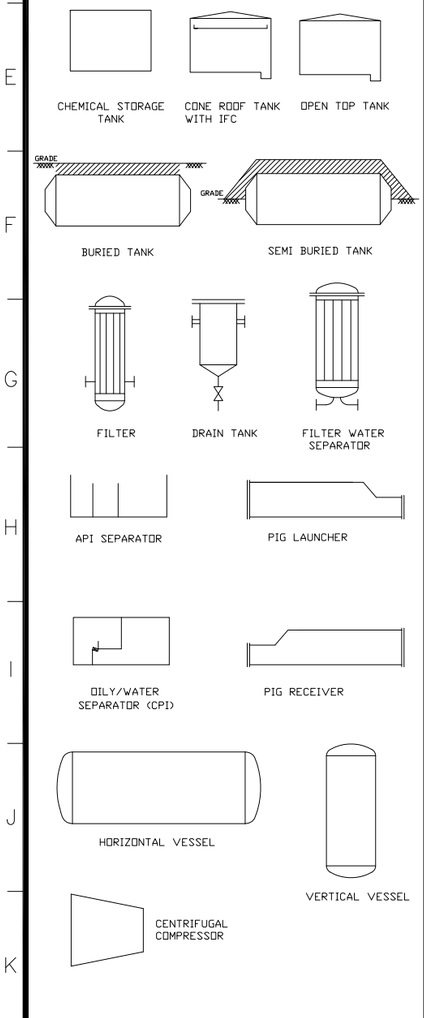
TITLE : PIPING & INSTRUMENTATION DIAGRAM
PARTICLE FILTERS (F-01B)

JOB NO.	DRAWING NO.	SHEET NO.	SCALE	SHEET SIZE	REV.
0504215	0504215-PID-007	1 OF 1	NTS	A3	0

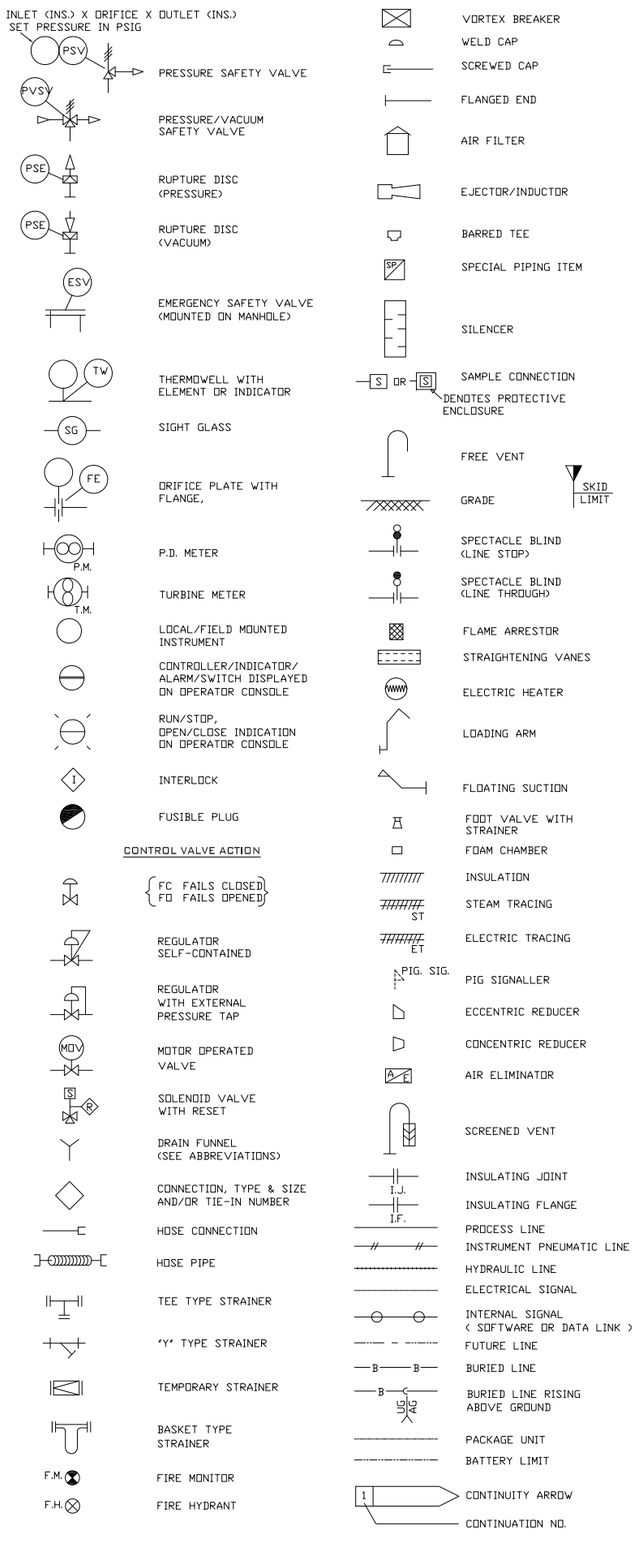
ROTARY EQUIPMENT



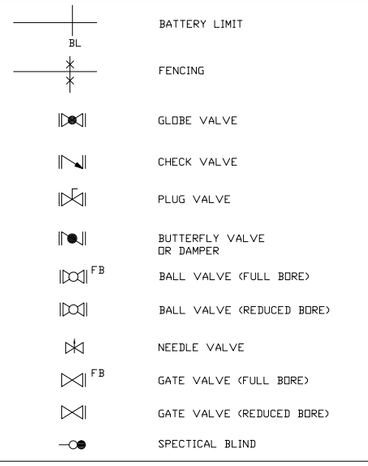
TANKS AND VESSELS



PIPING AND INSTRUMENTATION SYMBOLS



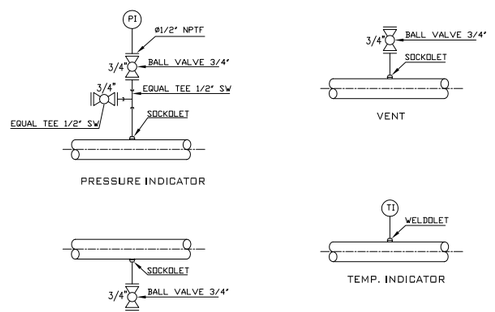
PIPING AND INSTRUMENTATION SYMBOLS



FLOW DIAGRAM IDENTIFICATION LETTERS

LETTER	FIRST LETTER	SUBSEQUENT LETTER
A	ANALYSIS	ALARM
B	BURNER FLAME	BLOCK/BYPASS
C	CONDUCTIVITY (ELECTRICAL)	CONTROLLER/CLOSED
D	DENSITY (SP. GR.)	DIFFERENTIAL
E	VOLTAGE (EMF/ELECTRICAL)	ELEMENT (PRIMARY)
F	FLOW	RATIO (FRACTION)
G	GAUGING (DIMENSIONAL)	GLASS/GAUGE
H	HAND ACTUATED (MANUAL)	HIGH
I	CURRENT (AMPS)	INDICATOR
J	POWER (WATTS)	MILTIPOINT (SCAN)
K	TIME	CONTROL STATION
L	LEVEL	LIGHT/LOW
M	MOISTURE (HUMIDITY)	MIDDLE
N	(UNCLASSIFIED)	(UNCLASSIFIED)
O	(UNCLASSIFIED)	ORIFICE/OPEN
P	PRESSURE/VACUUM	POINT
Q	QUANTITY/NUMBER	TOTALIZER/INTEGRATER
R	RUN/RESTRICTION	RECORDER
S	SPEED/FREQUENCY	SAFETY/SWITCH
T	TEMPERATURE	TRANSMITTER
U	MULTIVARIABLE	MALFUNCTION
V	VIBRATION/VISCOSITY	VALVE
W	WEIGHT/FORCE	WELL/PROBE
X	(UNCLASSIFIED)	UNCLASSIFIED
Y	(UNCLASSIFIED)	RELAY
Z	POSITION	DRIVE/ACTUATE

VENT AND DRAIN DETAILS

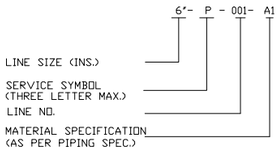


HEADER SIZE	DRAIN SIZE	VENT SIZE
3/4"–4"	3/4"	3/4"
6"–10"	3/4"	3/4"
12"–ABOVE	1 1/2"	3/4"

PIPING ABBREVATIONS

AG	– ABOVE GROUND	IJ	– INSULATING JOINT	TIP	– TIE-IN POINT
ATM	– ATMOSPHERE	HC	– HOSE CONNECTION/ HALF COUPLING HEAT CONSERVATION	T-T	– TANGENT TO TANGENT
BF	– BLIND FLANGE			UG	– UNDERGROUND
BL	– BATTERY LIMIT			V	– VENT
CO	– CHAIN OPERATED	OWS	– OILY WATER SEWER	VB	– VORTEX BREAKER
CSC	– CAR SEAL CLOSED	UC	– UTILITY CONNECTION	RW	– RAW WATER
CSO	– CAR SEAL OPEN	LC	– LOCKED CLOSE	P	– PLUGGED
DR	– DRAIN	LO	– LOCKED OPEN	RO	– RESTRICTION ORIFICE
DPI	– DIFFERENTIAL PRESSURE INDICATOR	LOR	– LOCAL-OFF-REMOTE	TS	– TEMPORARY STRAINER
FB	– FULL BORE	LP	– LOW PRESSURE	TYP	– TYPICAL
FC	– FAIL CLOSED	MOV	– MOTOR OPERATED VALVE	ESD	– EMERGENCY SHUT DOWN
FO	– FAIL OPEN	NC	– NORMALLY CLOSED		
FOB	– FLAT ON BOTTOM	NO	– NORMALLY OPEN		
FOT	– FLAT ON TOP	PP	– PERSONNEL PROTEXCTION		
GOV	– GEAR OPERATED VALVE	SC	– SAMPLE CONNECTION		
HP	– HORSE POWER OR HIGH PRESSURE	S-S	– SEAM TO SEAM		
IFC	– INTERNAL FLOATING COVER	SWS	– STORM WATER SEWER		
F/W	– FILTER WATER				

LINE NUMBER IDENTIFICATION



DRAIN SYSTEM	
DRAIN	D
OILY WATER SEWER	OWS
RECOVERED OIL	RO
FLARE	FL
OIL SYSTEM	
CRUDE OIL	CR
DIESEL FUEL	DF
GAS SYSTEMS	
FUEL GAS	FG
VENT	V
INSTRUMENT AIR	IA
SPECIAL LIQUIDS	
FOAM SOLUTION	FS
FOAM CONCENTRATE	FC
CHEMICAL INJECTION	CI
METHANOL	ME
PROCESS SERVICE	
PROCESS STREAM	P
WATER SYSTEMS	
FIRE WATER	FW
WASTE WATER	WW
RAW WATER	RW
PRODUCED WATER	PW

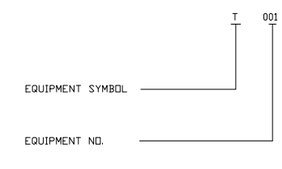
PIPING SPECIFICATIONS

C1 – 600#

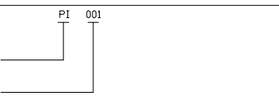
B1 – 300#

A1 – 150#

EQUIPMENT NUMBER IDENTIFICATION



INSTRUMENT NUMBER IDENTIFICATION



REV.	DATE	DESCRIPTION OF REVISION	PREP'D:	CHECK	APPR.
0	09-12-2019	ISSUED FOR REVIEW	MJ	RK	AJ

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

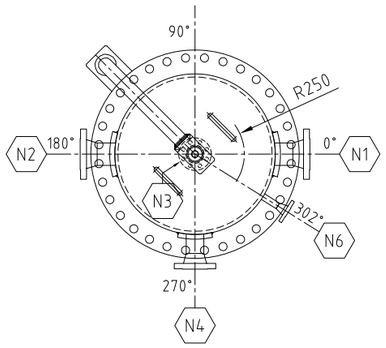
PROJECT : SINJHORO PLANT PRODUCED WATER DISPOSAL

TITLE : PIPING AND INSTRUMENTATION DIAGRAM LEGEND SHEET

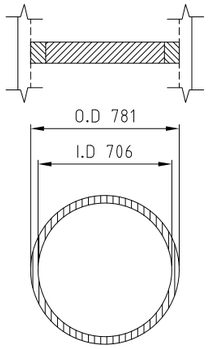
JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504215	0504215-PID-000	1 OF 1	NTS	A3	0

ANNEXURE-D

GENERAL ARRANGEMENT DRAWINGS

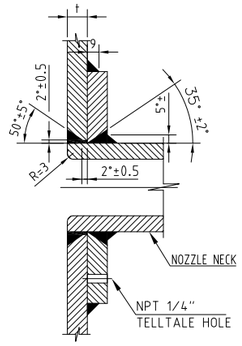


ORIENTATION PLAN

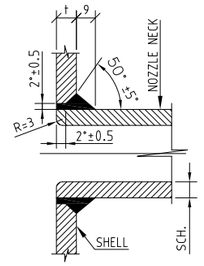


SUPPORT RING PLATE DETAIL

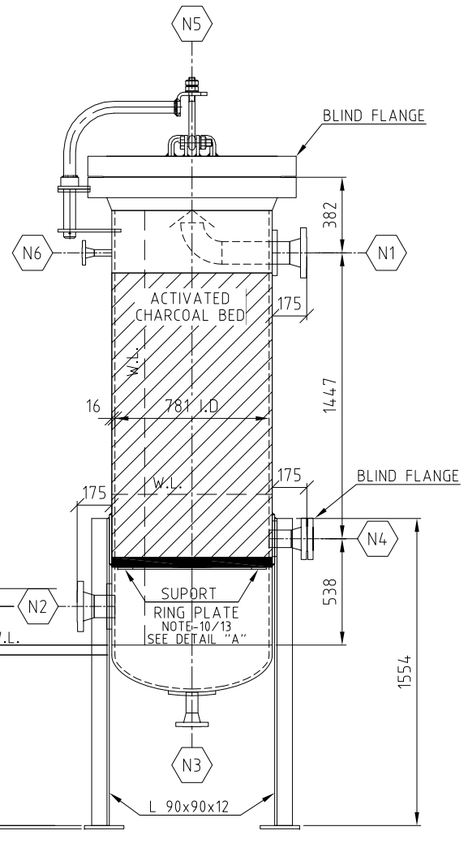
10mm THK.
DETAIL "A"



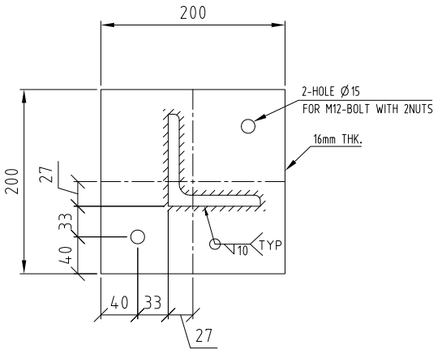
TYPICAL DETAIL OF
NOZZLES NECK WELDING
REINFORCEMENT



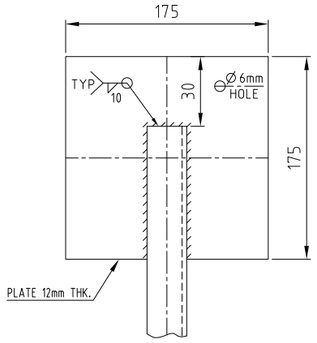
TYPICAL DETAIL OF
NOZZLES NECK WELDING



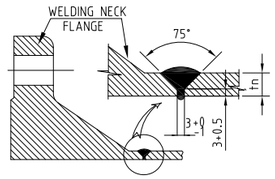
ELEVATION



BASE PLATE



LEG REINFORCING DETAIL



TYPICAL DETAIL OF
NECK FLANGE WELDING

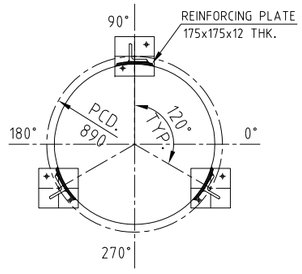
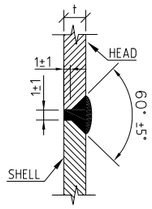


PLATE ORIENTATION PLAN



TYPICAL DETAIL OF
WELDING SEAM

DESIGN DATA

DESIGN CODE	ASME SEC. VIII DIV.1
ITEM NO.	CHARCOAL FILTER (F-01B)
QUANTITY (NOS.)	01
SERVICE	PRODUCED WATER/CONDENSATE
DENSITY(Kg/M^3)	1000
NOMINAL CAPACITY M^3	1.07
OPERATING CAPACITY M^3	0.884
DESIGN TEMPERATURE (°F)	130
DESIGN PRESSURE (PSI)	720
HYDROSTATIC TEST PRESSURE(PSI)	950
CORROSION ALLOWANCE mm	1.5
U-STAMP	YES
WIND	100 mile/hr
SEISMIC	ZONE 2B
PWHT	NO
JOINT EFFICIENCY	1
RADIOGRAPHY	RT-1 100%
WEIGHT EMPTY (Kg)	3134.8
OPERATING WEIGHT (Kg)	3904.3
WEIGHT FULL OF WATER (Kg)	4282.5

MATERIALS

SHELL	SA 516 GR. 70
HEADS	SA 516 GR. 70
PIPES	ASTM A-106 Gr.B
FLANGES	ASTM A-105
STIFFENERS / SUPPORTS	ASTM A-36
GASKETS	SPIRAL WOUND 316L S.S, 3mm THICK COMPRESSED GRAPHITE FILLED, AS PER ASME B16.20
STUD BOLT/NUTS	SA-193 Gr.B7/SA-194 Gr. 2H
LEGS	SA-516 GR.70
REINF. PAD	SA-516 GR.70

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. POST WELD HEAT TREATMENT IS NOT REQUIRED.
3. FLANGE BOLT HOLES TO STRADDLE THE NORMAL HORIZONTAL AND VERTICAL CENTERLINES. ALL REINFORCEMENT PADS FOR NOZZLES TO BE PROVIDED WITH 1/4" DIA HOLES.THESE HOLES TO BE FILLED WITH PLASTIC SEALANT OR GREASE AFTER PRESSURE TESTING.
4. ALL INTERNAL SURFACES SHALL BE CLEAN AND SMOOTH (EXCEPT WELDING).
5. THE FINISH OF THE FLANGE FACING SHALL BE SMOOTH FINISH BETWEEN 125-250 MICRO INCH (3.2-6.3 MICRO METER) VESSEL TOLERANCES SHALL BE AS PER ASME SECTION VIII DIV-1.
6. ALL FLANGES TO CONFIRM ASME B16.5 AND MANWAY FLANGE TO CONFIRM ASME B16.47.
7. ALL PARTS WELDED DIRECTLY TO THE VESSELS SHALL BE OF SAME BASE MATERIAL.RE-PADS TO BE PROVIDED FOR EXTERNAL CLIPS/BRACKETS FOR LADDERS AND PLATFORMS.
8. EXTERNAL PAINTING (SEE SPECIFICATION # 0504215-SP-002).
9. THE INTERNAL SHALL BE POSITIONED AT THE CENTRE OF VESSEL FOR PROPER WATER DISTRIBUTION.
10. THE SCREEN SHALL BE POROUS AND ABLE TO WITHSTAND THE LOAD IN OPERATING CONDITION BUT SHALL NOT ALLOW CHARCOAL TO PASS THROUGH IT.
11. VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
12. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
13. INTERNAL SUPPORT RINGS MUST BE EVALUATED BY VENDOR.
14. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
15. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
16. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
17. VENDOR TO SPECIFY THE DETAILS OF CHARCOAL BED.
18. INTERNAL SUPPORT FOR CHARCOAL BED SHALL BE ABLE TO WITHSTAND ITS WEIGHT AS SPECIFIED BY VENDOR.
19. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
20. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DUPLEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON-CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA. AND FILLER METAL AS PER STANDARDS.
21. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

NOZZLE DATA

Nozzle #	QTY.	Nominal Size	Schedule/ Thickness	Pressure/ Class	Service	Flange Type	REINF. PAD O.D x I.D	REINF. PAD THK.
N1	1	4"	Sch.80	300#	INLET	WN-RF	180x118	20
N2	1	4"	Sch.80	300#	OUTLET	WN-RF	180x118	20
N3	1	2"	Sch.160	300#	DRAIN	WN-RF	100x64	10
N4	1	3"	Sch.80	300#	BED REMOVAL	WN-RF	140x92	18
N5	1	32"	Sch.STD	300#	MANWAY	WN-RF	-	-
N6	1	1"	Sch.160	300#	VENT	WN-RF	-	-

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
0	13-12-19	ISSUED FOR REVIEW	N.U	SAR		

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT : DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE : GENERAL ARRANGEMENT DRAWING FOR CHARCOAL FILTER (F-02)

JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
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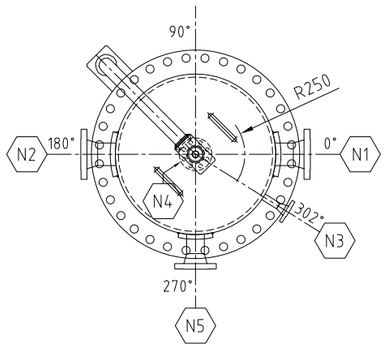
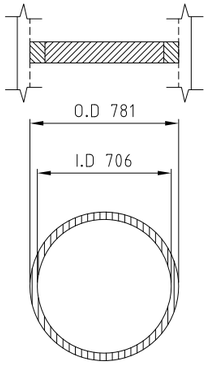


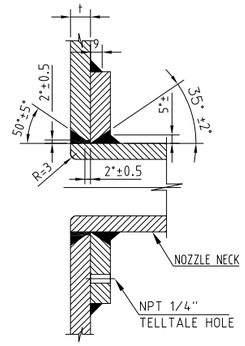
ORIENTATION PLAN



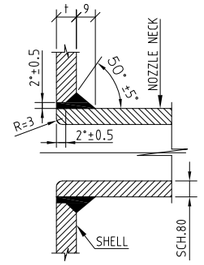
SUPPORT RING PLATE DETAIL

10mm THK.

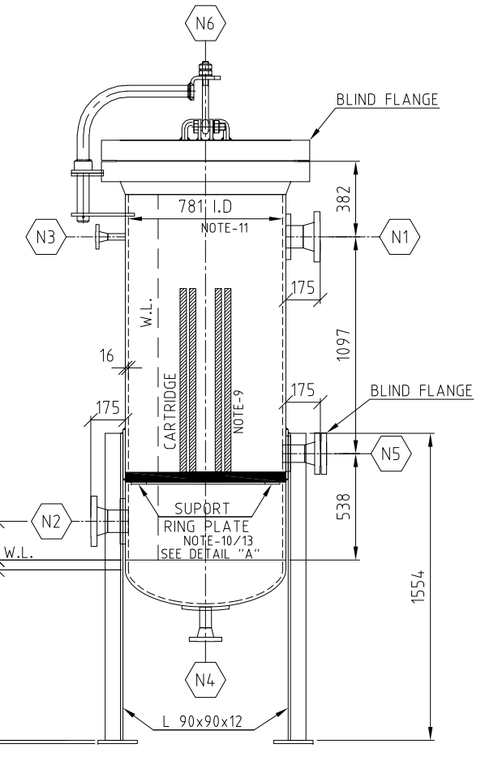
DETAIL "A"



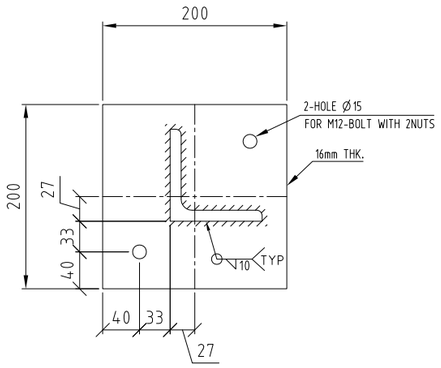
TYPICAL DETAIL OF NOZZLES NECK WELDING REINFORCEMENT



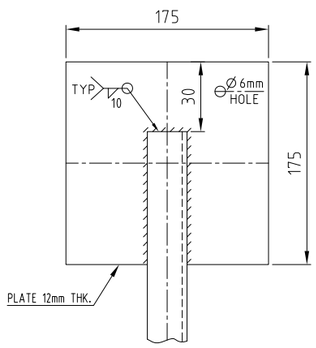
TYPICAL DETAIL OF NOZZLES NECK WELDING



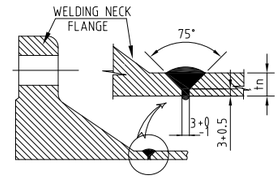
ELEVATION



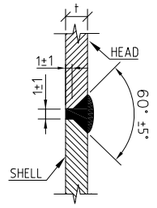
BASE PLATE DETAIL



LEG REINFORCING DETAIL



TYPICAL DETAIL OF NECK FLANGE WELDING



TYPICAL DETAIL OF WELDING SEAM

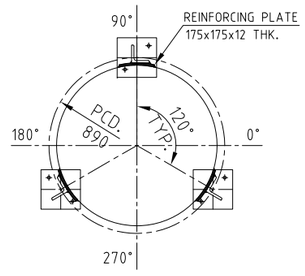


PLATE ORIENTATION PLAN

NOZZLE DATA

Nozzle #	QTY.	Nominal Size	Schedule/ Thickness	Pressure/ Class	Service	Flange Type	REINFORCEMENT	REINF. PAD O.D x I.D	REINF. PAD THK.
N1	1	4"	Sch.80	300#	INLET	WN–RF	YES	180x118	20
N2	1	4"	Sch.80	300#	OUTLET	WN–RF	YES	180x118	20
N3	1	1"	Sch.160	300#	VENT	WN–RF	NO	–	–
N4	1	2"	Sch.160	300#	DRAIN	WN–RF	YES	100x64	10
N5	1	3"	Sch.80	300#	TUBESHEET DRAIN	WN–RF	YES	140x92	18
N6	1	32"	SCH.STD	300#	MANWAY	WN–RF	NO	–	–

DESIGN DATA

DESIGN CODE	ASME SEC. VIII DIV.1
ITEM NO.	PARTICLE FILTER (F–01A/C)
QUANTITY (NOS.)	02
SERVICE	PRODUCED WATER/CONDENSATE
DENSITY(Kg/M^3)	1000
NOMINAL CAPACITY M^3	0.818
OPERATING CAPACITY M^3	0.66
DESIGN TEMPERATURE (°F)	130
DESIGN PRESSURE (PSI)	720
HYDROSTATIC TEST PRESSURE(PSI)	950
CORROSION ALLOWANCE mm	1.5
U–STAMP	YES
WIND	100 mile/hr
SEISMIC	ZONE 2B
PWHT	NO
JOINT EFFICIENCY	1
RADIOGRAPHY	RT–1 100%
WEIGHT EMPTY (Kg)	2317.5
OPERATING WEIGHT (Kg)	3215.3
WEIGHT FULL OF WATER (Kg)	3387

MATERIALS

SHELL	SA 516 GR. 70
HEADS	SA 516 GR. 70
PIPES	ASTM A–106 Gr.B
FLANGES	ASTM A–105
STIFFENERS / SUPPORTS	ASTM A–36
GASKETS	SPIRAL WOUND 316L S.S, 3mm THICK COMPRESSED GRAPHITE FILLED, AS PER ASME B16.20
STUD BOLT/NUTS	SA–193 Gr.B7/SA–194 Gr. 2H
LEGS	SA–516 GR.70
REINF. PAD	SA–516 GR.70

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. POST WELD HEAT TREATMENT IS NOT REQUIRED.
3. FLANGE BOLT HOLES TO STRADDLE THE NORMAL HORIZONTAL AND VERTICAL CENTERLINES.ALL REINFORCEMENT PADS FOR NOZZLES TO BE PROVIDED WITH 1/4" DIA HOLES. THESE HOLES TO BE FILLED WITH PLASTIC SEALANT OR GREASE AFTER PRESSURE TESTING.
4. ALL INTERNAL SURFACES SHALL BE CLEAN AND SMOOTH (EXCEPT WELDING).
5. THE FINISH OF THE FLANGE FACING SHALL BE SMOOTH FINISH BETWEEN 125–250 MICRO INCH (3.2–6.3 MICRO METER) VESSEL TOLERANCES SHALL BE AS PER ASME SECTION VIII DIV–1.
6. ALL FLANGES TO CONFIRM ASME B16.5 AND MANWAY FLANGE TO CONFIRM ASME B16.47.
7. ALL PARTS WELDED DIRECTLY TO THE VESSELS SHALL BE OF SAME BASE MATERIAL. RE–PADS TO BE PROVIDED FOR EXTERNAL CLIPS/BRACKETS FOR LADDERS AND PLATFORMS.
8. EXTERNAL PAINTING (SEE SPECIFICATION # 0504214–SP–014).
9. VENDOR TO SPECIFY THE NUMBER OF CARTRIDGES AS PER THE VESSEL DIMENSIONS.
10. THE SUPPORT PLATE SHALL BE ABLE TO WITHSTAND THE LOAD IN OPERATING CONDITION.
11. VESSEL INTERNALS SHALL BE SUPPLIED BY VENDOR.
12. VENDOR TO PROVIDE FULL DETAILS OF VESSEL INTERNALS.
13. INTERNAL SUPPORT RINGS MUST BE EVALUATED BY VENDOR.
14. FABRICATOR TO PROVIDE ALL FLANGE BOLTING AND GASKETS TO CONNECT PIPING TO VESSEL.
15. DRAIN WILL BE LOCATED AT CLOSE PROXIMITY TO THE VESSEL(AT LOW POINT).
16. VENT TO BE LOCATED AT HIGHEST POINT ON INLET PIPING.
17. VESSEL SHALL BE INTERNALLY CERAMIC COATED OF DFT 80 MICRONS.
18. ALL VESSEL INTERNALS ALONG WITH INTERNAL SUPPORTS SHALL BE OF DUPLEX STEEL.
19. VENDOR TO SPECIFY SPECIAL WELDING (i.e. WELDING OF CARBON STEEL AND DUPLEX STEEL) DETAIL OF VESSEL INTERNALS. SPECIAL WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARDS OF GTAW (i.e. GAS TUNGSTEN ARC WELDING) AND A NON–CONSUMABLE TUNGSTEN ELECTRODE SHALL BE USED TO PRODUCE WELD. ALSO VENDOR TO SPECIFY THE ELECTRODE DIA.AND FILLER METAL AS PER STANDARDS.
20. WELDING PROCEDURE SPECIFICATIONS (WPS) AND PROCEDURE QUALIFICATION RECORD (PQR) SHALL BE SUBMITTED TO OWNER FOR APPROVAL BEFORE ANY WELDING CAN BE PERFORMED. WELDER QUALIFICATIONS SHALL BE REVIEWED BY OWNER'S INSPECTOR.

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
0	13–12–19	ISSUED FOR REVIEW	N.U	SAR		

PETROCHEMICAL ENGINEERING CONSULTANTS
C–2, BLOCK NO. 17, GULSHAN–E–IQBAL, NEAR NATIONAL STADIUM, KARACHI–75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX. +92 21 34961089, E–Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

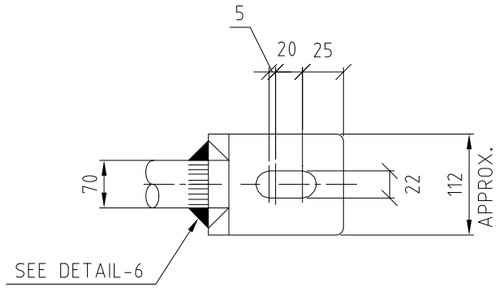
PROJECT : DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE : GENERAL ARRANGEMENT DRAWING FOR PARTICLE FILTER (F-01A/B)

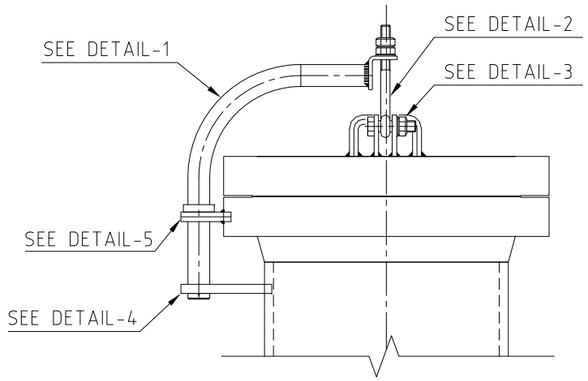
JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504215	0504215–GA–002	1 OF 1	1:30	A3	0

ANNEXURE-E

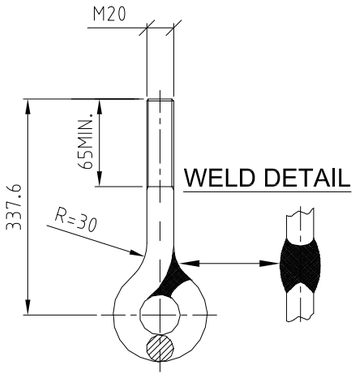
DAVIT ARM DETAILS



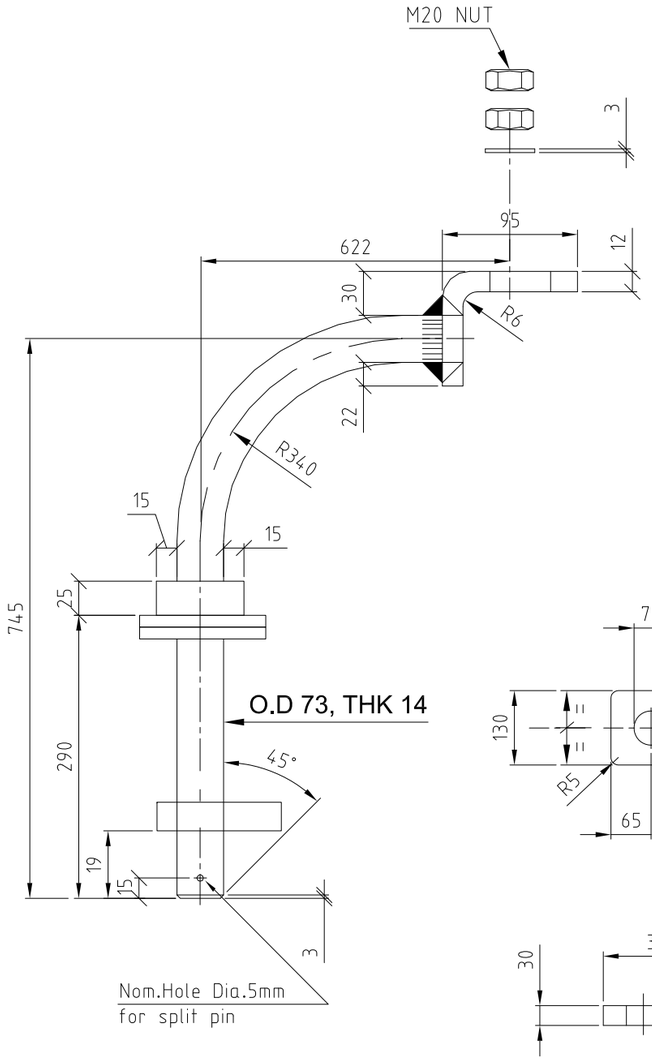
DETAIL-1



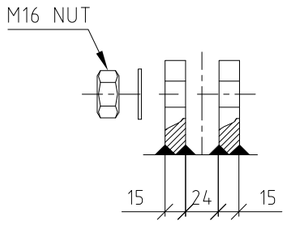
MANHOLE DETAIL
WITH DAVIT ARM

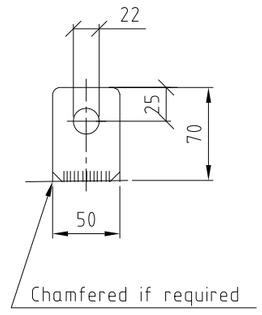


DETAIL-2

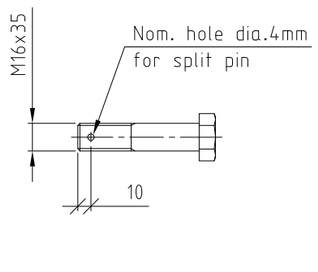


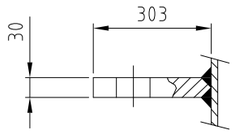
DETAIL-1



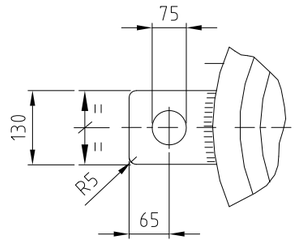


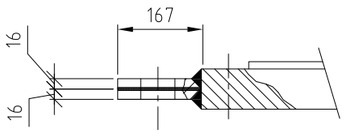
DETAIL-3



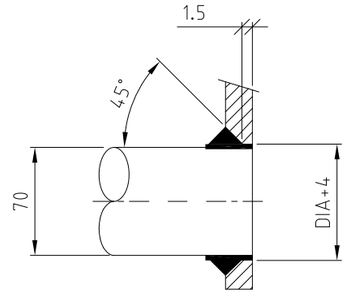


DETAIL-4





DETAIL-5



DETAIL-6

NOTES:

1. Design
   a. Position of davit to be stated on equipment drawing.
   b. Welding shall be in accordance with the applicable design code.
   c. When insert are welded to fill nozzle area davit construction cannot be applied.
2. Finishing
   a. All movable parts of davit assembly to be thoroughly lubricated and coated with grease before dispatch.
   b. Davit assembly must be in true vertical alignment after welding to flange.
   c. No zinc containing coatings to be applied on the stainless steel eye bolt.
3. All dimensions are in millimeters.
4. Materials

Blind Flange:	As specified on requisition and/or equip. drawing
Grips:	Carbon Steel, weldable quality
Davit:	Carbon Steel, weldable quality
Davit bearing ring:	Carbon Steel, weldable quality
Eye bolt acc. To detail 2:	ASTM A 320–B8
Eye bolt acc. To DN 444:	Carbon steel, commercial quality
Davit top–end:	ASTM–283–C or equivalent
Bolt/nut:	ASTM A 193–B7/ ASTM A 194 – GR 2h
Washer:	Carbon steel, commercial quality
Split pin:	Carbon steel, commercial quality
Lugs:	equivalent to nozzle material
Flanges and nozzle neck:	As per requisition or equipment drawing
Screw thread of fastners:	Metric coarse thr. serie tolerance class 6g/6h to iso 965/2

REV.	DATE	DESCRIPTION OF REVISION	DRAWN	CHK'D	APP'VD	APP'VD
0	09/12/19	ISSUED FOR REVIEW	MK	SAR		

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.

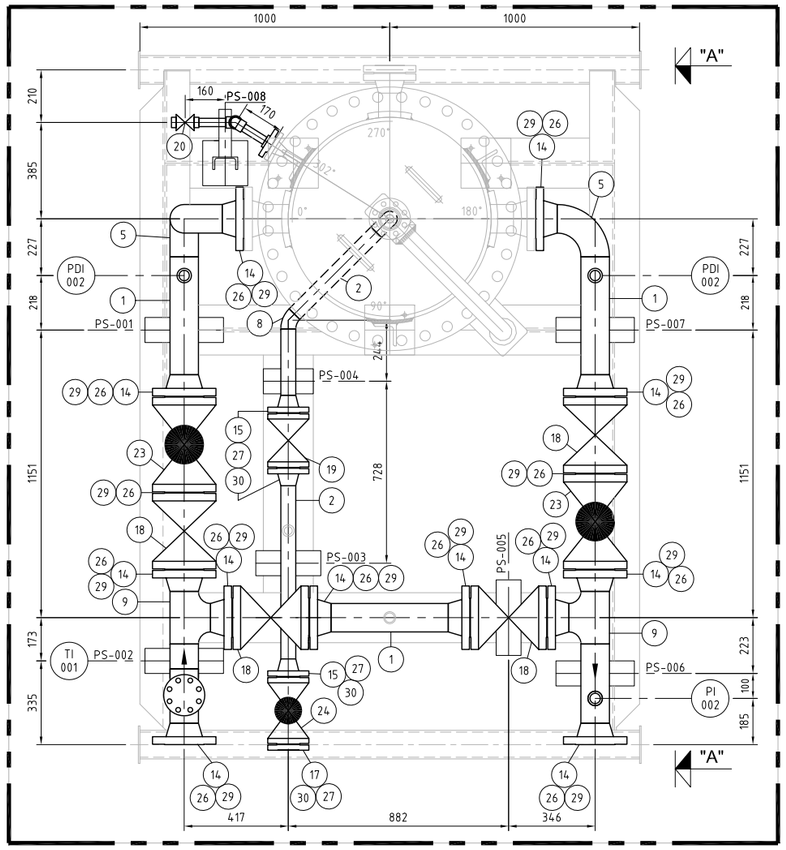
PROJECT : DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE : DAVIT ARM DETAIL

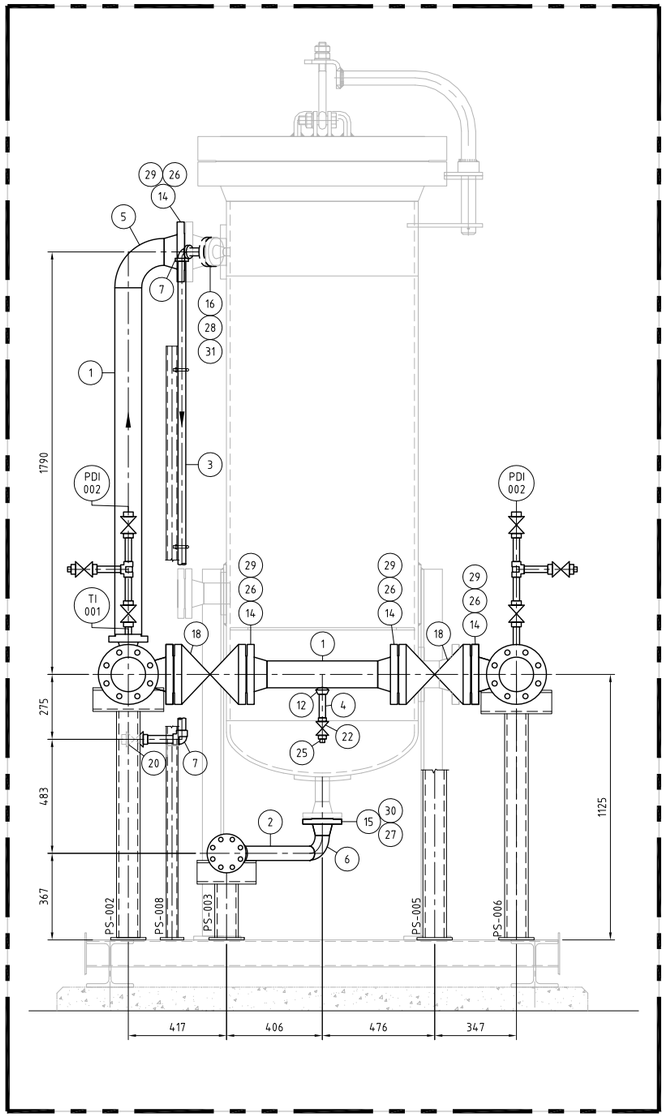
JOB NO	DRAWING NO	SHEET NO	SCALE	SHEET SIZE	REV
0504215	0504215–GA–003	1 OF 1	1:50	A3	0

ANNEXURE-F

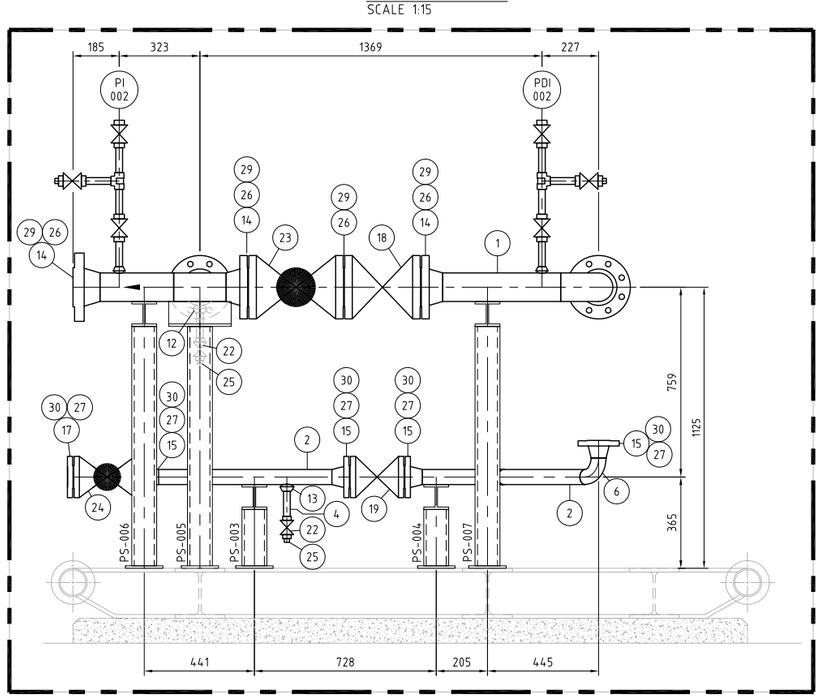
PIPING ARRANGEMENT DRAWINGS



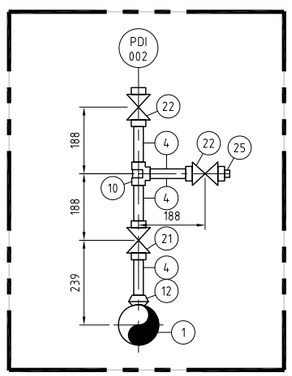
PLAN VIEW
SCALE 1:15



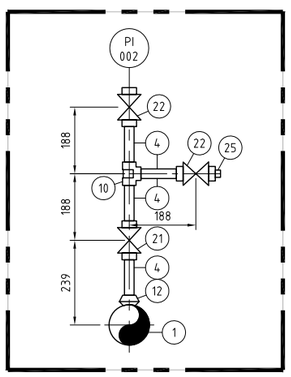
ELEVATION VIEW
SCALE 1:20



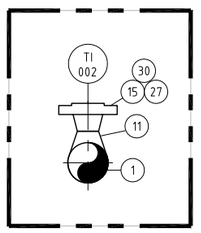
SECTION -A
SCALE 1:15



PDI DETAIL



PI DETAIL



TI DETAIL

BILL OF MATERIAL

Sr.NO.	SIZE	DESCRIPTION	QTY.	(MAT. SPEC)	REMARKS
1	4"	PIPE SCH.40 BE SMLS, ASTM A-106 GR.B	3.5M	B1	
2	2"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.5M	B1	
3	1"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	2.3M	B1	
4	3/4"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.5M	B1	
5	4"	ELBOW 90° LR SCH. 40, ASTM A-234 GR.WPB BW	3	B1	
6	2"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	1	B1	
7	1"	ELBOW 90° 3000#, ASTM A-105 S.W	2	B1	
8	2"	ELBOW 45° LR SCH. 80, ASTM A-234 GR.WPB BW	1	B1	
9	4"	EQUAL TEE SCH. 40, ASTM A-234 GR.WPB BW	2	B1	
10	3/4"	EQUAL TEE 3000#, ASTM A-105 S.W	3	B1	
11	4"x2"	RED. TEE SCH. 40x80, ASTM A-234 GR.WPB BW	1	B1	
12	4"x3/4"	SOCKOLET, 3000#, ASTM A-105	4	B1	
13	2"x3/4"	SOCKOLET, 3000#, ASTM A-105	1	B1	
14	4"	FLG, WN 300# RF, SCH.40 ASTM A-105	12	B1	
15	2"	FLG, WN 300# RF, SCH.80 ASTM A-105	5	B1	
16	1"	FLG, SW 300# RF, SCH.80 ASTM A-105	1	B1	
17	2"	FLG, BLIND 300# RF, ASTM A-105	1	B1	
18	4"	GATE VALVE RF. 300#, SEE TAG NO. VG-103	4	B1	
19	2"	GATE VALVE RF. 300#, SEE TAG NO. VG-103	1	B1	
20	1"	GATE VALVE 800# SW, SEE TAG NO. VG-100	1	B1	
21	3/4"	GATE VALVE 800# SW, SEE TAG NO. VG-100	3	B1	
22	3/4"	GATE VALVE 800# SW-NPT, ASTM A-105 VG-100	8	-	
23	4"	GLOBE VALVE RF. 300#, SEE TAG NO. VGL-103	2	B1	
24	2"	GLOBE VALVE RF. 300#, SEE TAG NO. VGL-103	1	B1	
25	3/4"	PLUG, ROUND HEAD NPT, ASTM A-105	5	-	
26	4"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	14	B1	
27	2"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	6	B1	
28	1"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	B1	
29	3/4"	LG STUD BOLTS C/W 2 NUTS 110mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	112	B1	
30	5/8"	LG STUD BOLTS C/W 2 NUTS 90mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	48	B1	
31	5/8"	LG STUD BOLTS C/W 2 NUTS 80mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	4	B1	

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
0	09/12/2019	ISSUED FOR REVIEW	MK	SAR		
			CONSULTANT			CLIENT

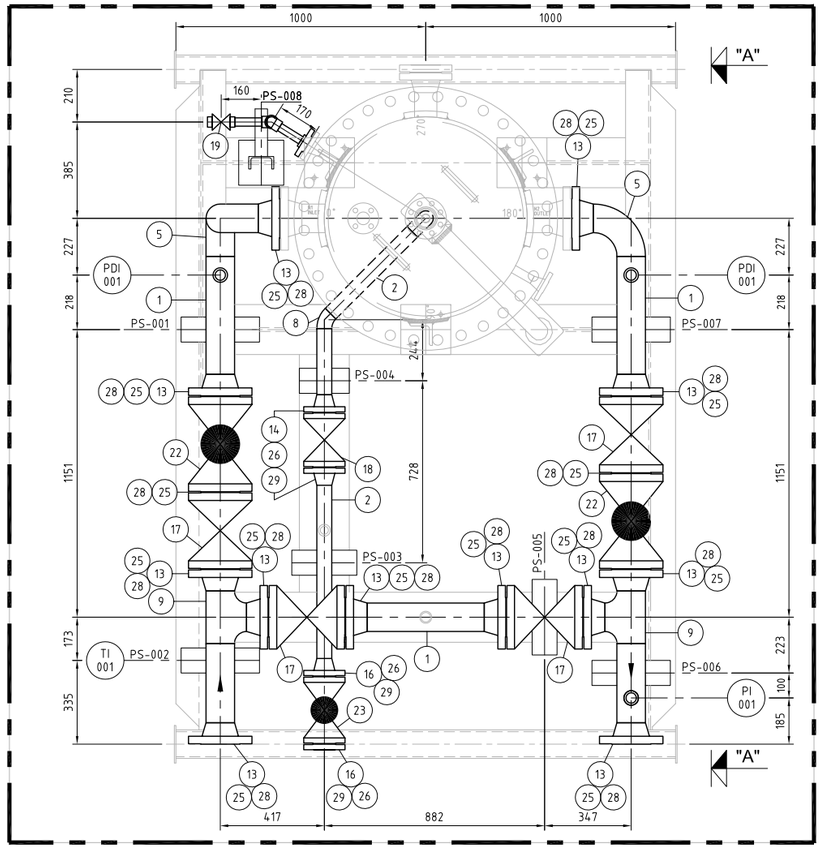
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

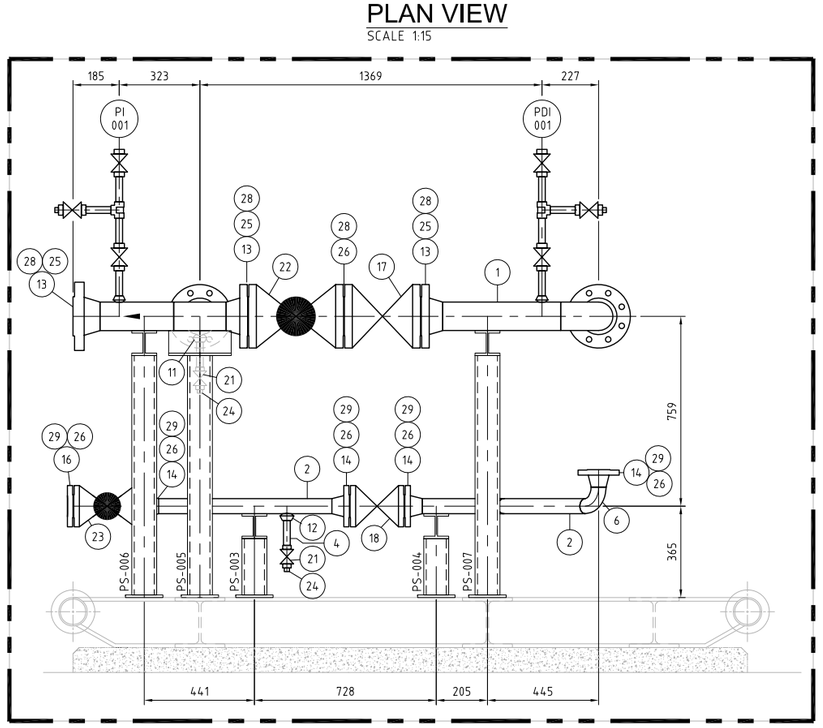
TITLE: CHARCOAL FILTER (F-02) PIPING ARRANGEMENT

DRAWING NO.	SHEET NO.	OF	SCALE	REV.
0504215-FL-001	1	1	A3 -	0



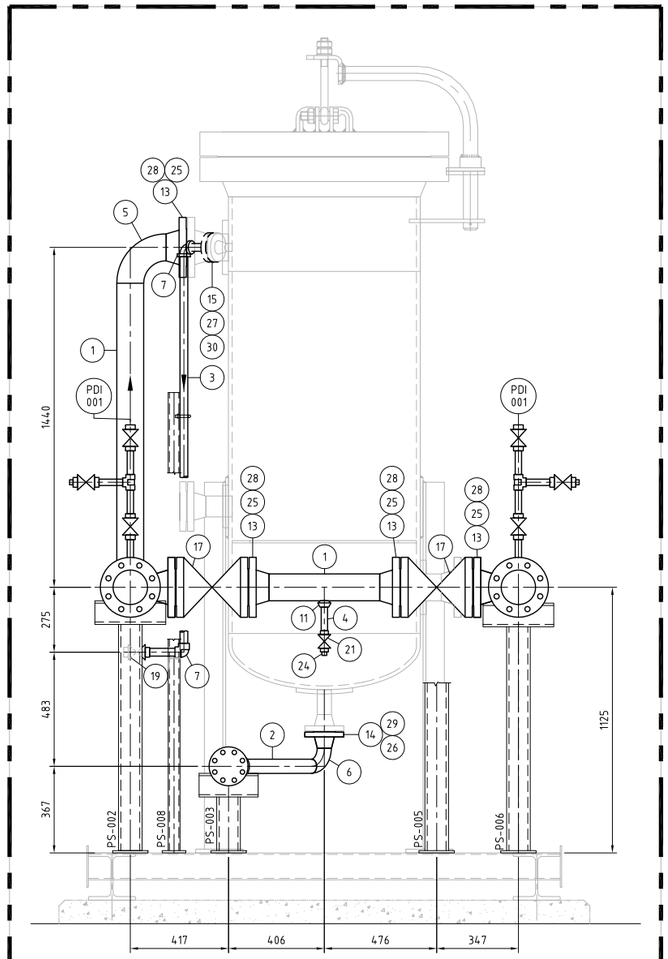
PLAN VIEW

SCALE 1:15



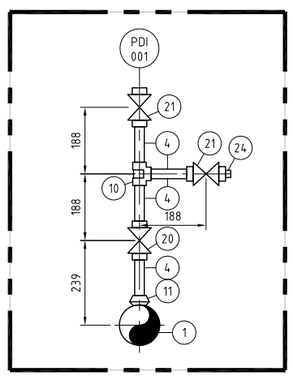
SECTION -A

SCALE 1:15

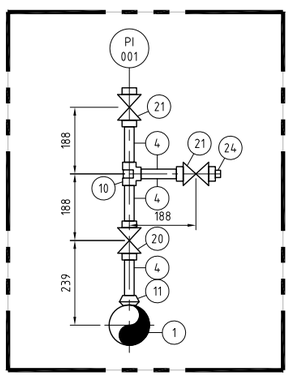


ELEVATION VIEW

SCALE 1:20



PDI DETAIL



PI DETAIL

BILL OF MATERIAL

Sr.NO.	SIZE	DESCRIPTION	QTY.	(MAT. SPEC)	REMARKS
1	4"	PIPE SCH.40 BE SMLS, ASTM A-106 GR.B	3.3M	B1	
2	2"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.5M	B1	
3	1"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	2.0M	B1	
4	3/4"	PIPE SCH.80 PE SMLS, ASTM A-106 GR.B	1.5M	B1	
5	4"	ELBOW 90° LR SCH. 40, ASTM A-234 GR.WPB BW	3	B1	
6	2"	ELBOW 90° LR SCH. 80, ASTM A-234 GR.WPB BW	1	B1	
7	1"	ELBOW 90° 3000#, ASTM A-105 S.W	2	B1	
8	2"	ELBOW 45° LR SCH. 80, ASTM A-234 GR.WPB BW	1	B1	
9	4"	EQUAL TEE SCH. 40, ASTM A-234 GR.WPB BW	2	B1	
10	3/4"	EQUAL TEE 3000#, ASTM A-105 S.W	3	B1	
11	4"x3/4"	SOCKOLET, 3000#, ASTM A-105	4	B1	
12	2"x3/4"	SOCKOLET, 3000#, ASTM A-105	1	B1	
13	4"	FLG, WN 300# RF, SCH.40 ASTM A-105	12	B1	
14	2"	FLG, WN 300# RF, SCH.80 ASTM A-105	4	B1	
15	1"	FLG, SW 300# RF, SCH.80 ASTM A-105	1	B1	
16	2"	FLG, BLIND 300# RF, ASTM A-105	1	B1	
17	4"	GATE VALVE RF. 300#, SEE TAG NO. VG-103	4	B1	
18	2"	GATE VALVE RF. 300#, SEE TAG NO. VG-103	1	B1	
19	1"	GATE VALVE 800# SW, SEE TAG NO. VG-100	1	B1	
20	3/4"	GATE VALVE 800# SW, SEE TAG NO. VG-100	3	B1	
21	3/4"	GATE VALVE 800# SW-NPT, ASTM A-105 VG-100	8	-	
22	4"	GLOBE VALVE RF. 300#, SEE TAG NO. VGL-103	2	B1	
23	2"	GLOBE VALVE RF. 300#, SEE TAG NO. VGL-103	1	B1	
24	3/4"	PLUG, ROUND HEAD NPT, ASTM A-105	5	-	
25	4"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	14	B1	
26	2"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	5	B1	
27	1"	GASKET 300# 3mm THICK COMPRESSED GRAPHITE FILLED SPIRAL WOUND 304 SS CENTRAL RING AS PER ASME B-16.20	1	B1	
28	3/4"	LG STUD BOLTS C/W 2 NUTS 110mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	112	B1	
29	5/8"	LG STUD BOLTS C/W 2 NUTS 90mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	40	B1	
30	5/8"	LG STUD BOLTS C/W 2 NUTS 80mm LONG ASTM A 193 Gr. B7M CADMIUM PLATED ASTM A-194 Gr. 2HM CADMIUM PLATED	4	B1	

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.
3. THE TOTAL QUANTITIES AGAINST EACH ITEM IS APPLICABLE TO ONE VESSEL, HOWEVER SAME QUANTITIES SHALL BE TAKEN FOR THE OTHER VESSEL.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
0	09/12/2019	ISSUED FOR REVIEW	MK	SAR		
			CONSULTANT			CLIENT

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

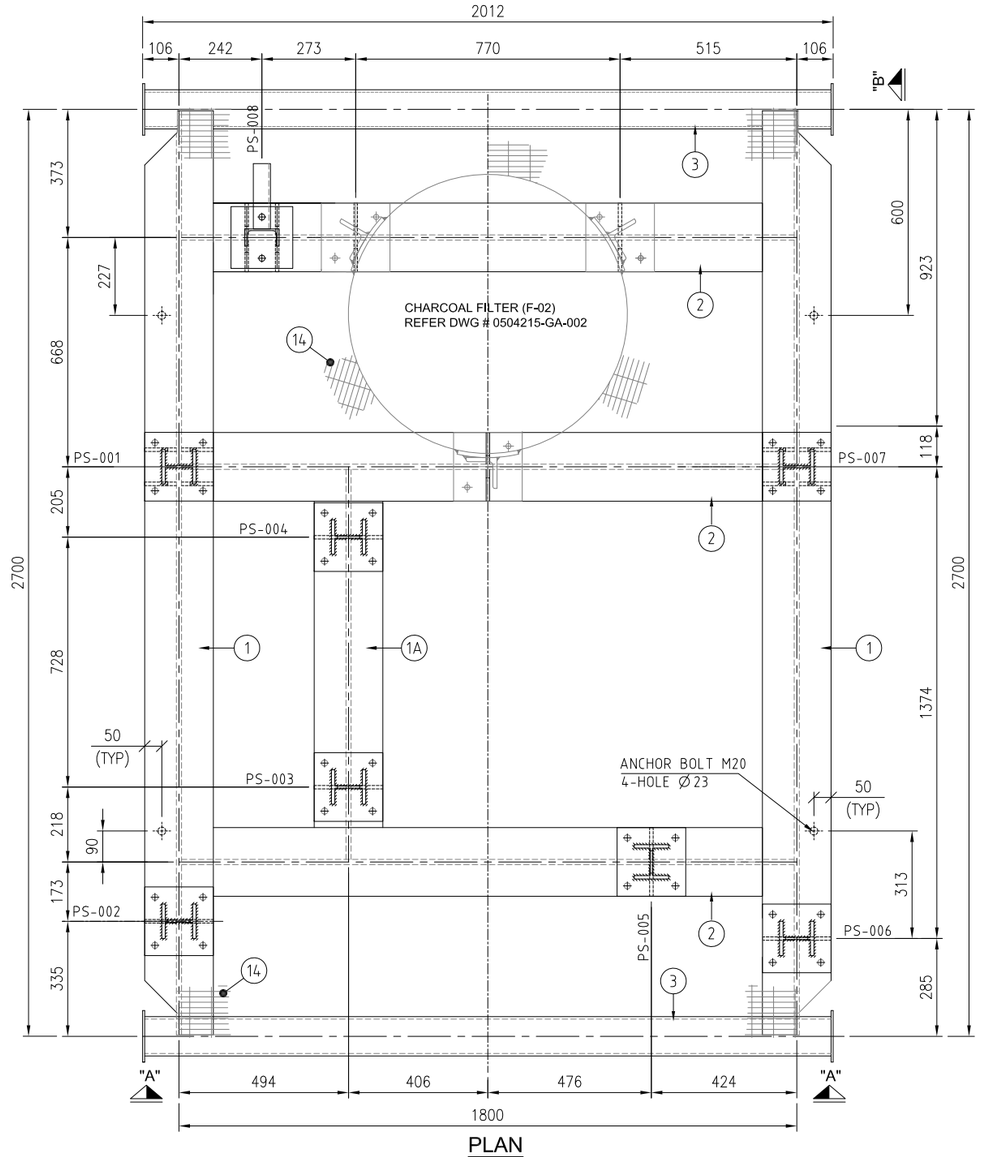
PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE: PARTICLE FILTER (F-01A/B) PIPING ARRANGEMENT

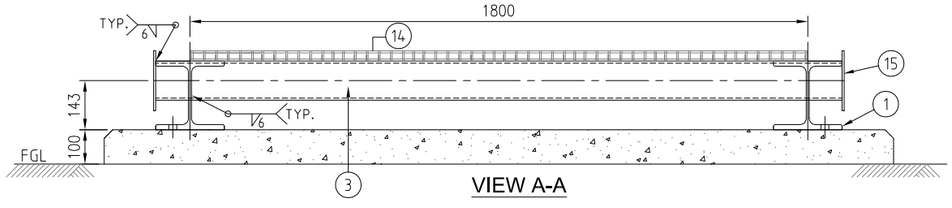
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504215-FL-002	1	1	A3	0

ANNEXURE-G

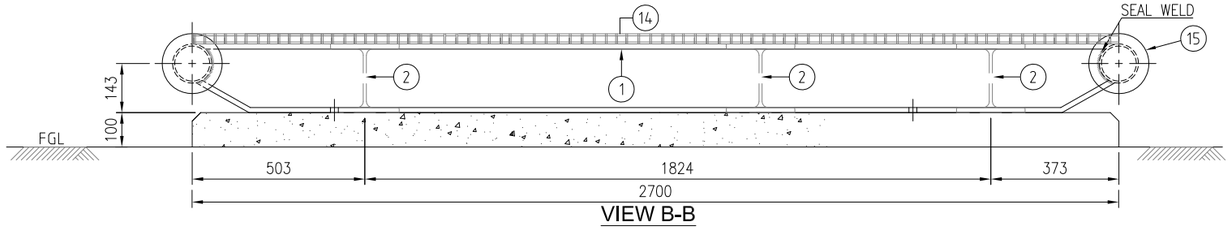
SKID DRAWINGS



PLAN



VIEW A-A



VIEW B-B

16	GUSSET PLATE (AREA=17091mm²) 10mm THK.	28	ASTM A-36	78.5 KG/M²	38
15	COVER PLATE Ø175x6mm THK.	4	ASTM A-36	47.1 KG/M²	5
14	GRATING, LOAD BEARING BAR AREA =4.4 M²	1	ASTM A-36	42.87 Kg/m²	189
13	BOLT M16x85	36	A193 Gr.B7 A194 Gr.2H	-	-
12A	U-BOLT 3/8"Ø WITH 4 NUTS FOR PIPE Ø2"	2	ASTM A-36	-	-
12	U-BOLT 1/4"Ø WITH 4 NUTS FOR PIPE Ø1"	3	ASTM A-36	-	-
11	U-BOLT 1/2"Ø WITH 4 NUTS FOR PIPE Ø4"	4	ASTM A-36	-	-
10	BASE PLATE 180x180x10mm THK.	1	ASTM A-36	78.5 KG/M²	3
9	BASE PLATE 200x200x10mm THK.	7	ASTM A-36	78.5 KG/M²	22
8	CH-100x50x10 200mm LG.	3	ASTM A-36	10.2 KG/M	6
7A	CH-100x50x10 2505mm LG.	1	ASTM A-36	10.2 KG/M	26
7	CH-100x50x10 200mm LG.	1	ASTM A-36	10.2 KG/M	2
6B	HEB-100 (1015mm LG.)	1	ASTM A-36	20.4 KG/M	21
6A	HEB-100 (310mm LG.)	3	ASTM A-36	20.4 KG/M	19
6	HEB-100 (227mm LG.)	2	ASTM A-36	20.4 KG/M	9
5	HEB-100 (310mm LG.)	4	ASTM A-36	20.4 KG/M	26
4	HEB-100 (958mm LG.)	4	ASTM A-36	20.4 KG/M	78
3	PIPE Ø4" SCH.40 (2000 LG.)	2	ASTM A-106 GR.B	16.06 KG/M	64
2	HEB-200 (1785mm LG.)	3	ASTM A-36	61.3 KG/M	328
1A	HEB-200 (1135mm LG.)	1	ASTM A-36	61.3 KG/M	70
1	HEB-200 (2700mm LG.)	2	ASTM A-36	61.3 KG/M	331
PART NO.	DESCRIPTION	QTY.	MATERIAL	UNIT WT.(KG/M)	TOTAL WT. (KG)
				TOTAL WT.(Kg)	1237

BILL OF MATERIAL

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. CONTRACTOR WILL ADD ANY REQUIRED ITEM AS PER SCOPE OF WORKS, DRAWINGS AND SPECIFICATIONS.
3. MENTIONED QUANTITIES ARE ESTIMATED; CONTRACTOR WILL VERIFY AND ESTIMATE THE BILL OF OF QUANTITIES
4. DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		
			CONSULTANT			CLIENT

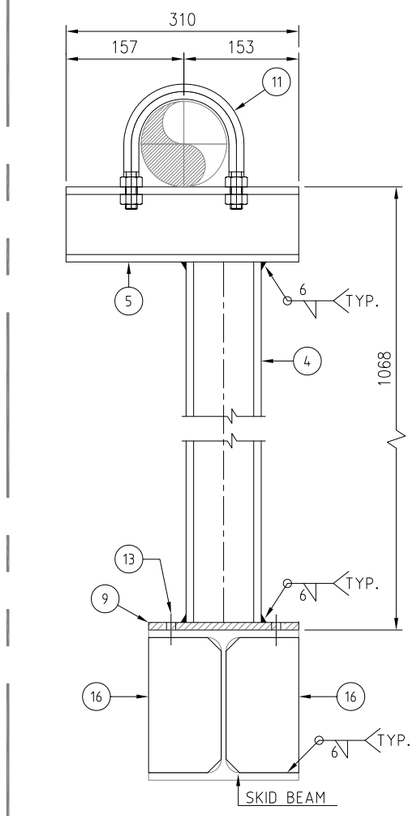
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

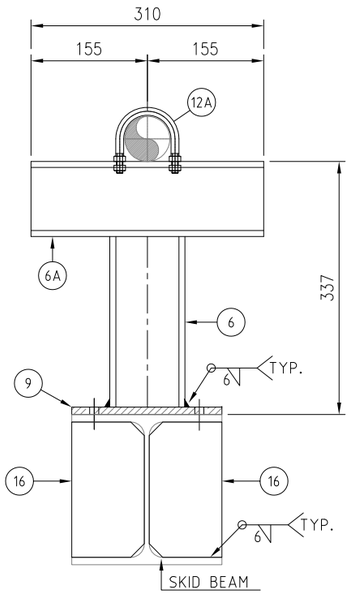
PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE: CHARCOAL FILTER (F-02) SKID & PIPE SUPPORT DETAIL

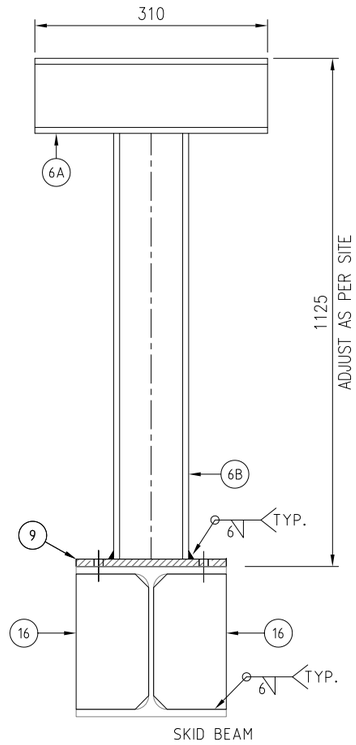
DRAWING NO.	SHEET NO.	OF	SCALE	REV.
0504215-CIV-ST-001	1	2	A3	1



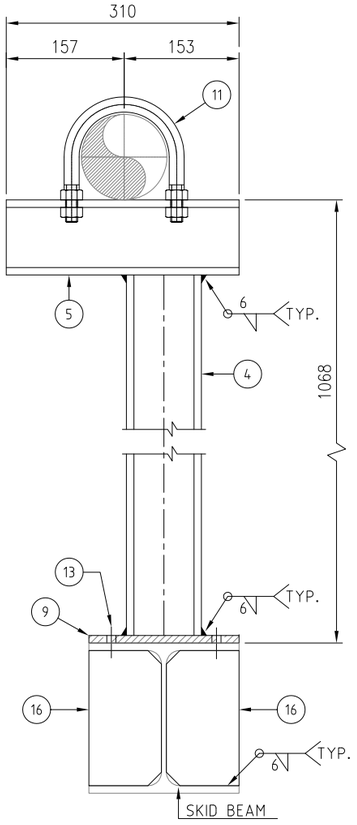
PS-001 & PS-002



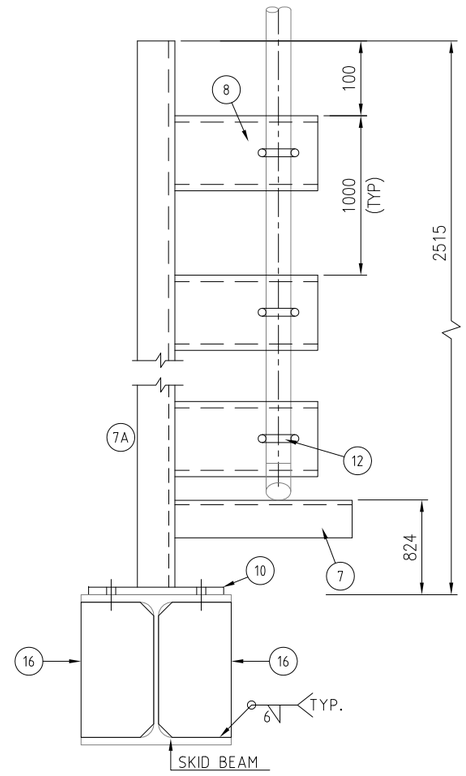
PS-003 & PS-004



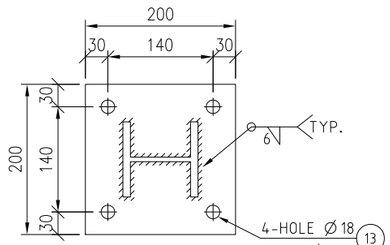
PS-005



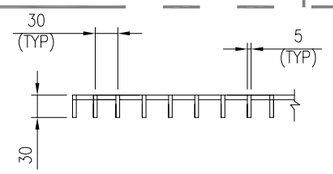
PS-006 & PS-007



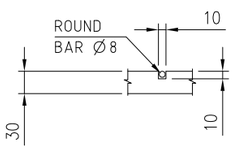
PS-008



ITEM-9



SECTION 1-1



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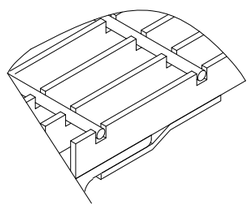
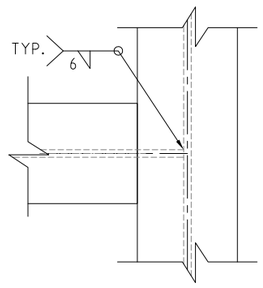
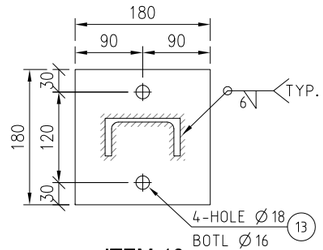
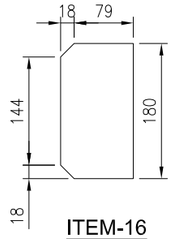


GRATING ATTACHMENT





ITEM-10



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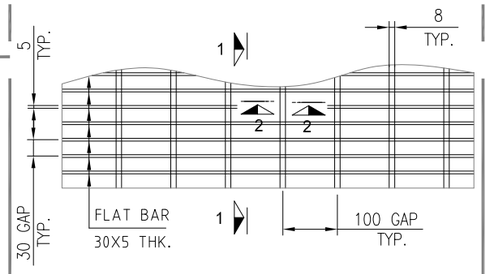
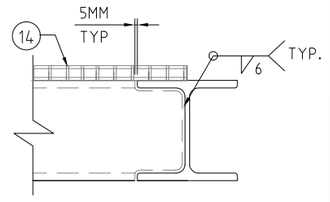


TYP. GRATING DETAIL



TYP BEAM TO BEAM (HEB-200)
CONNECTION DETAIL

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

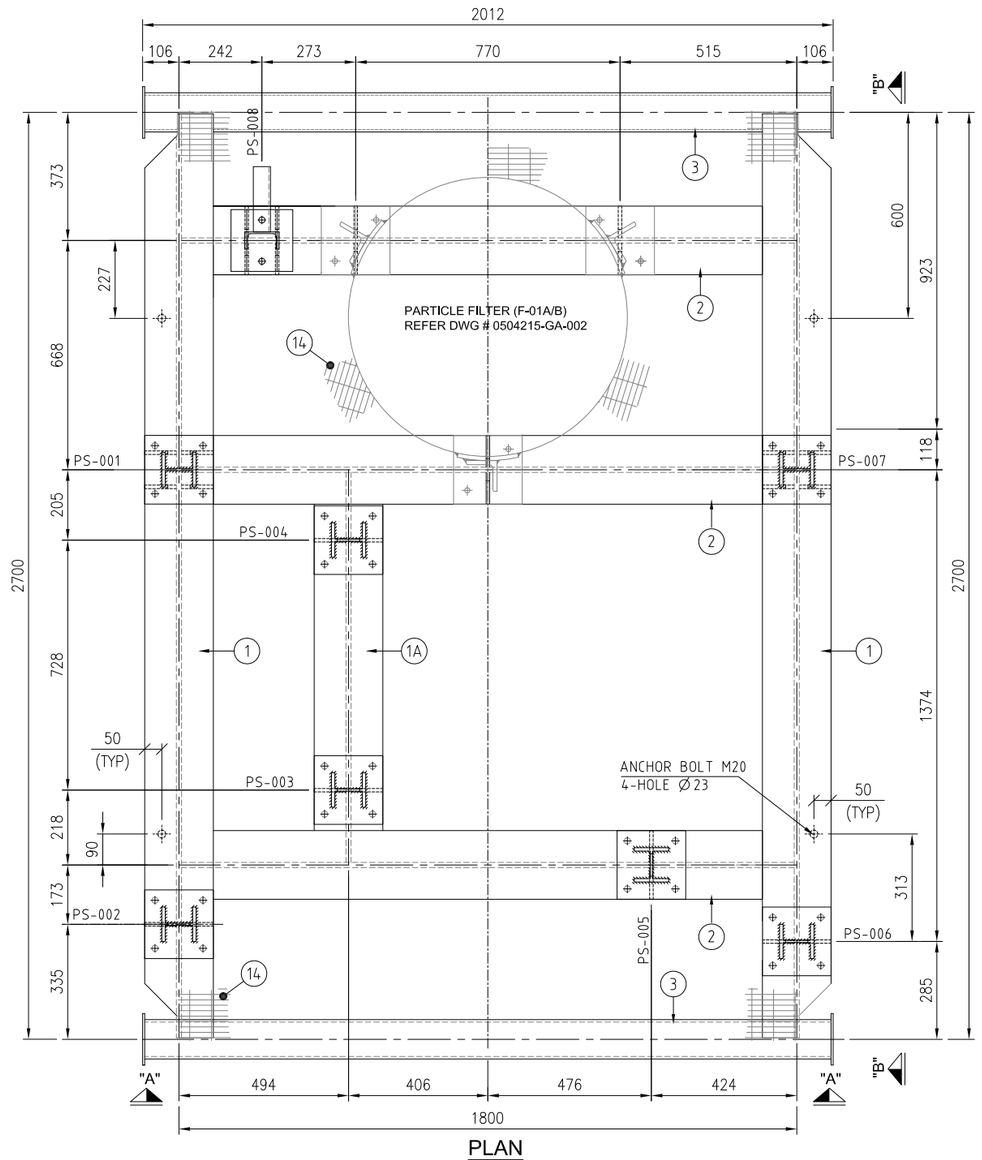
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

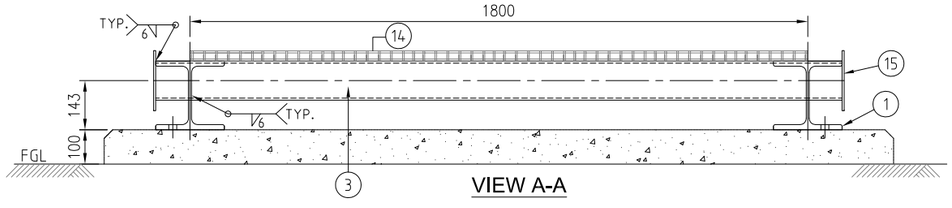
PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE: CHARCOAL FILTER (F-02) SKID & PIPE SUPPORT DETAIL

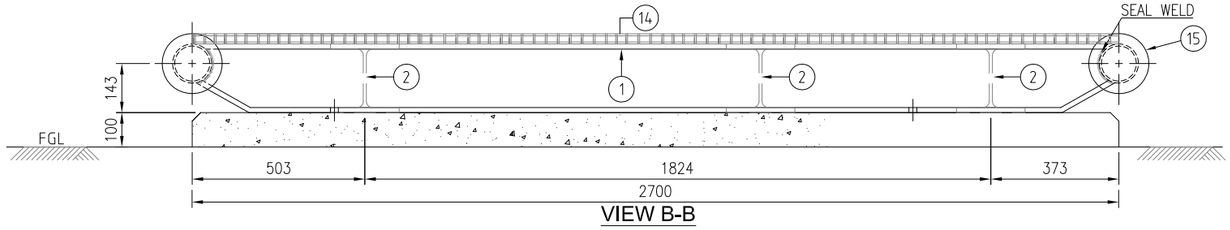
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504215-CIV-ST-001	2	2	A3	1



PLAN



VIEW A-A



VIEW B-B

16	GUSSET PLATE (AREA=17091mm²) 10mm THK.	28	ASTM A-36	78.5 KG/M²	38
15	COVER PLATE Ø175x6mm THK.	4	ASTM A-36	47.1 KG/M²	5
14	GRATING, LOAD BEARING BAR AREA =4.4 M²	1	ASTM A-36	42.87 Kg/m²	189
13	BOLT M16x85	36	A193 Gr.B7 A194 Gr.2H	-	-
12A	U-BOLT 3/8"Ø WITH 4 NUTS FOR PIPE Ø2"	2	ASTM A-36	-	-
12	U-BOLT 1/4"Ø WITH 4 NUTS FOR PIPE Ø1"	3	ASTM A-36	-	-
11	U-BOLT 1/2"Ø WITH 4 NUTS FOR PIPE Ø4"	4	ASTM A-36	-	-
10	BASE PLATE 180x180x10mm THK.	1	ASTM A-36	78.5 KG/M²	3
9	BASE PLATE 200x200x10mm THK.	7	ASTM A-36	78.5 KG/M²	22
8	CH-100x50x10 200mm LG.	3	ASTM A-36	10.2 KG/M	6
7A	CH-100x50x10 2505mm LG.	1	ASTM A-36	10.2 KG/M	26
7	CH-100x50x10 200mm LG.	1	ASTM A-36	10.2 KG/M	2
6B	HEB-100 (1015mm LG.)	1	ASTM A-36	20.4 KG/M	21
6A	HEB-100 (310mm LG.)	3	ASTM A-36	20.4 KG/M	19
6	HEB-100 (227mm LG.)	2	ASTM A-36	20.4 KG/M	9
5	HEB-100 (310mm LG.)	4	ASTM A-36	20.4 KG/M	26
4	HEB-100 (958mm LG.)	4	ASTM A-36	20.4 KG/M	78
3	PIPE Ø4" SCH.40 (2000 LG.)	2	ASTM A-106 GR.B	16.06 KG/M	64
2	HEB-200 (1785mm LG.)	3	ASTM A-36	61.3 KG/M	328
1A	HEB-200 (1135mm LG.)	1	ASTM A-36	61.3 KG/M	70
1	HEB-200 (2700mm LG.)	2	ASTM A-36	61.3 KG/M	331
PART NO.	DESCRIPTION	QTY.	MATERIAL	UNIT WT.(KG/M)	TOTAL WT. (KG)
				TOTAL WT.(Kg)	1237

BILL OF MATERIAL

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. CONTRACTOR WILL ADD ANY REQUIRED ITEM AS PER SCOPE OF WORKS, DRAWINGS AND SPECIFICATIONS.
3. MENTIONED QUANTITIES ARE ESTIMATED; CONTRACTOR WILL VERIFY AND ESTIMATE THE BILL OF OF QUANTITIES
4. DIMENSIONS, ELEVATIONS AND ORIENTATIONS TO BE VERIFIED BY THE CONTRACTOR BEFORE UNDERTAKING ANY KIND OF FABRICATION, CONSTRUCTION AND INSTALLATION WORK AT SITE.

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
				CONSULTANT		CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

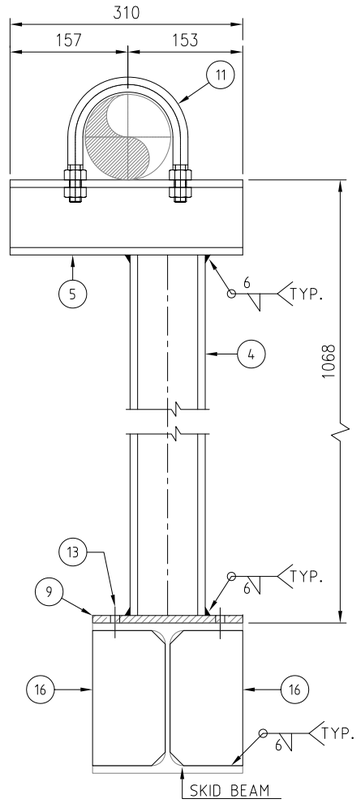
PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300, PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

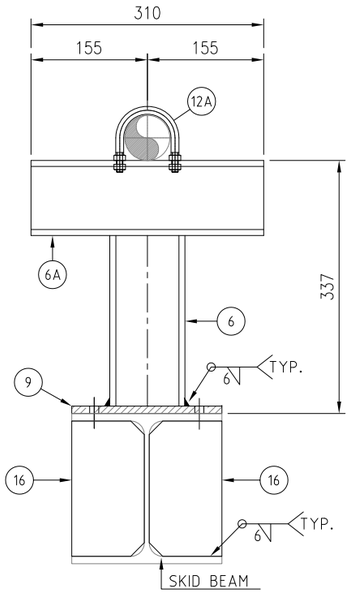
PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE: PARTICLE FILTER (F-01A/B) SKID & PIPE SUPPORT DETAIL

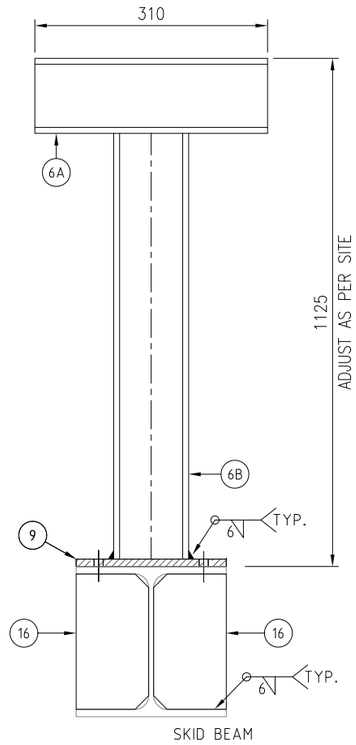
DRAWING NO.	SHEET NO.	SHEET OF	SCALE	REV.
0504215-CIV-ST-002	1	2	A3	1



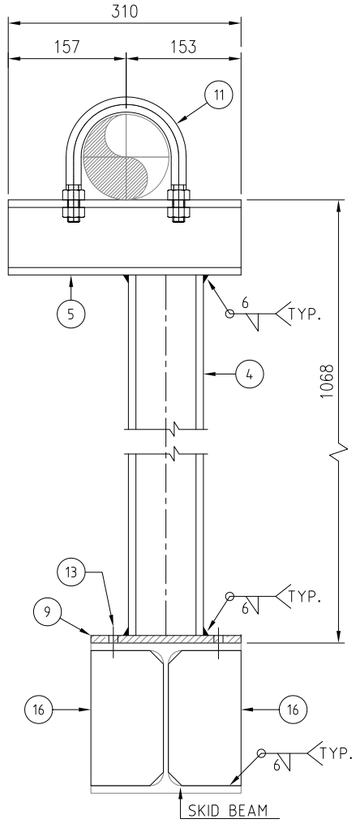
PS-001 & PS-002



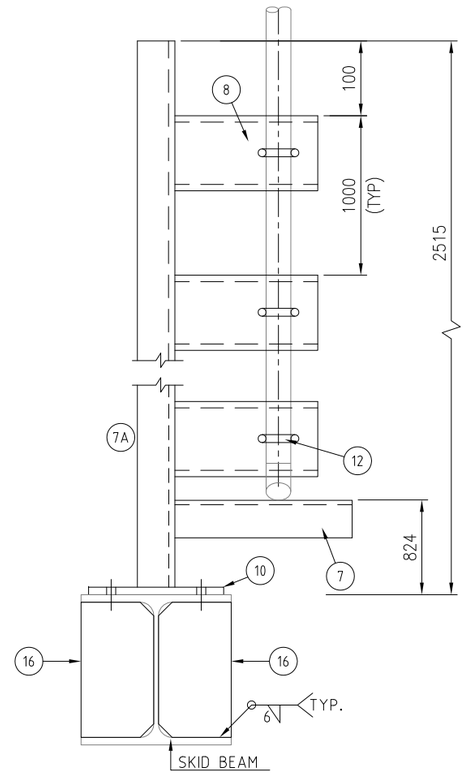
PS-003 & PS-004



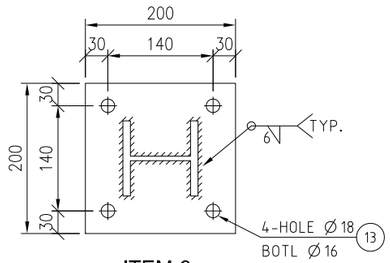
PS-005



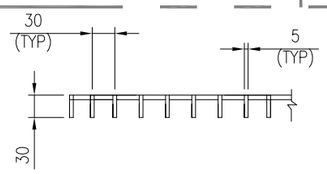
PS-006 & PS-007



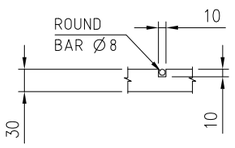
PS-008



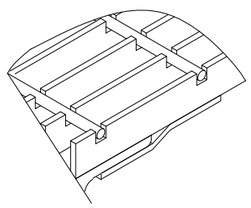
ITEM-9



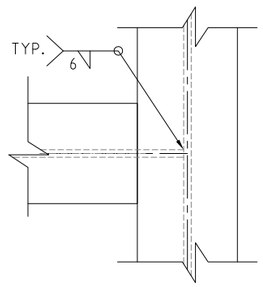
SECTION 1-1

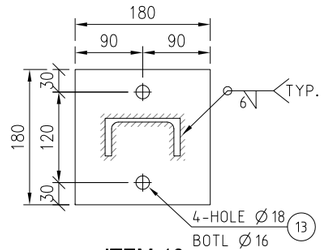


SECTION 2-2

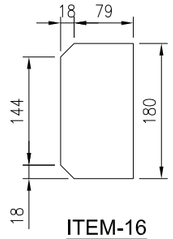


GRATING ATTACHMENT

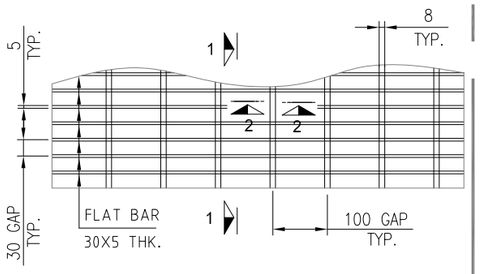




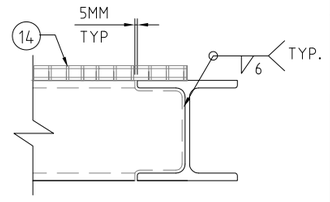
ITEM-10



ITEM-16



TYP. GRATING DETAIL



TYP BEAM TO BEAM (HEB-200) CONNECTION DETAIL

REV.	DATE	DESCRIPTION	DRAWN	CHK'D	APP'VD	APP'VD
			CONSULTANT			CLIENT
1	05/12/2019	ISSUED FOR REVIEW	ZA	AS		
0	04/12/2019	INTERDISCIPLINARY CHECK	ZA	AS		

PETROCHEMICAL ENGINEERING CONSULTANTS
C-2, BLOCK NO. 17, GULSHAN-E-IQBAL, NEAR NATIONAL STADIUM, KARACHI-75300. PAKISTAN.
TEL. +92 (21) 34827780, 34961088, FAX: +92 21 34961089, E-Mail: contact@pcec.com.pk web site: www.pcec.com.pk

CLIENT: OIL & GAS DEVELOPMENT COMPANY LTD.

PROJECT: DETAIL ENGINEERING DESIGN FOR SINJHORO PRODUCED WATER DISPOSAL

TITLE: PARTICLE FILTER (F-01A/B) SKID & PIPE SUPPORT DETAIL

DRAWING NO.	SHEET NO.	OF	SCALE	REV.
0504215-CIV-ST-002	2	2	A3	1

ANNEXURE-H

PIPING SPECIFICATIONS

OIL & GAS DEVELOPMENT COMPANY LIMITED

PIPING SPECIFICATION

B1 (Plant Piping)

SPEC. NO. : 0504215-B1-01-SP-001	DATE : 08-06-18	Revision : 0	Prep. By. : WAZEER

SERVICE	RATING	CORROSION ALLOWANCE	DESIGN CODE
PROCESS GAS	ASME CLASS 300#	1.5 mm	ASME B31.3

PIPES

SIZE	DESIGNATION	DESCRIPTION
2 1/2" to 8"	Sch. 40	ASTM A106 Gr. B / API 5L Gr. B (SMLS) B.E. AS PER ASME B36.10
3/4" to 2"	Sch. 80	ASTM A106 Gr. B / API 5L Gr. B (SMLS) P.E. AS PER ASME B36.10
1/2"	Sch. 160	ASTM A106 Gr. B / API 5L Gr. B (SMLS) P.E. AS PER ASME B36.10

FITTINGS

SIZE	DESCRIPTION
2" to 8"	BW, A-234 Gr. WPB AS PER ASME B16.9
≤ 1 1/2"	SW, A-105 AS PER ASME B16.11, 3000#

FLANGES

SIZE	CLASS	DESCRIPTION
2" to 8"	300#	WN, RF, ASME B16.5, ASTM A-105
≤ 1 1/2"	300#	SW, RF, ASME B16.5, ASTM A-105 (Note-3)

BOLTS & GASKETS

Stud Bolts	ASTM A-193 B7M, Cadmium Plated
Nuts	ASTM A-194 2HM, Cadmium Plated
Gaskets	3mm Thick Compressed Graphite Filled, Spiral Wound 304 S.S.Central Ring Per ASME B 16.20

VALVES

	SIZE	DESCRIPTION		SIZE	DESCRIPTION		SIZE	DESCRIPTION
GATE	≤ 1 1/2" 2" to 8"	VG-100 VG-103	BALL	≤ 1 1/2" 2" to 8"	VB-102 VB-103	OTHERS		
CHECK	≤ 1 1/2" 2" to 4"	VC-100 VC-102	GLOBE	≤ 1 1/2" 2" to 8"	VGL-100 VGL-103	OTHERS		

PRESSURE - TEMPERATURE RATING-ASME B16.5, MATERIAL GROUP 1.1

TEMPERATURE °F	−20 to 100	131	212	302	392	482	-	-
MAX. PRESSURE Psig	741.1	721	675.8759	654.1202	635.2653	607.7081	-	-

DESIGN CONDITIONS	720 psig @ 130 °F	HYDROSTATIC TEST PRESSURE	936 psig

BRANCH CONNECTIONS

BRANCH SIZE (INCH) \ RUN SIZE (INCH)	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	3	2	1½	1	¾	½
½					S		S	S	S	S	S	S	S	S	S	S	Ts	Ts	Ts	Ts	ET
¾					S		S	S	S	S	S	S	S	S	S	S	Ts	Ts	Ts	ET	
1					S		S	S	S	S	S	S	S	S	S	S	Ts	Ts	ET		
1½					S		S	S	S	S	S	S	S	S	S	S	Ts	ET			
2					W		W	W	W	W	W	W	W	W	RT	RT	ET				
3					W		W	W	W	W =	W	W	W	RT	RT	ET					
4					W		W	W	W	W =	W	RT	RT	RT	ET						
6					W		W	W	RT	RT	RT	RT	RT	ET							
8					W		W	RT	RT	RT	RT	RT	ET								
10					W		RT	RT	RT	RT	RT	ET									
12					RT		RT	RT	RT	RT	ET										
14					RT		RT	RT	RT	ET											
16					RT		RT	RT	ET												
18					RT		RT	ET													
20					RT		ET														
22																					
24					ET																

LEGENDS:

ET	=	Equal Tee, Butt Welding
RT	=	Reducing Tee, Butt Welding
Ts	=	Reducing Tee, Socket Welding
W	=	Weldolet
S	=	Sockolet 3000#

NOTES:

1. Reduced fitting thickness shall match heavier pipe wall thickness, taper to match thinner pipe wall.
2. Instrument connections shall be screwed beyond the first block valve of process piping.
3. Bore to match pipe I.D. for Welding Neck flanges.
4. Under ground piping should be coated with Zinc-Rich or Zinc Silicate primer, & apply 3 Layer Polyethylene Coted.

OIL & GAS DEVELOPMENT COMPANY LIMITED

VALVE SPECIFICATION
FOR GLOBE VALVES

DOC. NO. : 0504215-GLVS-01-004	DATE : -15-03-2019	REV. : 0	PREP. BY A.V.

VALVE	SIZE	RATING (lb)	ENDS	STYLE	OPERATOR	DESIGN & TEST	MATERIAL	
							BODY	TRIM
VGL-100	≤1 1/2"	800	SW	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-105	316 S.STEEL
VGL-101	2" - 12"	150	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-216 GR. WCB	316 S.STEEL
VGL-103	2" - 8"	300	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS	HANDWHEEL	ASME B 16.34	A-216 GR. WCB	316 S.STEEL

OIL & GAS DEVELOPMENT COMPANY LIMITED

VALVE SPECIFICATION
FOR GATE VALVES

DOC. NO. : 0504215-GTVS-01-003	DATE : - 15-03-2019	REV. : 0	PREP. BY A.V.

VALVE	SIZE	RATING (lb)	ENDS	STYLE	OPERATOR	DESIGN & TEST	MATERIAL	
							BODY	TRIM
VG-100	≤ 1 1/2"	800	SW	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 602	A-105	316 S.STEEL
VG-101	2" - 12"	150	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 600	A-216 GR. WCB	316 S.STEEL
VG-103	2" - 8"	300	RF (ASME B16.5)	OS&Y, BOLTED BONNET & GLAND, SOLID WEDGE & RENEWABLE SEATS	HANDWHEEL	API 600	A-216 GR. WCB	316 S.STEEL

ANNEXURE-I

VENDORS LIST

PREFERRED VENDOR LIST

1.0 VALVES

1.1 Globe Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	AES	International
II.	Crane	International
III.	Newco	International
IV.	Walworth	International
V.	Kitz	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	Velan	International
XI.	Ecoline –KSB	International

1.2 Gate Valves (API 6D)

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Kvaerner Oiltool	International
III.	Control Flow Inc.	International
IV.	Newco	International
V.	FMC	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	KF	International
XI.	Velan	International
XII.	Ecoline –KSB	International

PREFERRED VENDOR LIST

1.3 Ball Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Control Flow	International
III.	Neles Jamesbury	International
IV.	Orbit	International
V.	Valvitalia	International
VI.	LVF	International
VII.	JC Valvulas	International
VIII.	KVC	International
IX.	KF	International
X.	Ecoline –KSB	International
XI.	Force	International
XII.	Quadrant	International
XIII.	Flow-Tek / Bray	International
XIV.	PBV	International

1.4 Needle Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Anderson Greenwood	International
II.	Kenmac	International
III.	KF	International
IV.	Oliver	International
V.	Parker	International
VI.	Precision Valves	International
VII.	Swagelok	International

PREFERRED VENDOR LIST

2.0 Filter Elements

2.1 Particle Filter Cartridges

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Twinfilter	International
II.	Syntech Fibres (Pvt.) Ltd.	International
III.	Yunda Filters	International

2.2 Charcoal Bed

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Calgon Carbon	International
II.	Lenntech	International
III.	CPL	International
IV.	Activated Carbon Technologies (Pvt.) Ltd.	International

PREFERRED VENDOR LIST

1.0 VALVES

1.1 Globe Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	AES	International
II.	Crane	International
III.	Newco	International
IV.	Walworth	International
V.	Kitz	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	Velan	International
XI.	Ecoline –KSB	International

1.2 Gate Valves (API 6D)

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Kvaerner Oiltool	International
III.	Control Flow Inc.	International
IV.	Newco	International
V.	FMC	International
VI.	LVF	International
VII.	Valveitalia	International
VIII.	JC Valvulas	International
IX.	KVC	International
X.	KF	International
XI.	Velan	International
XII.	Ecoline –KSB	International

PREFERRED VENDOR LIST

1.3 Ball Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Cameron	International
II.	Control Flow	International
III.	Neles Jamesbury	International
IV.	Orbit	International
V.	Valvitalia	International
VI.	LVF	International
VII.	JC Valvulas	International
VIII.	KVC	International
IX.	KF	International
X.	Ecoline –KSB	International
XI.	Force	International
XII.	Quadrant	International
XIII.	Flow-Tek / Bray	International
XIV.	PBV	International

1.4 Needle Valves

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Anderson Greenwood	International
II.	Kenmac	International
III.	KF	International
IV.	Oliver	International
V.	Parker	International
VI.	Precision Valves	International
VII.	Swagelok	International

PREFERRED VENDOR LIST

2.0 Filter Elements

2.1 Particle Filter Cartridges

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Twinfilter	International
II.	Syntech Fibres (Pvt.) Ltd.	International
III.	Yunda Filters	International

2.2 Charcoal Bed

Sr. #	Vendor / Supplier Name	Country of Origin
I.	Calgon Carbon	International
II.	Lenntech	International
III.	CPL	International
IV.	Activated Carbon Technologies (Pvt.) Ltd.	International

"Annexure-J"

Documents submission check List
(In case of manufacturers quoted other than Preferred vendor list)

Bidder to submit following documents with technical bid for technical evaluation

Sr.No	Description	Attached (Yes/No)	Page No.
1	Bidder to clearly mention the name of final vendor if other than Prefferred vendor list.		
2	Name, address, contact numbers, contact person name, valid email address and website address of Manufacturer/vendor.		
3	In case of Ball/Gate/Check valve manufacturer. Last 05 years valid API-6D certificate is required. API-6D certificate must be valid at the time of bid opening.		
4	For globe valves, ASME B 16.34 design standard should be used.		
5	Supply record of quoted material to International E&P companies during last 5 years. (please be specific to provide only the relevant record)		
6	Copies of un-priced purchase orders of manufacturer/vendor for supply of quoted material (03Nos.) to International E&P companies.		
7	Copies of third party inspection reports (03 Nos.) of Manufacturer/vendor for supply of quoted material (03Nos) to International E&P companies.		
8	Equipment details of Manufacturer.		
9	Audited financial statements for last three years of bidder.		
10	Auditing firm name, address, contact numbers, email address and website address of auditing firm of bidder.		
11	Occupational Health & Safety Management System Certificate of Manufacturer/Vendor.		
12	Printed Catalogue of Manufacturer for quoted material.		